# Analytic integration of real-virtual counterterms in NNLO jet cross sections I



JHEP09(2008)107

(http://iopscience.iop.org/1126-6708/2008/09/107)

Published by Institute of Physics Publishing for SISSA

Received: *July 11, 2008*
Accepted: *September 2, 2008*
Published: *September 22, 2008*

# Analytic integration of real-virtual counterterms in NNLO jet cross sections I

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Abstract: We present analytic evaluations of some integrals needed to give explicitly the integrated real-virtual counterterms, based on a recently proposed subtraction scheme for next-to-next-to-leading order (NNLO) jet cross sections. After an algebraic reduction of the integrals, integration-by-parts identities are used for the reduction to master integrals and for the computation of the master integrals themselves by means of differential equations. The results are written in terms of one- and two-dimensional harmonic polylogarithms, once an extension of the standard basis is made. We expect that the techniques described here will be useful in computing other integrals emerging in calculations in perturbative quantum field theories.

Keywords: Jets, QCD.

*On leave of absence from INFN, Sezione di Torino.



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## 1. Introduction

LHC physics demands calculating physical observables beyond leading order (LO) accuracy, by including the virtual and real corrections that appear at higher orders. However, the evaluation of phase space integrals beyond LO is not straightforward because it involves infrared singularities that have to be consistently treated before any numerical computation may be performed. At next-to-leading order (NLO), infrared divergences can be handled using a *subtraction scheme* exploiting the fact that the structure of the kinematical singularities of QCD matrix elements is universal and independent of the hard process. This allows us to build process-independent counterterms which regularize the one-loop (or virtual) corrections and real phase space integrals simultaneously [1].

In recent years a lot of effort has been devoted to the extension of the subtraction method to the computation of the radiative corrections at the next-to-next-to-leading order (NNLO) [2−11]. In particular, in ref. [12, 13], a subtraction scheme was defined for computing NNLO corrections to QCD jet cross sections to processes without coloured partons in the initial state and an arbitrary number of massless particles (coloured or colourless) in the final state. This scheme however is of practical utility only after the universal counterterms for the regularization of the real emissions are integrated over the phase space of the unresolved particles. The integrated counterterms can be computed once and for all and their knowledge is necessary to regularize the infrared divergences appearing in virtual corrections. That is indeed the task of this work: we analytically evaluate some of the integrals needed for giving explicitly the counterterms appearing in the scheme [12, 13]. The method is an adaptation of a technique developed in the last two decades to compute multi-loop Feynman diagrams [14−19]. To our knowledge this is the first time that these techniques are applied to integrals of the type

$$F(z) = \int_0^1 \int_0^{\alpha_0} \mathrm{d}x\, \mathrm{d}y\, x^{k_1\epsilon}\,(1-x)^{k_2\epsilon}\, y^{k_3\epsilon}\,(1-y)^{k_4\epsilon}\,(1-xyz)^{k_5\epsilon}\, f(x,y,z)\,, \tag{1.1}$$

where

$$f(x,y,z) = \frac{1}{x^{n_1}}\,\frac{1}{(1-x)^{n_2}}\,\frac{1}{y^{n_3}}\,\frac{1}{(1-y)^{n_4}}\,\frac{1}{(1-xyz)^{n_5}}\,, \tag{1.2}$$

with $n_i$ being non-negative integers and $0 < \alpha_0 \leq 1$.

An alternative method for computing the $\epsilon$-expansion of the integrals is iterated sector decomposition. This approach allows one to express the expansion coefficients of all functions we consider as finite, multidimensional integrals. Integrating these representations numerically, we obtain the expansion coefficients for any fixed value of the arguments. Every integral in this paper was computed numerically as well, with this alternative method for selected values of the parameters. We found that in all cases the analytical and numerical results agreed up to the uncertainty associated with the numerical integration.

The outline of the paper is the following. In section 2 we outline the steps of our method. In section 3 we define the integrals of the subtraction terms that we will consider in the paper. Our analytic results will be presented in terms of one- and two-dimensional harmonic polylogarithms. We summarize those properties of these functions that are important for our computations in sections 4 and 5, respectively. In sections 6 and 7 we calculate analytically the integrals needed for integrating the soft-type counterterms as a series expansion in the dimensional regularization parameter $\epsilon$. In section 8 we calculate some of the integrals needed for integrating the collinear counterterms. In sections 9 and 10 we calculate two sets of convoluted integrated counterterms, which can be obtained from a successive integration of the results obtained in section 8. In section 11 we briefly discuss the numerical calculation of the integrated subtraction terms. Finally in section 12 we present the conclusions of this work and we discuss possible developments concerning more complicated classes of integrals. Appendix A contains the spin-averaged splitting functions at tree level and at one-loop, which are needed for the evaluation of the counterterms. There are further appendices containing the (often rather lengthy) expressions of the integrated counterterms.



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## 2. The method

Our method of computing the integrals involves the following steps:

**Algebraic reduction of the integrand by means of partial fractioning.** For each class of integrals, we perform a partial fractioning of the integrand in order to obtain a set of independent integrals. For example, for the integrand in eq. (1.2) with $n_1 = n_2 = n_3 = n_4 = n_5 = 1$ one can perform partial fractioning with respect to the integration variable $x$ first, so that

$$\frac{1}{x\,(1-x)\,(1-xyz)} = \frac{1}{x} + \frac{1}{1-yz}\,\frac{1}{1-x} - \frac{y^2z^2}{1-yz}\,\frac{1}{1-xyz}\,. \tag{2.1}$$

Note the appearance of the new denominator $1-yz$, not originally present in the integrand and coming from $x$ partial fractioning.[1] One then performs partial fractioning with respect to $y$, by considering the denominator $1-xyz$ as a constant: that is because the latter was already involved in the $x$ partial fractioning and, to avoid an infinite loop, it cannot be subjected to any further transformation. For example:

$$\begin{aligned}\frac{1}{y\,(1-y)\,(1-yz)\,(1-xyz)} = &-\frac{z^2}{1-z}\,\frac{1}{(1-yz)\,(1-xyz)} + \frac{1}{y\,(1-xyz)} + \\ &+\frac{1}{1-z}\,\frac{1}{(1-y)\,(1-xyz)}\,.\end{aligned} \tag{2.2}$$

After this final partial fractioning over $y$, the original integrand $f$, depending on five denominators, is transformed into a combination of terms having at most two denominators, out of which at most one depends on $x$.[2]

**Reduction to master integrals by means of integration-by-parts identities.** We then write integration-by-parts identities (ibps) for the chosen set of independent amplitudes. If the upper limits in the $x$ or $y$ integrals in eq. (1.1) differ from one, $\alpha_0 < 1$, surface terms have to be taken into account. That is to be contrasted with the case of loop calculations, in which surface terms always vanish. By solving the ibps with the standard Laporta algorithm, complete reduction to master integrals is accomplished.

**Analytic evaluation of the master integrals.** After having identified for each class of integrals a set of master integrals, we write the corresponding system of differential equations. The $\epsilon$-expansion of the master integrals is obtained by solving such systems expanded in powers of $\epsilon$. A natural basis consists of one- and two-dimensional harmonic polylogarithms [20, 21]; for representing some master integrals, an extension of the standard basis functions has proved to be necessary.

[1] By increasing the number of variables, the number of additional denominators grows very fast.

[2] Performing first the partial fractioning in $y$ and then in $x$ results in a different basis of independent amplitudes.



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## 3. Integrals needed for the integrated subtraction terms

The subtraction method developed in refs. [12, 13] relies on the universal soft and collinear factorization properties of QCD squared matrix elements. Although the necessary factorization formulae for NNLO computations have been known for almost a decade, the explicit definition of a subtraction scheme has been hampered for several reasons. Firstly, the various factorization formulae overlap in a rather complicated way beyond NLO accuracy and these overlaps have to be disentangled in order to avoid multiple subtractions. At NNLO accuracy this was first achieved in ref. [11]. A general and simple solution to this problem was subsequently given in ref. [22], where a method was described to obtain pure-soft factorization at any order in perturbation theory leading to soft-singular factors without collinear singularities.

Secondly, the factorization formulae are valid only in the strict soft and collinear limits and have to be extended to the whole phase space. A method that works at any order in perturbation theory requires a mapping of the original $n$ momenta $\{p\}_n = \{p_1, \dots, p_n\}$ to $m$ momenta $\{\tilde{p}\}_m = \{\tilde{p}_1, \dots, \tilde{p}_m\}$ ($m$ is the number of hard partons and $n-m$ is the number of unresolved ones) that preserves momentum conservation. Such a mapping leads to an exact factorization of the original $n$-particle phase space of total momentum $Q$,

$$\mathrm{d}\phi_n(p_1, \dots, p_n; Q) = \prod_{i=1}^{n} \frac{\mathrm{d}^d p_i}{(2\pi)^{d-1}} \, \delta_+(p_i^2) \, (2\pi)^d \delta^{(d)} \left( Q - \sum_{i=1}^{n} p_i \right) , \tag{3.1}$$

in the form

$$\mathrm{d}\phi_n(\{p\}_n; Q) = \mathrm{d}\phi_m(\{\tilde{p}\}_m; Q) \, [\mathrm{d}p_{n-m;m}(\{p\}_{n-m}; Q)] \, . \tag{3.2}$$

In the context of computing QCD corrections, this sort of exact phase-space factorization was first introduced in ref. [1], where only three of the original momenta $\{p\}$ — that of the emitter $p_i^\mu$, the spectator $p_k^\mu$ and the emitted particle $p_j^\mu$ – were mapped to two momenta, $\tilde{p}_{ij}^\mu$ and $\tilde{p}_k^\mu$, the rest of the phase space was left unchanged. This sort of mapping requires that both $i$ and $k$ be hard partons, which is always satisfied in a computation at NLO accuracy because only one parton is unresolved. However, in a computation beyond NLO the spectator momentum may also become unresolved unless this is explicitly avoided by using colour-ordered subamplitudes [7, 8]. In order to take into account the colour degrees of freedom explicitly, as well as to define a phase space mapping valid at any order in perturbation theory, in ref. [23], two types of "democratic" phase-space mappings were introduced. In this paper we are concerned with the integrals of the singly-unresolved counterterms, therefore, in the rest of the paper we deal with the case when $n - m = 1$. Symbolically, the mapping

$$\{p\}_n \xrightarrow{\mathrm{C}_{ir}} \{\tilde{p}\}_{n-1}^{(ir)} = \{\tilde{p}_1, \dots, \tilde{p}_{ir}, \dots, \tilde{p}_n\} \, , \tag{3.3}$$

used for collinear subtractions, denotes a mapping where the momenta $p_i^\mu$ and $p_r^\mu$ are replaced by a single momentum $\tilde{p}_{ir}^\mu$ and all other momenta are rescaled, while for soft-type subtractions,

$$\{p\}_n \xrightarrow{\mathrm{S}_r} \{\tilde{p}\}_{n-1}^{(r)} = \{\tilde{p}_1, \dots, \tilde{p}_n\} \tag{3.4}$$

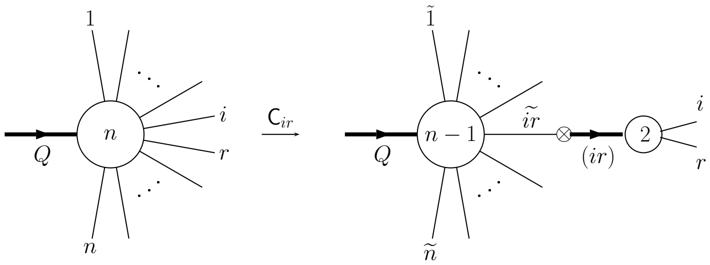


**Figure 1:** Graphical representation of the collinear momentum mapping and the implied phase space factorization.



denotes a mapping such that the momentum $p_r^\mu$, that may become soft, is missing from the set, and all other momenta are rescaled and transformed by a proper Lorentz transformation. These mappings are defined such that the recoil due to the emission of the unresolved partons is taken by all hard partons. In both cases the factorized phase-space measure can be written in the form of a convolution.

### 3.1 Definition of the collinear integrals

In the case of collinear mapping the factorized phase-space measure can be written as

$$[\mathrm{d}p_{1;n-1}^{(ir)}(p_r,\tilde{p}_{ir};Q)] = \mathrm{d}\alpha\,(1-\alpha)^{2(n-2)(1-\epsilon)-1}\,\frac{s_{\widetilde{ir}Q}}{2\pi}\,\mathrm{d}\phi_2(p_i,p_r;p_{(ir)})\Theta(\alpha)\Theta(1-\alpha)\,, \quad (3.5)$$

where $s_{\widetilde{ir}Q} = 2\tilde{p}_{ir}\cdot Q$ and $p_{(ir)}^\mu = (1-\alpha)\tilde{p}_{ir}^\mu + \alpha Q^\mu$. The collinear momentum mapping and the implied factorization of the phase-space measure are represented graphically in figure 1. The picture on the left shows the $n$-particle phase space $\mathrm{d}\phi_n(\{p\};Q)$, where in the circle we have indicated the number of momenta. The picture on the right corresponds to eq. (3.2) (with $n-m=1$) and eq. (3.5): the two circles represent the $(n-1)$-particle phase space $\mathrm{d}\phi_{n-1}(\{\tilde{p}\}^{(ir)};Q)$ and the two-particle phase space $\mathrm{d}\phi_2(p_i,p_r;p_{(ir)})$ respectively, while the symbol $\otimes$ stands for the convolution over $\alpha$, as precisely defined in eq. (3.5).

Writing the factorized phase space in the form of eq. (3.5) has some advantages:

- It makes the symmetry property of the factorized phase space under the permutation of the factorized momenta manifest. For instance, for any function $f$,

$$\int[\mathrm{d}p_{1;n-1}^{(ir)}(p_r,\tilde{p}_{ir};Q)]\,f(p_i,p_r) = \int[\mathrm{d}p_{1;n-1}^{(ir)}(p_r,\tilde{p}_{ir};Q)]\,f(p_r,p_i)\,, \quad (3.6)$$

  which can be used to reduce the number of independent integrals.
- It exhibits the $n$-dependence of the factorized phase space explicitly. This allows for including $n$-dependent factors of $(1-\alpha)^{2d_0-2(n-2)(1-\epsilon)}\Theta(\alpha_0-\alpha)$ (with $d_0\big|_{\epsilon=0}\geq 2$) in the subtraction terms such that the integrated counterterms will be $n$-independent (for details see ref. [24]).
- Eq. (3.5) generalizes very straightforwardly for more complicated factorizations. (The formula for the general case when phase-spaces of $N$ groups of $r_1, r_2, \ldots, r_N$ partons are factorized simultaneously can be given explicitly.)

To write the factorized two-particle phase-space measure we introduce the variable $v$,

$$v = \frac{z_r - z_r^{(-)}}{z_r^{(+)} - z_r^{(-)}}\,. \tag{3.7}$$

In eq. (3.7) $z_r$ is the momentum fraction of parton $r$ in the Altarelli-Parisi splitting function that describes the $f_{(ir)} \to f_i + f_r$ collinear splittings ($f$ denotes the flavour of the partons). This momentum fraction takes values between

$$z_r^{(-)} = \frac{\alpha}{2\alpha + x - \alpha x} \tag{3.8}$$

and $z_r^{(+)} = 1 - z_r^{(-)}$ ($x = s_{\widetilde{ir}Q}/Q^2$). Using the variables $s_{ir} = 2p_i{\cdot}p_r$, and $v$ the two-particle phase-space measure reads

$$\begin{aligned} \mathrm{d}\phi_2(p_i, p_r; p_{(ir)}) \ &= \frac{s_{ir}^{-\epsilon}}{8\pi}\,\bar{S}_\epsilon\,\mathrm{d}s_{ir}\,\mathrm{d}v\,\delta\big(s_{ir} - Q^2\alpha\big(\alpha + (1-\alpha)x\big)\big) \\ &\quad \times [v\,(1-v)]^{-\epsilon}\,\Theta(1-v)\Theta(v)\,, \end{aligned} \tag{3.9}$$

where[3]

$$\bar{S}_\epsilon = \frac{(4\pi)^\epsilon}{\Gamma(1-\epsilon)}\,. \tag{3.10}$$

The integrated collinear subtraction terms involve the integrals of the (spin-averaged) Altarelli-Parisi splitting kernels over the unresolved phase space [24]

$$\frac{(4\pi)^2}{\bar{S}_\epsilon}(Q^2)^{(1+\kappa)\epsilon}\int_0^{\alpha_0}\mathrm{d}\alpha\,(1-\alpha)^{2d_0-1}\frac{s_{\widetilde{ir}Q}}{2\pi}\int \mathrm{d}\phi_2(p_i, p_r; p_{(ir)})\frac{1}{s_{ir}^{1+\kappa\epsilon}}P^{(\kappa)}_{f_i f_r}(z_i, z_r; \epsilon)\,, \quad \kappa = 0,\, 1\,. \tag{3.11}$$

As explained in ref. [24], we include harmless factors of $(1-\alpha)^{2d_0-2(n-2)(1-\epsilon)}\Theta(\alpha_0 - \alpha)$ (with $d_0|_{\epsilon=0} \geq 2$) in the subtraction terms to make their integrals independent of $n$ and to restrict the phase space over which the subtractions are non-zero. Thus $\alpha_0 \in (0,1]$ is the cut parameter controlling this restriction ($\alpha_0 = 1$ corresponds to subtracting over the full phase space) and $d_0$ is an exponent which may be fixed freely (with the constraint that $d_0|_{\epsilon=0} \geq 2$). For a more elaborate discussion, including the explanation of our eventual choice of $d_0 = 3 - 3\varepsilon$, see appendix A of ref. [24]. $P^{(0)}_{f_i f_r}$ and $P^{(1)}_{f_i f_r}$ denote the average of the tree-level and one-loop splitting kernels over the spin states of the parent parton (Altarelli-Parisi splitting functions), respectively. These spin-averaged splitting kernels depend, in general, on $z_i$ and $z_r$, with the constraint

$$z_i + z_r = 1\,, \tag{3.12}$$

[3]The $\overline{\mathrm{MS}}$ renormalization scheme as often employed in the literature uses $S_\varepsilon = (4\pi)^\varepsilon \mathrm{e}^{-\varepsilon\gamma_E}$. It is not difficult to check that in a computation at the NLO accuracy using $\bar{S}_\epsilon$ leads to the same expressions as the usual $\overline{\mathrm{MS}}$ definition. At NNLO the different normalizations lead to slightly different bookkeeping of the IR and UV poles at intermediate steps of the computation, but the physical cross section of infrared-safe observables is the same. Our normalization leads to somewhat simpler bookkeeping at the NNLO level.



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| $\delta$ | Function | $g_I^{(\pm)}(z)$ |
|---|---|---|
| 0 | $g_A$ | 1 |
| $\mp 1$ | $g_B^{(\pm)}$ | $(1-z)^{\pm\epsilon}$ |
| 0 | $g_C^{(\pm)}$ | $(1-z)^{\pm\epsilon}{}_2F_1(\pm\epsilon,\pm\epsilon,1\pm\epsilon,z)$ |
| $\pm 1$ | $g_D^{(\pm)}$ | ${}_2F_1(\pm\epsilon,\pm\epsilon,1\pm\epsilon,1-z)$ |

**Table 1:** The values of $\delta$ and $g_I^{(\pm)}(z_r)$ at which eq. (3.13) needs to be evaluated.

and are listed in appendix A. Inspecting the actual form of the Altarelli-Parisi splitting functions and using the symmetry property of the factorized phase space under the interchange $i \leftrightarrow r$, we find that (3.11) can be expressed as a linear combination of the integrals

$$\frac{(4\pi)^2}{\bar{S}_\epsilon}(Q^2)^{(1+\kappa)\epsilon}\int_0^{\alpha_0}\mathrm{d}\alpha\,(1-\alpha)^{2d_0-1}\,\frac{s_{\widetilde{ir}Q}}{2\pi}\int\mathrm{d}\phi_2(p_i,p_r;p_{(ir)})\,\frac{z_r^{k+\delta\epsilon}}{s_{ir}^{1+\kappa\epsilon}}\,g_I^{(\pm)}(z_r)\,, \qquad (3.13)$$

for $k=-1,0,1,2$, $\kappa=0,1$ and the values of $\delta$ and functions $g_I^{(\pm)}$ as given in table 1.

Using eqs. (3.7)–(3.9) and $z_r$ expressed with $v$,

$$z_r = \frac{\alpha+(1-\alpha)xv}{2\alpha+(1-\alpha)x}\,, \qquad (3.14)$$

we can see that the integrals in eq. (3.13) take the form

$$\mathcal{I}(x;\epsilon,\alpha_0,d_0;\kappa,k,\delta,g_I^{(\pm)}) = x\int_0^{\alpha_0}\mathrm{d}\alpha\,\alpha^{-1-(1+\kappa)\epsilon}\,(1-\alpha)^{2d_0-1}\,[\alpha+(1-\alpha)x]^{-1-(1+\kappa)\epsilon}$$
$$\times\int_0^1\mathrm{d}v[v\,(1-v)]^{-\epsilon}\left(\frac{\alpha+(1-\alpha)xv}{2\alpha+(1-\alpha)x}\right)^{k+\delta\epsilon}g_I^{(\pm)}\left(\frac{\alpha+(1-\alpha)xv}{2\alpha+(1-\alpha)x}\right)\,. \qquad (3.15)$$

We compute the integrals corresponding to the first two rows of table 1 in section 8.

### 3.2 Definition of the soft-type integrals

In the case of soft mapping the factorized phase-space measure can be written as

$$[\mathrm{d}p_{1;n-1}^{(r)}(p_r;Q)] = \mathrm{d}y(1-y)^{(n-2)(1-\epsilon)-1}\frac{Q^2}{2\pi}\mathrm{d}\phi_2(p_r,K;Q)$$
$$\times\Theta(y)\Theta(1-y)\,, \qquad (3.16)$$

where the timelike momentum $K$ is massive with $K^2=(1-y)Q^2$. We show the soft momentum mapping and the implied phase space factorization in figure 2. The picture on the left shows again the $n$-particle phase space $\mathrm{d}\phi_n(\{p\};Q)$, while the picture on the right corresponds to eq. (3.2) (with $n-m=1$) and eq. (3.16): the two circles represent the two-particle phase space $\mathrm{d}\phi_2(p_r,K;Q)$ and the $(n-1)$-particle phase space $\mathrm{d}\phi_{n-1}(\{\tilde{p}\}^{(r)};Q)$ respectively. The symbol $\otimes$ stands for the convolution over $y$ as defined in eq. (3.16).

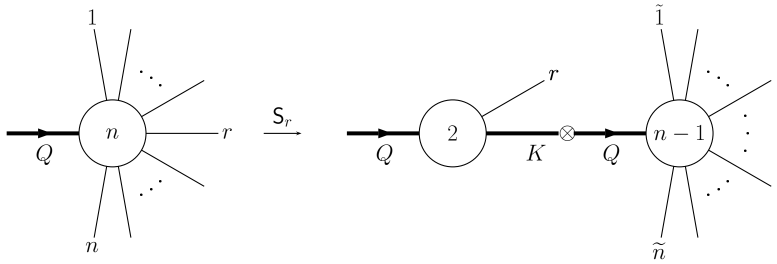


**Figure 2:** Graphical representation of the soft momentum mapping and the implied phase space factorization.



The integrated soft and soft-collinear subtraction terms involve the integral of the eikonal factor and its collinear limit over the factorized phase space of eq. (3.16) [24], namely the integrals

$$-\frac{(4\pi)^2}{\bar{S}_\epsilon}(Q^2)^{(1+\kappa)\epsilon}\int_0^{y_0}\mathrm{d}y\,(1-y)^{d_0'-1}\frac{Q^2}{2\pi}\int\mathrm{d}\phi_2(p_r,K;Q)\left(\frac{s_{ik}}{s_{ir}s_{kr}}\right)^{1+\kappa\epsilon},\quad \kappa=0,1\,, \tag{3.17}$$

$$\frac{(4\pi)^2}{\bar{S}_\epsilon}(Q^2)^{(1+\kappa)\epsilon}\int_0^{y_0}\mathrm{d}y\,(1-y)^{d_0'-1}\frac{Q^2}{2\pi}\int\mathrm{d}\phi_2(p_r,K;Q)2\left(\frac{1}{s_{ir}}\frac{z_i}{z_r}\right)^{1+\kappa\epsilon},\quad \kappa=0,1\,. \tag{3.18}$$

Here again, we included harmless factors of $(1-y)^{d_0'-(n-2)(1-\epsilon)}\Theta(y_0-y)$ (with $d_0'|_{\epsilon=0}\geq 2$) in the subtraction terms to make their integrals independent of $n$ and to restrict the phase space over which the subtractions are non-zero. Thus $y_0\in(0,1]$ is the cut parameter controlling the restriciton ($y_0=1$ corresponds to subtracting over the full phase space) and $d_0'$ is an exponent (in principle independent of $d_0$, hence the prime) which may be fixed freely (but with $d_0'|_{\epsilon=0}\geq 2$). See appendix A of ref. [24] for a more detailed discussion, including the explanation of our eventual choice of $d_0'=3-3\varepsilon$. The computation of these integrals is fairly straightforward using energy and angle variables.

In order to write the factorized phase-space measure, we choose a frame in which

$$Q^\mu=\sqrt{s}(1,\ldots)\,,\qquad \tilde{p}_i^\mu=\tilde{E}_i(1,\ldots,1)\,,\qquad \tilde{p}_k^\mu=\tilde{E}_k(1,\ldots,\sin\chi,\cos\chi)\,, \tag{3.19}$$

and

$$p_r^\mu=E_r(1,..\text{“angles”}..,\sin\vartheta\sin\varphi,\sin\vartheta\cos\varphi,\cos\vartheta)\,. \tag{3.20}$$

In eq. (3.19) the dots stand for vanishing components, while the notation “angles” in eq. (3.20) denotes the dependence of $p_r$ on the $d-3$ angular variables that can be trivially integrated. Then in terms of the scaled energy-like variable

$$\varepsilon_r=\frac{2p_r\cdot Q}{Q^2}=\frac{2E_r}{\sqrt{s}} \tag{3.21}$$

and the angular variables $\vartheta$ and $\varphi$ the two-particle phase space reads

$$\begin{aligned}\mathrm{d}\phi_2(p_r,K;Q)=&\frac{(Q^2)^{-\epsilon}}{16\pi^2}\bar{S}_\epsilon\frac{\Gamma^2(1-\epsilon)}{\Gamma(1-2\epsilon)}\,\mathrm{d}\varepsilon_r\,\varepsilon_r^{1-2\epsilon}\delta(y-\varepsilon_r)\\&\times\mathrm{d}(\cos\vartheta)\,\mathrm{d}(\cos\varphi)(\sin\vartheta)^{-2\epsilon}(\sin\varphi)^{-1-2\epsilon}\,,\end{aligned} \tag{3.22}$$

where $y \in (0,1]$ and the cosines of both angles run from $-1$ to $+1$.

To write the integrands in these variables, we observe that the precise definitions of $\tilde{p}_i$ and $\tilde{p}_k$ as given in ref. [12] imply

$$s_{ik} = (1-\varepsilon_r) s_{\tilde{i}\tilde{k}}\,, \qquad s_{ir} = s_{\tilde{i}r}\,, \qquad s_{kr} = s_{\tilde{k}r}\,, \tag{3.23}$$

and

$$s_{iQ} = (1-\varepsilon_r) s_{\tilde{i}Q} + s_{\tilde{i}r}\,. \tag{3.24}$$

From eqs. (3.19), (3.20), (3.23) and (3.24) we find

$$\frac{s_{ik}}{s_{ir}s_{kr}} = (1-\varepsilon_r)\frac{s_{\tilde{i}\tilde{k}}}{s_{\tilde{i}r}s_{\tilde{k}r}} = \frac{4Y_{\tilde{i}\tilde{k},Q}}{Q^2}\frac{(1-\varepsilon_r)}{\varepsilon_r^2}\frac{1}{(1-\cos\vartheta)(1-\cos\chi\cos\vartheta-\sin\chi\sin\vartheta\cos\varphi)}\,, \tag{3.25}$$

and

$$\frac{1}{s_{ir}}\frac{z_i}{z_r} = \frac{1}{s_{\tilde{i}r}}\frac{(1-\varepsilon_r)s_{\tilde{i}Q}+s_{\tilde{i}r}}{s_{rQ}} = \frac{1}{Q^2}\frac{1}{\varepsilon_r}\left[1+\frac{2(1-\varepsilon_r)}{\varepsilon_r(1-\cos\vartheta)}\right]. \tag{3.26}$$

In eq. (3.25) above we have set

$$Y_{\tilde{i}\tilde{k},Q} = \frac{Q^2 s_{\tilde{i}\tilde{k}}}{s_{\tilde{i}Q}s_{\tilde{k}Q}}\,. \tag{3.27}$$

Using eqs. (3.22), (3.25) and (3.26) we see that the integral of the soft subtraction term in eq. (3.17) may be written as

$$\begin{aligned}\mathcal{J}(Y_{\tilde{i}\tilde{k},Q};\epsilon,y_0,d_0';\kappa) = &-(4Y_{\tilde{i}\tilde{k},Q})^{1+\kappa\epsilon}\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\Omega^{(1+\kappa\epsilon,1+\kappa\epsilon)}(\cos\chi)\\ &\times\int_0^{y_0}\mathrm{d}y\,y^{-1-2(1+\kappa)\epsilon}(1-y)^{d_0'+\kappa\epsilon}\,,\end{aligned} \tag{3.28}$$

where $\Omega^{(i,k)}(\cos\chi)$ denotes the angular integral

$$\begin{aligned}\Omega^{(i,k)}(\cos\chi) = &\int_{-1}^{1}\mathrm{d}(\cos\vartheta)\,(\sin\vartheta)^{-2\epsilon}\int_{-1}^{1}\mathrm{d}(\cos\varphi)\,(\sin\varphi)^{-1-2\epsilon}\\ &\times(1-\cos\vartheta)^{-i}(1-\cos\chi\cos\vartheta-\sin\chi\sin\vartheta\cos\varphi)^{-k}\,.\end{aligned} \tag{3.29}$$

Furthermore, from eq. (3.19) it is easy to see that

$$\cos\chi = 1-2\,Y_{\tilde{i}\tilde{k},Q} \equiv 1-\frac{2Q^2 s_{\tilde{i}\tilde{k}}}{s_{\tilde{i}Q}s_{\tilde{k}Q}}\,. \tag{3.30}$$

We compute the soft integrals $\mathcal{J}(Y,\epsilon;y_0,d_0';\kappa)$ in section 6.

The soft-collinear subtraction term in eq. (3.18) leads to the integral

$$\begin{aligned}\mathcal{K}(\epsilon,y_0,d_0';\kappa) = &\,2\int_0^{y_0}\mathrm{d}y\,y^{-(2+\kappa)\epsilon}(1-y)^{d_0'-1}\int_{-1}^{1}\mathrm{d}(\cos\vartheta)\,(\sin\vartheta)^{-2\epsilon}\\ &\times\left[1+\frac{2(1-y)}{y(1-\cos\vartheta)}\right]^{1+\kappa\epsilon}\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\int_{-1}^{1}\mathrm{d}(\cos\varphi)\,(\sin\varphi)^{-1-2\epsilon}\,,\end{aligned} \tag{3.31}$$

which we compute in section 7.

### 3.3 Iterated integrals

In an NNLO computation, iterations of the above integrals also appear. In this paper we compute also two of those. The first one is the integration of a soft integral with a collinear one in its argument,

$$\begin{aligned}\mathcal{J}{*}\mathcal{I}(Y_{\tilde{i}\tilde{k},Q};\epsilon,\alpha_0,d_0,y_0,d_0';k) =& -4Y_{\tilde{i}\tilde{k},Q}\,\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\,\Omega^{(1,1)}(\cos\chi) \\ &\times \int_0^{y_0} \mathrm{d}y\, y^{-1-2\epsilon}(1-y)^{d_0'}\,\mathcal{I}(y;\epsilon,\alpha_0,d_0;0,k,0,1)\,,\end{aligned} \tag{3.32}$$

which we need for $k = -1, 0, 1, 2$. Details of the computation are given in section 9. The second case is when the collinear integral appears in the argument of a soft-collinear one,

$$\begin{aligned}\mathcal{K}{*}\mathcal{I}(\epsilon,\alpha_0,d_0,y_0,d_0';k) =& 2\,\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)} \int_{-1}^{1} \mathrm{d}(\cos\vartheta)\,(\sin\vartheta)^{-2\epsilon} \\ &\times \int_{-1}^{1} \mathrm{d}(\cos\varphi)\,(\sin\varphi)^{-1-2\epsilon} \int_0^{y_0} \mathrm{d}y\, y^{-1-2\epsilon}\,(1-y)^{d_0'-1} \\ &\times \frac{2-y(1+\cos\vartheta)}{1-\cos\vartheta}\,\mathcal{I}(y;\epsilon,\alpha_0,d_0;0,k,0,1)\,,\end{aligned} \tag{3.33}$$

needed again for $k = -1, 0, 1, 2$. Details of the computation are given in section 10.

## 4. One-dimensional harmonic polylogarithms

As anticipated in the introduction, it is convenient to represent the integrals depending on a single variable $x$ in terms of a general class of special functions called harmonic polylogarithms (*HPL's*) introduced in ref. [20]. The *HPL's* of weight one, i.e. depending on one index $w = -1, 0, 1$, are defined as:

$$H(-1;x) \equiv \log(1+x)\,; \quad H(0;x) \equiv \log(x)\,; \quad H(1;x) \equiv -\log(1-x)\,. \tag{4.1}$$

These functions are then just logarithms of linear functions of $x$. The *HPL's* of higher weight are defined recursively by the relation

$$H(a,\vec{w};x) \equiv \int_0^x f(a;x')\,H(\vec{w};x')\,\mathrm{d}x' \quad \text{for } a \neq 0 \text{ and } \vec{w} \neq \vec{0}_n\,, \tag{4.2}$$

i.e. in the case in which not all the indices are zero. The left-most index takes the values $a = -1, 0, 1$ and $\vec{w}$ is an $n-$dimensional vector with components $w_i = -1, 0, 1$. We call $n$ the weight of the *HPL's* , so the above relation allows one to increase the weight $w = n \to n+1$. The basis functions $f(a;x)$ are given by

$$f(-1;x) \equiv \frac{1}{1+x}\,; \quad f(0;x) \equiv \frac{1}{x}\,; \quad f(1;x) \equiv \frac{1}{1-x}\,. \tag{4.3}$$

In the case in which all indices are zero, one defines instead,

$$H(\vec{0}_n;x) \equiv \frac{1}{n!}\log^n(x)\,. \tag{4.4}$$



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The *HPL's* introduced above fulfill many interesting relations, one of the most important ones being that of generating a "shuffle algebra",

$$H(\vec{w}_1;x)\,H(\vec{w}_2;x) \;=\; \sum_{\vec{w}=\vec{w}_1\uplus\vec{w}_2} H(\vec{w};x)\,, \tag{4.5}$$

where $\vec{w}_1 \uplus \vec{w}_2$ denotes the merging of the two weight vectors $\vec{w}_1$ and $\vec{w}_2$, i.e. all possible concatenations of $\vec{w}_1$ and $\vec{w}_2$ in which relative orderings of $\vec{w}_1$ and $\vec{w}_2$ are preserved.

The basis of *HPL's* can be extended by adding some new basis functions to the set in eq. (4.3); for our computation we have to introduce the function

$$f(2;x) \;\equiv\; \frac{1}{x-2}\,. \tag{4.6}$$

The *HPL's* can be evaluated numerically in a fast and accurate way; there are various packages available for this purpose [25–27].

## 5. Two-dimensional harmonic polylogarithms

To represent integrals depending on two arguments, an extension of the *HPL's* to functions of two variables proves to be convenient [21]. Since a harmonic polylogarithm is basically a repeated integration on *one* variable, a second independent variable is introduced as a parameter entering the basis functions: $f(i;x) \;\to\; f(i,\alpha;x)$. We may say that in addition to the discrete index $i$, we have now a continuous index $\alpha$. In ref. [21] the following basis functions were originally introduced:

$$f(c_i(\alpha);x) \;=\; \frac{1}{x-c_i(\alpha)}\,, \tag{5.1}$$

where

$$c_1(\alpha) \;=\; 1-\alpha \quad \text{or} \quad c_2(\alpha) \;=\; -\alpha\,. \tag{5.2}$$

Let us remark that the above extension keeps most of the properties of the one-dimensional *HPL's*. In this work we have to introduce the following new basis functions, which are slightly more complicated than the ones above,

$$f(c_1(\alpha);x) = \frac{1}{x-c_1(\alpha)} \quad f(c_2(\alpha);x) = \frac{1}{x-c_2(\alpha)}\,, \tag{5.3}$$

with

$$c_1(\alpha) \;=\; \frac{\alpha}{\alpha-1}\,, \qquad c_2(\alpha) \;=\; \frac{2\alpha}{\alpha-1}\,. \tag{5.4}$$

The explicit definition of the two-dimensional harmonic polylogarithms (*2dHPL's* ) reads:

$$H(c_i(\alpha),\vec{w}(\alpha);x) \;\equiv\; \int_0^x f(c_i(\alpha);x')\,H(\vec{w}(\alpha);x')\,\mathrm{d}x'\,. \tag{5.5}$$

In general, the *2dHPL's* have complicated analyticity properties, with imaginary parts coming from integrating over the zeroes of the basis functions. Our computation does not involve such complications because we can always assume $0 \le x\,,\alpha \le 1$. That implies that $c_k(\alpha) < 0$ for any $k$: the denominators are never singular and the *2dHPL's* are real. The numerical evaluation of our *2dHPL's* can be achieved by extending the algorithm described and implemented in ref. [28].

### 5.1 Special values

For some special values of the argument, the *2dHPL's* reduce to ordinary one-dimensional *HPL's*. It is easy to see that for $\alpha = 0$ and $\alpha = 1$ we have

$$f(c_k(\alpha = 0); x) \;=\; f(0; x), \quad \lim_{\alpha \to 1} f(c_k(\alpha); x) = 0. \tag{5.6}$$

From this it follows that

$$\begin{aligned} &H(\ldots, c_i(\alpha = 0), \ldots; x) = H(\ldots, 0, \ldots; x), \\ &\lim_{\alpha \to 1} H(\ldots, c_i(\alpha), \ldots; x) = 0. \end{aligned} \tag{5.7}$$

Similarly, for $x = 1$, the *2dHPL's* reduce to combinations of one-dimensional *HPL's* in $\alpha$. This reduction can be performed using an extension of the algorithm presented in [21]. We first write the *2dHPL's* in $x = 1$ as the integral of the derivative with respect to $\alpha$,

$$H(\vec{w}(\alpha); 1) = H(\vec{w}(\alpha = 1); 1) + \int_1^{\alpha} \mathrm{d}\alpha' \, \frac{\partial}{\partial \alpha'} H(\vec{w}(\alpha'); 1). \tag{5.8}$$

In the case where $\vec{w}$ only contains objects of the type $c_i$, we have $H(\vec{w}(\alpha = 1); x) = 0$. Thus,

$$H(\vec{w}(\alpha); 1) = \int_1^{\alpha} \mathrm{d}\alpha' \, \frac{\partial}{\partial \alpha'} H(\vec{w}(\alpha'); 1). \tag{5.9}$$

The derivative is then carried out on the integral representation of $H(\vec{w}(\alpha'); 1)$, and integrating back gives the desired reduction of $H(\vec{w}(\alpha); 1)$ to one-dimensional *HPL's* in $\alpha$, e.g.

$$\begin{aligned} H(c_1(\alpha); 1) &= -\, H(0; \alpha)\,, \\ H(c_2(\alpha); 1) &= H(-1; \alpha) - H(0; \alpha) - \ln 2. \end{aligned} \tag{5.10}$$

### 5.2 Interchange of arguments

The basis of *2dHPL's* introduced above selects $x$ as the explicit (integration) variable and $\alpha$ as a parameter, but an alternative representation involving a repeated integration over $\alpha$ of (different) basis functions depending on $x$ as an external parameter is also possible. Therefore, we have to deal with the typical problem of analytic computations: multiple representations of the same function. It is well known that a complete analytic control requires the absence of "hidden zeroes" in the formulae. That means that one has to know all the transformation properties (identities) of the functions introduced in order to have a single representative out of each class of identical objects. In ref. [21] an algorithm was presented which allows one to interchange the roles of the two variables. The algorithm is basically the same as the one presented for the special values at $x = 1$: let us just replace everywhere $x = 1$ by $x$ in eq. (5.9). Then we have to introduce the following set of basis functions for the *2dHPL's* ,

$$f(d_k(x); \alpha) \;=\; \frac{1}{\alpha + d_k(x)}\,, \tag{5.11}$$

where

$$d_k(x) \;=\; \frac{x}{x - k}\,. \tag{5.12}$$

All the properties defined at the beginning of this section can be easily extended to this new class of denominators. One finds for example:

$$\begin{aligned} H(c_1(\alpha);x) &= H(0;x) \,-\, H(0;\alpha) \,+\, H(d_1(x);\alpha)\,, \\ H(c_2(\alpha);x) &= H(0;x) \,-\, H(0;\alpha) \,-\, \ln 2 \,+\, H(d_2(x);\alpha)\,. \end{aligned} \tag{5.13}$$

## 6. The soft integral $\mathcal{J}$

In this section we present the analytic calculation of the soft integral defined in eq. (3.28) for $\kappa = 0, 1$ and $d'_0 = D'_0 + d'_1\epsilon$, with $D'_0 \geq 2$ being an integer. The angular integral $\Omega^{(i,k)}(\cos\chi)$ was evaluated in ref. [29]. The integration over $y$ leads to a hypergeometric function, and for the complete soft integral (3.28) we obtain the analytic expression

$$\begin{aligned} \mathcal{J}(Y,\epsilon;y_0,d'_0;\kappa) = &- Y^{-(1+\kappa)\epsilon}\, y_0^{-2(1+\kappa)\epsilon}\, \frac{1}{(1+\kappa)^2\epsilon^2}\frac{\Gamma^2(1-(1+\kappa)\epsilon)}{\Gamma(1-2(1+\kappa)\epsilon)} \\ &\times {}_2F_1(-d'_0-\kappa\epsilon, -2(1+\kappa)\epsilon, 1-2(1+\kappa)\epsilon, y_0) \\ &\times {}_2F_1(-(1+\kappa)\epsilon, -(1+\kappa)\epsilon, 1-\epsilon, 1-Y)\,, \end{aligned} \tag{6.1}$$

i.e. , we only need to find the $\epsilon$-expansion of an integral of the form

$$f(x,\epsilon;n_1,n_2,n_3,r_1,r_2,r_3) = \int_0^1 \mathrm{d}t\, t^{-n_1-r_1\epsilon}\,(1-t)^{-n_2-r_2\epsilon}\,(1-xt)^{-n_3-r_3\epsilon}. \tag{6.2}$$

which can be obtained using the HypExp *Mathematica* package [30]. Nevertheless, we compute the expansion to show our procedure. The first hypergeometric function on the right hand side of eq. (6.1) is of the specific form ${}_2F_1(a,b,1+b;x)$, whose expansion reduces to the expansion of the incomplete beta function $B_x$, which is a simple case to illustrate the steps of our procedure. It involves the integrals

$$\begin{aligned} \beta(x,\epsilon;n_1,n_3,r_1,r_3) = f(x,\epsilon;n_1,0,n_3,r_1,0,r_3) &= \int_0^1 \mathrm{d}t\, t^{-n_1-r_1\epsilon}\,(1-xt)^{-n_3-r_3\epsilon} \\ &= x^{-1+n_1+r_1\epsilon}\, B_x(1-n_1-r_1\epsilon, 1-n_3-r_3\epsilon). \end{aligned} \tag{6.3}$$

The class of independent integrals can be easily obtained using partial fractioning in $x$. However, when writing down the integration-by-parts identities for the independent integrals, we have to take into account a surface term coming from the fact that the denominator in $(1-xt')$ does not vanish for $t'=1$,

$$\int_0^1 \mathrm{d}t'\, \frac{\partial}{\partial t'}\left(t'^{-n_1-r_1\epsilon}\,(1-xt')^{-n_3-r_3\epsilon}\right) = (1-x)^{-n_3-r_3\epsilon}. \tag{6.4}$$

Solving the inhomogeneous linear system we find a single master integral

$$\beta^{(1)}(x,\epsilon) = \beta(x,\epsilon;0,0,r_1,r_3), \tag{6.5}$$

which fulfills the differential equation

$$\frac{\partial}{\partial x}\beta^{(1)} = \frac{r_1\epsilon - 1}{x}\,\beta^{(1)} + \frac{(1-x)^{-r_3\epsilon}}{x}\,, \tag{6.6}$$

with initial condition

$$\beta^{(1)}(x=0;\epsilon) = \int_0^1 \mathrm{d}t'\, t'^{-r_1\epsilon} = \frac{1}{1-r_1\epsilon} = \sum_{k=0}^{\infty} r_1^k \epsilon^k \,. \tag{6.7}$$

Solving this differential equation, we obtain the expansion of the incomplete beta function in terms of *HPL's* and thus the expansion of hypergeometric functions of the form ${}_2F_1(a,b,1+b;x)$.

Turning to the general case, we note that if we want to calculate the integral (6.2) using the integration-by-parts identities, we must require $r_1 \cdot r_2 \cdot r_3 \neq 0$, because the integration-by-parts identities can exhibit poles in $r_i = 0$. It is also useful to notice that not all of the integrals are independent, but only those where just one of the indices $n_1$, $n_2$, $n_3$ is nonzero and where $n_2, n_3 \geq 0$. In fact, all other integrals can be reduced to one of this class using partial fractioning, e.g.

$$f(x,\epsilon;1,-1,1,r_1,r_2,r_3) = f(x,\epsilon;1,0,0,r_1,r_2,r_3) - (1-x)f(x,\epsilon;0,0,1,r_1,r_2,r_3)\,. \tag{6.8}$$

If $r_1 \cdot r_2 \cdot r_3 \neq 0$, we can write immediately the integration-by-parts identities for the independent integrals for $f$ obtained by partial fractioning,

$$\int_0^1 \mathrm{d}t\, \frac{\partial}{\partial t}\left(t^{-n_1-r_1\epsilon}\,(1-t)^{-n_2-r_2\epsilon}\,(1-xt)^{-n_3-r_3\epsilon}\right) = 0. \tag{6.9}$$

Solving the integration-by-parts identities we find that $f$ has two master integrals,

$$f^{(1)}(x,\epsilon) = f(x,\epsilon;0,0,0,r_1,r_2,r_3), \quad f^{(2)}(x,\epsilon) = f(x,\epsilon;0,0,1,r_1,r_2,r_3). \tag{6.10}$$

The master integrals fulfill the following differential equations

$$\begin{aligned}
\frac{\partial}{\partial x} f^{(1)} =& \frac{\epsilon r_3}{x} f^{(2)} - \frac{\epsilon r_3}{x} f^{(1)}, \\
\frac{\partial}{\partial x} f^{(2)} =& f^{(1)}\left(\frac{-\epsilon r_1 - \epsilon r_2 - \epsilon r_3 + 1}{x} + \frac{\epsilon r_1 + \ \epsilon r_2 + \epsilon r_3 - 1}{x-1}\right) + \\
& f^{(2)}\left(\frac{-\epsilon r_2 - \epsilon\ r_3}{x-1} + \frac{\epsilon r_1 + \epsilon r_2 + \epsilon r_3 - 1}{x}\right),
\end{aligned} \tag{6.11}$$

with initial condition

$$f^{(1)}(x=0,\epsilon) = f^{(2)}(x=0,\epsilon) = B(1-r_1\epsilon, 1-r_2\epsilon). \tag{6.12}$$

Solving this set of linear differential equations we can write down the $\epsilon$-expansion of the hypergeometric function in terms of *HPL's* in $x$.

The solution for the integral $\mathcal{J}$ can be easily obtained by using the expansion of the hypergeometric function we just obtained. The results for $\kappa = 0,1$ and $D_0' = 3$ can be found in appendix B.

As representative examples, in figure 3 we compare the analytic and numeric results for the $\epsilon^2$ coefficient in the expansion of $\mathcal{J}(Y,\epsilon;y_0,3-3\epsilon;\kappa)$ for $\kappa = 0,1$ and $y_0 = 0.1, 1$. The agreement between the two computations is seen to be excellent for the whole $Y$-range. We find a similar agreement for other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters.

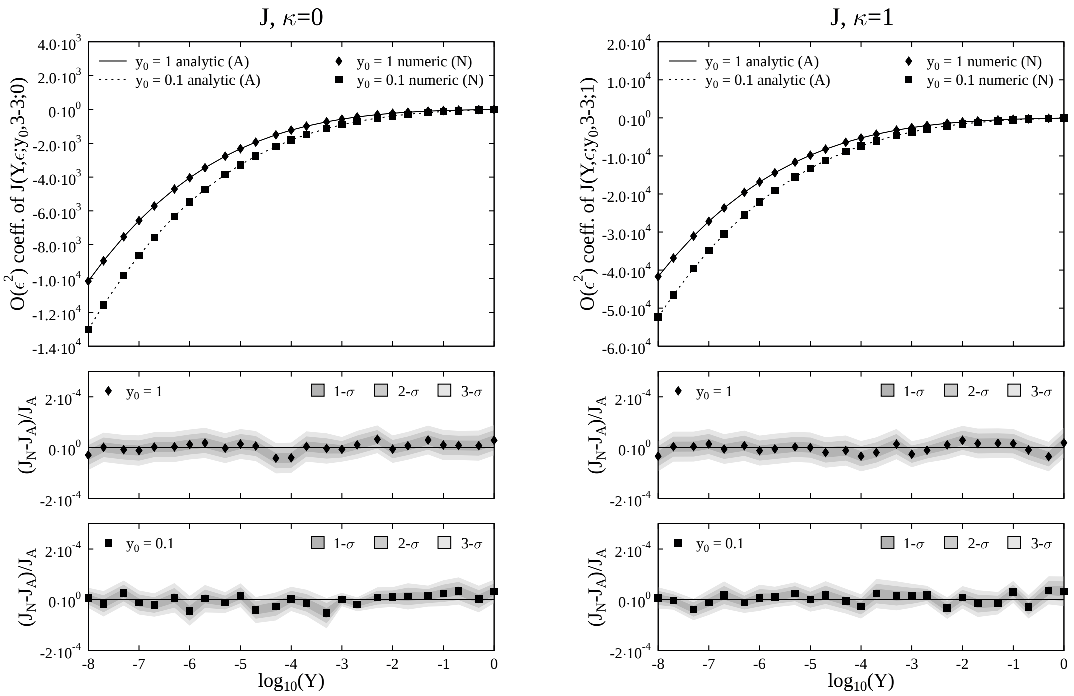


**Figure 3:** Representative results for the $\mathcal{J}$ integral. The plots show the coefficient of the $\mathrm{O}(\epsilon^2)$ term in $\mathcal{J}(Y,\epsilon;y_0,3-3\epsilon;\kappa)$ for $\kappa=0$ (left figure) and $\kappa=1$ (right figure) with $y_0=0.1,1$.

## 7. The soft-collinear integral $\mathcal{K}$

In this section we calculate analytically the soft-collinear integral defined in eq. (3.31) for $\kappa=0,1$ and $d_0'=D_0'+d_1'\epsilon$, $D_0'$ being an integer. The $\varphi$ integral is trivial to perform and we find

$$\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\int_{-1}^{1}\mathrm{d}(\cos\varphi)\,(\sin\varphi)^{-1-2\epsilon}=2^{-1+2\epsilon}. \tag{7.1}$$

Putting $\cos\vartheta=2\xi-1$, we are left with the integral

$$\mathcal{K}(\epsilon;y_0,d_0';\kappa)=2\int_0^{y_0}\mathrm{d}y\int_0^1\mathrm{d}\xi\;y^{-1-2(1+\kappa)\epsilon}(1-y)^{d_0'-1}\xi^{-\epsilon}(1-\xi)^{-1-(1+\kappa)\epsilon}(1-y\xi)^{1+\kappa\epsilon}. \tag{7.2}$$

### 7.1 Analytic result for $\kappa=0$

For $\kappa=0$, the integral decouples into a product of two one-dimensional integrals and we get

$$\mathcal{K}(\epsilon;y_0,d_0';0)=2\,B_{y_0}(-2\epsilon,d_0')\,B(1-\epsilon,-\epsilon)-2\,B_{y_0}(1-2\epsilon,d_0')\,B(2-\epsilon,-\epsilon), \tag{7.3}$$

Using the expansion of the incomplete $B$-function, carried out in section 6, we can immediately write down the expansion of $\mathcal{K}$ for $\kappa=0$. The result for $D_0'=3$ can be found in appendix C.

### 7.2 Analytic result for $\kappa = 1$

The integral (3.31) for $\kappa = 1$ reads

$$\mathcal{K}(\epsilon; y_0, d_0'; 1) = 2 \int_0^{y_0} \mathrm{d}y \int_0^1 \mathrm{d}\xi \; y^{-1-4\epsilon}(1-y)^{d_0'-1}\xi^{-\epsilon}(1-\xi)^{-1-2\epsilon}(1-y\xi)^{1+\epsilon}. \tag{7.4}$$

The analytic solution for this integral cannot be obtained in a straightforward way, due to the presence of the factor $(1-y\xi)^{\epsilon}$ that couples the two integrals. Therefore, we rewrite the integral in the form

$$\mathcal{K}(\epsilon; y_0, d_0'; 1) = 2\, y_0^{-4\epsilon}\, K(\epsilon; y_0, d_1'; 1, 1-D_0', 0, 1, -1), \tag{7.5}$$

where

$$\begin{aligned} &K(\epsilon; y_0, d_1'; n_1, n_2, n_3, n_4, n_5) \\ &\quad = \int_0^1 \mathrm{d}y \int_0^1 \mathrm{d}\xi \; y^{-n_1-4\epsilon}(1-y_0 y)^{-n_2-d_1'\epsilon}\xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0 y\xi)^{-n_5+\epsilon}. \end{aligned} \tag{7.6}$$

We now calculate the integral $K$ using the Laporta algorithm. The independent integrals can be obtained by partial fractioning in $y$ and $\xi$, using the prescription that denominators depending on both integration variables are only partial fractioned in $\xi$, e.g.

$$\begin{aligned} \frac{1}{\xi(1-y_0 y\xi)} &\to \frac{1}{\xi} + \frac{y_0 y}{1-y_0 y\xi}, \\ \frac{1}{y(1-y_0 y\xi)} &\to \frac{1}{y(1-y_0 y\xi)}. \end{aligned} \tag{7.7}$$

When writing down the integration-by-parts identities for the independent integrals, we have to take into account a surface term coming from the fact that the denominator in $(1-y_0 y)$ does not vanish in $y = 1$,

$$\begin{aligned} &\int_0^1 \mathrm{d}y \int_0^1 \mathrm{d}\xi \, \frac{\partial}{\partial\xi} \left( y^{-n_1-4\epsilon}(1-y_0 y)^{-n_2-d_1'\epsilon}\xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0 y\xi)^{-n_5+\epsilon} \right) \\ &\quad = 0 \\ &\int_0^1 \mathrm{d}y \int_0^1 \mathrm{d}\xi \, \frac{\partial}{\partial y} \left( y^{-n_1-4\epsilon}(1-y_0 y)^{-n_2-d_1'\epsilon}\xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0 y\xi)^{-n_5+\epsilon} \right) \\ &\quad = (1-y_0)^{-n_3-d_1'\epsilon}\, K_S(\epsilon; y_0, d_1'; n_3, n_4, n_5), \end{aligned} \tag{7.8}$$

with

$$K_S(\epsilon; y_0, d_1'; n_3, n_4, n_5) = \int_0^1 \mathrm{d}\xi\, \xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0\xi)^{-n_5+\epsilon}. \tag{7.9}$$

$K_S$ is just a hypergeometric function,

$$\begin{aligned} &K_S(\epsilon; y_0, d_1'; n_3, n_4, n_5) \\ &\quad = B(1-n_3-\epsilon, 1-n_4-\epsilon)\, {}_2F_1(1-n_3-\epsilon, n_5-2\epsilon, 2-n_2-n_4-3\epsilon; y_0), \end{aligned} \tag{7.10}$$

and can thus be calculated using the technique presented in section 6.

Knowing the series expansion for the surface term $K_S$, we can solve the integration-by-parts identities for the $K$ integrals, eq. (7.8). We find the following two master integrals,

$$\begin{aligned} K^{(1)}(\epsilon; y_0, d_1') &= K(\epsilon; y_0, d_1'; 0, 0, 0, 0, 0), \\ K^{(2)}(\epsilon; y_0, d_1') &= K(\epsilon; y_0, d_1'; -1, 0, 0, 0, 0), \end{aligned} \tag{7.11}$$

fulfilling the following differential equations,

$$\begin{aligned} \frac{\partial}{\partial y_0} K^{(1)} &= \frac{4\epsilon - 1}{y_0} K^{(1)} + \frac{(1-y_0)^{d_1'\epsilon}}{y_0} f^{(1)}, \\ \frac{\partial}{\partial y_0} K^{(2)} &= 2\,\frac{2\epsilon - 1}{y_0} K^{(2)} + \frac{(1-y_0)^{d_1'\epsilon}}{y_0} f^{(1)}, \end{aligned} \tag{7.12}$$

where $f^{(1)}$ denotes the master integral of the hypergeometric function calculated in section 6 and where the initial conditions are given by

$$\begin{aligned} K^{(1)}(\epsilon; y_0 = 0, d_1') &= B(1-4\epsilon, 1)\, B(1-\epsilon, 1-2\epsilon), \\ K^{(2)}(\epsilon; y_0 = 0, d_1') &= B(2-4\epsilon, 1)\, B(1-\epsilon, 1-2\epsilon). \end{aligned} \tag{7.13}$$

Plugging in the series expansion of $f^{(1)}$, and expanding $(1-y_0)^{d_1'\epsilon}$ into a power series in $\epsilon$, we can solve for the $K^{(1)}$ and $K^{(2)}$ as a power series in $\epsilon$ whose coefficients are written in terms of *HPL's* in $y_0$.

Knowing the series expansions of $K^{(1)}$ and $K^{(2)}$, we can obtain the integral $\mathcal{K}(\epsilon; y_0, d_0'; 1)$ for any fixed integer $D_0'$. In appendix C we give the explicit result for $D_0' = 3$.

## 8. The collinear integrals $\mathcal{I}$

In this section, we calculate the collinear integrals defined in eq. (3.15) for $g_I = g_A$ and $g_I = g_B$ analytically.

### 8.1 The $\mathcal{A}$-type collinear integrals for $k \geq 0$

The collinear integral for $g_I = g_A$ requires the evaluation of an integral of the form

$$\begin{aligned} \mathcal{A}(x, \epsilon; \alpha_0, d_0; \kappa, k) &= \frac{1}{x}\mathcal{I}(x, \epsilon; \alpha_0, d_0; \kappa, k, 0, g_A) \\ &= \int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \alpha^{-1-(1+\kappa)\epsilon}(1-\alpha)^{2d_0-1}[\alpha + (1-\alpha)x]^{-1-(1+\kappa)\epsilon} \\ &\quad \times v^{-\epsilon}(1-v)^{-\epsilon}\left(\frac{\alpha + (1-\alpha)xv}{2\alpha + (1-\alpha)x}\right)^k, \end{aligned} \tag{8.1}$$

where $k = -1, 0, 1, 2$, $\kappa = 0, 1$ and $d_0 = D_0 + d_1\epsilon$ with $D_0$ an integer. For $k \geq 0$ this two-dimensional integral decouples into the product of two one-dimensional integrals, out of which one is straightforward,

$$\begin{aligned} \mathcal{A}(x, \epsilon; \alpha_0, d_0; \kappa, k) &= \sum_{j=0}^{k} \binom{k}{j} x^j\, B(1+j-\epsilon, 1-\epsilon) \\ &\times \int_0^{\alpha_0} \mathrm{d}\alpha\, \alpha^{k-j-1-(1+\kappa)\epsilon}(1-\alpha)^{j+2d_0-1}[\alpha + (1-\alpha)x]^{-1-(1+\kappa)\epsilon}[2\alpha + (1-\alpha)x]^{-k}. \end{aligned} \tag{8.2}$$

We will therefore treat separately the cases $k \geq 0$ and $k < 0$.

For $k \geq 0$ the calculation of the $\mathcal{A}$ integrals reduces to the calculation of a one-dimensional integral of the form

$$
\begin{aligned}
A_+(x,&\epsilon;\alpha_0,d_1;\kappa;n_1,n_2,n_3,n_4) \\
&= \int_0^{\alpha_0} \mathrm{d}\alpha\, \alpha^{-n_1-(1+\kappa)\epsilon}(1-\alpha)^{-n_2+2d_1\epsilon}[\alpha+(1-\alpha)x]^{-n_3-(1+\kappa)\epsilon}[2\alpha+(1-\alpha)x]^{-n_4},
\end{aligned}
\tag{8.3}
$$

$n_i$ being integers. The integration-by-parts identities, including a surface term for the independent integrals, are

$$
\begin{aligned}
&\int_0^{\alpha_0} \mathrm{d}\alpha\, \frac{\partial}{\partial\alpha}\Big(\alpha^{-n_1-(1+\kappa)\epsilon}(1-\alpha)^{-n_2+2d_1\epsilon}[\alpha+(1-\alpha)x]^{-n_3-(1+\kappa)\epsilon}[2\alpha+(1-\alpha)x]^{-n_4}\Big) \\
&\qquad = \alpha_0^{-n_1-(1+\kappa)\epsilon}(1-\alpha_0)^{-n_2+2d_1\epsilon}[\alpha_0+(1-\alpha_0)x]^{-n_3-(1+\kappa)\epsilon}[2\alpha_0+(1-\alpha_0)x]^{-n_4}.
\end{aligned}
\tag{8.4}
$$

Using the Laporta algorithm we find three master integrals for $A_+$,

$$
\begin{aligned}
A_+^{(1)}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_+(x,\epsilon;\alpha_0,d_1;\kappa;0,0,0,0) = \int_0^{\alpha_0} \mathrm{d}\mu_\epsilon(\alpha;x), \\
A_+^{(2)}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_+(x,\epsilon;\alpha_0,d_1;\kappa;-1,0,0,0) = \int_0^{\alpha_0} \mathrm{d}\mu_\epsilon(\alpha;x)\,\alpha, \\
A_+^{(3)}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_+(x,\epsilon;\alpha_0,d_1;\kappa;0,0,0,1) = \int_0^{\alpha_0} \frac{\mathrm{d}\mu_\epsilon(\alpha;x)}{2\alpha+(1-\alpha)x}.
\end{aligned}
\tag{8.5}
$$

where

$$
\begin{aligned}
\mathrm{d}\mu_\epsilon(\alpha,x) &= \mathrm{d}\alpha\,\alpha^{-(1+\kappa)\epsilon}\,(1-\alpha)^{2d_1\epsilon}\,(\alpha+(1-\alpha)\,x)^{-(1+\kappa)\epsilon}, \\
&= \mathrm{d}\alpha + \epsilon\,\mathrm{d}\alpha\big(2d_1\ln(1-\alpha) - (1+\kappa)\ln\alpha - (1+\kappa)\ln(\alpha+x-\alpha x)\big) + \mathcal{O}(\epsilon^2), \\
&= \mathrm{d}\alpha + \epsilon\,\mathrm{d}\alpha\big(-(1+\kappa)H(0;\alpha) - (1+\kappa)H(0;x) - 2d_1H(1;\alpha) - (\kappa+1)H(d_1(x);\alpha)\big) \\
&\quad + \mathcal{O}(\epsilon^2).
\end{aligned}
\tag{8.6}
$$

where we used the $d$-representation of the two-dimensional *HPL's* defined in section 5,

$$
\begin{aligned}
H(d_1(x);\alpha) &= \ln\left(1+\frac{1-x}{x}\alpha\right), \\
H(d_1(x),d_1(x);\alpha) &= \frac{1}{2}\ln^2\left(1+\frac{1-x}{x}\alpha\right), \\
&\mathit{etc.}
\end{aligned}
\tag{8.7}
$$

Notice that all three master integrals are finite for $\epsilon = 0$. This allows us to expand the integrand into a power series in $\epsilon$ and integrate order by order in $\epsilon$, using the defining property of the *HPL's*, eq. (4.2). We obtain in this way the series expansion of the master integrals as a power series in $\epsilon$ whose coefficients are written in terms of the $d$-representation of the two-dimensional *HPL's* . We can then switch back to the $c$-representation using the algorithm described in section 5.

Having a representation of the master integrals, we can immediately write down the solutions for $\mathcal{A}(x,\epsilon;\alpha_0,d_0;\kappa,k)$ for $k\geq 0$ and fixed $D_0$ using eq. (8.2). In appendix D we give as an example the series expansions up to order $\epsilon^2$ for $D_0=3$.

### 8.2 The $\mathcal{A}$-type collinear integrals for $k=-1$

For $k=-1$, the integral (8.1) does not decouple, so we have to use the Laporta algorithm to calculate the full two-dimensional integral. However, for $k=-1$, we can get rid of the denominator in $(2\alpha+(1-\alpha)x)$ in the integrand. So we only have to deal with an integral of the form

$$\begin{aligned}A_-(x,\epsilon;\alpha_0,d_1;\kappa;n_1,n_2,n_3,n_4,n_5,n_6) &= \\ =\int_0^{\alpha_0}\mathrm{d}\alpha\int_0^1\mathrm{d}v\,\alpha^{-n_1-(1+\kappa)\epsilon}&(1-\alpha)^{-n_2+2d_1\epsilon}[\alpha+(1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} \\ \times v^{-n_4-\epsilon}(1-v)^{-n_5-\epsilon}&[\alpha+(1-\alpha)xv]^{-n_6},\end{aligned} \tag{8.8}$$

$n_i$ being integers.

We write down the integration-by-parts identities for $A_-$ including a surface term for $\alpha$,

$$\begin{aligned}&\int_0^{\alpha_0}\mathrm{d}\alpha\int_0^1\mathrm{d}v\,\frac{\partial}{\partial v}\Big(\alpha^{-n_1-(1+\kappa)\epsilon}(1-\alpha)^{-n_2+2d_1\epsilon}[\alpha+(1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} \\ &\quad\times v^{-n_4-\epsilon}(1-v)^{-n_5-\epsilon}[\alpha+(1-\alpha)xv]^{-n_6}\Big)=0\,, \\ &\int_0^{\alpha_0}\mathrm{d}\alpha\int_0^1\mathrm{d}v\,\frac{\partial}{\partial \alpha}\Big(\alpha^{-n_1-(1+\kappa)\epsilon}(1-\alpha)^{-n_2+2d_1\epsilon}[\alpha+(1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} \\ &\quad\times v^{-n_4-\epsilon}(1-v)^{-n_5-\epsilon}[\alpha+(1-\alpha)xv]^{-n_6}\Big) \\ &\quad=\alpha_0^{-n_1-(1+\kappa)\epsilon}(1-\alpha_0)^{-n_2+2d_1\epsilon}[\alpha_0+(1-\alpha_0)x]^{-n_3-(1+\kappa)\epsilon}\,A_{-,S}(x,\epsilon;\alpha_0,d_1;n_4,n_5,n_6)\,,\end{aligned} \tag{8.9}$$

with

$$\begin{aligned}A_{-,S}(x,\epsilon;\alpha_0,d_1;n_4,n_5,n_6) &= \int_0^1\mathrm{d}v\,v^{-n_4-\epsilon}(1-v)^{-n_5-\epsilon}[\alpha_0+(1-\alpha_0)xv]^{-n_6} \\ &=\alpha_0^{-n_6}B(1-n_4-\epsilon,1-n_5-\epsilon)\,{}_2F_1\left(1-n_4-\epsilon,n_6,2-n_4-n_5-2\epsilon;\frac{\alpha_0-1}{\alpha_0}x\right).\end{aligned} \tag{8.10}$$

As in the case of $\mathcal{K}$ we are going to evaluate this surface term using the Laporta algorithm, especially to get rid of the strange argument the hypergeometric function depends on, and to get an expression for $A_{-,S}$ in terms of two-dimensional *HPL's* in $\alpha_0$ and $x$.

**Evaluation of the surface term $A_{-,S}$.** Because the $v$ integration is over the whole range $[0,1]$, we do not have to take into account a surface term in the integration-by-parts identities for $A_{-,S}$,

$$\int_0^1\mathrm{d}v\,\frac{\partial}{\partial v}\left(v^{-n_4-\epsilon}(1-v)^{-n_5-\epsilon}[\alpha_0+(1-\alpha_0)xv]^{-n_6}\right)=0. \tag{8.11}$$

Using the Laporta algorithm we see that $A_{-,S}$ has two master integrals,

$$\begin{aligned} A^{(1)}_{-,S}(x,\epsilon;\alpha_0,d_1) &= A_{-,S}(x,\epsilon;\alpha_0,d_1;0,0,0), \\ A^{(2)}_{-,S}(x,\epsilon;\alpha_0,d_1) &= A_{-,S}(x,\epsilon;\alpha_0,d_1;0,0,1). \end{aligned} \tag{8.12}$$

$A^{(i)}_{-,S}(x,\epsilon;\alpha_0,d_1)$, $i=1,2$, are functions of the two variables $x$ and $\alpha_0$ defined on the square $[0,1]\times[0,1]$, so in principle we should write down a set of partial differential equations for the evolution of both $\alpha_0$ and $x$. However, it is easy to see that in $x=0$ we have

$$\begin{aligned} A^{(1)}_{-,S}(x=0,\epsilon;\alpha_0,d_1) &= B(1-\epsilon,1-\epsilon), \\ A^{(2)}_{-,S}(x=0,\epsilon;\alpha_0,d_1) &= \frac{1}{\alpha_0}B(1-\epsilon,1-\epsilon), \end{aligned} \tag{8.13}$$

for arbitrary $\alpha_0$. So we are in the special situation where we know the solutions on the line $\{x=0\}\times[0,1]$, and so we only need to consider the evolution for the $x$ variable. In other words, we consider $A^{(i)}_{-,S}$ as a function of $x$ only, keeping $\alpha_0$ as a parameter.

The differential equations for the evolution in the $x$ variable read

$$\begin{aligned} &\frac{\partial}{\partial x}A^{(1)}_{-,S} = 0, \\ &\frac{\partial}{\partial x}A^{(2)}_{-,S} = A^{(1)}_{-,S}\left(\frac{1-2\epsilon}{\alpha_0 x} + \frac{(\alpha_0-1)(2\epsilon-1)}{\alpha_0(\alpha_0 x - x - \alpha_0)}\right) + A^{(2)}_{-,S}\left(\frac{2\epsilon-1}{x} - \frac{(\alpha_0-1)\epsilon}{\alpha_0 x - x - \alpha_0}\right), \end{aligned} \tag{8.14}$$

and the initial condition for this system is given by eq. (8.13). As the system is already triangular, we can immdiately solve for $A^{(1)}_{-,S}$ and $A^{(2)}_{-,S}$. Notice in particular that the denominator in $(\alpha_0+x-x\alpha_0)$ will give rise to two-dimensional *HPL's* of the form $H(c_1(\alpha_0);x)$, etc.

**Evaluation of $A_-$.** Having an expression for the $\epsilon$-expansion of the surface term, we can solve the integration-by-parts identities for $A_-$, eq. (8.9). We find four master integrals,

$$\begin{aligned} A^{(1)}_{-}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_{-}(x,\epsilon;\alpha_0,d_1;\kappa;0,0,0,0,0,0), \\ A^{(2)}_{-}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_{-}(x,\epsilon;\alpha_0,d_1;\kappa;-1,0,0,0,0,0), \\ A^{(3)}_{-}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_{-}(x,\epsilon;\alpha_0,d_1;\kappa;-1,0,0,0,0,1), \\ A^{(4)}_{-}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_{-}(x,\epsilon;\alpha_0,d_1;\kappa;-2,0,0,0,0,1). \end{aligned} \tag{8.15}$$

It is easy to see that all of the master integrals are finite for $\epsilon=0$.

As in the case of the surface terms, we are only interested in the $x$ evolution, because the master integrals are known for $x=0$ for any value of $\alpha_0$,

$$\begin{aligned} A^{(1)}_{-}(x=0,\epsilon;\alpha_0,d_1;\kappa) &= B_{\alpha_0}(1-2(1+\kappa)\epsilon,1+2d_1\epsilon)\,B(1-\epsilon,1-\epsilon)\,, \\ A^{(2)}_{-}(x=0,\epsilon;\alpha_0,d_1;\kappa) &= B_{\alpha_0}(2-2(1+\kappa)\epsilon,1+2d_1\epsilon)\,B(1-\epsilon,1-\epsilon)\,, \end{aligned} \tag{8.16}$$

and

$$\begin{aligned} A^{(3)}_{-}(x=0,\epsilon;\alpha_0,d_1;\kappa) &= A^{(1)}_{-}(x=0,\epsilon;\alpha_0,d_1;\kappa)\,, \\ A^{(4)}_{-}(x=0,\epsilon;\alpha_0,d_1;\kappa) &= A^{(2)}_{-}(x=0,\epsilon;\alpha_0,d_1;\kappa)\,. \end{aligned} \tag{8.17}$$



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The master integrals $A_-^{(1)}$ and $A_-^{(2)}$ form a subtopology, i.e. the differential equations for these two master integrals close under themselves:

$$\begin{aligned}
\frac{\partial}{\partial x}A_-^{(1)} =& \frac{1-2(1+\kappa)\epsilon}{x}\,A_-^{(1)} - \frac{2(d_1\epsilon-(1+\kappa)\epsilon+1)}{x}\,A_-^{(2)} \\
&- \frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{1-(1+\kappa)\epsilon}}{x}\,A_{-,S}^{(1)}, \\
\frac{\partial}{\partial x}A_-^{(2)} =& \frac{1-(1+\kappa)\epsilon}{x-1}\,A_-^{(1)} + \frac{-2d_1\epsilon+(1+\kappa)\epsilon-2}{x-1}\,A_-^{(2)} \\
&- \frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{1-(1+\kappa)\epsilon}}{x-1}\,A_{-,S}^{(1)}.
\end{aligned} \tag{8.18}$$

The two equations can be triangularized by the change of variable

$$\begin{aligned}
\tilde{A}_-^{(1)} &= A_-^{(1)} - 2A_-^{(2)}, \\
\tilde{A}_-^{(2)} &= A_-^{(2)}.
\end{aligned} \tag{8.19}$$

The equations for the subtopology now take the triangularized form

$$\begin{aligned}
\frac{\partial}{\partial x}\tilde{A}_-^{(1)} =& \left(\frac{2\epsilon-2}{x-1}+\frac{1-2\epsilon}{x}\right)\tilde{A}_-^{(1)} + \left(\frac{4d_1+2}{x-1}-\frac{2d_1+2}{x}\right)\epsilon\,\tilde{A}_-^{(2)} \\
&+ (1-\alpha_0)^{2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\alpha_0^{1-\epsilon}\left(\frac{2-2\alpha_0}{x-1}+\frac{\alpha_0-1}{x}\right)A_{-,S}^{(1)}, \\
\frac{\partial}{\partial x}\tilde{A}_-^{(2)} =& \frac{1-\epsilon}{x-1}\tilde{A}_-^{(1)} - \frac{2d_1+1}{x-1}\,\epsilon\,\tilde{A}_-^{(2)} + (1-\alpha_0)^{2d_1\epsilon}\alpha_0^{1-\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\frac{a-1}{x-1}\,A_{-,S}^{(1)}.
\end{aligned} \tag{8.20}$$

The initial condition for $\tilde{A}_-^{(2)}$ can be obtained from eq. (8.16). For $\tilde{A}_-^{(1)}$ however, eq. (8.16) gives only trivial information. Furthermore, the solution of the differential equation has in general a pole in $x=1$, but it is easy to convince oneself that $\tilde{A}_-^{(1)}$ is finite in $x=1$, which serves as the initial condition.

We can now solve for the remaining two master integrals. The differential equations for $A_-^{(3)}$ and $A_-^{(4)}$ read

$$\begin{aligned}
\frac{\partial}{\partial x}A_-^{(3)} =& \frac{1-2(1+\kappa)\epsilon}{x}\,A_-^{(3)} - \frac{2(d_1\epsilon-(1+\kappa)\epsilon+1)}{x}\,A_-^{(4)} \\
&- \frac{(1-\alpha_0)^{2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{2-(1+\kappa)\epsilon}}{x}\,A_{-,S}^{(2)}, \\
\frac{\partial}{\partial x}A_-^{(4)} =& \left(\frac{1-2\epsilon}{x}+\frac{2\epsilon-1}{x-1}\right)A_-^{(2)} - \frac{(2+\kappa)\epsilon-2}{x-1}\,A_-^{(3)} \\
&+ \left(\frac{2\epsilon-1}{x}-\frac{(2d_1+\kappa)\epsilon)}{x-1}\right)A_-^{(4)} \\
&- \frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{2-(1+\kappa)\epsilon}}{x-1}\,A_{-,S}^{(2)}.
\end{aligned} \tag{8.21}$$

These equations can be brought into a triangularized form via the change of variable

$$\begin{aligned}
\tilde{A}_-^{(3)} &= A_-^{(3)} - A_-^{(4)}, \\
\tilde{A}_-^{(4)} &= A_-^{(4)},
\end{aligned} \tag{8.22}$$

and eq. (8.21) now reads

$$
\begin{aligned}
\frac{\partial}{\partial x}\tilde{A}_{-}^{(3)} =& \left(\frac{1-2\epsilon}{x}+\frac{2(\epsilon-1)}{x-1}\right)\tilde{A}_{-}^{(3)}+\left(\frac{2(d_1+1)\epsilon}{x-1}-\frac{2(d_1+1)\epsilon}{x}\right)\tilde{A}_{-}^{(4)} \\
&-(1-\alpha_0)^{1+2d_1\epsilon}\alpha_0^{2-\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\left(\frac{1}{x}-\frac{1}{x-1}\right)A_{-,S}^{(2)} \\
&+\left(\frac{1-2\epsilon}{x-1}+\frac{2\epsilon-1}{x}\right)A_{-}^{(2)}, \\
\frac{\partial}{\partial x}\tilde{A}_{-}^{(4)} =& \frac{2-2\epsilon}{x-1}\tilde{A}_{-}^{(3)}+\left(\frac{2\epsilon-1}{x}-\frac{2(d_1\epsilon+\epsilon)}{x-1}\right)\tilde{A}_{-}^{(4)} \\
&+\left(\frac{1-2\epsilon}{x}+\frac{2\epsilon-1}{x-1}\right)A_{-}^{(2)}-\frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\alpha_0^{2-\epsilon}}{x-1}A_{-,S}^{(2)}.
\end{aligned}
\tag{8.23}
$$

The initial condition for $A_{-}^{(3)}$ and $A_{-}^{(4)}$ can again be obtained from eq. (8.16) and requiring $A_{-}^{(3)}$ to be finite in $x=1$.

Having the analytic expressions for the master integrals, we can now easily obtain the solutions for $\mathcal{A}$ for $k=-1$ for a fixed value of $D_0$. The results for $D_0=3$ can be found in appendix D.

In figure 4 we compare the analytic and numeric results for the $\epsilon^2$ coefficient in the expansion of $\mathcal{I}(x,\epsilon;\alpha_0,3-3\epsilon;1,k,0,g_A)$ for $k=-1,2$ and $\alpha_0=0.1,1$ as representative examples. The dependence on $\alpha_0$ is not visible on the plots. The agreement between the two computations is excellent for the whole $x$-range. We find a similar agreement for other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters.

### 8.3 The $\mathcal{B}$-type collinear integrals

The $\mathcal{B}$-type collinear integrals require the evaluation of an integral of the form

$$
\begin{aligned}
\mathcal{B}(x,\epsilon;&\alpha_0,d_0;\delta,k) = \frac{1}{x}\mathcal{I}(x,\epsilon;\alpha_0,d_0;1,k,\delta,g_B) \\
&= \int_0^{\alpha_0}\mathrm{d}\alpha\int_0^1\mathrm{d}v\,\alpha^{-1-2\epsilon}(1-\alpha)^{2d_0-1}[\alpha+(1-\alpha)x]^{-1-2\epsilon}[2\alpha+(1-\alpha)x]^{-k} \\
&\quad\times v^{-\epsilon}(1-v)^{-\epsilon}[\alpha+(1-\alpha)xv]^{k+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-\delta\epsilon},
\end{aligned}
\tag{8.24}
$$

where $k=-1,0,1,2$, $\delta=\pm1$ and $d_0=D_0+d_1\epsilon$ (as before $D_0$ is an integer). Unlike the $\mathcal{A}$-type integrals, the $\mathcal{B}$-type integrals do not decouple for $k\geq 0$, due to the appearance of the $\epsilon$ pieces in the exponents, so we have to consider the denominators altogether, and have to deal with an integral of the form

$$
\begin{aligned}
B(x,&\epsilon;\alpha_0,d_1;\delta;n_1,n_2,n_3,n_4,n_5,n_6,n_7,n_8) = \\
&= \int_0^{\alpha_0}\mathrm{d}\alpha\int_0^1\mathrm{d}v\,\alpha^{-n_1-2\epsilon}(1-\alpha)^{-n_2+2d_1}[\alpha+(1-\alpha)x]^{-n_3-2\epsilon}[2\alpha+(1-\alpha)x]^{-n_4} \\
&\quad\times v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha+(1-\alpha)xv]^{-n_7+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-n_8-\delta\epsilon}.
\end{aligned}
\tag{8.25}
$$

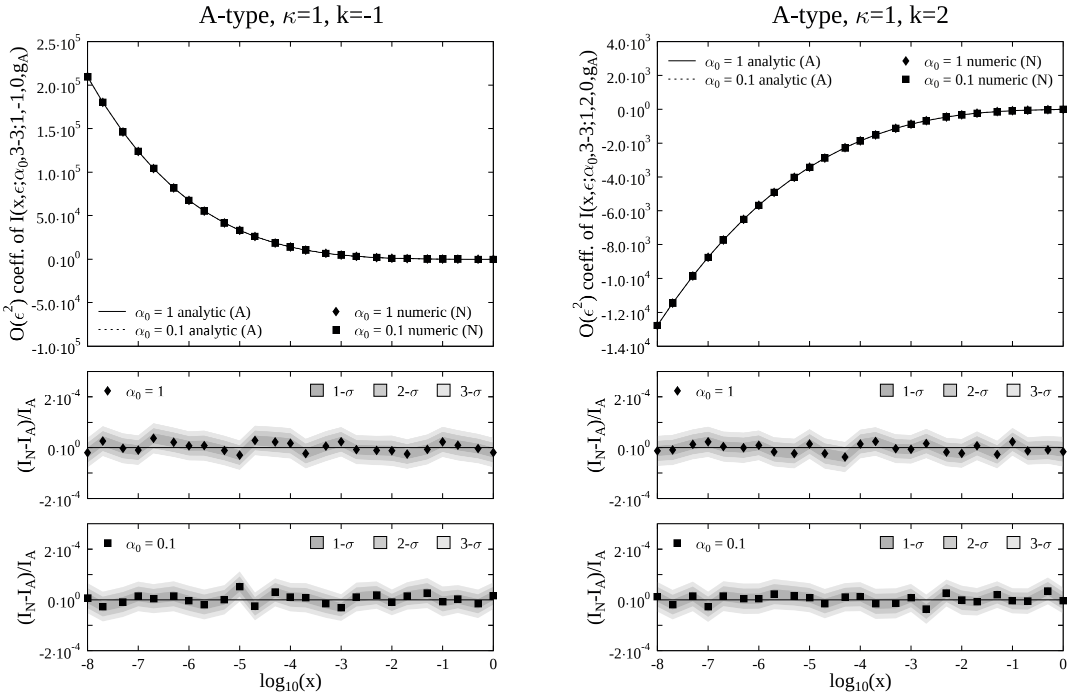


**Figure 4:** Representative results for the $\mathcal{A}$-type integrals. The plots show the coefficient of the $\mathrm{O}(\epsilon^2)$ term in $\mathcal{I}(x,\epsilon;\alpha_0,3-3\epsilon;1,k,0,g_A)$ for $k=-1$ (left figure) and $k=2$ (right figure) with $\alpha_0=0.1,1$.

We use again the Laporta algorithm, and write down the integration-by-parts identities for $B$,

$$\begin{aligned}
&\int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \frac{\partial}{\partial v}\Big(\alpha^{-n_1-2\epsilon}(1-\alpha)^{-n_2+2d_1}[\alpha+(1-\alpha)x]^{-n_3-2\epsilon}[2\alpha+(1-\alpha)x]^{-n_4} \\
&\qquad\qquad \times v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha+(1-\alpha)xv]^{-n_7+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-n_8-\delta\epsilon}\Big) \\
&\qquad = 0, \\
&\int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \frac{\partial}{\partial \alpha}\Big(\alpha^{-n_1-2\epsilon}(1-\alpha)^{-n_2+2d_1}[\alpha+(1-\alpha)x]^{-n_3-2\epsilon}[2\alpha+(1-\alpha)x]^{-n_4} \\
&\qquad\qquad \times v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha+(1-\alpha)xv]^{-n_7+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-n_8-\delta\epsilon}\Big) \\
&\quad = \alpha_0^{-n_1-2\epsilon}(1-\alpha_0)^{-n_2+2d_1}[\alpha_0+(1-\alpha_0)x]^{-n_3-2\epsilon}[2\alpha_0+(1-\alpha_0)x]^{-n_4} \\
&\qquad\qquad \times B_S(x,\epsilon;\alpha_0,d_1;\delta,k;n_5,n_6,n_7,n_8),
\end{aligned}$$

where the surface term is given by

$$\begin{aligned}
&B_S(x,\epsilon;\alpha_0,d_1;\delta;n_5,n_6,n_7,n_8) = \\
&\qquad = \int_0^1 \mathrm{d}v\, v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha_0+(1-\alpha_0)xv]^{-n_7+\delta\epsilon}[\alpha_0+(1-\alpha_0)(1-v)x]^{-n_8-\delta\epsilon}.
\end{aligned} \tag{8.26}$$

**Evaluation of the surface term $B_S$.** The surface term $B_S$ is no longer a hypergeometric function as it was the case for the $\mathcal{K}$ and $\mathcal{A}$-type integrals. It can nevertheless be easily calculated using the Laporta algorithm. The integration-by-parts identities for $B_S$ read

$$\int_0^1 \mathrm{d}v\, \frac{\partial}{\partial v}\left(v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha_0+(1-\alpha_0)xv]^{-n_7+\delta\epsilon}[\alpha_0+(1-\alpha_0)(1-v)x]^{-n_8-\delta\epsilon}\right)=0. \tag{8.27}$$

We find three master integrals for $B_S$,

$$\begin{aligned} B_S^{(1)}(x,\epsilon;\alpha_0,d_1;\delta) &= B_S(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0),\\ B_S^{(2)}(x,\epsilon;\alpha_0,d_1;\delta) &= B_S(x,\epsilon;\alpha_0,d_1;\delta;-1,0,0,0),\\ B_S^{(3)}(x,\epsilon;\alpha_0,d_1;\delta) &= B_S(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0), \end{aligned} \tag{8.28}$$

fulfilling the differential equations

$$\begin{aligned}
\frac{\partial}{\partial x}B_S^{(1)} =& B_S^{(1)}\Bigg(\frac{2\left(\epsilon\alpha_0-\alpha_0-\epsilon+1\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)}+\frac{-2\alpha_0\epsilon^2+2\epsilon^2+3\alpha_0\delta\epsilon-3\delta\epsilon-\alpha_0+1}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(\epsilon\delta-1\right)}\\
&+\frac{-2\delta\epsilon^2+2\epsilon^2-\delta\epsilon+2\epsilon-1}{\alpha_0 x(\epsilon\delta-1)}\Bigg)\\
&+B_S^{(2)}\left(\frac{4\left(\alpha_0-1\right)\left(\epsilon-1\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)}-\frac{4\left(\alpha_0-1\right)\left(\epsilon-1\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)}\right)\\
&+B_S^{(3)}\Bigg(\frac{\left(\alpha_0-1\right)\left(\delta\epsilon^2-\epsilon^2-\epsilon+1\right)}{\left(x\alpha_0-\alpha_0-x\right)\left(\epsilon\delta-1\right)}+\frac{2\delta\epsilon^2-2\epsilon^2+\delta\epsilon-2\epsilon+1}{x(\epsilon\delta-1)}\\
&-\frac{\left(\alpha_0-1\right)\left(2\delta\epsilon^2-2\epsilon^2+\delta\epsilon-2\epsilon+1\right)}{\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(\epsilon\delta-1\right)}\Bigg),\\
\frac{\partial}{\partial x}B_S^{(2)} =& -B_S^{(1)}\frac{(-\delta\epsilon+\epsilon-1)}{x}+B_S^{(2)}\frac{2(\epsilon-1)}{x}-B_S^{(3)}\frac{\alpha_0\epsilon\delta}{x},\\
\frac{\partial}{\partial x}B_S^{(3)} =& B_S^{(1)}\Bigg(-\frac{\delta\left(2\alpha_0\epsilon^2-2\epsilon^2-2\alpha_0\epsilon-2\alpha_0\delta\epsilon+2\delta\epsilon+2\epsilon+2\alpha_0\delta-2\delta\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)\left(1-\epsilon\delta\right)}\\
&+\frac{2\delta\epsilon^2-2\epsilon^2+\delta\epsilon-2\epsilon+1}{\alpha_0 x(1-\epsilon\delta)}-\frac{\delta\left(-2\alpha_0\delta\epsilon^2+2\delta\epsilon^2+3\alpha_0\epsilon-3\epsilon-\alpha_0\delta+\delta\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(1-\epsilon\delta\right)}\Bigg)\\
&+B_S^{(2)}\left(\frac{2\left(\alpha_0-1\right)\left(\epsilon-1\right)(2\epsilon-2\delta)\delta}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)\left(1-\epsilon\delta\right)}-\frac{2\left(\alpha_0-1\right)\left(\epsilon-1\right)(2\epsilon-2\delta)\delta}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(1-\epsilon\delta\right)}\right)\\
&+B_S^{(3)}\Bigg(\frac{-2\delta\epsilon^2+2\epsilon^2-\delta\epsilon+2\epsilon-1}{x(1-\epsilon\delta)}-\frac{\left(\alpha_0-1\right)\left(-2\delta\epsilon^2+2\epsilon^2-\delta\epsilon+2\epsilon-1\right)}{\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(1-\epsilon\delta\right)}\\
&+\frac{\left(\alpha_0-1\right)\left(-\delta\epsilon^2+\epsilon^2+\epsilon-1\right)}{\left(x\alpha_0-\alpha_0-x\right)\left(1-\epsilon\delta\right)}\Bigg).
\end{aligned} \tag{8.29}$$

The initial conditions for the differential equations are

$$
\begin{aligned}
B_S^{(1)}(x=0,\epsilon;\alpha_0,d_1;\delta) &= B(1-\epsilon,1-\epsilon),\\
B_S^{(2)}(x=0,\epsilon;\alpha_0,d_1;\delta) &= B(2-\epsilon,1-\epsilon),\\
B_S^{(3)}(x=0,\epsilon;\alpha_0,d_1;\delta) &= \frac{1}{\alpha_0}B(1-\epsilon,1-\epsilon),
\end{aligned}
\tag{8.30}
$$

The system can be triangularized by the change of variable

$$
\tilde{B}_S^{(1)} = B_S^{(1)} - 2B_S^{(2)}, \quad \tilde{B}_S^{(2)} = B_S^{(2)}, \quad \tilde{B}_S^{(3)} = B_S^{(3)}, \tag{8.31}
$$

and then solved in the usual way.

**Evaluation of the $B$ integral.** Solving the integration-by-parts identities for the $B$ integrals, we find nine master integrals

$$
\begin{aligned}
B^{(1)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0,0,0,0,0),\\
B^{(2)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0,0,0,0,1),\\
B^{(3)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0,0,0,1,0),\\
B^{(4)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,1,0,0,0,0),\\
B^{(5)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0,0,0,0,0),\\
B^{(6)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;-1,0,0,0,0,0,1,0),\\
B^{(7)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,1,0,0,1,0),\\
B^{(8)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0,0,0,1,0),\\
B^{(9)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0,0,0,0,1),
\end{aligned}
\tag{8.32}
$$

The master integrals $B^{(i)}$, $i \neq 4,7$, form a subtopology, i.e. the differential equations for these master integrals close under themselves. Furthermore the differential equations for $B^{(1)}, B^{(3)}, B^{(5)}$ and $B^{(6)}$ have a triangular structure in $\epsilon$, i.e. all other master integrals are suppressed by a power of $\epsilon$. For $\delta = +1$, the corresponding differential equations are given by

$$
\begin{aligned}
\frac{\partial}{\partial x}B^{(1)} = {} & \frac{2(\varepsilon-1)B_S^{(2)}(\alpha_0-1)^2}{(2d_1\varepsilon-4\,\varepsilon+1)(x\alpha_0-\alpha_0-x)} - \frac{2\varepsilon\ B^{(1)}}{x-1} + \left(\frac{4\varepsilon^2}{(2d_1\varepsilon-4\varepsilon\ +1)(x-1)} - \right.\\
& \left.\frac{\varepsilon(8\varepsilon-1)}{(2d_1\varepsilon-4\ \varepsilon+1)x}\right)B^{(2)} + \left(\frac{2\varepsilon^2}{(2d_1\ \varepsilon-4\varepsilon+1)(x-1)} - \frac{\varepsilon(4\varepsilon-1)}{(2\ d_1\varepsilon-4\varepsilon+1)x}\right)B^{(3)} + \\
& \left(\frac{2\varepsilon}{x-1} + \frac{2(2\varepsilon-1)\varepsilon}{(2d_1\varepsilon-4\varepsilon\ +1)x}\right)B^{(5)} - \frac{2\varepsilon B^{(6)}}{x} - \frac{2\varepsilon^2\ B^{(8)}}{(2d_1\varepsilon-4\varepsilon+1)(x-1)} - \\
& \frac{4\varepsilon^2\ B^{(9)}}{(2d_1\varepsilon-4\varepsilon+1)(x-1)} + \left(-\frac{2\ \varepsilon(\alpha_0-1)^2}{(2d_1\varepsilon-4\varepsilon+1)((\alpha_0-1)\ x-\alpha_0)} + \right.\\
& \left.\frac{(\alpha_0-1)^2}{(2d_1\varepsilon-4\varepsilon+1)(x\ \alpha_0-\alpha_0-x)} + \frac{2\varepsilon(\alpha_0-1)}{(2d_1\varepsilon-4\varepsilon\ +1)x}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(3)} = {} & -\frac{4\epsilon B^{(3)}}{x} + \frac{(-2d_1\epsilon+4\epsilon-1)\ B^{(6)}}{x} + \frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x},\\
\frac{\partial}{\partial x}B^{(5)} = {} & \left(\frac{-2d_1\epsilon+4\epsilon-1}{x} + \frac{2d_1\epsilon-4\epsilon\ +1}{x-1}\right)B^{(1)} + \left(\frac{-2d_1\epsilon+4\epsilon-1}{x-1} - \frac{4\ \epsilon}{x}\right)B^{(5)} + \\
& \left(\frac{\alpha_0-1}{x} - \frac{(\alpha_0-1)^2}{(\alpha_0-1)\ x-\alpha_0}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(6)} = {} & \left(\frac{1-2\epsilon}{x} + \frac{2\epsilon-1}{x-1}\right)\ B^{(1)} + \left(\frac{8\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\ (x-1)} - \frac{\epsilon}{(2d_1\epsilon-4\epsilon+1)(x-2)} - \right.\\
& \left.\frac{(8\epsilon-1)\ \epsilon}{(2d_1\epsilon-4\epsilon+1)x}\right)B^{(2)} + \left(-\frac{2\epsilon}{(x-1)^2} + \frac{2d_1\epsilon-5\epsilon+1}{(2d_1\epsilon-4\epsilon+1)\ (x-2)} - \right.\\
& \left.\frac{2(2d_1\epsilon^2-6\epsilon^2+\epsilon)}{(2d_1\epsilon\ -4\epsilon+1)(x-1)} + \frac{\epsilon-4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\ x}\right)B^{(3)} + \left(\frac{1-2\epsilon}{x-1} + \right.\\
& \left.\frac{4d_1\epsilon^2-12\ \epsilon^2-2d_1\epsilon+8\epsilon-1}{(2d_1\epsilon-4\epsilon+1)(x-2)} + \frac{2\ \epsilon(2\epsilon-1)}{(2d_1\epsilon-4\epsilon+1)x}\right)\ B^{(5)} + \left(-\frac{2\epsilon}{x-1} + \right.\\
& \left.\frac{-2d_1\epsilon+4\epsilon-1}{x-2} - \frac{1}{x}\right)B^{(6)} + \left(\frac{2\epsilon}{(x-1)^2} - \frac{4(2\ d_1\epsilon^2-5\epsilon^2+\epsilon)}{(2d_1\epsilon-4\epsilon+1)\ (x-2)} + \right.\\
& \left.\frac{4(2d_1\epsilon^2-5\epsilon^2+\epsilon)}{(2d_1\epsilon\ -4\epsilon+1)(x-1)}\right)B^{(8)} + \\
& \left(\frac{8\epsilon^2}{(2d_1\epsilon-4\ \epsilon+1)(x-2)} - \frac{8\epsilon^2}{(2d_1\epsilon-4\epsilon+1)(x-1)}\right)\ B^{(9)} + \\
& \left(\frac{4(\alpha_0-1)^3(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon\ +1)((\alpha_0-1)x-\alpha_0)} - \right.\\
& \left.\frac{4(\alpha_0-1)^2(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon\ -4\epsilon+1)(x-2)}\right)B_S^{(2)} + \\
& \left(-\frac{2(2\epsilon-1)\ (\alpha_0-1)^3}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)} + \frac{2\ \epsilon(\alpha_0-1)}{(2d_1\epsilon-4\epsilon+1)x} + \right.\\
& \left.\frac{2(\epsilon\ \alpha_0^2-\alpha_0^2-\epsilon\alpha_0+2\alpha_0-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)\ (x-2)}\right)B_S^{(1)} + \frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x-2},
\end{aligned}
$$

whereas for $\delta = -1$, the differential equations are

$$
\begin{aligned}
\frac{\partial}{\partial x}B^{(1)} =& \frac{2(\epsilon-1)B_S^{(2)}(\alpha_0-1)^2}{(2d_1\epsilon-4\epsilon+1)(x\ \alpha_0-\alpha_0-x)} - \frac{2\epsilon B^{(1)}}{x-1} + \left(\frac{\epsilon(4\epsilon\ -1)}{(2d_1\epsilon-4\epsilon+1)x} - \right.\\
& \left.\frac{2\epsilon^2}{(2d_1\epsilon-4\epsilon\ +1)(x-1)}\right)B^{(2)} + \left(\frac{\epsilon(8\epsilon-1)}{(2d_1\epsilon-4\ \epsilon+1)x} - \frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)(x-1)}\right)\\
& B^{(3)} + \left(\frac{2\epsilon}{x-1} - \frac{2\epsilon(2\epsilon-1)}{(2d_1\ \epsilon-4\epsilon+1)x}\right)B^{(5)} + \frac{2\epsilon B^{(6)}}{x} + \frac{4\ \epsilon^2 B^{(8)}}{(2d_1\epsilon-4\epsilon+1)(x-1)} +\\
& \frac{2\epsilon^2\ B^{(9)}}{(2d_1\epsilon-4\epsilon+1)(x-1)} + \left(\frac{2\epsilon\ (\alpha_0-1)^2}{(2d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)} - \right.\\
& \left.\frac{(2\epsilon-1)\ (\alpha_0-1)^2}{(2d_1\epsilon-4\epsilon+1)(x\alpha_0-\alpha_0-x)} - \frac{2\epsilon\ (\alpha_0-1)}{(2d_1\epsilon-4\epsilon+1)x}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(3)} =& -\frac{4\epsilon B^{(3)}}{x} + \frac{(-2d_1\epsilon+4\epsilon-1)\ B^{(6)}}{x} + \frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x},\\
\frac{\partial}{\partial x}B^{(5)} =& \left(\frac{-2d_1\epsilon+4\epsilon-1}{x} + \frac{2d_1\epsilon-4\epsilon\ +1}{x-1}\right)B^{(1)} + \left(\frac{-2d_1\epsilon+4\epsilon-1}{x-1} - \frac{4\ \epsilon}{x}\right)B^{(5)} +\\
& \left(\frac{\alpha_0-1}{x} - \frac{(\alpha_0-1)^2}{(\alpha_0-1)\ x-\alpha_0}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(6)} =& \left(\frac{1-2\epsilon}{x} + \frac{2\epsilon-1}{x-1}\right)\ B^{(1)} + \left(-\frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\ (x-1)} + \right.\\
& \left.\frac{\epsilon}{(2d_1\epsilon-4\epsilon+1)(x-2)} + \frac{(4\epsilon-1)\ \epsilon}{(2d_1\epsilon-4\epsilon+1)x}\right)B^{(2)} + \left(-\frac{4\epsilon}{(x-1)^2} + \right.\\
& \left.\frac{2d_1\epsilon-3\epsilon+1}{(2d_1\epsilon-4\epsilon+1)\ (x-2)} - \frac{4(2d_1\epsilon^2-2\epsilon^2+\epsilon)}{(2d_1\epsilon\ -4\epsilon+1)(x-1)} + \frac{8\epsilon^2-\epsilon}{(2d_1\epsilon-4\epsilon+1)\ x}\right)B^{(3)} +\\
& \left(\frac{1-2\epsilon}{x-1} + \frac{4d_1\epsilon^2-4\epsilon\ ^2-2d_1\epsilon+4\epsilon-1}{(2d_1\epsilon-4\epsilon+1)(x-2)} - \frac{2\epsilon\ (2\epsilon-1)}{(2d_1\epsilon-4\epsilon+1)x}\right)B^{(5)} + \left(-\frac{4\ \epsilon}{x-1} + \right.\\
& \left.\frac{-2d_1\epsilon+4\epsilon-1}{x-2} + \frac{4\epsilon\ -1}{x}\right)B^{(6)} + \left(\frac{4\epsilon}{(x-1)^2} - \frac{8(2d_1\ \epsilon^2-3\epsilon^2+\epsilon)}{(2d_1\epsilon-4\epsilon+1)(x-2)} + \right.\\
& \left.\frac{8\ (2d_1\epsilon^2-3\epsilon^2+\epsilon)}{(2d_1\epsilon-4\epsilon+1)\ (x-1)}\right)B^{(8)} + \left(\frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\ (x-1)} - \right.\\
& \left.\frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)(x-2)}\right)\ B^{(9)} + \left(\frac{4(\alpha_0-1)^3(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon\ +1)((\alpha_0-1)x-\alpha_0)} - \right.\\
& \left.\frac{4(\alpha_0-1)^2(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon\ -4\epsilon+1)(x-2)}\right)B_S^{(2)} +\\
& \left(\frac{2(\alpha_0-1)^3}{(\alpha_0-2)(2\ d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)} - \frac{2\epsilon(\alpha_0-1)}{(2d_1\ \epsilon-4\epsilon+1)x} + \right.\\
& \left.\frac{2(\epsilon\alpha_0^2-\alpha_0^2-3\epsilon\alpha_0+2\ \alpha_0+2\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)(x-2)}\right)\ B_S^{(1)} + \frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x-2}.
\end{aligned}
$$

The differential equations for $B^{(2)}, B^{(8)}$ and $B^{(9)}$ read, for $\delta = +1$,

$$
\begin{aligned}
\frac{\partial}{\partial x}B^{(2)} =&\left(\frac{4\epsilon-1}{x}-\frac{4\epsilon}{x-1}\right) B^{(2)}+\left(\frac{4\epsilon-1}{x}-\frac{2\epsilon}{x-1}\right) B^{(3)}-\frac{2(2\epsilon-1)B^{(5)}}{x}+\\
&\frac{(2d_1\epsilon-4\epsilon+1)\ B^{(6)}}{x}+\frac{2\epsilon B^{(8)}}{x-1}+\frac{4\epsilon\ B^{(9)}}{x-1}-\frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x},\\
\frac{\partial}{\partial x}B^{(8)} =&\left(\frac{2(d_1-2)\epsilon}{x-1}-\frac{2(d_1-2)\epsilon}{x}\right) B^{(3)}+\left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon\ )}{x-1}\right)B^{(8)}+\\
&\left(\frac{\alpha_0-1}{x}-\frac{(\alpha_0-1)^2}{(\alpha_0-1)x-\ \alpha_0}\right)B_S^{(3)},\\
\frac{\partial}{\partial x}B^{(9)} =&-\frac{2(\epsilon-1)B_S^{(2)}(\alpha_0-1)^2}{\epsilon(x\ \alpha_0-\alpha_0-x)^2}+\left(\frac{2(d_1-2)\epsilon}{x-1}-\frac{2(d_1-2)\epsilon}{x}\right)B^{(2)}+\\
&\left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon\ )}{x-1}\right)B^{(9)}+\left(-\frac{2(\alpha_0-1)^2}{\alpha_0(x\ \alpha_0-\alpha_0-x)}+\frac{2(\alpha_0-1)}{\alpha_0 x}+\right.\\
&\left.\frac{2\epsilon\alpha_0^2-\alpha_0^2-4\epsilon\ \alpha_0+2\alpha_0+2\epsilon-1}{\epsilon(x\alpha_0-\alpha_0-x)^2}\right) B_S^{(1)}+\left(\frac{(\alpha_0-1)^2}{(\alpha_0-1)x-\alpha_0}+\frac{1-\alpha_0}{x}\right) B_S^{(3)},
\end{aligned}
\tag{8.33}
$$

and for $\delta = -1$

$$
\begin{aligned}
\frac{\partial}{\partial x}B^{(2)} =&\left(-\frac{2\epsilon}{x-1}-\frac{1}{x}\right)B^{(2)}+\left(\frac{8\epsilon\ -1}{x}-\frac{4\epsilon}{x-1}\right)B^{(3)}-\frac{2(2\epsilon-1)\ B^{(5)}}{x}+\\
&\frac{(2d_1\epsilon-4\epsilon+1)B^{(6)}}{x}+\frac{4\epsilon\ B^{(8)}}{x-1}+\frac{2\epsilon B^{(9)}}{x-1}-\frac{(\alpha_0-1)\alpha_0\ B_S^{(3)}}{x},\\
\frac{\partial}{\partial x}B^{(8)} =&\left(\frac{2(d_1-2)\epsilon}{x-1}-\frac{2(d_1-2)\epsilon}{x}\right) B^{(3)}+\left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon\ )}{x-1}\right)B^{(8)}+\\
&\left(\frac{\alpha_0-1}{x}-\frac{(\alpha_0-1)^2}{(\alpha_0-1)x-\ \alpha_0}\right)B_S^{(3)},\\
\frac{\partial}{\partial x}B^{(9)} =&\frac{2(\epsilon-1)B_S^{(2)}(\alpha_0-1)^2}{\epsilon(x\ \alpha_0-\alpha_0-x)^2}+\left(\frac{2(d_1-2)\epsilon}{x-1}-\frac{2(d_1-2)\epsilon}{x}\right)B^{(2)}+\\
&\left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon\ )}{x-1}\right)B^{(9)}+\left(-\frac{2(\alpha_0-1)^2}{\alpha_0(x\ \alpha_0-\alpha_0-x)}+\frac{(\alpha_0-1)^2}{\epsilon(x\alpha_0-\alpha_0-x)^2}+\right.\\
&\left.\frac{2(\alpha_0-1)}{\alpha_0 x}\right)B_S^{(1)}+\left(\frac{(\alpha_0-1)^2}{(\alpha_0-1)\ x-\alpha_0}+\frac{1-\alpha_0}{x}\right)B_S^{(3)}.
\end{aligned}
\tag{8.34}
$$

Knowing the solutions for the subtopology, we can solve for the remaining two master integrals $B^{(4)}$ and $B^{(7)}$. They fulfill the following differential equations, for $\delta = +1$,

$$\begin{aligned}
\frac{\partial}{\partial x}B^{(4)} =& \left(\frac{-2d_1\epsilon+4\epsilon-1}{2x}+\frac{2d_1\epsilon-4\epsilon\ +1}{2(x-2)}\right)B^{(1)}+\left(\frac{-2d_1\epsilon+4\epsilon\ -1}{x-2}-\frac{4\epsilon}{x}\right)B^{(4)}+\\
&\left(\frac{\alpha_0-1}{2\ x}-\frac{(\alpha_0-1)^2}{2((\alpha_0-1)x-2\alpha_0)}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(7)} =& \left(\frac{(d_1-2)\epsilon}{x-2}-\frac{(d_1-2)\epsilon}{x}\right)\ B^{(3)}+\left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon\ )}{x-2}\right)B^{(7)}+\\
&\left(\frac{\alpha_0-1}{2x}-\frac{(\alpha_0-1)^2}{2\ ((\alpha_0-1)x-2\alpha_0)}\right)B_S^{(3)},
\end{aligned} \tag{8.35}$$

whereas for $\delta = -1$ the differential equations read

$$\begin{aligned}
\frac{\partial}{\partial x}B^{(4)} =& \left(\frac{-2d_1\epsilon+4\epsilon-1}{2x}+\frac{2d_1\epsilon-4\epsilon\ +1}{2(x-2)}\right)B^{(1)}+\left(\frac{-2d_1\epsilon+4\epsilon\ -1}{x-2}-\frac{4\epsilon}{x}\right)B^{(4)}+\\
&\left(\frac{\alpha_0-1}{2\ x}-\frac{(\alpha_0-1)^2}{2((\alpha_0-1)x-2\alpha_0)}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(7)} =& \left(\frac{(d_1-2)\epsilon}{x-2}-\frac{(d_1-2)\epsilon}{x}\right)\ B^{(3)}+\left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon\ )}{x-2}\right)B^{(7)}+\\
&\left(\frac{\alpha_0-1}{2x}-\frac{(\alpha_0-1)^2}{2\ ((\alpha_0-1)x-2\alpha_0)}\right)B_S^{(3)}.
\end{aligned} \tag{8.36}$$

The initial conditions are the following. At $x = 0$, we have

$$B^{(1)}(x=0,\epsilon;\alpha_0,d_1;\delta) = B^{(6)}(x=0,\epsilon;\alpha_0,d_1;\delta) = B_{\alpha_0}(1-4\epsilon,1+2d_1\epsilon)\,B(1-\epsilon,1-\epsilon). \tag{8.37}$$

At $x = 1$, we have

$$\begin{aligned}
B^{(5)}(x=1,\epsilon;\alpha_0,d_1;\delta) &= B^{(1)}(x=1,\epsilon;\alpha_0,d_1;\delta),\\
B^{(8)}(x=1,\epsilon;\alpha_0,d_1;\delta) &= B^{(2)}(x=1,\epsilon;\alpha_0,d_1;\delta),\\
B^{(9)}(x=1,\epsilon;\alpha_0,d_1;\delta) &= B^{(3)}(x=1,\epsilon;\alpha_0,d_1;\delta).
\end{aligned} \tag{8.38}$$

At $x = 2$, we have

$$\begin{aligned}
B^{(4)}(x=2,\epsilon;\alpha_0,d_1;\delta) &= \frac{1}{2}\,B^{(1)}(x=2,\epsilon;\alpha_0,d_1;\delta),\\
B^{(7)}(x=2,\epsilon;\alpha_0,d_1;\delta) &= \frac{1}{2}\,B^{(3)}(x=2,\epsilon;\alpha_0,d_1;\delta).
\end{aligned} \tag{8.39}$$

It is easy to check that $B^{(1)}$ is finite at $x = 0$ and $x = 2$. The integration constants of $B^{(2)}$ and $B^{(3)}$ can then be fixed in an implicit way by requiring the residues of the general solution for $B^{(1)}$ to vanish at $x = 0$ and $x = 2$.

Having the analytic expression for the master integrals, we can calculate the $\mathcal{B}$-type integrals for a fixed integer value of $D_0$. We give the explicit results for $D_0 = 3$ in appendix E.

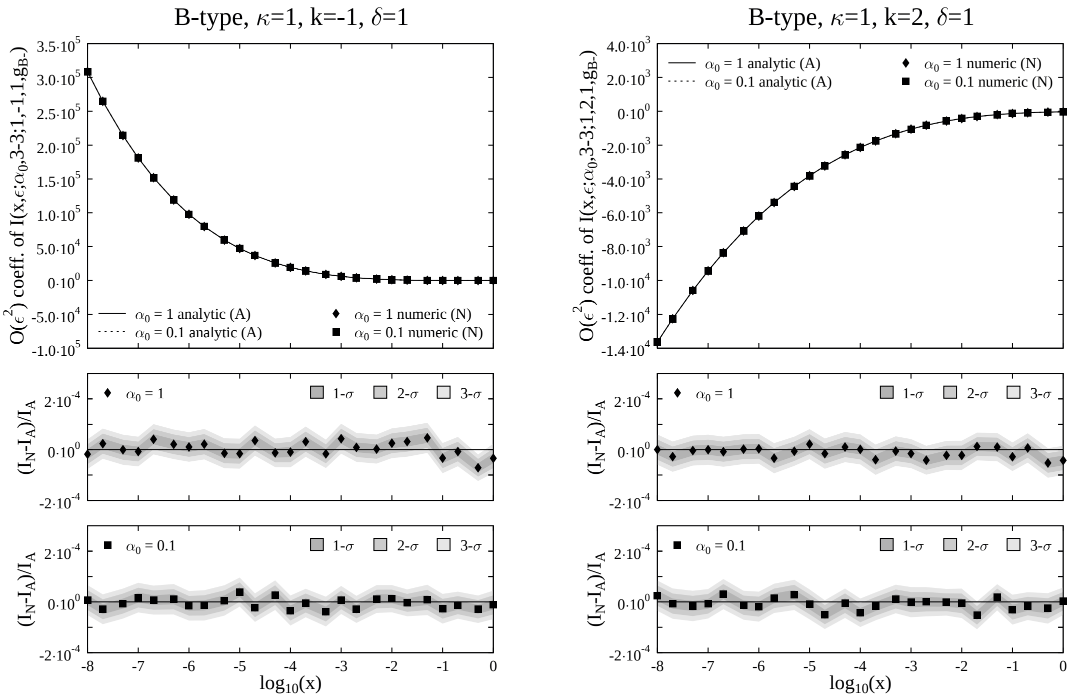


**Figure 5:** Representative results for the $\mathcal{B}$-type integrals. The plots show the coefficient of the $\mathrm{O}(\epsilon^2)$ term in $\mathcal{I}(x, \epsilon; \alpha_0, 3 - 3\epsilon; 1, k, 1, g_{B_-})$ for $k = -1$ (left figure) and $k = 2$ (right figure) with $\alpha_0 = 0.1, 1$.

In figure 5 we show some representative results of comparing the analytic and numeric computations for the $\epsilon^2$ coefficient in the expansion of $\mathcal{I}(x, \epsilon; \alpha_0, 3 - 3\epsilon; 1, k, 1, g_{B_-})$ for $k = -1, 2$ and $\alpha_0 = 0.1, 1$. The dependence on $\alpha_0$ is not visible on the plots. The two sets of results are in excellent agreement for the whole $x$-range. For other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters, we find similar agreement.

## 9. The soft $\boldsymbol{R} \times (0)$-type $\mathcal{J}{*}\mathcal{I}$ integrals

In this section we calculate the integral defined in eq. (3.32). Substituting the result for the angular integral $\Omega^{(1,1)}$, we can rewrite eq. (3.32) as

$$\begin{aligned} \mathcal{J}{*}\mathcal{I}(Y, \epsilon; y_0, d_0', \alpha_0, d_0; k) &= -Y\, B(-\epsilon, -\epsilon)\, {}_2F_1(1, 1, 1 - \epsilon; 1 - Y) \\ &\quad \times \int_0^{y_0} \mathrm{d}y\, y^{-1-2\epsilon} (1 - y)^{d_0'}\, \mathcal{I}(y; \epsilon, \alpha_0, d_0; 0, k, 0, g_A). \end{aligned} \tag{9.1}$$

The hypergeometric function can be easily evaluated using the technique described in section 6. The evaluation of the $y$ integral order by order in $\epsilon$ is a little bit more cumbersome because the integrand has two kinds of singularities,

1. The pole in $y = 0$.

2. The integral $\mathcal{I}$ is order by order logarithmically divergent for $y \sim 0$, as can be easily seen from the $\epsilon$-expansion given in appendix D.

The pole in $y = 0$ can easily be factorized by performing the integration by parts in $y$. The logarithmic singularities in $\mathcal{I}$ however are more subtle. We have to resum all these singularities before expanding the integral. We find that we can write[4]

$$\mathcal{I}(y;\epsilon,\alpha_0,d_0;0,k,0,g_A) = y^{-2\epsilon}\, I(y;\epsilon,\alpha_0,d_0;0,k,0,g_A), \tag{9.2}$$

where $I$ is a function that is order by order finite in $y = 0$. Eq. (9.1) can now be written as

$$\begin{aligned}\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;k) = &-Y\,B(-\epsilon,-\epsilon)\,{}_2F_1(1,1,1-\epsilon;1-Y)\\ &\times\left\{-\frac{1}{4\epsilon}\,y_0^{-4\epsilon}(1-y_0)^{d_0'}\,I(y_0;\epsilon,\alpha_0,d_0;0,k,0,g_A)\right.\\ &\left.+\frac{1}{4\epsilon}\int_0^{y_0}\mathrm{d}y\,y^{-4\epsilon}\frac{\partial}{\partial y}\Big[(1-y)^{d_0'}\,I(y;\epsilon,\alpha_0,d_0;0,k,0,g_A)\Big]\right\}.\end{aligned} \tag{9.3}$$

As $I$ does not have logarithmic divergences, the derivative does not produce any poles, and so the integral is uniformly convergent. We can thus just expand the integrand into a power series in $\epsilon$ and integrate order by order, using the definition of the *HPL's* ,[5] eq. (4.2). The result for $D_0 = D_0' = 3$ is given in appendix F.

As representative examples, in figure 6 we compare the analytic and numeric results for the $\epsilon^0$ coefficient in the expansion of $\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,3-3\epsilon,\alpha_0,3-3\epsilon;k)$ for $k = -1, 2$ and $y_0 = \alpha_0 = 0.1, 1$. The two computations agree very well over the whole $Y$-range. Other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters show similar agreement.

## 10. The soft-collinear $R \times (0)$-type $\mathcal{K}{*}\mathcal{I}$ integrals

In this section we calculate the integral defined in eq. (3.33). The $\varphi$ integral is given in eq. (7.1). Putting $\cos\vartheta = 2\xi - 1$, the integral can be rewritten as

$$\begin{aligned}&\mathcal{K}{*}\mathcal{I}(\epsilon;y_0,d_0',\alpha_0,d_0;k) =\\ &\quad 2\,B(1-\epsilon,-\epsilon)\int_0^{y_0}\mathrm{d}y\,y^{-1-4\epsilon}(1-y)^{d_0'}\,I(y;\epsilon,\alpha_0,d_0;0,k,0,g_A)\\ &\quad +2\,B(1-\epsilon,1-\epsilon)\int_0^{y_0}\mathrm{d}y\,y^{-4\epsilon}(1-y)^{d_0'-1}\,I(y;\epsilon,\alpha_0,d_0;0,k,0,g_A),\end{aligned} \tag{10.1}$$

where $I$ was defined in eq. (9.2). The first integral is exactly the same as in section 9. The second integral is uniformly convergent, so we can just expand under the integration sign, and integrate order by order. The result for $D_0 = D_0' = 3$ is given in appendix G.

[4]We checked this assumption explicitly on the $\epsilon$-expansion of $\mathcal{I}$ given in appendix D.

[5]Notice that the rational part of $I$ gives a non-vanishing contribution to the lower integration limit that has to be subtracted.



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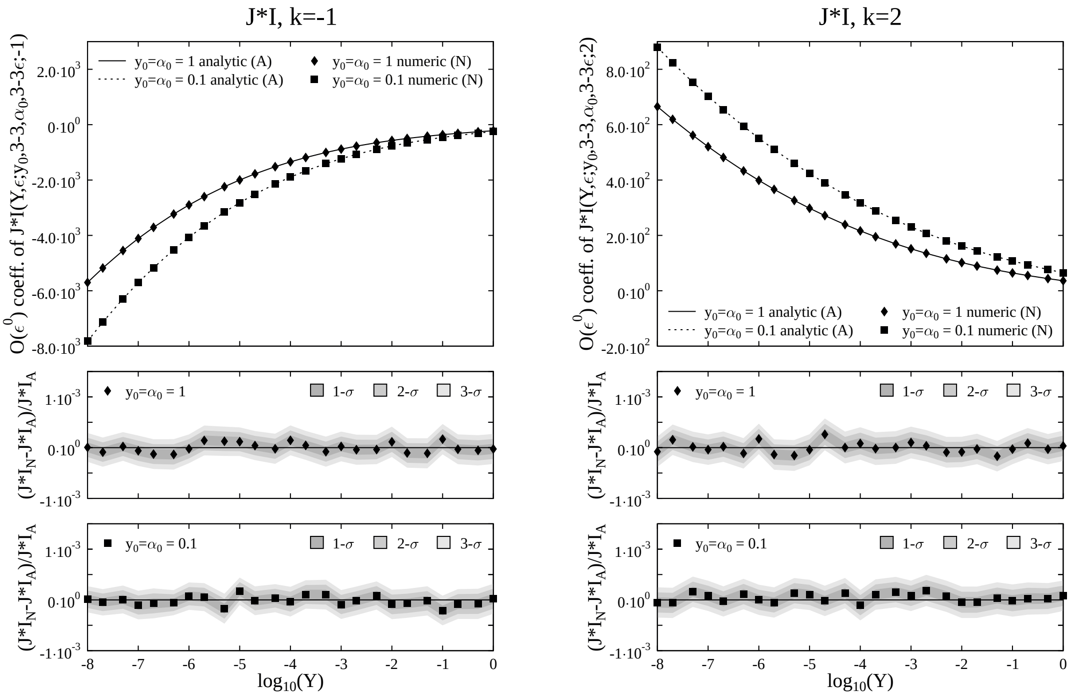


**Figure 6:** Representative results for the $\mathcal{J}*\mathcal{I}$ integrals. The plots show the coefficient of the $O(\epsilon^0)$ term in $\mathcal{J}*\mathcal{I}(Y, \epsilon; y_0, 3-3\epsilon, \alpha_0, 3-3\epsilon; k)$ for $k = -1$ (left figure) and $k = 2$ (right figure) with $y_0 = \alpha_0 = 0.1, 1$.

## 11. Numerical evaluation of integrated subtraction terms

Let us briefly discuss the numerical evaluation of the integrals which were analytically computed in the previous sections. First of all, if the singular integrals in the chosen integration variables are non-overlapping and furthermore occur in a single point in the integration region (which can always be mapped to the origin) then we can isolate the poles using standard residuum subtraction. Consider as an example the $\mathcal{K}(\epsilon; y_0, d_0'; \kappa)$ integral of eq. (7.2):

$$\mathcal{K}(\epsilon; y_0, d_0'; \kappa) = 2\int_0^{y_0} \mathrm{d}y \int_0^1 \mathrm{d}\xi \; y^{-1-2(1+\kappa)\epsilon}(1-y)^{d_0'-1}\xi^{-\epsilon}(1-\xi)^{-1-(1+\kappa)\epsilon}(1-y\xi)^{1+\kappa\epsilon}. \tag{11.1}$$

We see that the singularities come only from $y \to 0$ and $\xi \to 1$ and there are no overlapping singularities.[6] After remapping the singularity at $\xi \to 1$ to the origin by setting $\xi \to 1-\xi$, we can easily extract the poles using residuum subtraction. The finite integrals that are left over are straightforward to evaluate numerically.

In general, we encounter integrals which contain overlapping divergences. A typical

[6] Overlapping singularities would be signaled by the presence of "composite" denominators, i.e. denominators which vanish only when *both* $y \to 0$ and $\xi \to 1$, but not otherwise.

example occurs in the $\mathcal{A}$-type collinear integral for $k = -1$:

$$\mathcal{A}(x,\epsilon;\alpha_0,d_0;\kappa,-1) = \int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \alpha^{-1-(1+\kappa)\epsilon}(1-\alpha)^{2d_0-1}[\alpha-(1-\alpha)x]^{-1-(1+\kappa)\epsilon} \times v^{-\epsilon}(1-v)^{-\epsilon}\,\frac{2\alpha+(1-\alpha)x}{\alpha+(1-\alpha)xv}\,. \tag{11.2}$$

The singularities are at $\alpha \to 0$ and $v \to 0$, but the presence of the "composite" denominator $\alpha + (1-\alpha)xv$ (which vanishes only when both $\alpha \to 0$ and $v \to 0$) does not allow the use of simple residuum subtraction to isolate the poles. Instead one has to disentangle the overlapping singularities first, which we achieve by using sector decomposition [31]. This consists of the following steps

- We first transform the integral so that the range of integration is the unit square. This is easily achieved by setting $\alpha \to \alpha_0\alpha$.
- Then we split the integral into two "sectors" by inserting $1 = [\Theta(\alpha - v) + \Theta(v - \alpha)]$ in the integrand.
- Next, we transform the variables in each sector such that the integration region is remapped to the unit square. When $\alpha \geq v$, we use $v \to \alpha v$, while for $v \geq \alpha$ we need $\alpha \to v\alpha$.
- Notice that in each sector either $\alpha$ or $v$ now factorizes from the composite denominator and the remainder is finite at $\alpha = 0, v = 0$.
- We can now apply residuum subtraction in each sector to extract the $\epsilon$ poles.

As before, the finite integrals left over are straightforward to compute numerically.

We have written a *Mathematica* package for the extraction of poles using these techniques. The program produces FORTRAN codes that may immediately be used in numerical integration programs. To produce the numerical results, we used the Monte Carlo integrator VEGAS [32]. The program SECTORDECOMPOSITION of ref. [33] was used to check our implementation.

## 12. Conclusions

In this work we have analytically evaluated some of the integrals needed for computing the integrated real-virtual counterterms that appear in the subtraction scheme for computing NNLO jet cross sections proposed in refs. [12, 13]. Such integrals have to be computed once and for all and their knowledge is necessary in order to make the subtraction scheme an effective tool. Our method is an adaptation of the current technique used to compute multi-loop Feynman diagrams: after an algebraic reduction to a class of independent amplitudes, integration-by-parts identities are generated and solved with the Laporta algorithm to achieve reduction to master integrals. The latter are computed with the differential equation method and are expressed in terms of one- and two-dimensional harmonic polylogarithms; the $\epsilon$-expansion has been performed up to the required order in $\epsilon$. The numerical evaluation of harmonic polylogarithms has been treated in many works, where it has been shown that it can be fast and accurate [25, 28]; there is not any specific problem in our case either. A check of all our analytic results has been made by means of a direct numerical calculation of the integrals, typically with a relative accuracy $\lesssim \mathcal{O}(10^{-4})$. Specific properties of the present calculation are:

1. the partial fractioning in many variables of the integrands, which requires in general the introduction of new denominators;
2. the occurrence of surface terms in integration-by-parts identities, consisting of integrals of lower dimensionality than the original ones;
3. a non-trivial basis extension for two-dimensional harmonic polylogarithms, together with corresponding consistency relations in order to have complete analytic control over the results.

Our method can in principle be applied to the analytic evaluation of classes of more complicated real-virtual integrated counter-terms, such as the $C$ and $D$-type integrals of section 8, even though the solution of the ibps in the latter case can be rather lengthy and the explicit expressions of the integrals can become rather cumbersome. For more complicated integrals, it is probably convenient to modify the algorithm used in this work in order to avoid the generation of additional denominators through the multiple partial fractioning. A preliminary study shows for example that our algorithm produces a lot of new denominators in the case of 3-dimensional integrals. For example, in reducing the integral over $x$ and $y$ considered in the introduction, one should not subject the "overlapping denominator" $1/(1-xy)$ to any partial fractioning; this way one ends up with 3-denominator integrals without any additional denominator.


## Acknowledgments

C.D. is a research fellow of the *Fonds National de la Recherche Scientifque*, Belgium. This work was partly supported by MIUR under contract $2006020509_0 04$, by the EC Marie-Curie Research Training Network "Tools and Precision Calculations for Physics Discoveries at Colliders" under contract MRTN-CT-2006-035505, by the Hungarian Scientific Research Fund grand OTKA K-60432 and by the Swiss National Science Foundation (SNF) under contract 200020-117602. We thank the Galileo Galilei Institute for Theoretical Physics and the "Laboratori Nazionali di Frascati" for the hospitality and the INFN for partial support during the completion of this work.


## A. Spin-averaged splitting kernels

In this appendix we recall the explicit expressions for the spin-averaged splitting kernels that enter eq. (3.11).

The azimuthally averaged Altarelli-Parisi splitting kernels read

$$P^{(0)}_{g_i g_r}(z_i, z_r; \epsilon) = 2C_{\rm A}\left[\frac{1}{z_i} + \frac{1}{z_r} - 2 + z_i z_r\right], \tag{A.1}$$

$$P^{(0)}_{q_i \bar{q}_r}(z_i, z_r; \epsilon) = T_{\rm R}\left[1 - \frac{2}{1-\epsilon} z_i z_r\right], \tag{A.2}$$

$$P^{(0)}_{q_i g_r}(z_i, z_r; \epsilon) = C_{\rm F}\left[\frac{2}{z_r} - 2 + (1-\epsilon) z_r\right], \tag{A.3}$$

while their one-loop generalizations are

$$P^{(1)}_{f_i f_r}(z_i, z_r; \epsilon) = r^{f_i f_r}_{\rm S,ren}(z_i, z_r; \epsilon) P^{(0)}_{f_i f_r}(z_i, z_r; \epsilon) + \begin{cases} 2C_{\rm A}\, r^{gg}_{\rm N.S.}\, \dfrac{1-2\epsilon z_i z_r}{1-\epsilon}, & \text{if} \quad f_i f_r = gg\,, \\ 0\,, & \text{if} \quad f_i f_r = q\bar{q}\,, \\ C_{\rm F}\, r^{qg}_{\rm N.S.}\,(1-\epsilon z_r)\,, & \text{if} \quad f_i f_r = qg\,. \end{cases} \tag{A.4}$$

The renormalized $r^{f_i f_r}_{\rm S,ren}(z_i, z_r; \epsilon)$ functions that appear above are expressed in terms of the corresponding unrenormalized ones as

$$r^{f_i f_r}_{\rm S,ren}(z_i, z_r; \epsilon) = r^{f_i f_r}_{\rm S.}(z_i, z_r; \epsilon) - \frac{\beta_0}{2\epsilon} \frac{\bar{S}_\epsilon}{(4\pi)^2 c_\Gamma} \left[\left(\frac{\mu^2}{s_{ir}}\right)^\epsilon \cos(\pi\epsilon)\right]^{-1}, \tag{A.5}$$

where the unrenormalized $r^{f_i f_r}_{\rm S.}(z_i, z_r; \epsilon)$ factors may be written in the following form

$$\begin{aligned} r^{gg}_{\rm S.}(z_i, z_r; \epsilon) &= \frac{C_{\rm A}}{\epsilon^2}\Bigg[-\frac{\pi\epsilon}{\sin(\pi\epsilon)}\left(\frac{z_i}{z_r}\right)^\epsilon + z_i^\epsilon\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_r) \\ &\qquad -z_i^{-\epsilon}\, {}_2F_1(-\epsilon, -\epsilon, 1-\epsilon, z_r)\Bigg], \qquad\qquad (A.6) \\ r^{q\bar{q}}_{\rm S.}(z_i, z_r; \epsilon) &= \frac{1}{\epsilon^2}(C_{\rm A} - 2C_{\rm F}) + \frac{C_{\rm A}}{\epsilon^2}\Bigg[-\frac{\pi\epsilon}{\sin(\pi\epsilon)}\left(\frac{z_i}{z_r}\right)^\epsilon + z_i^\epsilon\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_r) \\ &\qquad -\frac{\pi\epsilon}{\sin(\pi\epsilon)}\left(\frac{z_r}{z_i}\right)^\epsilon + z_r^\epsilon\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_i)\Bigg] \\ &\quad + \frac{1}{1-2\epsilon}\left[\frac{\beta_0 - 3C_{\rm F}}{\epsilon} + C_{\rm A} - 2C_{\rm F} + \frac{C_{\rm A} + 4T_{\rm R}(n_{\rm f} - n_{\rm s})}{3(3-2\epsilon)}\right], \qquad (A.7) \\ r^{qg}_{\rm S.}(z_i, z_r; \epsilon) &= -\frac{1}{\epsilon^2}\Bigg[2(C_{\rm A} - C_{\rm F}) + C_{\rm A}\frac{\pi\epsilon}{\sin(\pi\epsilon)}\left(\frac{z_i}{z_r}\right)^\epsilon - C_{\rm A} z_i^\epsilon\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_r) \\ &\qquad -(C_{\rm A} - 2C_{\rm F}) z_i^{-\epsilon}\, {}_2F_1(-\epsilon, -\epsilon, 1-\epsilon, z_r)\Bigg]. \qquad\qquad (A.8) \end{aligned}$$

The $r^{f_i f_r}_{\rm N.S.}$ non-singular factors are

$$r^{gg}_{\rm N.S.} = \frac{C_{\rm A}(1-\epsilon) - 2T_{\rm R}(n_{\rm f} - n_{\rm s})}{(1-2\epsilon)(2-2\epsilon)(3-2\epsilon)}, \qquad r^{qg}_{\rm N.S.} = \frac{C_{\rm A} - C_{\rm F}}{1-2\epsilon}. \tag{A.9}$$

For QCD, $n_{\rm s} = 0$. Finally $\beta_0$ in eqs. (A.5) and (A.7) is given by

$$\beta_0 = \frac{11}{3} C_{\rm A} - \frac{4}{3} T_{\rm R} n_{\rm f} - \frac{2}{3} T_{\rm R} n_{\rm s}\,. \tag{A.10}$$



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## B. The $\mathcal{J}$ integrals

The $\varepsilon$ expansion for this integral reads

$$\mathcal{J}(Y,\varepsilon;y_0,3+d_1'\varepsilon;\kappa)=\frac{1}{\varepsilon^2}i_{-2}^{(\kappa)}+\frac{1}{\varepsilon}i_{-1}^{(\kappa)}+i_0+\varepsilon i_1^{(\kappa)}+\varepsilon^2 i_2^{(\kappa)}+\mathcal{O}\left(\varepsilon^3\right), \qquad \text{(B.1)}$$

where

$$i_{-2}^{(\kappa)}=-\frac{1}{(\kappa+1)^2},$$

$$i_{-1}^{(\kappa)}=-\frac{2y_0^3}{3(\kappa+1)}+\frac{3y_0^2}{\kappa+1}-\frac{6y_0}{\kappa+1}+\frac{2H(0;y_0)}{\kappa+1}+\frac{H(0;Y)}{\kappa+1},$$

$$i_0^{(\kappa)}=\frac{2d_1'y_0^3}{9(3\kappa+1)}+\frac{2d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{8\kappa y_0^3}{9(3\kappa+1)}-\frac{4y_0^3}{9(3\kappa+1)}-\frac{7d_1'y_0^2}{6(3\kappa+1)}-\frac{7d_1'\kappa y_0^2}{6(3\kappa+1)}+\frac{20\kappa y_0^2}{3(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}+$$
$$\frac{11d_1'y_0}{3(3\kappa+1)}+\frac{11d_1'\kappa y_0}{3(3\kappa+1)}-\frac{86\kappa y_0}{3(3\kappa+1)}-\frac{12y_0}{3\kappa+1}+\left(\frac{4y_0^3}{3}-6y_0^2+12y_0\right)H(0;y_0)+\Big(\frac{2y_0^3}{3}-3y_0^2+6y_0-$$
$$2H(0;y_0)\Big)H(0;Y)+\Big(\frac{2d_1'y_0^3}{3(3\kappa+1)}+\frac{2d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{4\kappa y_0^3}{3(3\kappa+1)}-\frac{3d_1'y_0^2}{3\kappa+1}-\frac{3d_1'\kappa y_0^2}{3\kappa+1}-\frac{6\kappa y_0^2}{3\kappa+1}+\frac{6d_1'y_0}{3\kappa+1}+$$
$$\frac{6d_1'\kappa y_0}{3\kappa+1}+\frac{12\kappa y_0}{3\kappa+1}-\frac{11d_1'}{3(3\kappa+1)}-\frac{11d_1'\kappa}{3(3\kappa+1)}-\frac{22\kappa}{3(3\kappa+1)}\Big)H(1;y_0)-4H(0,0;y_0)-H(0,0;Y)+\Big(-$$
$$\frac{2\kappa d_1'}{(\kappa+1)^2}-\frac{2d_1'}{(\kappa+1)^2}-\frac{4\kappa}{(\kappa+1)^2}\Big)H(0,1;y_0)-H(1,0;Y),$$

$$i_1^{(\kappa)}=$$
$$-\frac{2d_1'^2y_0^3}{27(3\kappa+1)}+\frac{8d_1'y_0^3}{27(3\kappa+1)}-\frac{2d_1'^2\kappa y_0^3}{27(3\kappa+1)}+\frac{16d_1'\kappa y_0^3}{27(3\kappa+1)}-\frac{28\kappa y_0^3}{27(3\kappa+1)}-\frac{8y_0^3}{27(3\kappa+1)}+\frac{17d_1'^2y_0^2}{36(3\kappa+1)}-\frac{22d_1'y_0^2}{9(3\kappa+1)}+\frac{17d_1'^2\kappa y_0^2}{36(3\kappa+1)}-$$
$$\frac{49d_1'\kappa y_0^2}{9(3\kappa+1)}+\frac{73\kappa y_0^2}{6(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}-\frac{49d_1'^2y_0}{18(3\kappa+1)}+\frac{151d_1'y_0}{9(3\kappa+1)}-\frac{49d_1'^2\kappa y_0}{18(3\kappa+1)}+\frac{355d_1'\kappa y_0}{9(3\kappa+1)}-\frac{319\kappa y_0}{3(3\kappa+1)}-\frac{24y_0}{3\kappa+1}+\Big(-$$
$$\frac{4d_1'y_0^3}{9(3\kappa+1)}-\frac{4d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{40\kappa y_0^3}{9(3\kappa+1)}+\frac{8y_0^3}{9(3\kappa+1)}+\frac{7d_1'y_0^2}{3(3\kappa+1)}+\frac{7d_1'\kappa y_0^2}{3\kappa+1}-\frac{98\kappa y_0^2}{3(3\kappa+1)}-\frac{6y_0^2}{3\kappa+1}-\frac{22d_1'y_0}{3(3\kappa+1)}-\frac{22d_1'\kappa y_0}{3\kappa+1}+$$
$$\frac{416\kappa y_0}{3(3\kappa+1)}+\frac{24y_0}{3\kappa+1}\Big)H(0;y_0)+\Big(-\frac{2d_1'^2y_0^3}{9(3\kappa+1)}+\frac{4d_1'y_0^3}{9(3\kappa+1)}-\frac{2d_1'^2\kappa y_0^3}{9(3\kappa+1)}+\frac{4d_1'\kappa y_0^3}{9(3\kappa+1)}+\frac{4\kappa y_0^3}{3(3\kappa+1)}+\frac{7d_1'^2y_0^2}{6(3\kappa+1)}-$$
$$\frac{3d_1'y_0^2}{3\kappa+1}+\frac{7d_1'^2\kappa y_0^2}{6(3\kappa+1)}-\frac{13d_1'\kappa y_0^2}{3(3\kappa+1)}-\frac{29\kappa y_0^2}{3(3\kappa+1)}-\frac{11d_1'^2y_0}{3(3\kappa+1)}+\frac{12d_1'y_0}{3\kappa+1}-\frac{11d_1'^2\kappa y_0}{3(3\kappa+1)}+\frac{64d_1'\kappa y_0}{3(3\kappa+1)}+\frac{122\kappa y_0}{3(3\kappa+1)}+\frac{49d_1'^2}{18(3\kappa+1)}-$$
$$\frac{85d_1'}{9(3\kappa+1)}+\frac{49d_1'^2\kappa}{18(3\kappa+1)}-\frac{157d_1'\kappa}{9(3\kappa+1)}-\frac{97\kappa}{3(3\kappa+1)}\Big)H(1;y_0)+\frac{1}{6}\pi^2H(1;Y)+\Big(-\frac{56\kappa y_0^3}{3(3\kappa+1)}-\frac{8y_0^3}{3(3\kappa+1)}+\frac{84\kappa y_0^2}{3\kappa+1}+$$
$$\frac{12y_0^2}{3\kappa+1}-\frac{168\kappa y_0}{3\kappa+1}-\frac{24y_0}{3\kappa+1}\Big)H(0,0;y_0)+\Big(-\frac{14\kappa y_0^3}{3(3\kappa+1)}-\frac{2y_0^3}{3(3\kappa+1)}+\frac{21\kappa y_0^2}{3\kappa+1}+\frac{3y_0^2}{3\kappa+1}-\frac{42\kappa y_0}{3\kappa+1}-\frac{6y_0}{3\kappa+1}+$$
$$\Big(\frac{14\kappa}{(\kappa+1)^2}+\frac{2}{(\kappa+1)^2}\Big)H(0;y_0)\Big)H(0,0;Y)+\Big(-\frac{4d_1'y_0^3}{3(3\kappa+1)}-\frac{4d_1'\kappa y_0^3}{3\kappa+1}-\frac{16\kappa y_0^3}{3(3\kappa+1)}+\frac{6d_1'y_0^2}{3\kappa+1}+\frac{18d_1'\kappa y_0^2}{3\kappa+1}+$$
$$\frac{24\kappa y_0^2}{3\kappa+1}-\frac{12d_1'y_0}{3\kappa+1}-\frac{36d_1'\kappa y_0}{3\kappa+1}-\frac{48\kappa y_0}{3\kappa+1}\Big)H(0,1;y_0)+H(0;Y)\Big(-\frac{2d_1'y_0^3}{9(3\kappa+1)}-\frac{2d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{20\kappa y_0^3}{9(3\kappa+1)}+\frac{4y_0^3}{9(3\kappa+1)}+$$
$$\frac{7d_1'y_0^2}{6(3\kappa+1)}+\frac{7d_1'\kappa y_0^2}{2(3\kappa+1)}-\frac{49\kappa y_0^2}{3(3\kappa+1)}-\frac{3y_0^2}{3\kappa+1}-\frac{11d_1'y_0}{3(3\kappa+1)}-\frac{11d_1'\kappa y_0}{3\kappa+1}+\frac{208\kappa y_0}{3(3\kappa+1)}+\frac{12y_0}{3\kappa+1}+\Big(-\frac{28\kappa y_0^3}{3(3\kappa+1)}-\frac{4y_0^3}{3(3\kappa+1)}+$$
$$\frac{42\kappa y_0^2}{3\kappa+1}+\frac{6y_0^2}{3\kappa+1}-\frac{84\kappa y_0}{3\kappa+1}-\frac{12y_0}{3\kappa+1}\Big)H(0;y_0)+\Big(-\frac{2d_1'y_0^3}{3(3\kappa+1)}-\frac{2d_1'\kappa y_0^3}{3\kappa+1}-\frac{8\kappa y_0^3}{3(3\kappa+1)}+\frac{3d_1'y_0^2}{3\kappa+1}+\frac{9d_1'\kappa y_0^2}{3\kappa+1}+\frac{12\kappa y_0^2}{3\kappa+1}-$$
$$\frac{6d_1'y_0}{3\kappa+1}-\frac{18d_1'\kappa y_0}{3\kappa+1}-\frac{24\kappa y_0}{3\kappa+1}+\frac{11d_1'}{3(3\kappa+1)}+\frac{11d_1'\kappa}{3\kappa+1}+\frac{44\kappa}{3(3\kappa+1)}\Big)H(1;y_0)+\Big(\frac{28\kappa}{(\kappa+1)^2}+\frac{4}{(\kappa+1)^2}\Big)H(0,0;y_0)+$$
$$\Big(\frac{6\kappa d_1'}{(\kappa+1)^2}+\frac{2d_1'}{(\kappa+1)^2}+\frac{8\kappa}{(\kappa+1)^2}\Big)H(0,1;y_0)\Big)+\Big(-\frac{4d_1'y_0^3}{3(3\kappa+1)}-\frac{4d_1'\kappa y_0^3}{3\kappa+1}-\frac{16\kappa y_0^3}{3(3\kappa+1)}+\frac{6d_1'y_0^2}{3\kappa+1}+\frac{18d_1'\kappa y_0^2}{3\kappa+1}+$$
$$\frac{24\kappa y_0^2}{3\kappa+1}-\frac{12d_1'y_0}{3\kappa+1}-\frac{36d_1'\kappa y_0}{3\kappa+1}-\frac{48\kappa y_0}{3\kappa+1}+\frac{22d_1'}{3(3\kappa+1)}+\frac{22d_1'\kappa}{3\kappa+1}+\frac{88\kappa}{3(3\kappa+1)}\Big)H(1,0;y_0)+\Big(-\frac{14\kappa y_0^3}{3(3\kappa+1)}-$$
$$\frac{2y_0^3}{3(3\kappa+1)}+\frac{21\kappa y_0^2}{3\kappa+1}+\frac{3y_0^2}{3\kappa+1}-\frac{42\kappa y_0}{3\kappa+1}-\frac{6y_0}{3\kappa+1}+\Big(\frac{14\kappa}{(\kappa+1)^2}+\frac{2}{(\kappa+1)^2}\Big)H(0;y_0)\Big)H(1,0;Y)+\Big(-\frac{2d_1'^2y_0^3}{3(3\kappa+1)}-$$
$$\frac{2d_1'^2\kappa y_0^3}{3(3\kappa+1)}-\frac{8d_1'\kappa y_0^3}{3(3\kappa+1)}-\frac{4\kappa y_0^3}{3(3\kappa+1)}+\frac{3d_1'^2y_0^2}{3\kappa+1}+\frac{3d_1'^2\kappa y_0^2}{3\kappa+1}+\frac{12d_1'\kappa y_0^2}{3\kappa+1}+\frac{6\kappa y_0^2}{3\kappa+1}-\frac{6d_1'^2y_0}{3\kappa+1}-\frac{6d_1'^2\kappa y_0}{3\kappa+1}-\frac{24d_1'\kappa y_0}{3\kappa+1}-$$
$$\frac{12\kappa y_0}{3\kappa+1}+\frac{11d_1'^2}{3(3\kappa+1)}+\frac{11d_1'^2\kappa}{3(3\kappa+1)}+\frac{44d_1'\kappa}{3(3\kappa+1)}+\frac{22\kappa}{3(3\kappa+1)}\Big)H(1,1;y_0)+\Big(\frac{56\kappa}{(\kappa+1)^2}+\frac{8}{(\kappa+1)^2}\Big)H(0,0,0;y_0)+$$

$$\left(\frac{7\kappa}{(\kappa+1)^2}+\frac{1}{(\kappa+1)^2}\right)H(0,0,0;Y)+\left(\frac{12\kappa d_1'}{(\kappa+1)^2}+\frac{4d_1'}{(\kappa+1)^2}+\frac{16\kappa}{(\kappa+1)^2}\right)H(0,0,1;y_0)+\left(\frac{12\kappa d_1'}{(\kappa+1)^2}+\right.$$
$$\left.\frac{4d_1'}{(\kappa+1)^2}+\frac{16\kappa}{(\kappa+1)^2}\right)H(0,1,0;y_0)+\left(\frac{7\kappa}{(\kappa+1)^2}+\frac{1}{(\kappa+1)^2}\right)H(0,1,0;Y)+\left(\frac{2\kappa d_1'^2}{(\kappa+1)^2}+\frac{2d_1'^2}{(\kappa+1)^2}+\right.$$
$$\left.\frac{8\kappa d_1'}{(\kappa+1)^2}+\frac{4\kappa}{(\kappa+1)^2}\right)H(0,1,1;y_0)+H(1,0,0;Y)+H(1,1,0;Y)+\frac{22\kappa\zeta_3}{3\kappa+1}+\frac{2\zeta_3}{3\kappa+1},$$

$$i_2^{(\kappa)}=\frac{2\kappa y_0^3 d_1'^3}{81(3\kappa+1)}+\frac{2y_0^3 d_1'^3}{81(3\kappa+1)}-\frac{43\kappa y_0^2 d_1'^3}{216(3\kappa+1)}-\frac{43y_0^2 d_1'^3}{216(3\kappa+1)}+\frac{251\kappa y_0 d_1'^3}{108(3\kappa+1)}+\frac{251y_0 d_1'^3}{108(3\kappa+1)}-\frac{8\kappa y_0^3 d_1'^2}{27(3\kappa+1)}-$$
$$\frac{4y_0^3 d_1'^2}{27(3\kappa+1)}+\frac{31\kappa y_0^2 d_1'^2}{9(3\kappa+1)}+\frac{167y_0^2 d_1'^2}{108(3\kappa+1)}-\frac{833\kappa y_0 d_1'^2}{18(3\kappa+1)}-\frac{542y_0 d_1'^2}{27(3\kappa+1)}+\frac{28\kappa y_0^3 d_1'}{27(3\kappa+1)}+\frac{8y_0^3 d_1'}{27(3\kappa+1)}-\frac{1663\kappa y_0^2 d_1'}{108(3\kappa+1)}-$$
$$\frac{205y_0^2 d_1'}{54(3\kappa+1)}+\frac{12815\kappa y_0 d_1'}{54(3\kappa+1)}+\frac{1481y_0 d_1'}{27(3\kappa+1)}-\frac{92\kappa y_0^3}{81(3\kappa+1)}-\frac{16y_0^3}{81(3\kappa+1)}+\frac{245\kappa y_0^2}{12(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}-\frac{2141\kappa y_0}{6(3\kappa+1)}-\frac{48y_0}{3\kappa+1}+$$
$$\left(\frac{2\kappa y_0^3 d_1'^3}{27(3\kappa+1)}+\frac{2y_0^3 d_1'^3}{27(3\kappa+1)}-\frac{17\kappa y_0^2 d_1'^3}{36(3\kappa+1)}-\frac{17y_0^2 d_1'^3}{36(3\kappa+1)}+\frac{49\kappa y_0 d_1'^3}{18(3\kappa+1)}+\frac{49y_0 d_1'^3}{18(3\kappa+1)}-\frac{251\kappa d_1'^3}{108(3\kappa+1)}-\frac{251d_1'^3}{108(3\kappa+1)}-\right.$$
$$\frac{4\kappa y_0^3 d_1'^2}{9(3\kappa+1)}-\frac{8y_0^3 d_1'^2}{27(3\kappa+1)}+\frac{9\kappa y_0^2 d_1'^2}{2(3\kappa+1)}+\frac{22y_0^2 d_1'^2}{9(3\kappa+1)}-\frac{34\kappa y_0 d_1'^2}{3\kappa+1}-\frac{151y_0 d_1'^2}{9(3\kappa+1)}+\frac{539\kappa d_1'^2}{18(3\kappa+1)}+\frac{395d_1'^2}{27(3\kappa+1)}+\frac{4\kappa y_0^3 d_1'}{27(3\kappa+1)}+$$
$$\frac{8y_0^3 d_1'}{27(3\kappa+1)}-\frac{77\kappa y_0^2 d_1'}{18(3\kappa+1)}-\frac{3y_0^2 d_1'}{3\kappa+1}+\frac{451\kappa y_0 d_1'}{9(3\kappa+1)}+\frac{24y_0 d_1'}{3\kappa+1}-\frac{2483\kappa d_1'}{54(3\kappa+1)}-\frac{575d_1'}{27(3\kappa+1)}+\frac{4\kappa y_0^3}{3(3\kappa+1)}-\frac{91\kappa y_0^2}{6(3\kappa+1)}+$$
$$\left.\frac{391\kappa y_0}{3(3\kappa+1)}-\frac{233\kappa}{2(3\kappa+1)}\right)H(1;y_0)+\left(\frac{8d_1'y_0^3}{9(3\kappa+1)}+\frac{56d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{176\kappa y_0^3}{9(3\kappa+1)}-\frac{16y_0^3}{9(3\kappa+1)}-\frac{14d_1'y_0^2}{3(3\kappa+1)}-\frac{98d_1'\kappa y_0^2}{3(3\kappa+1)}+\right.$$
$$\left.\frac{428\kappa y_0^2}{3(3\kappa+1)}+\frac{12y_0^2}{3\kappa+1}+\frac{44d_1'y_0}{3(3\kappa+1)}+\frac{308d_1'\kappa y_0}{3(3\kappa+1)}-\frac{1808\kappa y_0}{3(3\kappa+1)}-\frac{48y_0}{3\kappa+1}\right)H(0,0;y_0)+\left(\frac{4d_1'^2y_0^3}{9(3\kappa+1)}-\frac{8d_1'y_0^3}{9(3\kappa+1)}+\right.$$
$$\frac{4d_1'^2\kappa y_0^3}{3(3\kappa+1)}-\frac{8d_1'\kappa y_0^3}{3(3\kappa+1)}-\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{7d_1'^2y_0^2}{3(3\kappa+1)}+\frac{6d_1'y_0^2}{3\kappa+1}-\frac{7d_1'^2\kappa y_0^2}{3\kappa+1}+\frac{70d_1'\kappa y_0^2}{3(3\kappa+1)}+\frac{116\kappa y_0^2}{3(3\kappa+1)}+\frac{22d_1'^2y_0}{3(3\kappa+1)}-$$
$$\left.\frac{24d_1'y_0}{3\kappa+1}+\frac{22d_1'^2\kappa y_0}{3\kappa+1}-\frac{328d_1'\kappa y_0}{3(3\kappa+1)}-\frac{488\kappa y_0}{3(3\kappa+1)}\right)H(0,1;y_0)+H(0,0;Y)\left(\frac{2d_1'y_0^3}{9(3\kappa+1)}+\frac{14d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{44\kappa y_0^3}{9(3\kappa+1)}-\right.$$
$$\frac{4y_0^3}{9(3\kappa+1)}-\frac{7d_1'y_0^2}{6(3\kappa+1)}-\frac{49d_1'\kappa y_0^2}{6(3\kappa+1)}+\frac{107\kappa y_0^2}{3(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}+\frac{11d_1'y_0}{3(3\kappa+1)}+\frac{77d_1'\kappa y_0}{3(3\kappa+1)}-\frac{452\kappa y_0}{3(3\kappa+1)}-\frac{12y_0}{3\kappa+1}+$$
$$\left(\frac{20\kappa y_0^3}{3\kappa+1}+\frac{4y_0^3}{3(3\kappa+1)}-\frac{90\kappa y_0^2}{3\kappa+1}-\frac{6y_0^2}{3\kappa+1}+\frac{180\kappa y_0}{3\kappa+1}+\frac{12y_0}{3\kappa+1}\right)H(0;y_0)+\left(\frac{2d_1'y_0^3}{3(3\kappa+1)}+\frac{14d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{16\kappa y_0^3}{3(3\kappa+1)}-\right.$$
$$\left.\frac{3d_1'y_0^2}{3\kappa+1}-\frac{21d_1'\kappa y_0^2}{3\kappa+1}-\frac{24\kappa y_0^2}{3\kappa+1}+\frac{6d_1'y_0}{3\kappa+1}+\frac{42d_1'\kappa y_0}{3\kappa+1}+\frac{48\kappa y_0}{3\kappa+1}-\frac{11d_1'}{3(3\kappa+1)}-\frac{77d_1'\kappa}{3(3\kappa+1)}-\frac{88\kappa}{3(3\kappa+1)}\right)H(1;y_0)+$$
$$\left.\left(-\frac{60\kappa}{(\kappa+1)^2}-\frac{4}{(\kappa+1)^2}\right)H(0,0;y_0)+\left(-\frac{14\kappa d_1'}{(\kappa+1)^2}-\frac{2d_1'}{(\kappa+1)^2}-\frac{16\kappa}{(\kappa+1)^2}\right)H(0,1;y_0)\right)+\left(-\frac{7\pi^2\kappa}{6(3\kappa+1)}-\right.$$
$$\left.\frac{\pi^2}{6(3\kappa+1)}\right)H(0,1;Y)+\left(\frac{4d_1'^2y_0^3}{9(3\kappa+1)}-\frac{8d_1'y_0^3}{9(3\kappa+1)}+\frac{4d_1'^2\kappa y_0^3}{3(3\kappa+1)}-\frac{8d_1'\kappa y_0^3}{3(3\kappa+1)}-\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{7d_1'^2y_0^2}{3(3\kappa+1)}+\frac{6d_1'y_0^2}{3\kappa+1}-\right.$$
$$\frac{7d_1'^2\kappa y_0^2}{3\kappa+1}+\frac{70d_1'\kappa y_0^2}{3(3\kappa+1)}+\frac{116\kappa y_0^2}{3(3\kappa+1)}+\frac{22d_1'^2y_0}{3(3\kappa+1)}-\frac{24d_1'y_0}{3\kappa+1}+\frac{22d_1'^2\kappa y_0}{3\kappa+1}-\frac{328d_1'\kappa y_0}{3(3\kappa+1)}-\frac{488\kappa y_0}{3(3\kappa+1)}-\frac{49d_1'^2}{9(3\kappa+1)}+$$
$$\left.\frac{170d_1'}{9(3\kappa+1)}-\frac{49d_1'^2\kappa}{3(3\kappa+1)}+\frac{266d_1'\kappa}{3(3\kappa+1)}+\frac{388\kappa}{3(3\kappa+1)}\right)H(1,0;y_0)+\left(\frac{2d_1'y_0^3}{9(3\kappa+1)}+\frac{14d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{44\kappa y_0^3}{9(3\kappa+1)}-\frac{4y_0^3}{9(3\kappa+1)}-\right.$$
$$\frac{7d_1'y_0^2}{6(3\kappa+1)}-\frac{49d_1'\kappa y_0^2}{6(3\kappa+1)}+\frac{107\kappa y_0^2}{3(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}+\frac{11d_1'y_0}{3(3\kappa+1)}+\frac{77d_1'\kappa y_0}{3(3\kappa+1)}-\frac{452\kappa y_0}{3(3\kappa+1)}-\frac{12y_0}{3\kappa+1}+\left(\frac{20\kappa y_0^3}{3\kappa+1}+\frac{4y_0^3}{3(3\kappa+1)}-\right.$$
$$\left.\frac{90\kappa y_0^2}{3\kappa+1}-\frac{6y_0^2}{3\kappa+1}+\frac{180\kappa y_0}{3\kappa+1}+\frac{12y_0}{3\kappa+1}\right)H(0;y_0)+\left(\frac{2d_1'y_0^3}{3(3\kappa+1)}+\frac{14d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{3d_1'y_0^2}{3\kappa+1}-\frac{21d_1'\kappa y_0^2}{3\kappa+1}-\right.$$
$$\left.\frac{24\kappa y_0^2}{3\kappa+1}+\frac{6d_1'y_0}{3\kappa+1}+\frac{42d_1'\kappa y_0}{3\kappa+1}+\frac{48\kappa y_0}{3\kappa+1}-\frac{11d_1'}{3(3\kappa+1)}-\frac{77d_1'\kappa}{3(3\kappa+1)}-\frac{88\kappa}{3(3\kappa+1)}\right)H(1;y_0)+\left(-\frac{60\kappa}{(\kappa+1)^2}-\right.$$
$$\left.\left.\frac{4}{(\kappa+1)^2}\right)H(0,0;y_0)+\left(-\frac{14\kappa d_1'}{(\kappa+1)^2}-\frac{2d_1'}{(\kappa+1)^2}-\frac{16\kappa}{(\kappa+1)^2}\right)H(0,1;y_0)+\frac{2\kappa\pi^2}{3(3\kappa+1)}\right)H(1,0;Y)+$$
$$\left(\frac{2\kappa y_0^3 d_1'^3}{9(3\kappa+1)}+\frac{2y_0^3 d_1'^3}{9(3\kappa+1)}-\frac{7\kappa y_0^2 d_1'^3}{6(3\kappa+1)}-\frac{7y_0^2 d_1'^3}{6(3\kappa+1)}+\frac{11\kappa y_0 d_1'^3}{3(3\kappa+1)}+\frac{11y_0 d_1'^3}{3(3\kappa+1)}-\frac{49\kappa d_1'^3}{18(3\kappa+1)}-\frac{49d_1'^3}{18(3\kappa+1)}-\frac{4y_0^3 d_1'^2}{9(3\kappa+1)}+\right.$$
$$\frac{2\kappa y_0^2 d_1'^2}{3\kappa+1}+\frac{3y_0^2 d_1'^2}{3\kappa+1}-\frac{14\kappa y_0 d_1'^2}{3\kappa+1}-\frac{12y_0 d_1'^2}{3\kappa+1}+\frac{12\kappa d_1'^2}{3\kappa+1}+\frac{85d_1'^2}{9(3\kappa+1)}-\frac{20\kappa y_0^3 d_1'}{9(3\kappa+1)}+\frac{17\kappa y_0^2 d_1'}{3\kappa+1}-\frac{74\kappa y_0 d_1'}{3\kappa+1}+\frac{533\kappa d_1'}{9(3\kappa+1)}-$$
$$\left.\frac{4\kappa y_0^3}{3(3\kappa+1)}+\frac{29\kappa y_0^2}{3(3\kappa+1)}-\frac{122\kappa y_0}{3(3\kappa+1)}+\frac{97\kappa}{3(3\kappa+1)}\right)H(1,1;y_0)-\frac{1}{6}\pi^2H(1,1;Y)+\left(\frac{80\kappa y_0^3}{3\kappa+1}+\frac{16y_0^3}{3(3\kappa+1)}-\right.$$
$$\left.\frac{360\kappa y_0^2}{3\kappa+1}-\frac{24y_0^2}{3\kappa+1}+\frac{720\kappa y_0}{3\kappa+1}+\frac{48y_0}{3\kappa+1}\right)H(0,0,0;y_0)+\left(\frac{10\kappa y_0^3}{3\kappa+1}+\frac{2y_0^3}{3(3\kappa+1)}-\frac{45\kappa y_0^2}{3\kappa+1}-\frac{3y_0^2}{3\kappa+1}+\frac{90\kappa y_0}{3\kappa+1}+\right.$$
$$\left.\frac{6y_0}{3\kappa+1}+\left(-\frac{30\kappa}{(\kappa+1)^2}-\frac{2}{(\kappa+1)^2}\right)H(0;y_0)\right)H(0,0,0;Y)+\left(\frac{8d_1'y_0^3}{3(3\kappa+1)}+\frac{56d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{64\kappa y_0^3}{3(3\kappa+1)}-\frac{12d_1'y_0^2}{3\kappa+1}-\right.$$
$$\left.\frac{84d_1'\kappa y_0^2}{3\kappa+1}-\frac{96\kappa y_0^2}{3\kappa+1}+\frac{24d_1'y_0}{3\kappa+1}+\frac{168d_1'\kappa y_0}{3\kappa+1}+\frac{192\kappa y_0}{3\kappa+1}\right)H(0,0,1;y_0)+\left(\frac{8d_1'y_0^3}{3(3\kappa+1)}+\frac{56d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{64\kappa y_0^3}{3(3\kappa+1)}-\right.$$
$$\left.\frac{12d_1'y_0^2}{3\kappa+1}-\frac{84d_1'\kappa y_0^2}{3\kappa+1}-\frac{96\kappa y_0^2}{3\kappa+1}+\frac{24d_1'y_0}{3\kappa+1}+\frac{168d_1'\kappa y_0}{3\kappa+1}+\frac{192\kappa y_0}{3\kappa+1}\right)H(0,1,0;y_0)+\left(\frac{10\kappa y_0^3}{3\kappa+1}+\frac{2y_0^3}{3(3\kappa+1)}-\right.$$

$$\frac{45\kappa y_0^2}{3\kappa+1} - \frac{3y_0^2}{3\kappa+1} + \frac{90\kappa y_0}{3\kappa+1} + \frac{6y_0}{3\kappa+1} + \Big(-\frac{30\kappa}{(\kappa+1)^2} - \frac{2}{(\kappa+1)^2}\Big)H(0;y_0)\Big) H(0,1,0;Y) + \Big(\frac{4d_1'^2 y_0^3}{3(3\kappa+1)} +$$
$$\frac{4d_1'^2\kappa y_0^3}{3\kappa+1} + \frac{32d_1'\kappa y_0^3}{3(3\kappa+1)} + \frac{16\kappa y_0^3}{3(3\kappa+1)} - \frac{6d_1'^2 y_0^2}{3\kappa+1} - \frac{18d_1'^2\kappa y_0^2}{3\kappa+1} - \frac{48d_1'\kappa y_0^2}{3\kappa+1} - \frac{24\kappa y_0^2}{3\kappa+1} + \frac{12d_1'^2 y_0}{3\kappa+1} + \frac{36d_1'^2\kappa y_0}{3\kappa+1} + \frac{96d_1'\kappa y_0}{3\kappa+1} +$$
$$\frac{48\kappa y_0}{3\kappa+1}\Big)H(0,1,1;y_0) + \Big(\frac{8d_1'y_0^3}{3(3\kappa+1)} + \frac{56d_1'\kappa y_0^3}{3(3\kappa+1)} + \frac{64\kappa y_0^3}{3(3\kappa+1)} - \frac{12d_1'y_0^2}{3\kappa+1} - \frac{84d_1'\kappa y_0^2}{3\kappa+1} - \frac{96\kappa y_0^2}{3\kappa+1} + \frac{24d_1'y_0}{3\kappa+1} +$$
$$\frac{168d_1'\kappa y_0}{3\kappa+1} + \frac{192\kappa y_0}{3\kappa+1} - \frac{44d_1'}{3(3\kappa+1)} - \frac{308d_1'\kappa}{3(3\kappa+1)} - \frac{352\kappa}{3(3\kappa+1)}\Big)H(1,0,0;y_0) + \Big(\frac{14\kappa y_0^3}{3(3\kappa+1)} + \frac{2y_0^3}{3(3\kappa+1)} - \frac{21\kappa y_0^2}{3\kappa+1} -$$
$$\frac{3y_0^2}{3\kappa+1} + \frac{42\kappa y_0}{3\kappa+1} + \frac{6y_0}{3\kappa+1} + \Big(-\frac{14\kappa}{(\kappa+1)^2} - \frac{2}{(\kappa+1)^2}\Big)H(0;y_0)\Big) H(1,0,0;Y) + \Big(\frac{4d_1'^2y_0^3}{3(3\kappa+1)} + \frac{4d_1'^2\kappa y_0^3}{3\kappa+1} +$$
$$\frac{32d_1'\kappa y_0^3}{3(3\kappa+1)} + \frac{16\kappa y_0^3}{3(3\kappa+1)} - \frac{6d_1'^2y_0^2}{3\kappa+1} - \frac{18d_1'^2\kappa y_0^2}{3\kappa+1} - \frac{48d_1'\kappa y_0^2}{3\kappa+1} - \frac{24\kappa y_0^2}{3\kappa+1} + \frac{12d_1'^2y_0}{3\kappa+1} + \frac{36d_1'^2\kappa y_0}{3\kappa+1} + \frac{96d_1'\kappa y_0}{3\kappa+1} + \frac{48\kappa y_0}{3\kappa+1} -$$
$$\frac{22d_1'^2}{3(3\kappa+1)} - \frac{22d_1'^2\kappa}{3\kappa+1} - \frac{176d_1'\kappa}{3(3\kappa+1)} - \frac{88\kappa}{3(3\kappa+1)}\Big) H(1,0,1;y_0) + \Big(\frac{4d_1'^2y_0^3}{3(3\kappa+1)} + \frac{4d_1'^2\kappa y_0^3}{3\kappa+1} + \frac{32d_1'\kappa y_0^3}{3(3\kappa+1)} + \frac{16\kappa y_0^3}{3(3\kappa+1)} -$$
$$\frac{6d_1'^2y_0^2}{3\kappa+1} - \frac{18d_1'^2\kappa y_0^2}{3\kappa+1} - \frac{48d_1'\kappa y_0^2}{3\kappa+1} - \frac{24\kappa y_0^2}{3\kappa+1} + \frac{12d_1'^2y_0}{3\kappa+1} + \frac{36d_1'^2\kappa y_0}{3\kappa+1} + \frac{96d_1'\kappa y_0}{3\kappa+1} + \frac{48\kappa y_0}{3\kappa+1} - \frac{22d_1'^2}{3(3\kappa+1)} - \frac{22d_1'^2\kappa}{3\kappa+1} -$$
$$\frac{176d_1'\kappa}{3(3\kappa+1)} - \frac{88\kappa}{3(3\kappa+1)}\Big) H(1,1,0;y_0) + \Big(\frac{14\kappa y_0^3}{3(3\kappa+1)} + \frac{2y_0^3}{3(3\kappa+1)} - \frac{21\kappa y_0^2}{3\kappa+1} - \frac{3y_0^2}{3\kappa+1} + \frac{42\kappa y_0}{3\kappa+1} + \frac{6y_0}{3\kappa+1} + \Big(-\frac{14\kappa}{(\kappa+1)^2} -$$
$$\frac{2}{(\kappa+1)^2}\Big)H(0;y_0)\Big)H(1,1,0;Y) + \Big(\frac{2\kappa y_0^3 d_1'^3}{3(3\kappa+1)} + \frac{2y_0^3d_1'^3}{3(3\kappa+1)} - \frac{3\kappa y_0^2 d_1'^3}{3\kappa+1} - \frac{3y_0^2d_1'^3}{3\kappa+1} + \frac{6\kappa y_0 d_1'^3}{3\kappa+1} + \frac{6y_0d_1'^3}{3\kappa+1} -$$
$$\frac{11\kappa d_1'^3}{3(3\kappa+1)} - \frac{11d_1'^3}{3(3\kappa+1)} + \frac{4\kappa y_0^3 d_1'^2}{3\kappa+1} - \frac{18\kappa y_0^2 d_1'^2}{3\kappa+1} + \frac{36\kappa y_0 d_1'^2}{3\kappa+1} - \frac{22\kappa d_1'^2}{3\kappa+1} + \frac{4\kappa y_0^3 d_1'}{3\kappa+1} - \frac{18\kappa y_0^2 d_1'}{3\kappa+1} + \frac{36\kappa y_0 d_1'}{3\kappa+1} - \frac{22\kappa d_1'}{3\kappa+1} +$$
$$\frac{4\kappa y_0^3}{3(3\kappa+1)} - \frac{6\kappa y_0^2}{3\kappa+1} + \frac{12\kappa y_0}{3\kappa+1} - \frac{22\kappa}{3(3\kappa+1)}\Big) H(1,1,1;y_0) + \Big(-\frac{240\kappa}{(\kappa+1)^2} - \frac{16}{(\kappa+1)^2}\Big)H(0,0,0,0;y_0) + \Big(-$$
$$\frac{15\kappa}{(\kappa+1)^2} - \frac{1}{(\kappa+1)^2}\Big) H(0,0,0,0;Y) + \Big(-\frac{56\kappa d_1'}{(\kappa+1)^2} - \frac{8d_1'}{(\kappa+1)^2} - \frac{64\kappa}{(\kappa+1)^2}\Big)H(0,0,0,1;y_0) + \Big(-\frac{56\kappa d_1'}{(\kappa+1)^2} -$$
$$\frac{8d_1'}{(\kappa+1)^2} - \frac{64\kappa}{(\kappa+1)^2}\Big)H(0,0,1,0;y_0) + \Big(-\frac{15\kappa}{(\kappa+1)^2} - \frac{1}{(\kappa+1)^2}\Big)H(0,0,1,0;Y) + \Big(-\frac{12\kappa d_1'^2}{(\kappa+1)^2} - \frac{4d_1'^2}{(\kappa+1)^2} -$$
$$\frac{32\kappa d_1'}{(\kappa+1)^2} - \frac{16\kappa}{(\kappa+1)^2}\Big) H(0,0,1,1;y_0) + \Big(-\frac{56\kappa d_1'}{(\kappa+1)^2} - \frac{8d_1'}{(\kappa+1)^2} - \frac{64\kappa}{(\kappa+1)^2}\Big)H(0,1,0,0;y_0) + \Big(-\frac{7\kappa}{(\kappa+1)^2} -$$
$$\frac{1}{(\kappa+1)^2}\Big)H(0,1,0,0;Y) + \Big(-\frac{12\kappa d_1'^2}{(\kappa+1)^2} - \frac{4d_1'^2}{(\kappa+1)^2} - \frac{32\kappa d_1'}{(\kappa+1)^2} - \frac{16\kappa}{(\kappa+1)^2}\Big) H(0,1,0,1;y_0) + \Big(-\frac{12\kappa d_1'^2}{(\kappa+1)^2} -$$
$$\frac{4d_1'^2}{(\kappa+1)^2} - \frac{32\kappa d_1'}{(\kappa+1)^2} - \frac{16\kappa}{(\kappa+1)^2}\Big)H(0,1,1,0;y_0) + \Big(-\frac{7\kappa}{(\kappa+1)^2} - \frac{1}{(\kappa+1)^2}\Big) H(0,1,1,0;Y) + \Big(-\frac{2\kappa d_1'^3}{(\kappa+1)^2} -$$
$$\frac{2d_1'^3}{(\kappa+1)^2} - \frac{12\kappa d_1'^2}{(\kappa+1)^2} - \frac{12\kappa d_1'}{(\kappa+1)^2} - \frac{4\kappa}{(\kappa+1)^2}\Big)H(0,1,1,1;y_0) + \Big(-\frac{11\kappa}{(\kappa+1)^2} - \frac{1}{(\kappa+1)^2}\Big)H(1,0,0,0;Y) +$$
$$\Big(-\frac{11\kappa}{(\kappa+1)^2} - \frac{1}{(\kappa+1)^2}\Big) H(1,0,1,0;Y) - H(1,1,0,0;Y) - H(1,1,1,0;Y) + H(0;y_0)\Big(\frac{4d_1'^2y_0^3}{27(3\kappa+1)} -$$
$$\frac{16d_1'y_0^3}{27(3\kappa+1)} + \frac{4d_1'^2\kappa y_0^3}{9(3\kappa+1)} - \frac{80d_1'\kappa y_0^3}{27(3\kappa+1)} + \frac{128\kappa y_0^3}{27(3\kappa+1)} + \frac{16y_0^3}{27(3\kappa+1)} - \frac{17d_1'^2y_0^2}{18(3\kappa+1)} + \frac{44d_1'y_0^2}{9(3\kappa+1)} - \frac{17d_1'^2\kappa y_0^2}{6(3\kappa+1)} + \frac{80d_1'\kappa y_0^2}{3(3\kappa+1)} -$$
$$\frac{164\kappa y_0^2}{3(3\kappa+1)} - \frac{6y_0^2}{3\kappa+1} + \frac{49d_1'^2y_0}{9(3\kappa+1)} - \frac{302d_1'y_0}{9(3\kappa+1)} + \frac{49d_1'^2\kappa y_0}{3(3\kappa+1)} - \frac{574d_1'\kappa y_0}{3(3\kappa+1)} + \frac{1420\kappa y_0}{3(3\kappa+1)} + \frac{48y_0}{3\kappa+1} - \frac{92\kappa\zeta_3}{3\kappa+1} - \frac{4\zeta_3}{3\kappa+1}\Big) +$$
$$H(0;Y)\Big(\frac{2d_1'^2y_0^3}{27(3\kappa+1)} - \frac{8d_1'y_0^3}{27(3\kappa+1)} + \frac{2d_1'^2\kappa y_0^3}{9(3\kappa+1)} - \frac{40d_1'\kappa y_0^3}{27(3\kappa+1)} + \frac{64\kappa y_0^3}{27(3\kappa+1)} + \frac{8y_0^3}{27(3\kappa+1)} - \frac{17d_1'^2y_0^2}{36(3\kappa+1)} + \frac{22d_1'y_0^2}{9(3\kappa+1)} -$$
$$\frac{17d_1'^2\kappa y_0^2}{12(3\kappa+1)} + \frac{40d_1'\kappa y_0^2}{3(3\kappa+1)} - \frac{82\kappa y_0^2}{3(3\kappa+1)} - \frac{3y_0^2}{3\kappa+1} + \frac{49d_1'^2y_0}{18(3\kappa+1)} - \frac{151d_1'y_0}{9(3\kappa+1)} + \frac{49d_1'^2\kappa y_0}{6(3\kappa+1)} - \frac{287d_1'\kappa y_0}{3(3\kappa+1)} + \frac{710\kappa y_0}{3(3\kappa+1)} +$$
$$\frac{24y_0}{3\kappa+1} + \Big(\frac{4d_1'y_0^3}{9(3\kappa+1)} + \frac{28d_1'\kappa y_0^3}{9(3\kappa+1)} - \frac{88\kappa y_0^3}{9(3\kappa+1)} - \frac{8y_0^3}{9(3\kappa+1)} - \frac{7d_1'y_0^2}{3(3\kappa+1)} - \frac{49d_1'\kappa y_0^2}{3(3\kappa+1)} + \frac{214\kappa y_0^2}{3(3\kappa+1)} + \frac{6y_0^2}{3\kappa+1} + \frac{22d_1'y_0}{3(3\kappa+1)} +$$
$$\frac{154d_1'\kappa y_0}{3(3\kappa+1)} - \frac{904\kappa y_0}{3(3\kappa+1)} - \frac{24y_0}{3\kappa+1}\Big)H(0;y_0) + \Big(\frac{2d_1'^2y_0^3}{9(3\kappa+1)} - \frac{4d_1'y_0^3}{9(3\kappa+1)} + \frac{2d_1'^2\kappa y_0^3}{3(3\kappa+1)} - \frac{4d_1'\kappa y_0^3}{3(3\kappa+1)} - \frac{8\kappa y_0^3}{3(3\kappa+1)} -$$
$$\frac{7d_1'^2y_0^2}{6(3\kappa+1)} + \frac{3d_1'y_0^2}{3\kappa+1} - \frac{7d_1'^2\kappa y_0^2}{2(3\kappa+1)} + \frac{35d_1'\kappa y_0^2}{3(3\kappa+1)} + \frac{58\kappa y_0^2}{3(3\kappa+1)} + \frac{11d_1'^2y_0}{3(3\kappa+1)} - \frac{12d_1'y_0}{3\kappa+1} + \frac{11d_1'^2\kappa y_0}{3\kappa+1} - \frac{164d_1'\kappa y_0}{3(3\kappa+1)} - \frac{244\kappa y_0}{3(3\kappa+1)} -$$
$$\frac{49d_1'^2}{18(3\kappa+1)} + \frac{85d_1'}{9(3\kappa+1)} - \frac{49d_1'^2\kappa}{6(3\kappa+1)} + \frac{133d_1'\kappa}{3(3\kappa+1)} + \frac{194\kappa}{3(3\kappa+1)}\Big)H(1;y_0) + \Big(\frac{40\kappa y_0^3}{3\kappa+1} + \frac{8y_0^3}{3(3\kappa+1)} - \frac{180\kappa y_0^2}{3\kappa+1} - \frac{12y_0^2}{3\kappa+1} +$$
$$\frac{360\kappa y_0}{3\kappa+1} + \frac{24y_0}{3\kappa+1}\Big)H(0,0;y_0) + \Big(\frac{4d_1'y_0^3}{3(3\kappa+1)} + \frac{28d_1'\kappa y_0^3}{3(3\kappa+1)} + \frac{32\kappa y_0^3}{3(3\kappa+1)} - \frac{6d_1'y_0^2}{3\kappa+1} - \frac{42d_1'\kappa y_0^2}{3\kappa+1} - \frac{48\kappa y_0^2}{3\kappa+1} + \frac{12d_1'y_0}{3\kappa+1} +$$
$$\frac{84d_1'\kappa y_0}{3\kappa+1} + \frac{96\kappa y_0}{3\kappa+1}\Big) H(0,1;y_0) + \Big(\frac{4d_1'y_0^3}{3(3\kappa+1)} + \frac{28d_1'\kappa y_0^3}{3(3\kappa+1)} + \frac{32\kappa y_0^3}{3(3\kappa+1)} - \frac{6d_1'y_0^2}{3\kappa+1} - \frac{42d_1'\kappa y_0^2}{3\kappa+1} - \frac{48\kappa y_0^2}{3\kappa+1} +$$
$$\frac{12d_1'y_0}{3\kappa+1} + \frac{84d_1'\kappa y_0}{3\kappa+1} + \frac{96\kappa y_0}{3\kappa+1} - \frac{22d_1'}{3(3\kappa+1)} - \frac{154d_1'\kappa}{3(3\kappa+1)} - \frac{176\kappa}{3(3\kappa+1)}\Big) H(1,0;y_0) + \Big(\frac{2d_1'^2y_0^3}{3(3\kappa+1)} + \frac{2d_1'^2\kappa y_0^3}{3\kappa+1} +$$
$$\frac{16d_1'\kappa y_0^3}{3(3\kappa+1)} + \frac{8\kappa y_0^3}{3(3\kappa+1)} - \frac{3d_1'^2y_0^2}{3\kappa+1} - \frac{9d_1'^2\kappa y_0^2}{3\kappa+1} - \frac{24d_1'\kappa y_0^2}{3\kappa+1} - \frac{12\kappa y_0^2}{3\kappa+1} + \frac{6d_1'^2y_0}{3\kappa+1} + \frac{18d_1'^2\kappa y_0}{3\kappa+1} + \frac{48d_1'\kappa y_0}{3\kappa+1} + \frac{24\kappa y_0}{3\kappa+1} -$$

$$\frac{11d_1'^2}{3(3\kappa+1)} - \frac{11d_1'^2\kappa}{3\kappa+1} - \frac{88d_1'\kappa}{3(3\kappa+1)} - \frac{44\kappa}{3(3\kappa+1)}\Bigg) H(1,1;y_0) + \left(-\frac{120\kappa}{(\kappa+1)^2} - \frac{8}{(\kappa+1)^2}\right) H(0,0,0;y_0) + \left(-\frac{28\kappa d_1'}{(\kappa+1)^2} - \frac{4d_1'}{(\kappa+1)^2} - \frac{32\kappa}{(\kappa+1)^2}\right) H(0,0,1;y_0) + \left(-\frac{28\kappa d_1'}{(\kappa+1)^2} - \frac{4d_1'}{(\kappa+1)^2} - \frac{32\kappa}{(\kappa+1)^2}\right) H(0,1,0;y_0) + \left(-\frac{6\kappa d_1'^2}{(\kappa+1)^2} - \frac{2d_1'^2}{(\kappa+1)^2} - \frac{16\kappa d_1'}{(\kappa+1)^2} - \frac{8\kappa}{(\kappa+1)^2}\right) H(0,1,1;y_0) - \frac{46\kappa\zeta_3}{3\kappa+1} - \frac{2\zeta_3}{3\kappa+1}\Bigg) + H(1;Y)\Bigg(\frac{7\kappa\pi^2 y_0^3}{9(3\kappa+1)} + \frac{\pi^2 y_0^3}{9(3\kappa+1)} - \frac{7\kappa\pi^2 y_0^2}{2(3\kappa+1)} - \frac{\pi^2 y_0^2}{2(3\kappa+1)} + \frac{7\kappa\pi^2 y_0}{3\kappa+1} + \frac{\pi^2 y_0}{3\kappa+1} + \left(-\frac{7\pi^2\kappa}{3(3\kappa+1)} - \frac{\pi^2}{3(3\kappa+1)}\right) H(0;y_0) - \frac{16\kappa\zeta_3}{3\kappa+1}\Bigg) + \frac{92\kappa y_0^3\zeta_3}{3(3\kappa+1)} + \frac{4y_0^3\zeta_3}{3(3\kappa+1)} - \frac{138\kappa y_0^2\zeta_3}{3\kappa+1} - \frac{6y_0^2\zeta_3}{3\kappa+1} + \frac{276\kappa y_0\zeta_3}{3\kappa+1} + \frac{12y_0\zeta_3}{3\kappa+1} + \frac{11\kappa\pi^4}{30(3\kappa+1)} + \frac{\pi^4}{30(3\kappa+1)}.$$

## C. The $\mathcal{K}$ integrals

### C.1 The $\mathcal{K}$ integral for $\kappa = 0$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{K}(\varepsilon; y_0, 3 + d_1'\varepsilon; 0) = \frac{1}{\varepsilon^2} k_{-2}^{(0)} + \frac{1}{\varepsilon} k_{-1}^{(0)} + k_0^{(0)} + \varepsilon k_1^{(0)} + \varepsilon^2 k_2^{(0)} + \mathcal{O}\left(\varepsilon^3\right), \tag{C.1}$$

where

$$k_{-2}^{(0)} = 1,$$

$$k_{-1}^{(0)} = \frac{2y_0^3}{3} - 3y_0^2 + 6y_0 - 2H(0;y_0),$$

$$k_0^{(0)} = -\frac{2d_1'x^3}{9} + \frac{10x^3}{9} + \frac{7d_1'x^2}{6} - 5x^2 - \frac{11d_1'x}{3} + 14x + \left(-\frac{4x^3}{3} + 6x^2 - 12x\right) H(0;x) + \left(-\frac{2d_1'x^3}{3} + 3d_1'x^2 - 6d_1'x + \frac{11d_1'}{3}\right) H(1;x) + 4H(0,0;x) + 2d_1'H(0,1;x) - \frac{\pi^2}{6},$$

$$k_1^{(0)} = \frac{2d_1'^2x^3}{27} - \frac{14d_1'x^3}{27} - \frac{\pi^2x^3}{9} + \frac{56x^3}{27} - \frac{17d_1'^2x^2}{36} + \frac{28d_1'x^2}{9} + \frac{\pi^2x^2}{2} - 9x^2 + \frac{49d_1'^2x}{18} - \frac{157d_1'x}{9} - \pi^2x + 32x + \left(\frac{4d_1'x^3}{9} - \frac{20x^3}{9} - \frac{7d_1'x^2}{3} + 10x^2 + \frac{22d_1'x}{3} - 28x + \frac{\pi^2}{3}\right) H(0;x) + \left(\frac{2d_1'^2x^3}{9} - \frac{10d_1'x^3}{9} - \frac{7d_1'^2x^2}{6} + 5d_1'x^2 + \frac{11d_1'^2x}{3} - 14d_1'x - \frac{49d_1'^2}{18} + \frac{91d_1'}{9}\right) H(1;x) + \left(\frac{8x^3}{3} - 12x^2 + 24x\right) H(0,0;x) + \left(\frac{4d_1'x^3}{3} - 6d_1'x^2 + 12d_1'x\right) H(0,1;x) + \left(\frac{4d_1'x^3}{3} - 6d_1'x^2 + 12d_1'x - \frac{22d_1'}{3}\right) H(1,0;x) + \left(\frac{2d_1'^2x^3}{3} - 3d_1'^2x^2 + 6d_1'^2x - \frac{11d_1'^2}{3}\right) H(1,1;x) - 8H(0,0,0;x) - 4d_1'H(0,0,1;x) - 4d_1'H(0,1,0;x) - 2d_1'^2H(0,1,1;x) - 2\zeta_3,$$

$$k_2^{(0)} = -\frac{2}{81}x^3d_1'^3 + \frac{43x^2d_1'^3}{216} - \frac{251x\,d_1'^3}{108} + 2H(0,1,1,1;x)d_1'^3 + \frac{2x^3d_1'^2}{9} - \frac{191x^2d_1'^2}{108} + \frac{548xd_1'^2}{27} + 4H(0,0,1,1;x)d_1'^2 + 4H(0,1,0,1;x)d_1'^2 + 4H(0,1,1,0;x)d_1'^2 + \frac{1}{27}\pi^2x^3d_1' - \frac{28x^3d_1'}{27} - \frac{7}{36}\pi^2x^2d_1' + \frac{355x^2d_1'}{54} + \frac{11}{18}\pi^2xd_1' - \frac{1619xd_1'}{27} + 8H(0,0,0,1;x)d_1' + 8H(0,0,1,0;x)d_1' + 8H(0,1,0,0;x)d_1' - \frac{5\pi^2x^3}{27} + \frac{328x^3}{81} + \frac{5\pi^2x^2}{6} - 17x^2 - \frac{7\pi^2x}{3} + 72x + \left(-\frac{2}{27}x^3d_1'^3 + \frac{17x^2d_1'^3}{36} - \frac{49xd_1'^3}{18} + \frac{251d_1'^3}{108} + \frac{14x^3d_1'^2}{27} - \frac{28x^2d_1'^2}{9} + \frac{157x\,d_1'^2}{9} - \frac{401d_1'^2}{27} + \frac{1}{9}\pi^2x^3d_1' - \frac{56x^3d_1'}{27} - \frac{1}{2}\pi^2x^2d_1' + 9x^2d_1' + \pi^2xd_1' - 32xd_1' - \frac{11\pi^2d_1'}{18} + \frac{677d_1'}{27}\right) H(1;x) + \left(-\frac{8d_1'x^3}{9} + \frac{40x^3}{9} + \frac{14d_1'x^2}{3} - 20x^2 - \frac{44d_1'x}{3} + 56x - \frac{2\pi^2}{3}\right) H(0,0;x) + \left(-\frac{4}{9}d_1'^2x^3 + \frac{20d_1'x^3}{9} + \frac{7d_1'^2x^2}{3} - 10d_1'x^2 - \frac{22d_1'^2x}{3} + 28d_1'x - \frac{d_1'\pi^2}{3}\right) H(0,1;x) + \left(-\frac{4}{9}d_1'^2x^3 + \frac{20d_1'x^3}{9} + \frac{7d_1'^2x^2}{3} - 10d_1'x^2 - \frac{22d_1'^2x}{3} + 28d_1'x + \frac{49d_1'^2}{9} - \frac{182d_1'}{9}\right) H(1,0;x) + \left(-\frac{2}{9}x^3d_1'^3 + \frac{7x^2d_1'^3}{6} - \frac{11xd_1'^3}{3} + \frac{49d_1'^3}{18} + \frac{10x^3d_1'^2}{9} - 5x^2d_1'^2 + 14xd_1'^2 - \frac{91d_1'^2}{9}\right) H(1,1;x) + \left(-\frac{16x^3}{3} + \right.$$



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$24x^2-48x\Big)H(0,0,0;x)+\Big(-\frac{8d_1'x^3}{3}+12\,d_1'x^2-24d_1'x\Big)H(0,0,1;x)+\Big(-\frac{8d_1'x^3}{3}+12d_1'\,x^2-24d_1'x\Big)H(0,1,0;x)+\Big(-\frac{4}{3}d_1'^2x^3+6d_1'^2\,x^2-12d_1'^2x\Big)H(0,1,1;x)+\Big(-\frac{8d_1'x^3}{3}+12d_1'\,x^2-24d_1'x+\frac{44d_1'}{3}\Big)H(1,0,0;x)+\Big(-\frac{4}{3}\,d_1'^2x^3+6d_1'^2x^2-12d_1'^2x+\frac{22d_1'^2}{3}\Big)\,H(1,0,1;x)+\Big(-\frac{4}{3}d_1'^2x^3+6d_1'^2x^2-12d_1'^2\,x+\frac{22d_1'^2}{3}\Big)H(1,1,0;x)+\Big(-\frac{2}{3}x^3d_1'^3+3\,x^2d_1'^3-6xd_1'^3+\frac{11d_1'^3}{3}\Big)H(1,1,1;x)+16\,H(0,0,0,0;x)+H(0;x)\Big(-\frac{4}{27}d_1'^2x^3+\frac{28d_1'\,x^3}{27}+\frac{2\pi^2x^3}{9}-\frac{112x^3}{27}+\frac{17d_1'^2\,x^2}{18}-\frac{56d_1'x^2}{9}-\pi^2x^2+18x^2-\frac{49d_1'^2\,x}{9}+\frac{314d_1'x}{9}+2\pi^2x-64x+4\zeta_3\Big)-\frac{4}{3}\,x^3\zeta_3+6x^2\zeta_3-12x\zeta_3-\frac{\pi^4}{40}.$

## C.2 The $\mathcal{K}$ integral for $\kappa=1$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{K}(\varepsilon;y_0,3+d_1'\varepsilon;)=\frac{1}{\varepsilon^2}k_{-2}^{(1)}+\frac{1}{\varepsilon}k_{-1}^{(1)}+k_0^{(1)}+\varepsilon k_1^{(1)}+\varepsilon^2k_2^{(1)}+\mathcal{O}\left(\varepsilon^3\right), \tag{C.2}$$

where

$k_{-2}^{(1)}=\frac{1}{4},$

$k_{-1}^{(1)}=\frac{y_0^3}{3}-\frac{3y_0^2}{2}+3y_0-H(0;y_0),$

$k_0^{(1)}=-\frac{d_1'x^3}{9}+x^3+\frac{7d_1'x^2}{12}-\frac{53\,x^2}{12}-\frac{11d_1'x}{6}+\frac{73x}{6}+\Big(-\frac{4x^3}{3}+6\,x^2-12x\Big)H(0;x)+\Big(-\frac{d_1'x^3}{3}-\frac{x^3}{3}+\frac{3\,d_1'x^2}{2}+\frac{3x^2}{2}-3d_1'x-3x+\frac{11\,d_1'}{6}+\frac{11}{6}\Big)H(1;x)+4H(0,0;x)+(d_1'+1)H(0,1;x)-\frac{\pi^2}{12},$

$k_1^{(1)}=\frac{d_1'^2x^3}{27}-\frac{4d_1'x^3}{9}-\frac{\pi^2\,x^3}{9}+\frac{7x^3}{3}-\frac{17d_1'^2x^2}{72}+\frac{95d_1'\,x^2}{36}+\frac{\pi^2x^2}{2}-\frac{259x^2}{24}+\frac{49d_1'^2\,x}{36}-\frac{265d_1'x}{18}-\pi^2x+\frac{515x}{12}+\Big(\frac{4\,d_1'x^3}{9}-4x^3-\frac{7d_1'x^2}{3}+\frac{53x^2}{3}+\frac{22\,d_1'x}{3}-\frac{146x}{3}+\frac{\pi^2}{3}\Big)\,H(0;x)+\Big(\frac{d_1'^2x^3}{9}-\frac{8d_1'x^3}{9}-x^3-\frac{7\,d_1'^2x^2}{12}+\frac{23d_1'x^2}{6}+\frac{61x^2}{12}+\frac{11\,d_1'^2x}{6}-\frac{31d_1'x}{3}-\frac{83x}{6}-\frac{49d_1'^2}{36}+\frac{133d_1'}{18}+\frac{39}{4}\Big)H(1;x)+\Big(\frac{16x^3}{3}-24\,x^2+48x\Big)H(0,0;x)+\Big(\frac{4d_1'x^3}{3}+\frac{2x^3}{3}-6\,d_1'x^2-3x^2+12d_1'x+6x+2\Big)H(0,1;x)+\Big(\frac{4d_1'\,x^3}{3}+\frac{4x^3}{3}-6d_1'x^2-6x^2+12d_1'x+12x-\frac{22\,d_1'}{3}-\frac{22}{3}\Big)H(1,0;x)+\Big(\frac{d_1'^2x^3}{3}+\frac{2\,d_1'x^3}{3}-\frac{x^3}{3}-\frac{3d_1'^2x^2}{2}-3d_1'x^2+\frac{3\,x^2}{2}+3d_1'^2x+6d_1'x-3x-\frac{11d_1'^2}{6}-\frac{11\,d_1'}{3}+\frac{11}{6}\Big)H(1,1;x)-16H(0,0,0;x)+(-4d_1'-2)\,H(0,0,1;x)+(-4d_1'-4)H(0,1,0;x)+\Big(-d_1'^2-2d_1'+1\Big)\,H(0,1,1;x)-\frac{3\zeta_3}{2},$

$k_2^{(1)}=-\frac{1}{81}x^3d_1'^3+\frac{43x^2d_1'^3}{432}-\frac{251x\,d_1'^3}{216}+\frac{5x^3d_1'^2}{27}-\frac{635x^2\,d_1'^2}{432}+\frac{3631xd_1'^2}{216}+\frac{1}{27}\pi^2x^3\,d_1'-\frac{11x^3d_1'}{9}-\frac{7}{36}\pi^2x^2d_1'+\frac{1195\,x^2d_1'}{144}+\frac{11}{18}\pi^2xd_1'-\frac{5831x\,d_1'}{72}-\frac{\pi^2x^3}{3}+5x^3+\frac{53\pi^2\,x^2}{36}-\frac{1169x^2}{48}-\frac{73\pi^2x}{18}+\frac{1139x}{8}+\Big(-\frac{1}{27}x^3d_1'^3+\frac{17x^2d_1'^3}{72}-\frac{49x\,d_1'^3}{36}+\frac{251d_1'^3}{216}+\frac{11x^3d_1'^2}{27}-\frac{173\,x^2d_1'^2}{72}+\frac{481xd_1'^2}{36}-\frac{2455\,d_1'^2}{216}+\frac{1}{9}\pi^2x^3d_1'-\frac{17x^3\,d_1'}{9}-\frac{1}{2}\pi^2x^2d_1'+\frac{571x^2d_1'}{72}+\pi^2x\,d_1'-\frac{1013xd_1'}{36}-\frac{11\pi^2d_1'}{18}+\frac{1591\,d_1'}{72}+\frac{\pi^2x^3}{9}-\frac{7x^3}{3}-\frac{\pi^2\,x^2}{2}+\frac{307x^2}{24}+\pi^2x-\frac{191x}{4}-\frac{11\pi^{\,2}}{18}+\frac{895}{24}\Big)H(1;x)+\Big(-\frac{16d_1'x^3}{9}+16\,x^3+\frac{28d_1'x^2}{3}-\frac{212x^2}{3}-\frac{88d_1'\,x}{3}+\frac{584x}{3}-\frac{4\pi^2}{3}\Big)\,H(0,0;x)+\Big(-\frac{4}{9}d_1'^2x^3+\frac{34d_1'x^3}{9}+2\,x^3+\frac{7d_1'^2x^2}{3}-\frac{33d_1'x^2}{2}-\frac{19\,x^2}{2}-\frac{22d_1'^2x}{3}+45d_1'x+26x-\frac{d_1'\pi^{\,2}}{3}-\frac{\pi^2}{3}+4\Big)H(0,1;x)+\Big(-\frac{4}{9}d_1'^2x^3+\frac{32d_1'x^3}{9}+4x^3+\frac{7d_1'^2x^2}{3}-\frac{46d_1'\,x^2}{3}-\frac{61x^2}{3}-\frac{22d_1'^2x}{3}+\frac{124d_1'\,x}{3}+\frac{166x}{3}+\frac{49d_1'^2}{9}-\frac{266d_1'}{9}-39\Big)\,H(1,0;x)+\Big(-\frac{1}{9}x^3d_1'^3+\frac{7x^2\,d_1'^3}{12}-\frac{11xd_1'^3}{6}+\frac{49d_1'^3}{36}+\frac{7x^3\,d_1'^2}{9}-\frac{13x^2d_1'^2}{4}+\frac{17xd_1'^2}{2}-\frac{217\,d_1'^2}{36}+\frac{19x^3d_1'}{9}-$

$$\frac{43x^2 d_1'}{4}+\frac{59x\,d_1'}{2}-\frac{751d_1'}{36}-x^3+\frac{61x^2}{12}-\frac{83\,x}{6}+\frac{39}{4}\Big)H(1,1;x)+\Big(-\frac{64x^3}{3}+96x^2-192\,x\Big)H(0,0,0;x)+$$
$$\Big(-\frac{16d_1'x^3}{3}-2x^3+24d_1'x^2+9\,x^2-48d_1'x-18x-2\Big)H(0,0,1;x)+\Big(-\frac{16d_1'\,x^3}{3}-\frac{8x^3}{3}+24d_1'x^2+$$
$$12x^2-48d_1'x-24x-8\Big)\,H(0,1,0;x)+\Big(-\frac{4}{3}d_1'^2x^3-\frac{4d_1'x^3}{3}+\frac{2\,x^3}{3}+6d_1'^2x^2+6d_1'x^2-3x^2-$$
$$12d_1'^2x-12d_1'x+6x-4\,d_1'+2\Big)H(0,1,1;x)+\Big(-\frac{16d_1'x^3}{3}-\frac{16\,x^3}{3}+24d_1'x^2+24x^2-48d_1'x-$$
$$48x+\frac{88\,d_1'}{3}+\frac{88}{3}\Big)H(1,0,0;x)+\Big(-\frac{4}{3}d_1'^2x^3-2\,d_1'x^3+6d_1'^2x^2+9d_1'x^2-12d_1'^2x-18d_1'x+\frac{22\,d_1'^2}{3}+$$
$$11d_1'\Big)H(1,0,1;x)+\Big(-\frac{4}{3}d_1'^2\,x^3-\frac{8d_1'x^3}{3}+\frac{4x^3}{3}+6d_1'^2x^2+12d_1'x^2-6\,x^2-12d_1'^2x-24d_1'x+12x+$$
$$\frac{22d_1'^2}{3}+\frac{44d_1'}{3}-\frac{22}{3}\Big)H(1,1,0;x)+\Big(-\frac{1}{3}x^3d_1'^3+\frac{3x^2\,d_1'^3}{2}-3xd_1'^3+\frac{11d_1'^3}{6}-x^3d_1'^2+\frac{9x^2\,d_1'^2}{2}-9xd_1'^2+$$
$$\frac{11d_1'^2}{2}+x^3d_1'-\frac{9x^2\,d_1'}{2}+9xd_1'-\frac{11d_1'}{2}-\frac{x^3}{3}+\frac{3x^2}{2}-3\,x+\frac{11}{6}\Big)H(1,1,1;x)+64H(0,0,0,0;x)+$$
$$(16d_1'+6)\,H(0,0,0,1;x)+(16d_1'+8)H(0,0,1,0;x)+\Big(4d_1'^2+4d_1'-2\Big)\,H(0,0,1,1;x)+$$
$$(16d_1'+16)H(0,1,0,0;x)+\Big(4d_1'^2+6d_1'\Big)\,H(0,1,0,1;x)+\Big(4d_1'^2+8d_1'-4\Big)H(0,1,1,0;x)+$$
$$\Big(d_1'^3+3\,d_1'^2-3d_1'+1\Big)H(0,1,1,1;x)+H(0;x)\Big(-\frac{4}{27}d_1'^2\,x^3+\frac{16d_1'x^3}{9}+\frac{4\pi^2x^3}{9}-\frac{28\,x^3}{3}+\frac{17d_1'^2x^2}{18}-$$
$$\frac{95d_1'x^2}{9}-2\pi^2\,x^2+\frac{259x^2}{6}-\frac{49d_1'^2x}{9}+\frac{530d_1'x}{9}+4\,\pi^2x-\frac{515x}{3}+6\zeta_3\Big)-2x^3\zeta_3+9x^2\,\zeta_3-18x\zeta_3-\frac{11\pi^4}{360}.$$

# D. The $\mathcal{A}$-type collinear integrals

## D.1 The $\mathcal{A}$ integral for $k=0$ and arbitrary $\kappa$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;\kappa,0,0,g_A) &= x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;\kappa,2)\\ &= \frac{1}{\varepsilon}a_{-1}^{(\kappa,0)}+a_0^{(\kappa,0)}+\varepsilon a_1^{(\kappa,0)}+\varepsilon^2 a_2^{(\kappa,0)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned} \tag{D.1}$$

where

$$a_{-1}^{(\kappa,0)} = -\frac{1}{(\kappa+1)},$$

$$a_0^{(\kappa,0)} = \frac{\alpha_0^4}{4(x-1)}+\frac{\kappa\alpha_0^4}{4(\kappa+1)}+\frac{\alpha_0^4}{4(\kappa+1)}-\frac{\alpha_0^3}{x-1}-\frac{4\kappa\,\alpha_0^3}{3(\kappa+1)}-\frac{4\alpha_0^3}{3(\kappa+1)}+\frac{\alpha_0^3}{3\,(x-1)^2}+\frac{3\alpha_0^2}{2(x-1)}+\frac{3\kappa\alpha_0^2}{\kappa+1}+$$
$$\frac{3\alpha_0^2}{\kappa+1}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{2\,(x-1)^3}-\frac{\alpha_0}{x-1}-\frac{4\kappa\alpha_0}{\kappa+1}-\frac{4\,\alpha_0}{\kappa+1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}+\Big(1+$$
$$\frac{1}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(1-\frac{1}{(x-1)^5}\Big)\,H(0;x)+\frac{H(c_1(\alpha_0);x)}{(x-1)^5}-\frac{2}{\kappa+1},$$

$$a_1^{(\kappa,0)} = -\frac{d_1\alpha_0^4}{8(\kappa+1)}-\frac{d_1\kappa\alpha_0^4}{8(\kappa+1)}-\frac{d_1\kappa\alpha_0^4}{8(x-1)(\kappa+1)}+\frac{7\kappa\,\alpha_0^4}{8(x-1)(\kappa+1)}+\frac{7\kappa\alpha_0^4}{8(\kappa+1)}-\frac{d_1\alpha_0^4}{8(x-1)(\kappa+1)}+$$
$$\frac{5\alpha_0^4}{8(x-1)\,(\kappa+1)}+\frac{5\alpha_0^4}{8(\kappa+1)}+\frac{13d_1\alpha_0^3}{18\,(\kappa+1)}+\frac{13d_1\kappa\alpha_0^3}{18(\kappa+1)}+\frac{d_1\,\kappa\alpha_0^3}{2(x-1)(\kappa+1)}-\frac{7\kappa\alpha_0^3}{2(x-1)\,(\kappa+1)}-\frac{2d_1\kappa\alpha_0^3}{9(x-1)^2(\kappa+1)}+$$
$$\frac{19\kappa\alpha_0^3}{12(x-1)^2(\kappa+1)}-\frac{61\kappa\,\alpha_0^3}{12(\kappa+1)}+\frac{d_1\alpha_0^3}{2(x-1)(\kappa+1)}-\frac{5\,\alpha_0^3}{2(x-1)(\kappa+1)}-\frac{2d_1\alpha_0^3}{9(x-1)^2(\kappa+1)}+\frac{35\alpha_0^3}{36(x-1)^2(\kappa+1)}-\frac{125\alpha_0^3}{36\,(\kappa+1)}-$$
$$\frac{23d_1\alpha_0^2}{12(\kappa+1)}-\frac{23d_1\kappa\,\alpha_0^2}{12(\kappa+1)}-\frac{3d_1\kappa\alpha_0^2}{4(x-1)(\kappa+1)}+\frac{41\kappa\alpha_0^2}{8(x-1)(\kappa+1)}+\frac{2d_1\kappa\,\alpha_0^2}{3(x-1)^2(\kappa+1)}-\frac{39\kappa\alpha_0^2}{8(x-1)^2\,(\kappa+1)}-\frac{d_1\kappa\alpha_0^2}{2(x-1)^3(\kappa+1)}+$$
$$\frac{27\,\kappa\alpha_0^2}{8(x-1)^3(\kappa+1)}+\frac{107\kappa\alpha_0^2}{8\,(\kappa+1)}-\frac{3d_1\alpha_0^2}{4(x-1)(\kappa+1)}+\frac{89\,\alpha_0^2}{24(x-1)(\kappa+1)}+\frac{2d_1\alpha_0^2}{3(x-1)^2(\kappa+1)}-\frac{71\alpha_0^2}{24(x-1)^2(\kappa+1)}-$$
$$\frac{d_1\alpha_0^2}{2\,(x-1)^3(\kappa+1)}+\frac{43\alpha_0^2}{24(x-1)^3(\kappa+1)}+\frac{203\alpha_0^2}{24(\kappa+1)}+\frac{25d_1\alpha_0}{6(\kappa+1)}+\frac{25d_1\kappa\alpha_0}{6(\kappa+1)}+\frac{d_1\kappa\,\alpha_0}{2(x-1)(\kappa+1)}-\frac{5\kappa\alpha_0}{2(x-1)(\kappa+1)}-$$
$$\frac{2d_1\kappa\alpha_0}{3(x-1)^2(\kappa+1)}+\frac{5\kappa\,\alpha_0}{(x-1)^2(\kappa+1)}+\frac{d_1\kappa\alpha_0}{(x-1)^3(\kappa+1)}-\frac{15\kappa\alpha_0}{2(x-1)^3(\kappa+1)}-\frac{2d_1\kappa\,\alpha_0}{(x-1)^4(\kappa+1)}+\frac{45\kappa\alpha_0}{4(x-1)^4(\kappa+1)}-$$

$$
\frac{105\kappa\alpha_0}{4(\kappa+1)}+\frac{d_1\alpha_0}{2(x-1)\,(\kappa+1)}-\frac{13\alpha_0}{6(x-1)(\kappa+1)}-\frac{2d_1\alpha_0}{3\,(x-1)^2(\kappa+1)}+\frac{3\alpha_0}{(x-1)^2(\kappa+1)}+\frac{d_1\ \alpha_0}{(x-1)^3(\kappa+1)}-\frac{23\alpha_0}{6(x-1)^3(\kappa\ +1)}-
$$
$$
\frac{2d_1\alpha_0}{(x-1)^4(\kappa+1)}+\frac{61\alpha_0}{12(x-1)^4(\ \kappa+1)}-\frac{169\alpha_0}{12(\kappa+1)}+\bigg(-\frac{\kappa\ \alpha_0^4}{2(x-1)}-\frac{\kappa\alpha_0^4}{2}-\frac{\alpha_0^4}{2\ (x-1)}-\frac{\alpha_0^4}{2}+\frac{2\kappa\alpha_0^3}{x-1}-\frac{2\kappa\ \alpha_0^3}{3(x-1)^2}+\frac{8\kappa\alpha_0^3}{3}+
$$
$$
\frac{2\ \alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}-\frac{3\ \kappa\alpha_0^2}{x-1}+\frac{2\kappa\alpha_0^2}{(x-1)^2}-\frac{\kappa\ \alpha_0^2}{(x-1)^3}-6\kappa\alpha_0^2-\frac{3\alpha_0^2}{x-1}+\frac{2\ \alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}-6\alpha_0^2+\frac{2\kappa\ \alpha_0}{x-1}-
$$
$$
\frac{2\kappa\alpha_0}{(x-1)^2}+\frac{2\kappa\ \alpha_0}{(x-1)^3}-\frac{2\kappa\alpha_0}{(x-1)^4}+8\kappa\alpha_0+\frac{2\ \alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\alpha_0}{(x-1)^3}-\frac{2\ \alpha_0}{(x-1)^4}+8\alpha_0-\frac{5\kappa}{4(x-1)}+\frac{5\kappa}{6\ (x-1)^2}-
$$
$$
\frac{5\kappa}{6(x-1)^3}+\frac{5\kappa}{4\ (x-1)^4}+\frac{25\kappa}{12(x-1)^5}-\frac{25\kappa}{12}-\frac{5}{4(x-1)}+\frac{5}{6(x-1)^2}-\frac{5}{6\ (x-1)^3}+\frac{5}{4(x-1)^4}+\frac{49}{12(x-1)^5}-
$$
$$
\frac{1}{12}\bigg)\ H(0;\alpha_0)+\bigg(\frac{5\kappa}{4(x-1)}-\frac{5\kappa}{6\ (x-1)^2}+\frac{5\kappa}{6(x-1)^3}-\frac{5\kappa}{4\ (x-1)^4}-\frac{25\kappa}{12(x-1)^5}+\frac{25\kappa}{12}+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+
$$
$$
\frac{5}{6\ (x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{49}{12}\bigg)\ H(0;x)+\bigg(-\frac{d_1\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2(x-1)}+\frac{8\ d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{x-1}-\frac{2d_1\alpha_0^3}{3(x-1)^2}-
$$
$$
6\ d_1\alpha_0^2-\frac{3d_1\alpha_0^2}{x-1}+\frac{2d_1\ \alpha_0^2}{(x-1)^2}-\frac{d_1\alpha_0^2}{(x-1)^3}+8d_1\alpha_0+\frac{2d_1\ \alpha_0}{x-1}-\frac{2d_1\alpha_0}{(x-1)^2}+\frac{2d_1\alpha_0}{(x-1)^3}-\frac{2\ d_1\alpha_0}{(x-1)^4}-\frac{25d_1}{6}-\frac{d_1}{2(x-1)}+
$$
$$
\frac{2d_1}{3\ (x-1)^2}-\frac{d_1}{(x-1)^3}+\frac{2d_1}{(x-1)^4}\bigg)\ H(1;\alpha_0)+\bigg(\frac{2d_1}{(x-1)^5}-\frac{\kappa}{(x-1)^5}+\kappa\ -\frac{1}{(x-1)^5}+1\bigg)H(0;\alpha_0)H(1;x)+\bigg(-
$$
$$
\frac{\kappa\ \alpha_0^4}{4(x-1)}-\frac{\kappa\alpha_0^4}{4}-\frac{\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{4}+\frac{\kappa\alpha_0^3}{x-1}-\frac{\kappa\ \alpha_0^3}{3(x-1)^2}+\frac{4\kappa\ \alpha_0^3}{3}+\frac{\alpha_0^3}{x-1}-\frac{\alpha_0^3}{3(x-1)^2}+\frac{4\ \alpha_0^3}{3}-\frac{3\kappa\alpha_0^2}{2(x-1)}+\frac{\kappa\ \alpha_0^2}{(x-1)^2}-
$$
$$
\frac{\kappa\alpha_0^2}{2(x-1)^3}-3\kappa\ \alpha_0^2-\frac{3\alpha_0^2}{2(x-1)}+\frac{\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{2\ (x-1)^3}-3\alpha_0^2+\frac{\kappa\alpha_0}{x-1}-\frac{\kappa\alpha_0}{(x-1)^2}+\ \frac{\kappa\alpha_0}{(x-1)^3}-\frac{\kappa\alpha_0}{(x-1)^4}+4\kappa\ \alpha_0+
$$
$$
\frac{\alpha_0}{x-1}-\frac{\alpha_0}{(x-1)^2}+\frac{\alpha_0}{(x-1)^3}-\frac{\alpha_0}{}(x-1)^4+4\alpha_0-\frac{5\kappa}{4(x-1)}+\frac{5\kappa}{6\ (x-1)^2}-\frac{5\kappa}{6(x-1)^3}+\frac{5\kappa}{4\ (x-1)^4}+\frac{25\kappa}{12(x-1)^5}-
$$
$$
\frac{25\kappa}{12}+\bigg(-\frac{2\kappa}{(x-1)^5}-\frac{2}{(x-1)^5}\bigg)\ H(0;\alpha_0)-\frac{2d_1H(1;\alpha_0)}{(x-1)^5}-\frac{5}{4(x-1)}+\frac{5}{6\ (x-1)^2}-\frac{5}{6(x-1)^3}+\frac{5}{4(x-1)^4}+
$$
$$
\frac{49}{12\ (x-1)^5}-\frac{25}{12}\bigg)H(c_1(\alpha_0);x)+\bigg(-\frac{2\kappa}{(x-1)^5}-2\kappa-\frac{2}{(x-1)^5}-2\bigg)H(0,0;\alpha_0)+\bigg(\frac{2\ \kappa}{(x-1)^5}-2\kappa+\frac{2}{(x-1)^5}-
$$
$$
2\bigg)\ H(0,0;x)+\bigg(-\frac{2d_1}{(x-1)^5}-2d_1\bigg)\ H(0,1;\alpha_0)+\bigg(-\frac{\kappa}{(x-1)^5}+\kappa\ -\frac{1}{(x-1)^5}+1\bigg)H(0,c_1(\alpha_0);x)+\bigg(-
$$
$$
\frac{2\ d_1}{(x-1)^5}+\frac{\kappa}{(x-1)^5}-\kappa\ +\frac{1}{(x-1)^5}-1\bigg)H(1,0;x)+\bigg(\frac{2\ d_1}{(x-1)^5}-\frac{\kappa}{(x-1)^5}+\kappa\ -\frac{1}{(x-1)^5}+1\bigg)H(1,c_1(\alpha_0);x)+
$$
$$
\bigg(-\frac{\kappa}{(x-1)^5}-\frac{1}{(x-1)^5}\bigg)H(c_1(\alpha_0),c_1(\alpha_0);x)+\frac{\pi^2\ \kappa}{2(x-1)^5(\kappa+1)}-\frac{\pi^2\kappa}{2(\kappa+1)}+\ \frac{\pi^2}{6(x-1)^5(\kappa+1)}-\frac{4}{\kappa+1},
$$

$$
a_2^{(\kappa,0)}=\frac{d_1^2\alpha_0^4}{16(\kappa+1)}-\frac{3d_1\alpha_0^4}{8(\kappa+1)}+\frac{d_1^2\kappa\alpha_0^4}{16(\kappa+1)}-\frac{5d_1\kappa\ \alpha_0^4}{8(\kappa+1)}+\frac{d_1^2\kappa\alpha_0^4}{16(x-1)(\kappa\ +1)}-\frac{5d_1\kappa\alpha_0^4}{8(x-1)(\kappa+1)}-\frac{\pi^2\ \kappa\alpha_0^4}{24(x-1)(\kappa+1)}+
$$
$$
\frac{35\kappa\alpha_0^4}{16(x-1)\ (\kappa+1)}+\frac{35\kappa\alpha_0^4}{16(\kappa+1)}+\frac{d_1^2\ \alpha_0^4}{16(x-1)(\kappa+1)}-\frac{3d_1\alpha_0^4}{8(x-1)(\kappa+1)}-\ \frac{\pi^2\alpha_0^4}{24(x-1)(\kappa+1)}+\frac{21\alpha_0^4}{16(x-1)\ (\kappa+1)}+\frac{21\alpha_0^4}{16(\kappa+1)}-
$$
$$
\frac{\pi^2\alpha_0^4}{24}-\ \frac{43d_1^2\alpha_0^3}{108(\kappa+1)}+\frac{505d_1\alpha_0^3}{216\ (\kappa+1)}-\frac{43d_1^2\kappa\alpha_0^3}{108(\kappa+1)}+\frac{33\ d_1\kappa\alpha_0^3}{8(\kappa+1)}-\frac{d_1^2\kappa\alpha_0^3}{4(x-1)\ (\kappa+1)}+\frac{5d_1\kappa\alpha_0^3}{2(x-1)(\kappa\ +1)}+\frac{\pi^2\kappa\alpha_0^3}{6(x-1)(\kappa+1)}-
$$
$$
\frac{35\kappa\ \alpha_0^3}{4(x-1)(\kappa+1)}+\frac{4d_1^2\kappa\alpha_0^3}{27(x-1)^2\ (\kappa+1)}-\frac{13d_1\kappa\alpha_0^3}{8(x-1)^2(\kappa\ +1)}-\frac{\pi^2\kappa\alpha_0^3}{18(x-1)^2(\kappa+1)}+\frac{1055\ \kappa\alpha_0^3}{216(x-1)^2(\kappa+1)}-\frac{2945\kappa\alpha_0^3}{216\ (\kappa+1)}-
$$
$$
\frac{d_1^2\alpha_0^3}{4(x-1)(\kappa+1)}+\frac{3d_1\ \alpha_0^3}{2(x-1)(\kappa+1)}+\frac{\pi^2\alpha_0^3}{6(x-1)(\kappa+1)}-\ \frac{21\alpha_0^3}{4(x-1)(\kappa+1)}+\frac{4d_1^2\alpha_0^3}{27(x-1)^2\ (\kappa+1)}-\frac{181d_1\alpha_0^3}{216(x-1)^2(\kappa+1)}-
$$
$$
\frac{\pi\ ^2\alpha_0^3}{18(x-1)^2(\kappa+1)}+\frac{473\alpha_0^3}{216(x-1)^2\ (\kappa+1)}-\frac{1607\alpha_0^3}{216(\kappa+1)}+\frac{2\pi^2\ \alpha_0^3}{9}+\frac{95d_1^2\alpha_0^2}{72(\kappa+1)}-\frac{347d_1\ \alpha_0^2}{48(\kappa+1)}+\frac{95d_1^2\kappa\alpha_0^2}{72(\kappa+1)}-\ \frac{673d_1\kappa\alpha_0^2}{48(\kappa+1)}+
$$
$$
\frac{3d_1^2\kappa\ \alpha_0^2}{8(x-1)(\kappa+1)}-\frac{167d_1\kappa\alpha_0^2}{48(x-1)\ (\kappa+1)}-\frac{\pi^2\kappa\alpha_0^2}{4(x-1)(\kappa\ +1)}+\frac{1721\kappa\alpha_0^2}{144(x-1)(\kappa+1)}-\frac{4d_1^2\ \kappa\alpha_0^2}{9(x-1)^2(\kappa+1)}+\frac{247d_1\kappa\alpha_0^2}{48\ (x-1)^2(\kappa+1)}+
$$
$$
\frac{\pi^2\kappa\alpha_0^2}{6(x-1)^2(\kappa\ +1)}-\frac{2279\kappa\alpha_0^2}{144(x-1)^2(\kappa+1)}+\frac{d_1^2\ \kappa\alpha_0^2}{2(x-1)^3(\kappa+1)}-\frac{259d_1\kappa\alpha_0^2}{48\ (x-1)^3(\kappa+1)}-\frac{\pi^2\kappa\alpha_0^2}{12(x-1)^3(\kappa\ +1)}+\frac{1987\kappa\alpha_0^2}{144(x-1)^3(\kappa+1)}+
$$
$$
\frac{5987\ \kappa\alpha_0^2}{144(\kappa+1)}+\frac{3d_1^2\alpha_0^2}{8(x-1)(\kappa\ +1)}-\frac{311d_1\alpha_0^2}{144(x-1)(\kappa+1)}-\frac{\pi^2\ \alpha_0^2}{4(x-1)(\kappa+1)}+\frac{1103\alpha_0^2}{144(x-1)(\kappa+1)}-\frac{4d_1^2\alpha_0^2}{9(x-1)^2(\kappa+1)}+
$$
$$
\frac{125d_1\alpha_0^2}{48\ (x-1)^2(\kappa+1)}+\frac{\pi^2\alpha_0^2}{6(x-1)^2(\kappa\ +1)}-\frac{977\alpha_0^2}{144(x-1)^2(\kappa+1)}+\frac{d_1^2\alpha_0^2}{2\ (x-1)^3(\kappa+1)}-\frac{355d_1\alpha_0^2}{144(x-1)^3(\kappa\ +1)}-\frac{\pi^2\alpha_0^2}{12(x-1)^3(\kappa+1)}+
$$
$$
\frac{661\alpha_0^2}{144\ (x-1)^3(\kappa+1)}+\frac{2741\alpha_0^2}{144(\kappa+1)}-\frac{\pi^2\ \alpha_0^2}{2}-\frac{205d_1^2\alpha_0}{36(\kappa+1)}+\frac{575d_1\alpha_0}{24\ (\kappa+1)}-\frac{205d_1^2\kappa\alpha_0}{36(\kappa+1)}+\frac{1325\ d_1\kappa\alpha_0}{24(\kappa+1)}-\frac{d_1^2\kappa\alpha_0}{4(x-1)\ (\kappa+1)}-
$$
$$
\frac{2d_1\kappa\alpha_0}{3(x-1)(\kappa+1)}+\frac{\pi\ ^2\kappa\alpha_0}{6(x-1)(\kappa+1)}+\frac{32\kappa\alpha_0}{9(x-1)\ (\kappa+1)}+\frac{4d_1^2\kappa\alpha_0}{9(x-1)^2(\kappa\ +1)}-\frac{65d_1\kappa\alpha_0}{12(x-1)^2(\kappa+1)}-\frac{\pi^2\ \kappa\alpha_0}{6(x-1)^2(\kappa+1)}+
$$
$$
\frac{17\kappa\alpha_0}{(x-1)^2\ (\kappa+1)}-\frac{d_1^2\kappa\alpha_0}{(x-1)^3(\kappa+1)}+\frac{161\ d_1\kappa\alpha_0}{12(x-1)^3(\kappa+1)}+\frac{\pi^2\kappa\alpha_0}{6\ (x-1)^3(\kappa+1)}-\frac{338\kappa\alpha_0}{9(x-1)^3(\kappa\ +1)}+\frac{4d_1^2\kappa\alpha_0}{(x-1)^4(\kappa+1)}-
$$
$$
\frac{889d_1\ \kappa\alpha_0}{24(x-1)^4(\kappa+1)}-\frac{\pi^2\kappa\alpha_0}{6\ (x-1)^4(\kappa+1)}+\frac{668\kappa\alpha_0}{9(x-1)^4(\kappa\ +1)}-\frac{1127\kappa\alpha_0}{9(\kappa+1)}-\frac{d_1^2\alpha_0}{4(x-1)\ (\kappa+1)}+\frac{4d_1\alpha_0}{9(x-1)(\kappa+1)}+\frac{\pi^2\ \alpha_0}{6(x-1)(\kappa+1)}-
$$
$$
\frac{28\alpha_0}{9(x-1)(\kappa+1)}+\frac{4\ d_1^2\alpha_0}{9(x-1)^2(\kappa+1)}-\frac{97d_1\alpha_0}{36(x-1)^2\ (\kappa+1)}-\frac{\pi^2\alpha_0}{6(x-1)^2(\kappa+1)}+\frac{7\ \alpha_0}{(x-1)^2(\kappa+1)}-\frac{d_1^2\alpha_0}{(x-1)^3(\kappa\ +1)}+
$$

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$$\frac{209d_1\alpha_0}{36(x-1)^3(\kappa+1)}+\frac{\pi^2\alpha_0}{6(x-1)^3(\kappa+1)}-\frac{98\alpha_0}{9(x-1)^3(\kappa+1)}+\frac{4d_1^2\alpha_0}{(x-1)^4(\kappa+1)}-\frac{1081d_1\alpha_0}{72(x-1)^4(\kappa+1)}-\frac{\pi^2\alpha_0}{6(x-1)^4(\kappa+1)}+$$

$$\frac{158\alpha_0}{9(x-1)^4(\kappa+1)}-\frac{347\alpha_0}{9(\kappa+1)}+\frac{2\pi^2\alpha_0}{3}+\Big(\frac{d_1\alpha_0^4}{4}+\frac{1}{4}d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{4(x-1)}-\frac{7\kappa\alpha_0^4}{4(x-1)}-\frac{7\kappa\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{5\alpha_0^4}{4(x-1)}-\frac{5\alpha_0^4}{4}-$$

$$\frac{13d_1\alpha_0^3}{9}-\frac{13}{9}d_1\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{x-1}+\frac{7\kappa\alpha_0^3}{x-1}+\frac{4d_1\kappa\alpha_0^3}{9(x-1)^2}-\frac{19\kappa\alpha_0^3}{6(x-1)^2}+\frac{61\kappa\alpha_0^3}{6}-\frac{d_1\alpha_0^3}{x-1}+\frac{5\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{9(x-1)^2}-\frac{35\alpha_0^3}{18(x-1)^2}+$$

$$\frac{125\alpha_0^3}{18}+\frac{23d_1\alpha_0^2}{6}+\frac{23}{6}d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{2(x-1)}-\frac{41\kappa\alpha_0^2}{4(x-1)}-\frac{4d_1\kappa\alpha_0^2}{3(x-1)^2}+\frac{39\kappa\alpha_0^2}{4(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}-\frac{27\kappa\alpha_0^2}{4(x-1)^3}-\frac{107\kappa\alpha_0^2}{4}+$$

$$\frac{3d_1\alpha_0^2}{2(x-1)}-\frac{89\alpha_0^2}{12(x-1)}-\frac{4d_1\alpha_0^2}{3(x-1)^2}+\frac{71\alpha_0^2}{12(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{43\alpha_0^2}{12(x-1)^3}-\frac{203\alpha_0^2}{12}-\frac{25d_1\alpha_0}{3}-\frac{25d_1\kappa\alpha_0}{3}-\frac{d_1\kappa\alpha_0}{x-1}+$$

$$\frac{5\kappa\alpha_0}{x-1}+\frac{4d_1\kappa\alpha_0}{3(x-1)^2}-\frac{10\kappa\alpha_0}{(x-1)^2}-\frac{2d_1\kappa\alpha_0}{(x-1)^3}+\frac{15\kappa\alpha_0}{(x-1)^3}+\frac{4d_1\kappa\alpha_0}{(x-1)^4}-\frac{45\kappa\alpha_0}{2(x-1)^4}+\frac{105\kappa\alpha_0}{2}-\frac{d_1\alpha_0}{x-1}+\frac{13\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-$$

$$\frac{6\alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{23\alpha_0}{3(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{61\alpha_0}{6(x-1)^4}+\frac{169\alpha_0}{6}+\frac{205d_1}{72}+\frac{205d_1\kappa}{72}+\frac{17d_1\kappa}{8(x-1)}-\frac{45\kappa}{4(x-1)}-\frac{13d_1\kappa}{18(x-1)^2}+$$

$$\frac{35\kappa}{6(x-1)^2}+\frac{13d_1\kappa}{18(x-1)^3}-\frac{35\kappa}{6(x-1)^3}-\frac{17d_1\kappa}{8(x-1)^4}+\frac{45\kappa}{4(x-1)^4}-\frac{205d_1\kappa}{72(x-1)^5}+\frac{205\kappa}{12(x-1)^5}-\frac{205\kappa}{12}+\frac{17d_1}{8(x-1)}-$$

$$\frac{65}{12(x-1)}-\frac{13d_1}{18(x-1)^2}+\frac{55}{18(x-1)^2}+\frac{13d_1}{18(x-1)^3}-\frac{55}{18(x-1)^3}-\frac{17d_1}{8(x-1)^4}+\frac{65}{12(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^2}{6(x-1)^5}+$$

$$\frac{449}{36(x-1)^5}-\frac{\pi^2}{6}-\frac{161}{36}\Big)H(0;\alpha_0)+\Big(-\frac{17\kappa d_1}{8(x-1)}+\frac{13\kappa d_1}{18(x-1)^2}-\frac{13\kappa d_1}{18(x-1)^3}+\frac{17\kappa d_1}{8(x-1)^4}+\frac{205\kappa d_1}{72(x-1)^5}-\frac{205\kappa d_1}{72}-$$

$$\frac{17d_1}{8(x-1)}+\frac{13d_1}{18(x-1)^2}-\frac{13d_1}{18(x-1)^3}+\frac{17d_1}{8(x-1)^4}+\frac{205d_1}{72(x-1)^5}-\frac{205d_1}{72}+\frac{45\kappa}{4(x-1)}-\frac{35\kappa}{6(x-1)^2}+\frac{35\kappa}{6(x-1)^3}-\frac{45\kappa}{4(x-1)^4}-$$

$$\frac{\pi^2\kappa}{(x-1)^5}-\frac{205\kappa}{12(x-1)^5}+\pi^2\kappa+\frac{205\kappa}{12}+\frac{65}{12(x-1)}-\frac{55}{18(x-1)^2}+\frac{55}{18(x-1)^3}-\frac{65}{12(x-1)^4}-\frac{\pi^2}{6(x-1)^5}-\frac{449}{36(x-1)^5}+$$

$$\frac{\pi^2}{6}+\frac{449}{36}\Big)H(0;x)+\Big(\frac{d_1^2\alpha_0^4}{4}-\frac{5d_1\alpha_0^4}{4}-\frac{1}{4}d_1\kappa\alpha_0^4-\frac{d_1\kappa\alpha_0^4}{4(x-1)}+\frac{d_1^2\alpha_0^4}{4(x-1)}-\frac{5d_1\alpha_0^4}{4(x-1)}-\frac{13d_1^2\alpha_0^3}{9}+\frac{125d_1\alpha_0^3}{18}+$$

$$\frac{29}{18}d_1\kappa\alpha_0^3+\frac{d_1\kappa\alpha_0^3}{x-1}-\frac{11d_1\kappa\alpha_0^3}{18(x-1)^2}-\frac{d_1^2\alpha_0^3}{x-1}+\frac{5d_1\alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{9(x-1)^2}-\frac{35d_1\alpha_0^3}{18(x-1)^2}+\frac{23d_1^2\alpha_0^2}{6}-\frac{203d_1\alpha_0^2}{12}-\frac{59}{12}d_1\kappa\alpha_0^2-$$

$$\frac{17d_1\kappa\alpha_0^2}{12(x-1)}+\frac{23d_1\kappa\alpha_0^2}{12(x-1)^2}-\frac{19d_1\kappa\alpha_0^2}{12(x-1)^3}+\frac{3d_1^2\alpha_0^2}{2(x-1)}-\frac{89d_1\alpha_0^2}{12(x-1)}-\frac{4d_1^2\alpha_0^2}{3(x-1)^2}+\frac{71d_1\alpha_0^2}{12(x-1)^2}+\frac{d_1^2\alpha_0^2}{(x-1)^3}-\frac{43d_1\alpha_0^2}{12(x-1)^3}-\frac{25d_1^2\alpha_0}{3}+$$

$$\frac{169d_1\alpha_0}{6}+\frac{73d_1\kappa\alpha_0}{6}+\frac{d_1\kappa\alpha_0}{3(x-1)}-\frac{2d_1\kappa\alpha_0}{(x-1)^2}+\frac{11d_1\kappa\alpha_0}{3(x-1)^3}-\frac{37d_1\kappa\alpha_0}{6(x-1)^4}-\frac{d_1^2\alpha_0}{x-1}+\frac{13d_1\alpha_0}{3(x-1)}+\frac{4d_1^2\alpha_0}{3(x-1)^2}-\frac{6d_1\alpha_0}{(x-1)^2}-$$

$$\frac{2d_1^2\alpha_0}{(x-1)^3}+\frac{23d_1\alpha_0}{3(x-1)^3}+\frac{4d_1^2\alpha_0}{(x-1)^4}-\frac{61d_1\alpha_0}{6(x-1)^4}+\frac{205d_1^2}{36}-\frac{305d_1}{18}-\frac{155d_1\kappa}{18}+\frac{d_1\kappa}{3(x-1)}+\frac{25d_1\kappa}{36(x-1)^2}-\frac{25d_1\kappa}{12(x-1)^3}+$$

$$\frac{37d_1\kappa}{6(x-1)^4}+\frac{d_1^2}{4(x-1)}-\frac{2d_1}{3(x-1)}-\frac{4d_1^2}{9(x-1)^2}+\frac{73d_1}{36(x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{49d_1}{12(x-1)^3}-\frac{4d_1^2}{(x-1)^4}+\frac{61d_1}{6(x-1)^4}\Big)H(1;\alpha_0)+$$

$$\Big(\frac{3\kappa\alpha_0^4}{x-1}+3\kappa\alpha_0^4+\frac{\alpha_0^4}{x-1}+\alpha_0^4-\frac{12\kappa\alpha_0^3}{x-1}+\frac{4\kappa\alpha_0^3}{(x-1)^2}-16\kappa\alpha_0^3-\frac{4\alpha_0^3}{x-1}+\frac{4\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}+\frac{18\kappa\alpha_0^2}{x-1}-\frac{12\kappa\alpha_0^2}{(x-1)^2}+$$

$$\frac{6\kappa\alpha_0^2}{(x-1)^3}+36\kappa\alpha_0^2+\frac{6\alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2-\frac{12\kappa\alpha_0}{x-1}+\frac{12\kappa\alpha_0}{(x-1)^2}-\frac{12\kappa\alpha_0}{(x-1)^3}+\frac{12\kappa\alpha_0}{(x-1)^4}-48\kappa\alpha_0-\frac{4\alpha_0}{x-1}+$$

$$\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\alpha_0}{(x-1)^4}-16\alpha_0+\frac{15\kappa}{2(x-1)}-\frac{5\kappa}{(x-1)^2}+\frac{5\kappa}{(x-1)^3}-\frac{15\kappa}{2(x-1)^4}-\frac{33\kappa}{2(x-1)^5}+\frac{17\kappa}{2}+\frac{5}{2(x-1)}-$$

$$\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}-\frac{49}{6(x-1)^5}+\frac{1}{6}\Big)H(0,0;\alpha_0)+\Big(-\frac{15\kappa}{2(x-1)}+\frac{5\kappa}{(x-1)^2}-\frac{5\kappa}{(x-1)^3}+\frac{15\kappa}{2(x-1)^4}+$$

$$\frac{33\kappa}{2(x-1)^5}-\frac{33\kappa}{2}-\frac{5}{2(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2(x-1)^4}+\frac{49}{6(x-1)^5}-\frac{49}{6}\Big)H(0,0;x)+\Big(d_1\alpha_0^4+$$

$$d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{x-1}+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{16}{3}d_1\kappa\alpha_0^3-\frac{4d_1\kappa\alpha_0^3}{x-1}+\frac{4d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+$$

$$12d_1\kappa\alpha_0^2+\frac{6d_1\kappa\alpha_0^2}{x-1}-\frac{4d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-16d_1\kappa\alpha_0-\frac{4d_1\kappa\alpha_0}{x-1}+$$

$$\frac{4d_1\kappa\alpha_0}{(x-1)^2}-\frac{4d_1\kappa\alpha_0}{(x-1)^3}+\frac{4d_1\kappa\alpha_0}{(x-1)^4}-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{d_1}{6}+\frac{25d_1\kappa}{6}+\frac{5d_1\kappa}{2(x-1)}-\frac{5d_1\kappa}{3(x-1)^2}+$$

$$\frac{5d_1\kappa}{3(x-1)^3}-\frac{5d_1\kappa}{2(x-1)^4}-\frac{25d_1\kappa}{6(x-1)^5}+\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5d_1}{3(x-1)^3}-\frac{5d_1}{2(x-1)^4}-\frac{49d_1}{6(x-1)^5}\Big)H(0,1;\alpha_0)+$$

$$H(1;x)\Big(\frac{\pi^2\kappa d_1}{3(x-1)^5}+\frac{\pi^2d_1}{3(x-1)^5}-\frac{\pi^2\kappa}{2(x-1)^5}+\frac{\pi^2\kappa}{2}+\Big(-\frac{2\kappa d_1}{x-1}+\frac{\kappa d_1}{(x-1)^2}-\frac{2\kappa d_1}{3(x-1)^3}+\frac{\kappa d_1}{2(x-1)^4}+\frac{25\kappa d_1}{6(x-1)^5}-$$

$$\frac{2d_1}{x-1}+\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{d_1}{2(x-1)^4}+\frac{49d_1}{6(x-1)^5}+\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+$$

$$\frac{33\kappa}{4}+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{49}{12}\Big)H(0;\alpha_0)+\Big(-\frac{4\kappa d_1}{(x-1)^5}-\frac{4d_1}{(x-1)^5}+$$

$$\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0,0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{2\kappa d_1}{(x-1)^5}-2\kappa d_1+\frac{2d_1}{(x-1)^5}-2d_1\Big)H(0,1;\alpha_0)-$$

$$\frac{\pi^2}{6(x-1)^5}+\frac{\pi^2}{6}\Big)+\Big(-\frac{2\kappa d_1}{(x-1)^5}+2\kappa d_1-\frac{2d_1}{(x-1)^5}+2d_1+\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(0,1;x)+$$

$$\Big(\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{33\kappa}{4}+\Big(\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)+$$

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\left(\frac{2\kappa\, d_1}{(x-1)^5}-2\kappa d_1+\frac{2d_1}{(x-1)^5}-2d_1\right)H(1;\alpha_0)+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6\,(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+
\frac{49}{12}\Big)\,H(0,c_1(\alpha_0);x)+\Big(d_1\alpha_0^4+d_1\kappa\alpha_0^4+\frac{d_1\kappa\,\alpha_0^4}{x-1}+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{16}{3}\,d_1\kappa\alpha_0^3-\frac{4d_1\kappa\alpha_0^3}{x-1}+\frac{4d_1\kappa\,\alpha_0^3}{3(x-1)^2}-
\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3\,(x-1)^2}+12d_1\alpha_0^2+12d_1\kappa\alpha_0^2+\frac{6d_1\kappa\,\alpha_0^2}{x-1}-\frac{4d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\,\alpha_0^2}{(x-1)^3}+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\,\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}-
16d_1\alpha_0-16d_1\kappa\,\alpha_0-\frac{4d_1\kappa\alpha_0}{x-1}+\frac{4d_1\kappa\,\alpha_0}{(x-1)^2}-\frac{4d_1\kappa\alpha_0}{(x-1)^3}+\frac{4d_1\kappa\,\alpha_0}{(x-1)^4}-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4\,d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{3}+
\frac{25\,d_1\kappa}{3}+\frac{d_1\kappa}{x-1}-\frac{4d_1\kappa}{3\,(x-1)^2}+\frac{2d_1\kappa}{(x-1)^3}-\frac{4d_1\kappa}{(x-1)^4}+\frac{d_1}{x-1}-\frac{4d_1}{3(x-1)^2}+\frac{2d_1}{(x-1)^3}-\frac{4\,d_1}{(x-1)^4}\Big)H(1,0;\alpha_0)+\Big(\frac{2\kappa\,d_1}{x-1}-
\frac{\kappa d_1}{(x-1)^2}+\frac{2\kappa d_1}{3\,(x-1)^3}-\frac{\kappa d_1}{2(x-1)^4}-\frac{25\kappa d_1}{6\,(x-1)^5}+\frac{2d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3\,(x-1)^3}-\frac{d_1}{2(x-1)^4}-\frac{49d_1}{6(x-1)^5}-\frac{15\,\kappa}{4(x-1)}+
\frac{5\kappa}{2(x-1)^2}-\frac{5\kappa}{2\,(x-1)^3}+\frac{15\kappa}{4(x-1)^4}+\frac{33\kappa}{4\,(x-1)^5}-\frac{33\kappa}{4}-\frac{5}{4(x-1)}+\frac{5}{6\,(x-1)^2}-\frac{5}{6(x-1)^3}+\frac{5}{4(x-1)^4}+\frac{49}{12\,(x-1)^5}-
\frac{49}{12}\Big)H(1,0;x)+\Big(d_1^2\alpha_0^4+\frac{d_1^2\,\alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}-\frac{4d_1^2\,\alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2+\frac{6\,d_1^2\alpha_0^2}{x-1}-\frac{4d_1^2\alpha_0^2}{(x-1)^2}+\frac{2d_1^2\,\alpha_0^2}{(x-1)^3}-
16d_1^2\alpha_0-\frac{4d_1^2\alpha_0}{x-1}+\frac{4d_1^2\,\alpha_0}{(x-1)^2}-\frac{4d_1^2\alpha_0}{(x-1)^3}+\frac{4d_1^2\,\alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+\frac{d_1^2}{x-1}-\frac{4d_1^2}{3\,(x-1)^2}+\frac{2d_1^2}{(x-1)^3}-\frac{4d_1^2}{(x-1)^4}\Big)\,H(1,1;\alpha_0)+
H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{8}+\frac{1}{8}d_1\,\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{8(x-1)}-\frac{7\kappa\,\alpha_0^4}{8(x-1)}-\frac{7\kappa\alpha_0^4}{8}+\frac{d_1\alpha_0^4}{8\,(x-1)}-\frac{5\alpha_0^4}{8(x-1)}-\frac{5\alpha_0^4}{8}-\frac{13d_1\,\alpha_0^3}{18}-
\frac{13}{18}d_1\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{2\,(x-1)}+\frac{7\kappa\alpha_0^3}{2(x-1)}+\frac{2d_1\kappa\alpha_0^3}{9\,(x-1)^2}-\frac{19\kappa\alpha_0^3}{12(x-1)^2}+\frac{61\kappa\,\alpha_0^3}{12}-\frac{d_1\alpha_0^3}{2(x-1)}+\frac{5\alpha_0^3}{2(x-1)}+\frac{2\,d_1\alpha_0^3}{9(x-1)^2}-\frac{35\alpha_0^3}{36(x-1)^2}+
\frac{125\,\alpha_0^3}{36}+\frac{23d_1\alpha_0^2}{12}+\frac{23}{12}d_1\kappa\,\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{4(x-1)}-\frac{41\kappa\alpha_0^2}{8\,(x-1)}-\frac{2d_1\kappa\alpha_0^2}{3(x-1)^2}+\frac{39\kappa\,\alpha_0^2}{8(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{2(x-1)^3}-\frac{27\kappa\,\alpha_0^2}{8(x-1)^3}-\frac{107\kappa\alpha_0^2}{8}+
\frac{3d_1\alpha_0^2}{4\,(x-1)}-\frac{89\alpha_0^2}{24(x-1)}-\frac{2d_1\alpha_0^2}{3\,(x-1)^2}+\frac{71\alpha_0^2}{24(x-1)^2}+\frac{d_1\alpha_0^2}{2\,(x-1)^3}-\frac{43\alpha_0^2}{24(x-1)^3}-\frac{203\alpha_0^2}{24}-\frac{25\,d_1\alpha_0}{6}-\frac{25d_1\kappa\alpha_0}{6}-\frac{d_1\kappa\alpha_0}{2\,(x-1)}+
\frac{5\kappa\alpha_0}{2(x-1)}+\frac{2d_1\kappa\alpha_0}{3\,(x-1)^2}-\frac{5\kappa\alpha_0}{(x-1)^2}-\frac{d_1\kappa\,\alpha_0}{(x-1)^3}+\frac{15\kappa\alpha_0}{2(x-1)^3}+\frac{2d_1\kappa\,\alpha_0}{(x-1)^4}-\frac{45\kappa\alpha_0}{4(x-1)^4}+\frac{105\kappa\,\alpha_0}{4}-\frac{d_1\alpha_0}{2(x-1)}+\frac{13\alpha_0}{6(x-1)}+
\frac{2d_1\,\alpha_0}{3(x-1)^2}-\frac{3\alpha_0}{(x-1)^2}-\frac{d_1\,\alpha_0}{(x-1)^3}+\frac{23\alpha_0}{6(x-1)^3}+\frac{2d_1\,\alpha_0}{(x-1)^4}-\frac{61\alpha_0}{12(x-1)^4}+\frac{169\alpha_0}{12}+\frac{205\,d_1}{72}+\frac{205d_1\kappa}{72}+\frac{17d_1\kappa}{8\,(x-1)}-\frac{45\kappa}{4(x-1)}-
\frac{13d_1\kappa}{18\,(x-1)^2}+\frac{35\kappa}{6(x-1)^2}+\frac{13d_1\kappa}{18\,(x-1)^3}-\frac{35\kappa}{6(x-1)^3}-\frac{17d_1\kappa}{8\,(x-1)^4}+\frac{45\kappa}{4(x-1)^4}-\frac{205d_1\kappa}{72\,(x-1)^5}+\frac{205\kappa}{12(x-1)^5}-\frac{205\kappa}{12}+
\Big(\frac{3\kappa\alpha_0^4}{2(x-1)}+\frac{3\kappa\alpha_0^4}{2}+\frac{\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{2}-\frac{6\kappa\,\alpha_0^3}{x-1}+\frac{2\kappa\alpha_0^3}{(x-1)^2}-8\kappa\alpha_0^3-\frac{2\,\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{3(x-1)^2}-\frac{8\alpha_0^3}{3}+\frac{9\,\kappa\alpha_0^2}{x-1}-\frac{6\kappa\alpha_0^2}{(x-1)^2}+
\frac{3\kappa\,\alpha_0^2}{(x-1)^3}+18\kappa\alpha_0^2+\frac{3\alpha_0^2}{x-1}-\frac{2\,\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2-\frac{6\kappa\,\alpha_0}{x-1}+\frac{6\kappa\alpha_0}{(x-1)^2}-\frac{6\kappa\,\alpha_0}{(x-1)^3}+\frac{6\kappa\alpha_0}{(x-1)^4}-24\kappa\alpha_0-\frac{2\,\alpha_0}{x-1}+
\frac{2\alpha_0}{(x-1)^2}-\frac{2\alpha_0}{(x-1)^3}+\frac{2\,\alpha_0}{(x-1)^4}-8\alpha_0+\frac{15\kappa}{2(x-1)}-\frac{5\kappa}{(x-1)^2}+\frac{5\kappa}{(x-1)^3}-\frac{15\kappa}{2\,(x-1)^4}-\frac{33\kappa}{2(x-1)^5}+\frac{25\kappa}{2}+\frac{5}{2\,(x-1)}-
\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2\,(x-1)^4}-\frac{49}{6(x-1)^5}+\frac{25}{6}\Big)\,H(0;\alpha_0)+\Big(\frac{d_1\alpha_0^4}{2}+\frac{1}{2}d_1\kappa\,\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{2(x-1)}+\frac{d_1\alpha_0^4}{2\,(x-1)}-
\frac{8d_1\alpha_0^3}{3}-\frac{8}{3}d_1\kappa\alpha_0^3-\frac{2\,d_1\kappa\alpha_0^3}{x-1}+\frac{2d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{2\,d_1\alpha_0^3}{x-1}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+6d_1\alpha_0^2+6d_1\,\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\,\alpha_0^2}{(x-1)^2}+
\frac{d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{3d_1\,\alpha_0^2}{x-1}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-8\,d_1\alpha_0-8d_1\kappa\alpha_0-\frac{2d_1\kappa\alpha_0}{x-1}+\frac{2d_1\,\kappa\alpha_0}{(x-1)^2}-\frac{2d_1\kappa\alpha_0}{(x-1)^3}+\frac{2d_1\,\kappa\alpha_0}{(x-1)^4}-
\frac{2d_1\alpha_0}{x-1}+\frac{2d_1\,\alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{2d_1\,\alpha_0}{(x-1)^4}+\frac{25d_1}{6}+\frac{25d_1\kappa}{6}+\frac{5d_1\,\kappa}{2(x-1)}-\frac{5d_1\kappa}{3(x-1)^2}+\frac{5d_1\kappa}{3(x-1)^3}-\frac{5d_1\kappa}{2(x-1)^4}-\frac{25d_1\kappa}{6\,(x-1)^5}+
\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5d_1}{3\,(x-1)^3}-\frac{5d_1}{2(x-1)^4}-\frac{49d_1}{6(x-1)^5}\Big)\,H(1;\alpha_0)+\left(\frac{12\kappa}{(x-1)^5}+\frac{4}{(x-1)^5}\right)\,H(0,0;\alpha_0)+
\left(\frac{4\kappa d_1}{(x-1)^5}+\frac{4\,d_1}{(x-1)^5}\right)H(0,1;\alpha_0)+\left(\frac{4\kappa\,d_1}{(x-1)^5}+\frac{4d_1}{(x-1)^5}\right)H(1,0;\alpha_0)+\frac{4d_1^2\,H(1,1;\alpha_0)}{(x-1)^5}+\frac{17d_1}{8(x-1)}-\frac{65}{12\,(x-1)}-
\frac{13d_1}{18(x-1)^2}+\frac{55}{18(x-1)^2}+\frac{13\,d_1}{18(x-1)^3}-\frac{55}{18(x-1)^3}-\frac{17d_1}{8\,(x-1)^4}+\frac{65}{12(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^{\,2}}{6(x-1)^5}+\frac{449}{36\,(x-1)^5}-
\frac{305}{36}\Big)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{4\,\kappa d_1}{(x-1)^5}+2\kappa d_1-\frac{4d_1}{(x-1)^5}+2\,d_1+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0;\,\alpha_0)H(1,1;x)+
\Big(-\frac{2\kappa d_1}{x-1}+\frac{\kappa\,d_1}{(x-1)^2}-\frac{2\kappa d_1}{3(x-1)^3}+\frac{\kappa d_1}{2\,(x-1)^4}+\frac{25\kappa d_1}{6(x-1)^5}-\frac{2\,d_1}{x-1}+\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{d_1}{2\,(x-1)^4}+\frac{49d_1}{6(x-1)^5}+
\frac{15\kappa}{4(x-1)}-\frac{5\,\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4\,(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{33\kappa}{4}+\Big(-\frac{4\kappa d_1}{(x-1)^5}-\frac{4\,d_1}{(x-1)^5}+\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-
2\,\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{2\kappa\,d_1}{(x-1)^5}-2\kappa d_1+\frac{2d_1}{(x-1)^5}-2d_1\Big)\,H(1;\alpha_0)+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6\,(x-1)^3}-
\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{49}{12}\Big)\,H(1,c_1(\alpha_0);x)+\Big(\frac{3\kappa\alpha_0^4}{4(x-1)}+\frac{3\kappa\,\alpha_0^4}{4}+\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}-\frac{3\kappa\,\alpha_0^3}{x-1}+\frac{\kappa\alpha_0^3}{(x-1)^2}-
4\kappa\,\alpha_0^3-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3(x-1)^2}-\frac{4\,\alpha_0^3}{3}+\frac{9\kappa\alpha_0^2}{2(x-1)}-\frac{3\kappa\,\alpha_0^2}{(x-1)^2}+\frac{3\kappa\alpha_0^2}{2(x-1)^3}+9\kappa\,\alpha_0^2+\frac{3\alpha_0^2}{2(x-1)}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{2\,(x-1)^3}+
3\alpha_0^2-\frac{3\kappa\alpha_0}{x-1}+\frac{3\kappa\,\alpha_0}{(x-1)^2}-\frac{3\kappa\alpha_0}{(x-1)^3}+\frac{3\kappa\,\alpha_0}{(x-1)^4}-12\kappa\,\alpha_0-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}-4\alpha_0+
$$

$$\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2\,(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4\,(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{25\kappa}{4}+\left(\frac{6\kappa}{(x-1)^5}+\frac{2}{(x-1)^5}\right)H(0;\alpha_0)+\left(\frac{2\kappa d_1}{(x-1)^5}+\right.$$
$$\left.\frac{2\,d_1}{(x-1)^5}\right)H(1;\alpha_0)+\frac{5}{4(x-1)}-\frac{5}{6\,(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12\,(x-1)^5}+\left.\frac{25}{12}\right)H(c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\left(\frac{12\,\kappa}{(x-1)^5}+12\kappa+\frac{4}{(x-1)^5}+4\right)H(0,0,0;\alpha_0)+\left(-\frac{12\kappa}{(x-1)^5}+12\kappa-\frac{4}{(x-1)^5}+4\right)H(0,0,0;x)+$$
$$\left(\frac{4\kappa\,d_1}{(x-1)^5}+4\kappa d_1+\frac{4d_1}{(x-1)^5}+4d_1\right)H(0,0,1;\;\alpha_0)+\left(\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\right)H(0,0,c_1(\alpha_0);x)+$$
$$\left(\frac{4\kappa\,d_1}{(x-1)^5}+4\kappa d_1+\frac{4d_1}{(x-1)^5}+4d_1\right)H(0,1,0;\;\alpha_0)+\left(\frac{2\kappa d_1}{(x-1)^5}-2\kappa d_1+\frac{2\,d_1}{(x-1)^5}-2d_1-\frac{6\kappa}{(x-1)^5}+6\kappa-\right.$$
$$\left.\frac{2}{(x-1)^5}+2\right)H(0,1,0;x)+\left(\frac{4d_1^2}{(x-1)^5}+4\,d_1^2\right)H(0,1,1;\alpha_0)+\left(-\frac{2\kappa d_1}{(x-1)^5}+2\kappa\,d_1-\frac{2d_1}{(x-1)^5}+2d_1+\right.$$
$$\left.\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\right)H(0,1,c_1(\alpha_0);x)+\left(\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\right)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\left(\frac{4\kappa d_1}{(x-1)^5}+\frac{4\,d_1}{(x-1)^5}-\frac{6\kappa}{(x-1)^5}+6\kappa-\frac{2}{(x-1)^5}+2\right)H(1,0,0;x)+\left(-\frac{2\kappa d_1}{(x-1)^5}-\frac{2\,d_1}{(x-1)^5}+\frac{3\kappa}{(x-1)^5}-\right.$$
$$\left.3\kappa+\frac{1}{(x-1)^5}-1\right)H(1,0,c_1(\alpha_0);x)+\left(-\frac{4d_1^2}{(x-1)^5}+\frac{4\kappa\,d_1}{(x-1)^5}-2\kappa d_1+\frac{4d_1}{(x-1)^5}-2d_1-\frac{3\,\kappa}{(x-1)^5}+3\kappa-\right.$$
$$\left.\frac{1}{(x-1)^5}+1\right)H(1,1,0;x)+\left(\frac{4d_1^2}{(x-1)^5}-\frac{4\kappa d_1}{(x-1)^5}+2\kappa\,d_1-\frac{4d_1}{(x-1)^5}+2d_1+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-\right.$$
$$\left.1\right)H(1,1,c_1(\alpha_0);x)+\left(-\frac{2\kappa\,d_1}{(x-1)^5}-\frac{2d_1}{(x-1)^5}+\frac{3\kappa}{(x-1)^5}-3\,\kappa+\frac{1}{(x-1)^5}-1\right)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\left(\frac{3\kappa}{(x-1)^5}+\frac{1}{(x-1)^5}\right)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\frac{35\pi^2\kappa}{24(x-1)\,(\kappa+1)}+\frac{35\pi^2\kappa}{36(x-1)^2(\kappa+1)}-\frac{35\pi^2\kappa}{36(x-1)^3(\kappa+1)}+$$
$$\frac{35\pi^2\,\kappa}{24(x-1)^4(\kappa+1)}+\frac{247\pi^2\kappa}{72(x-1)^5\,(\kappa+1)}-\frac{247\pi^2\kappa}{72(\kappa+1)}-\frac{5\pi^2}{24(x-1)(\kappa+1)}+\frac{5\pi^2}{36(x-1)^2(\kappa+1)}-\frac{5\pi^2}{36(x-1)^3(\kappa+1)}+$$
$$\frac{5\pi^2}{24\,(x-1)^4(\kappa+1)}+\frac{49\pi^2}{72(x-1)^5(\kappa+1)}-\frac{25\pi^2}{72(\kappa+1)}-\frac{8}{\kappa+1}-\frac{7\,\kappa\zeta_3}{(x-1)^5(\kappa+1)}+\frac{7\kappa\zeta_3}{\kappa+1}-\frac{\zeta_3}{(x-1)^5(\kappa+1)}+\frac{3\zeta_3}{\kappa+1}.$$

### D.2 The $\mathcal{A}$ integral for $k=1$ and arbitrary $\kappa$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;\kappa,1,0,g_A)&=x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;\kappa,1)\\&=\frac{1}{\varepsilon}a_{-1}^{(\kappa,1)}+a_0^{(\kappa,1)}+\varepsilon a_1^{(\kappa,1)}+\varepsilon^2a_2^{(\kappa,1)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned}\qquad\text{(D.2)}$$

where

$$a_{-1}^{(\kappa,1)}=-\frac{1}{2(\kappa+1)},$$

$$a_0^{(\kappa,1)}=\frac{\alpha_0^4}{8(x-1)}+\frac{\kappa\alpha_0^4}{8(\kappa+1)}+\frac{\alpha_0^4}{8(\kappa+1)}-\frac{\alpha_0^3}{2(x-1)}-\frac{2\kappa\,\alpha_0^3}{3(\kappa+1)}-\frac{2\alpha_0^3}{3(\kappa+1)}+\frac{\alpha_0^3}{6\,(x-1)^2}+\frac{3\alpha_0^2}{4(x-1)}+$$
$$\frac{3\kappa\alpha_0^2}{2(\kappa+1)}+\frac{3\alpha_0^2}{2(\kappa+1)}-\frac{\alpha_0^2}{2\,(x-1)^2}+\frac{\alpha_0^2}{4(x-1)^3}-\frac{\alpha_0}{2(x-1)}-\frac{2\kappa\,\alpha_0}{\kappa+1}-\frac{2\alpha_0}{\kappa+1}+\frac{\alpha_0}{2\,(x-1)^2}-\frac{\alpha_0}{2(x-1)^3}+$$
$$\frac{\alpha_0}{2\,(x-1)^4}+\left(\frac{1}{2}+\frac{1}{2(x-1)^5}\right)H(0;\alpha_0)+\left(\frac{1}{2}-\frac{1}{2(x-1)^5}\right)H(0;x)+\frac{H(c_1(\alpha_0);x)}{2(x-1)^5}-\frac{1}{\kappa+1},$$

$$a_1^{(\kappa,1)}=-\frac{d_1\alpha_0^4}{16(\kappa+1)}-\frac{d_1\kappa\alpha_0^4}{16(\kappa+1)}-\frac{d_1\kappa\alpha_0^4}{16(x-1)(\kappa+1)}+\frac{7\kappa\,\alpha_0^4}{16(x-1)(\kappa+1)}+\frac{7\kappa\alpha_0^4}{16(\kappa+1)}-\frac{d_1\alpha_0^4}{16(x-1)(\kappa+1)}+$$
$$\frac{5\alpha_0^4}{16(x-1)(\kappa+1)}+\frac{5\alpha_0^4}{16(\kappa+1)}+\frac{13d_1\alpha_0^3}{36\,(\kappa+1)}+\frac{13d_1\kappa\alpha_0^3}{36(\kappa+1)}+\frac{d_1\,\kappa\alpha_0^3}{4(x-1)(\kappa+1)}-\frac{7\kappa\alpha_0^3}{4(x-1)\,(\kappa+1)}-\frac{d_1\kappa\alpha_0^3}{9(x-1)^2(\kappa+1)}+$$
$$\frac{19\,\kappa\alpha_0^3}{24(x-1)^2(\kappa+1)}-\frac{61\kappa\alpha_0^3}{24\,(\kappa+1)}+\frac{d_1\alpha_0^3}{4(x-1)(\kappa+1)}-\frac{5\alpha_0^3}{4\,(x-1)(\kappa+1)}-\frac{d_1\alpha_0^3}{9(x-1)^2(\kappa+1)}+\frac{35\,\alpha_0^3}{72(x-1)^2(\kappa+1)}-\frac{125\alpha_0^3}{72(\kappa+1)}-$$
$$\frac{23d_1\alpha_0^2}{24(\kappa+1)}-\frac{23d_1\kappa\,\alpha_0^2}{24(\kappa+1)}-\frac{3d_1\kappa\alpha_0^2}{8(x-1)(\kappa+1)}+\frac{41\kappa\alpha_0^2}{16(x-1)(\kappa+1)}+\frac{d_1\kappa\,\alpha_0^2}{3(x-1)^2(\kappa+1)}-\frac{39\kappa\alpha_0^2}{16(x-1)^2\,(\kappa+1)}-\frac{d_1\kappa\alpha_0^2}{4(x-1)^3(\kappa+1)}+$$
$$\frac{27\,\kappa\alpha_0^2}{16(x-1)^3(\kappa+1)}+\frac{107\kappa\alpha_0^2}{16\,(\kappa+1)}-\frac{3d_1\alpha_0^2}{8(x-1)(\kappa+1)}+\frac{89\,\alpha_0^2}{48(x-1)(\kappa+1)}+\frac{d_1\alpha_0^2}{3(x-1)^2(\kappa+1)}-\frac{71\alpha_0^2}{48(x-1)^2(\kappa+1)}-$$
$$\frac{d_1\alpha_0^2}{4(x-1)^3\,(\kappa+1)}+\frac{43\alpha_0^2}{48(x-1)^3(\kappa+1)}+\frac{203\,\alpha_0^2}{48(\kappa+1)}+\frac{25d_1\alpha_0}{12(\kappa+1)}+\frac{25d_1\,\kappa\alpha_0}{12(\kappa+1)}+\frac{d_1\kappa\alpha_0}{4(x-1)(\kappa+1)}-\frac{5\kappa\alpha_0}{4(x-1)(\kappa+1)}-$$
$$\frac{d_1\kappa\,\alpha_0}{3(x-1)^2(\kappa+1)}+\frac{5\kappa\alpha_0}{2(x-1)^2(\kappa+1)}+\frac{d_1\kappa\alpha_0}{2(x-1)^3(\kappa+1)}-\frac{15\kappa\,\alpha_0}{4(x-1)^3(\kappa+1)}-\frac{d_1\kappa\alpha_0}{(x-1)^4(\kappa+1)}+\frac{45\kappa\alpha_0}{8(x-1)^4(\kappa+1)}-$$

$$\frac{105\kappa\alpha_0}{8(\kappa+1)} + \frac{d_1\alpha_0}{4(x-1)(\kappa+1)} - \frac{13\alpha_0}{12(x-1)(\kappa+1)} - \frac{d_1\alpha_0}{3(x-1)^2(\kappa+1)} + \frac{3\alpha_0}{2(x-1)^2(\kappa+1)} + \frac{d_1\alpha_0}{2(x-1)^3(\kappa+1)} -$$
$$\frac{23\alpha_0}{12(x-1)^3(\kappa+1)} - \frac{d_1\alpha_0}{(x-1)^4(\kappa+1)} + \frac{61\alpha_0}{24(x-1)^4(\kappa+1)} - \frac{169\alpha_0}{24(\kappa+1)} + \Big( -\frac{\kappa\alpha_0^4}{4(x-1)} - \frac{\kappa\alpha_0^4}{4} - \frac{\alpha_0^4}{4(x-1)} - \frac{\alpha_0^4}{4} + \frac{\kappa\alpha_0^3}{x-1} -$$
$$\frac{\kappa\alpha_0^3}{3(x-1)^2} + \frac{4\kappa\alpha_0^3}{3} + \frac{\alpha_0^3}{x-1} - \frac{\alpha_0^3}{3(x-1)^2} + \frac{4\alpha_0^3}{3} - \frac{3\kappa\alpha_0^2}{2(x-1)} + \frac{\kappa\alpha_0^2}{(x-1)^2} - \frac{\kappa\alpha_0^2}{2(x-1)^3} - 3\kappa\alpha_0^2 - \frac{3\alpha_0^2}{2(x-1)} + \frac{\alpha_0^2}{(x-1)^2} -$$
$$\frac{\alpha_0^2}{2(x-1)^3} - 3\alpha_0^2 + \frac{\kappa\alpha_0}{x-1} - \frac{\kappa\alpha_0}{(x-1)^2} + \frac{\kappa\alpha_0}{(x-1)^3} - \frac{\kappa\alpha_0}{(x-1)^4} + 4\kappa\alpha_0 + \frac{\alpha_0}{x-1} - \frac{\alpha_0}{(x-1)^2} + \frac{\alpha_0}{(x-1)^3} - \frac{\alpha_0}{(x-1)^4} +$$
$$4\alpha_0 - \frac{5\kappa}{8(x-1)} + \frac{5\kappa}{12(x-1)^2} - \frac{5\kappa}{12(x-1)^3} + \frac{5\kappa}{8(x-1)^4} + \frac{25\kappa}{24(x-1)^5} - \frac{25\kappa}{24} - \frac{5}{8(x-1)} + \frac{5}{12(x-1)^2} - \frac{5}{12(x-1)^3} +$$
$$\frac{5}{8(x-1)^4} + \frac{49}{24(x-1)^5} - \frac{1}{24}\Big) H(0;\alpha_0) + \Big(\frac{5\kappa}{8(x-1)} - \frac{5\kappa}{12(x-1)^2} + \frac{5\kappa}{12(x-1)^3} - \frac{5\kappa}{8(x-1)^4} - \frac{25\kappa}{24(x-1)^5} + \frac{25\kappa}{24} +$$
$$\frac{5}{8(x-1)} - \frac{5}{12(x-1)^2} + \frac{5}{12(x-1)^3} - \frac{5}{8(x-1)^4} - \frac{49}{24(x-1)^5} + \frac{49}{24}\Big) H(0;x) + \Big(-\frac{d_1\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{4(x-1)} + \frac{4d_1\alpha_0^3}{3} +$$
$$\frac{d_1\alpha_0^3}{x-1} - \frac{d_1\alpha_0^3}{3(x-1)^2} - 3d_1\alpha_0^2 - \frac{3d_1\alpha_0^2}{2(x-1)} + \frac{d_1\alpha_0^2}{(x-1)^2} - \frac{d_1\alpha_0^2}{2(x-1)^3} + 4d_1\alpha_0 + \frac{d_1\alpha_0}{x-1} - \frac{d_1\alpha_0}{(x-1)^2} + \frac{d_1\alpha_0}{(x-1)^3} - \frac{d_1\alpha_0}{(x-1)^4} -$$
$$\frac{25d_1}{12} - \frac{d_1}{4(x-1)} + \frac{d_1}{3(x-1)^2} - \frac{d_1}{2(x-1)^3} + \frac{d_1}{(x-1)^4}\Big) H(1;\alpha_0) + \Big(\frac{d_1}{(x-1)^5} - \frac{\kappa}{2(x-1)^5} + \frac{\kappa}{2} - \frac{1}{2(x-1)^5} +$$
$$\frac{1}{2}\Big) H(0;\alpha_0)H(1;x) + \Big(-\frac{\kappa\alpha_0^4}{8(x-1)} - \frac{\kappa\alpha_0^4}{8} - \frac{\alpha_0^4}{8(x-1)} - \frac{\alpha_0^4}{8} + \frac{\kappa\alpha_0^3}{2(x-1)} - \frac{\kappa\alpha_0^3}{6(x-1)^2} + \frac{2\kappa\alpha_0^3}{3} + \frac{\alpha_0^3}{2(x-1)} -$$
$$\frac{\alpha_0^3}{6(x-1)^2} + \frac{2\alpha_0^3}{3} - \frac{3\kappa\alpha_0^2}{4(x-1)} + \frac{\kappa\alpha_0^2}{2(x-1)^2} - \frac{\kappa\alpha_0^2}{4(x-1)^3} - \frac{3\kappa\alpha_0^2}{2} - \frac{3\alpha_0^2}{4(x-1)} + \frac{\alpha_0^2}{2(x-1)^2} - \frac{\alpha_0^2}{4(x-1)^3} - \frac{3\alpha_0^2}{2} +$$
$$\frac{\kappa\alpha_0}{2(x-1)} - \frac{\kappa\alpha_0}{2(x-1)^2} + \frac{\kappa\alpha_0}{2(x-1)^3} - \frac{\kappa\alpha_0}{2(x-1)^4} + 2\kappa\alpha_0 + \frac{\alpha_0}{2(x-1)} - \frac{\alpha_0}{2(x-1)^2} + \frac{\alpha_0}{2(x-1)^3} - \frac{\alpha_0}{2(x-1)^4} + 2\alpha_0 -$$
$$\frac{5\kappa}{8(x-1)} + \frac{5\kappa}{12(x-1)^2} - \frac{5\kappa}{12(x-1)^3} + \frac{5\kappa}{8(x-1)^4} + \frac{25\kappa}{24(x-1)^5} - \frac{25\kappa}{24} + \Big(-\frac{\kappa}{(x-1)^5} - \frac{1}{(x-1)^5}\Big) H(0;\alpha_0) -$$
$$\frac{d_1 H(1;\alpha_0)}{(x-1)^5} - \frac{5}{8(x-1)} + \frac{5}{12(x-1)^2} - \frac{5}{12(x-1)^3} + \frac{5}{8(x-1)^4} + \frac{49}{24(x-1)^5} - \frac{25}{24}\Big) H(c_1(\alpha_0);x) + \Big(-$$
$$\frac{\kappa}{(x-1)^5} - \kappa - \frac{1}{(x-1)^5} - 1\Big) H(0,0;\alpha_0) + \Big(\frac{\kappa}{(x-1)^5} - \kappa + \frac{1}{(x-1)^5} - 1\Big) H(0,0;x) + \Big(-\frac{d_1}{(x-1)^5} -$$
$$d_1\Big) H(0,1;\alpha_0) + \Big(-\frac{\kappa}{2(x-1)^5} + \frac{\kappa}{2} - \frac{1}{2(x-1)^5} + \frac{1}{2}\Big) H(0,c_1(\alpha_0);x) + \Big(-\frac{d_1}{(x-1)^5} + \frac{\kappa}{2(x-1)^5} -$$
$$\frac{\kappa}{2} + \frac{1}{2(x-1)^5} - \frac{1}{2}\Big) H(1,0;x) + \Big(\frac{d_1}{(x-1)^5} - \frac{\kappa}{2(x-1)^5} + \frac{\kappa}{2} - \frac{1}{2(x-1)^5} + \frac{1}{2}\Big) H(1,c_1(\alpha_0);x) + \Big(-$$
$$\frac{\kappa}{2(x-1)^5} - \frac{1}{2(x-1)^5}\Big) H(c_1(\alpha_0),c_1(\alpha_0);x) + \frac{\pi^2\kappa}{4(x-1)^5(\kappa+1)} - \frac{\pi^2\kappa}{4(\kappa+1)} + \frac{\pi^2}{12(x-1)^5(\kappa+1)} - \frac{2}{\kappa+1},$$

$$a_2^{(\kappa,1)} = \frac{d_1^2\alpha_0^4}{32(\kappa+1)} - \frac{3d_1\alpha_0^4}{16(\kappa+1)} + \frac{d_1^2\kappa\alpha_0^4}{32(\kappa+1)} - \frac{5d_1\kappa\alpha_0^4}{16(\kappa+1)} + \frac{d_1^2\kappa\alpha_0^4}{32(x-1)(\kappa+1)} - \frac{5d_1\kappa\alpha_0^4}{16(x-1)(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^4}{48(x-1)(\kappa+1)} +$$
$$\frac{35\kappa\alpha_0^4}{32(x-1)(\kappa+1)} + \frac{35\kappa\alpha_0^4}{32(\kappa+1)} + \frac{d_1^2\alpha_0^4}{32(x-1)(\kappa+1)} - \frac{3d_1\alpha_0^4}{16(x-1)(\kappa+1)} - \frac{\pi^2\alpha_0^4}{48(x-1)(\kappa+1)} + \frac{21\alpha_0^4}{32(x-1)(\kappa+1)} + \frac{21\alpha_0^4}{32(\kappa+1)} -$$
$$\frac{\pi^2\alpha_0^4}{48} - \frac{43d_1^2\alpha_0^3}{216(\kappa+1)} + \frac{505d_1\alpha_0^3}{432(\kappa+1)} - \frac{43d_1^2\kappa\alpha_0^3}{216(\kappa+1)} + \frac{33d_1\kappa\alpha_0^3}{16(\kappa+1)} - \frac{d_1^2\kappa\alpha_0^3}{8(x-1)(\kappa+1)} + \frac{5d_1\kappa\alpha_0^3}{4(x-1)(\kappa+1)} + \frac{\pi^2\kappa\alpha_0^3}{12(x-1)(\kappa+1)} -$$
$$\frac{35\kappa\alpha_0^3}{8(x-1)(\kappa+1)} + \frac{2d_1^2\kappa\alpha_0^3}{27(x-1)^2(\kappa+1)} - \frac{13d_1\kappa\alpha_0^3}{16(x-1)^2(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^3}{36(x-1)^2(\kappa+1)} + \frac{1055\kappa\alpha_0^3}{432(x-1)^2(\kappa+1)} - \frac{2945\kappa\alpha_0^3}{432(\kappa+1)} -$$
$$\frac{d_1^2\alpha_0^3}{8(x-1)(\kappa+1)} + \frac{3d_1\alpha_0^3}{4(x-1)(\kappa+1)} + \frac{\pi^2\alpha_0^3}{12(x-1)(\kappa+1)} - \frac{21\alpha_0^3}{8(x-1)(\kappa+1)} + \frac{2d_1^2\alpha_0^3}{27(x-1)^2(\kappa+1)} - \frac{181d_1\alpha_0^3}{432(x-1)^2(\kappa+1)} -$$
$$\frac{\pi^2\alpha_0^3}{36(x-1)^2(\kappa+1)} + \frac{473\alpha_0^3}{432(x-1)^2(\kappa+1)} - \frac{1607\alpha_0^3}{432(\kappa+1)} + \frac{\pi^2\alpha_0^3}{9} + \frac{95d_1^2\alpha_0^2}{144(\kappa+1)} - \frac{347d_1\alpha_0^2}{96(\kappa+1)} + \frac{95d_1^2\kappa\alpha_0^2}{144(\kappa+1)} - \frac{673d_1\kappa\alpha_0^2}{96(\kappa+1)} +$$
$$\frac{3d_1^2\kappa\alpha_0^2}{16(x-1)(\kappa+1)} - \frac{167d_1\kappa\alpha_0^2}{96(x-1)(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^2}{8(x-1)(\kappa+1)} + \frac{1721\kappa\alpha_0^2}{288(x-1)(\kappa+1)} - \frac{2d_1^2\kappa\alpha_0^2}{9(x-1)^2(\kappa+1)} + \frac{247d_1\kappa\alpha_0^2}{96(x-1)^2(\kappa+1)} +$$
$$\frac{\pi^2\kappa\alpha_0^2}{12(x-1)^2(\kappa+1)} - \frac{2279\kappa\alpha_0^2}{288(x-1)^2(\kappa+1)} + \frac{d_1^2\kappa\alpha_0^2}{4(x-1)^3(\kappa+1)} - \frac{259d_1\kappa\alpha_0^2}{96(x-1)^3(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^2}{24(x-1)^3(\kappa+1)} + \frac{1987\kappa\alpha_0^2}{288(x-1)^3(\kappa+1)} +$$
$$\frac{5987\kappa\alpha_0^2}{288(\kappa+1)} + \frac{3d_1^2\alpha_0^2}{16(x-1)(\kappa+1)} - \frac{311d_1\alpha_0^2}{288(x-1)(\kappa+1)} - \frac{\pi^2\alpha_0^2}{8(x-1)(\kappa+1)} + \frac{1103\alpha_0^2}{288(x-1)(\kappa+1)} - \frac{2d_1^2\alpha_0^2}{9(x-1)^2(\kappa+1)} +$$
$$\frac{125d_1\alpha_0^2}{96(x-1)^2(\kappa+1)} + \frac{\pi^2\alpha_0^2}{12(x-1)^2(\kappa+1)} - \frac{977\alpha_0^2}{288(x-1)^2(\kappa+1)} + \frac{d_1^2\alpha_0^2}{4(x-1)^3(\kappa+1)} - \frac{355d_1\alpha_0^2}{288(x-1)^3(\kappa+1)} - \frac{\pi^2\alpha_0^2}{24(x-1)^3(\kappa+1)} +$$
$$\frac{661\alpha_0^2}{288(x-1)^3(\kappa+1)} + \frac{2741\alpha_0^2}{288(\kappa+1)} - \frac{\pi^2\alpha_0^2}{4} - \frac{205d_1^2\alpha_0}{72(\kappa+1)} + \frac{575d_1\alpha_0}{48(\kappa+1)} - \frac{205d_1^2\kappa\alpha_0}{72(\kappa+1)} + \frac{1325d_1\kappa\alpha_0}{48(\kappa+1)} - \frac{d_1^2\kappa\alpha_0}{8(x-1)(\kappa+1)} -$$
$$\frac{d_1\kappa\alpha_0}{3(x-1)(\kappa+1)} + \frac{\pi^2\kappa\alpha_0}{12(x-1)(\kappa+1)} + \frac{16\kappa\alpha_0}{9(x-1)(\kappa+1)} + \frac{2d_1^2\kappa\alpha_0}{9(x-1)^2(\kappa+1)} - \frac{65d_1\kappa\alpha_0}{24(x-1)^2(\kappa+1)} - \frac{\pi^2\kappa\alpha_0}{12(x-1)^2(\kappa+1)} +$$
$$\frac{17\kappa\alpha_0}{2(x-1)^2(\kappa+1)} - \frac{d_1^2\kappa\alpha_0}{2(x-1)^3(\kappa+1)} + \frac{161d_1\kappa\alpha_0}{24(x-1)^3(\kappa+1)} + \frac{\pi^2\kappa\alpha_0}{12(x-1)^3(\kappa+1)} - \frac{169\kappa\alpha_0}{9(x-1)^3(\kappa+1)} + \frac{2d_1^2\kappa\alpha_0}{(x-1)^4(\kappa+1)} -$$
$$\frac{889d_1\kappa\alpha_0}{48(x-1)^4(\kappa+1)} - \frac{\pi^2\kappa\alpha_0}{12(x-1)^4(\kappa+1)} + \frac{334\kappa\alpha_0}{9(x-1)^4(\kappa+1)} - \frac{1127\kappa\alpha_0}{18(\kappa+1)} - \frac{d_1^2\alpha_0}{8(x-1)(\kappa+1)} + \frac{2d_1\alpha_0}{9(x-1)(\kappa+1)} +$$

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$$\frac{\pi^2\alpha_0}{12(x-1)(\kappa+1)} - \frac{14\alpha_0}{9(x-1)(\kappa+1)} + \frac{2d_1^2\alpha_0}{9(x-1)^2(\kappa+1)} - \frac{97d_1\alpha_0}{72(x-1)^2(\kappa+1)} - \frac{\pi^2\alpha_0}{12(x-1)^2(\kappa+1)} + \frac{7\alpha_0}{2(x-1)^2(\kappa+1)} -$$
$$\frac{d_1^2\alpha_0}{2(x-1)^3(\kappa+1)} + \frac{209d_1\alpha_0}{72(x-1)^3(\kappa+1)} + \frac{\pi^2\alpha_0}{12(x-1)^3(\kappa+1)} - \frac{49\alpha_0}{9(x-1)^3(\kappa+1)} + \frac{2d_1^2\alpha_0}{(x-1)^4(\kappa+1)} - \frac{1081d_1\alpha_0}{144(x-1)^4(\kappa+1)} -$$
$$\frac{\pi^2\alpha_0}{12(x-1)^4(\kappa+1)} + \frac{79\alpha_0}{9(x-1)^4(\kappa+1)} - \frac{347\alpha_0}{18(\kappa+1)} + \frac{\pi^2\alpha_0}{3} + \Big( \frac{d_1\alpha_0^4}{8} + \frac{1}{8}d_1\kappa\alpha_0^4 + \frac{d_1\kappa\alpha_0^4}{8(x-1)} - \frac{7\kappa\alpha_0^4}{8(x-1)} - \frac{7\kappa\alpha_0^4}{8} +$$
$$\frac{d_1\alpha_0^4}{8(x-1)} - \frac{5\alpha_0^4}{8(x-1)} - \frac{5\alpha_0^4}{8} - \frac{13d_1\alpha_0^3}{18} - \frac{13}{18}d_1\kappa\alpha_0^3 - \frac{d_1\kappa\alpha_0^3}{2(x-1)} + \frac{7\kappa\alpha_0^3}{2(x-1)} + \frac{2d_1\kappa\alpha_0^3}{9(x-1)^2} - \frac{19\kappa\alpha_0^3}{12(x-1)^2} + \frac{61\kappa\alpha_0^3}{12} -$$
$$\frac{d_1\alpha_0^3}{2(x-1)} + \frac{5\alpha_0^3}{2(x-1)} + \frac{2d_1\alpha_0^3}{9(x-1)^2} - \frac{35\alpha_0^3}{36(x-1)^2} + \frac{125\alpha_0^3}{36} + \frac{23d_1\alpha_0^2}{12} + \frac{23}{12}d_1\kappa\alpha_0^2 + \frac{3d_1\kappa\alpha_0^2}{4(x-1)} - \frac{41\kappa\alpha_0^2}{8(x-1)} - \frac{2d_1\kappa\alpha_0^2}{3(x-1)^2} +$$
$$\frac{39\kappa\alpha_0^2}{8(x-1)^2} + \frac{d_1\kappa\alpha_0^2}{2(x-1)^3} - \frac{27\kappa\alpha_0^2}{8(x-1)^3} - \frac{107\kappa\alpha_0^2}{8} + \frac{3d_1\alpha_0^2}{4(x-1)} - \frac{89\alpha_0^2}{24(x-1)} - \frac{2d_1\alpha_0^2}{3(x-1)^2} + \frac{71\alpha_0^2}{24(x-1)^2} + \frac{d_1\alpha_0^2}{2(x-1)^3} -$$
$$\frac{43\alpha_0^2}{24(x-1)^3} - \frac{203\alpha_0^2}{24} - \frac{25d_1\alpha_0}{6} - \frac{25d_1\kappa\alpha_0}{6} - \frac{d_1\kappa\alpha_0}{2(x-1)} + \frac{5\kappa\alpha_0}{2(x-1)} + \frac{2d_1\kappa\alpha_0}{3(x-1)^2} - \frac{5\kappa\alpha_0}{(x-1)^2} - \frac{d_1\kappa\alpha_0}{(x-1)^3} + \frac{15\kappa\alpha_0}{2(x-1)^3} +$$
$$\frac{2d_1\kappa\alpha_0}{(x-1)^4} - \frac{45\kappa\alpha_0}{4(x-1)^4} + \frac{105\kappa\alpha_0}{4} - \frac{d_1\alpha_0}{2(x-1)} + \frac{13\alpha_0}{6(x-1)} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{3\alpha_0}{(x-1)^2} - \frac{d_1\alpha_0}{(x-1)^3} + \frac{23\alpha_0}{6(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} -$$
$$\frac{61\alpha_0}{12(x-1)^4} + \frac{169\alpha_0}{12} + \frac{205d_1}{144} + \frac{205d_1\kappa}{144} + \frac{17d_1\kappa}{16(x-1)} - \frac{45\kappa}{8(x-1)} - \frac{13d_1\kappa}{36(x-1)^2} + \frac{35\kappa}{12(x-1)^2} + \frac{13d_1\kappa}{36(x-1)^3} -$$
$$\frac{35\kappa}{12(x-1)^3} - \frac{17d_1\kappa}{16(x-1)^4} + \frac{45\kappa}{8(x-1)^4} - \frac{205d_1\kappa}{144(x-1)^5} + \frac{205\kappa}{24(x-1)^5} - \frac{205\kappa}{24} + \frac{17d_1}{16(x-1)} - \frac{65}{24(x-1)} - \frac{13d_1}{36(x-1)^2} +$$
$$\frac{55}{36(x-1)^2} + \frac{13d_1}{36(x-1)^3} - \frac{55}{36(x-1)^3} - \frac{17d_1}{16(x-1)^4} + \frac{65}{24(x-1)^4} - \frac{205d_1}{144(x-1)^5} - \frac{\pi^2}{12(x-1)^5} + \frac{449}{72(x-1)^5} - \frac{\pi^2}{12} -$$
$$\frac{161}{72} \Big) H(0;\alpha_0) + \Big( -\frac{17\kappa d_1}{16(x-1)} + \frac{13\kappa d_1}{36(x-1)^2} - \frac{13\kappa d_1}{36(x-1)^3} + \frac{17\kappa d_1}{16(x-1)^4} + \frac{205\kappa d_1}{144(x-1)^5} - \frac{205\kappa d_1}{144} - \frac{17d_1}{16(x-1)} +$$
$$\frac{13d_1}{36(x-1)^2} - \frac{13d_1}{36(x-1)^3} + \frac{17d_1}{16(x-1)^4} + \frac{205d_1}{144(x-1)^5} - \frac{205d_1}{144} + \frac{45\kappa}{8(x-1)} - \frac{35\kappa}{12(x-1)^2} + \frac{35\kappa}{12(x-1)^3} - \frac{45\kappa}{8(x-1)^4} -$$
$$\frac{\pi^2\kappa}{2(x-1)^5} - \frac{205\kappa}{24(x-1)^5} + \frac{\pi^2\kappa}{2} + \frac{205\kappa}{24} + \frac{65}{24(x-1)} - \frac{55}{36(x-1)^2} + \frac{55}{36(x-1)^3} - \frac{65}{24(x-1)^4} - \frac{\pi^2}{12(x-1)^5} - \frac{449}{72(x-1)^5} +$$
$$\frac{\pi^2}{12} + \frac{449}{72} \Big) H(0;x) + \Big( \frac{d_1^2\alpha_0^4}{8} - \frac{5d_1\alpha_0^4}{8} - \frac{1}{8}d_1\kappa\alpha_0^4 - \frac{d_1\kappa\alpha_0^4}{8(x-1)} + \frac{d_1^2\alpha_0^4}{8(x-1)} - \frac{5d_1\alpha_0^4}{8(x-1)} - \frac{13d_1^2\alpha_0^3}{18} + \frac{125d_1\alpha_0^3}{36} +$$
$$\frac{29}{36}d_1\kappa\alpha_0^3 + \frac{d_1\kappa\alpha_0^3}{2(x-1)} - \frac{11d_1\kappa\alpha_0^3}{36(x-1)^2} - \frac{d_1^2\alpha_0^3}{2(x-1)} + \frac{5d_1\alpha_0^3}{2(x-1)} + \frac{2d_1^2\alpha_0^3}{9(x-1)^2} - \frac{35d_1\alpha_0^3}{36(x-1)^2} + \frac{23d_1^2\alpha_0^2}{12} - \frac{203d_1\alpha_0^2}{24} -$$
$$\frac{59}{24}d_1\kappa\alpha_0^2 - \frac{17d_1\kappa\alpha_0^2}{24(x-1)} + \frac{23d_1\kappa\alpha_0^2}{24(x-1)^2} - \frac{19d_1\kappa\alpha_0^2}{24(x-1)^3} + \frac{3d_1^2\alpha_0^2}{4(x-1)} - \frac{89d_1\alpha_0^2}{24(x-1)} - \frac{2d_1^2\alpha_0^2}{3(x-1)^2} + \frac{71d_1\alpha_0^2}{24(x-1)^2} + \frac{d_1^2\alpha_0^2}{2(x-1)^3} -$$
$$\frac{43d_1\alpha_0^2}{24(x-1)^3} - \frac{25d_1^2\alpha_0}{6} + \frac{169d_1\alpha_0}{12} + \frac{73d_1\kappa\alpha_0}{12} + \frac{d_1\kappa\alpha_0}{6(x-1)} - \frac{d_1\kappa\alpha_0}{(x-1)^2} + \frac{11d_1\kappa\alpha_0}{6(x-1)^3} - \frac{37d_1\kappa\alpha_0}{12(x-1)^4} - \frac{d_1^2\alpha_0}{2(x-1)} + \frac{13d_1\alpha_0}{6(x-1)} +$$
$$\frac{2d_1^2\alpha_0}{3(x-1)^2} - \frac{3d_1\alpha_0}{(x-1)^2} - \frac{d_1^2\alpha_0}{(x-1)^3} + \frac{23d_1\alpha_0}{6(x-1)^3} + \frac{2d_1^2\alpha_0}{(x-1)^4} - \frac{61d_1\alpha_0}{12(x-1)^4} + \frac{205d_1^2}{72} - \frac{305d_1}{36} - \frac{155d_1\kappa}{36} + \frac{d_1\kappa}{6(x-1)} +$$
$$\frac{25d_1\kappa}{72(x-1)^2} - \frac{25d_1\kappa}{24(x-1)^3} + \frac{37d_1\kappa}{12(x-1)^4} + \frac{d_1^2}{8(x-1)} - \frac{d_1}{3(x-1)} - \frac{2d_1^2}{9(x-1)^2} + \frac{73d_1}{72(x-1)^2} + \frac{d_1^2}{2(x-1)^3} - \frac{49d_1}{24(x-1)^3} -$$
$$\frac{2d_1^2}{(x-1)^4} + \frac{61d_1}{12(x-1)^4} \Big) H(1;\alpha_0) + \Big( \frac{3\kappa\alpha_0^4}{2(x-1)} + \frac{3\kappa\alpha_0^4}{2} + \frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} - \frac{6\kappa\alpha_0^3}{x-1} + \frac{2\kappa\alpha_0^3}{(x-1)^2} - 8\kappa\alpha_0^3 - \frac{2\alpha_0^3}{x-1} +$$
$$\frac{2\alpha_0^3}{3(x-1)^2} - \frac{8\alpha_0^3}{3} + \frac{9\kappa\alpha_0^2}{x-1} - \frac{6\kappa\alpha_0^2}{(x-1)^2} + \frac{3\kappa\alpha_0^2}{(x-1)^3} + 18\kappa\alpha_0^2 + \frac{3\alpha_0^2}{x-1} - \frac{2\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} + 6\alpha_0^2 - \frac{6\kappa\alpha_0}{x-1} + \frac{6\kappa\alpha_0}{(x-1)^2} -$$
$$\frac{6\kappa\alpha_0}{(x-1)^3} + \frac{6\kappa\alpha_0}{(x-1)^4} - 24\kappa\alpha_0 - \frac{2\alpha_0}{x-1} + \frac{2\alpha_0}{(x-1)^2} - \frac{2\alpha_0}{(x-1)^3} + \frac{2\alpha_0}{(x-1)^4} - 8\alpha_0 + \frac{15\kappa}{4(x-1)} - \frac{5\kappa}{2(x-1)^2} + \frac{5\kappa}{2(x-1)^3} -$$
$$\frac{15\kappa}{4(x-1)^4} - \frac{33\kappa}{4(x-1)^5} + \frac{17\kappa}{4} + \frac{5}{4(x-1)} - \frac{5}{6(x-1)^2} + \frac{5}{6(x-1)^3} - \frac{5}{4(x-1)^4} - \frac{49}{12(x-1)^5} + \frac{1}{12} \Big) H(0,0;\alpha_0) +$$
$$\Big( -\frac{15\kappa}{4(x-1)} + \frac{5\kappa}{2(x-1)^2} - \frac{5\kappa}{2(x-1)^3} + \frac{15\kappa}{4(x-1)^4} + \frac{33\kappa}{4(x-1)^5} - \frac{33\kappa}{4} - \frac{5}{4(x-1)} + \frac{5}{6(x-1)^2} - \frac{5}{6(x-1)^3} +$$
$$\frac{5}{4(x-1)^4} + \frac{49}{12(x-1)^5} - \frac{49}{12} \Big) H(0,0;x) + \Big( \frac{d_1\alpha_0^4}{2} + \frac{1}{2}d_1\kappa\alpha_0^4 + \frac{d_1\kappa\alpha_0^4}{2(x-1)} + \frac{d_1\alpha_0^4}{2(x-1)} - \frac{8d_1\alpha_0^3}{3} - \frac{8}{3}d_1\kappa\alpha_0^3 -$$
$$\frac{2d_1\kappa\alpha_0^3}{x-1} + \frac{2d_1\kappa\alpha_0^3}{3(x-1)^2} - \frac{2d_1\alpha_0^3}{x-1} + \frac{2d_1\alpha_0^3}{3(x-1)^2} + 6d_1\alpha_0^2 + 6d_1\kappa\alpha_0^2 + \frac{3d_1\kappa\alpha_0^2}{x-1} - \frac{2d_1\kappa\alpha_0^2}{(x-1)^2} + \frac{d_1\kappa\alpha_0^2}{(x-1)^3} + \frac{3d_1\alpha_0^2}{x-1} -$$
$$\frac{2d_1\alpha_0^2}{(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - 8d_1\alpha_0 - 8d_1\kappa\alpha_0 - \frac{2d_1\kappa\alpha_0}{x-1} + \frac{2d_1\kappa\alpha_0}{(x-1)^2} - \frac{2d_1\kappa\alpha_0}{(x-1)^3} + \frac{2d_1\kappa\alpha_0}{(x-1)^4} - \frac{2d_1\alpha_0}{x-1} + \frac{2d_1\alpha_0}{(x-1)^2} -$$
$$\frac{2d_1\alpha_0}{(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} + \frac{d_1}{12} + \frac{25d_1\kappa}{12} + \frac{5d_1\kappa}{4(x-1)} - \frac{5d_1\kappa}{6(x-1)^2} + \frac{5d_1\kappa}{6(x-1)^3} - \frac{5d_1\kappa}{4(x-1)^4} - \frac{25d_1\kappa}{12(x-1)^5} + \frac{5d_1}{4(x-1)} - \frac{5d_1}{6(x-1)^2} +$$
$$\frac{5d_1}{6(x-1)^3} - \frac{5d_1}{4(x-1)^4} - \frac{49d_1}{12(x-1)^5} \Big) H(0,1;\alpha_0) + H(1;x) \Big( \frac{\pi^2\kappa d_1}{6(x-1)^5} + \frac{\pi^2 d_1}{6(x-1)^5} - \frac{\pi^2\kappa}{4(x-1)^5} + \frac{\pi^2\kappa}{4} + \Big( -$$
$$\frac{\kappa d_1}{x-1} + \frac{\kappa d_1}{2(x-1)^2} - \frac{\kappa d_1}{3(x-1)^3} + \frac{\kappa d_1}{4(x-1)^4} + \frac{25\kappa d_1}{12(x-1)^5} - \frac{d_1}{x-1} + \frac{d_1}{2(x-1)^2} - \frac{d_1}{3(x-1)^3} + \frac{d_1}{4(x-1)^4} + \frac{49d_1}{12(x-1)^5} +$$
$$\frac{15\kappa}{8(x-1)} - \frac{5\kappa}{4(x-1)^2} + \frac{5\kappa}{4(x-1)^3} - \frac{15\kappa}{8(x-1)^4} - \frac{33\kappa}{8(x-1)^5} + \frac{33\kappa}{8} + \frac{5}{8(x-1)} - \frac{5}{12(x-1)^2} + \frac{5}{12(x-1)^3} - \frac{5}{8(x-1)^4} -$$
$$\frac{49}{24(x-1)^5} + \frac{49}{24} \Big) H(0;\alpha_0) + \Big( -\frac{2\kappa d_1}{(x-1)^5} - \frac{2d_1}{(x-1)^5} + \frac{3\kappa}{(x-1)^5} - 3\kappa + \frac{1}{(x-1)^5} - 1 \Big) H(0,0;\alpha_0) + \Big( -$$

$$\frac{2d_1^2}{(x-1)^5}+\frac{\kappa d_1}{(x-1)^5}-\kappa d_1+\frac{d_1}{(x-1)^5}-d_1\bigg)H(0,1;\alpha_0)-\frac{\pi^2}{12\ (x-1)^5}+\frac{\pi^2}{12}\bigg)+\bigg(-\frac{\kappa\ d_1}{(x-1)^5}+\kappa d_1-\frac{d_1}{(x-1)^5}+$$
$$d_1+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\bigg)H(0;\alpha_0)H(0,1;x)+\bigg(\frac{15\kappa}{8(x-1)}-\frac{5\kappa}{4(x-1)^2}+\frac{5\kappa}{4(x-1)^3}-\frac{15\kappa}{8(x-1)^4}-$$
$$\frac{33\kappa}{8\ (x-1)^5}+\frac{33\kappa}{8}+\bigg(\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\bigg)H(0;\alpha_0)+\bigg(\frac{\kappa\ d_1}{(x-1)^5}-\kappa d_1+\frac{d_1}{(x-1)^5}-d_1\bigg)\ H(1;\alpha_0)+$$
$$\frac{5}{8(x-1)}-\frac{5}{12(x-1)^2}+\frac{5}{12(x-1)^3}-\frac{5}{8(x-1)^4}-\frac{49}{24(x-1)^5}+\frac{49}{24}\bigg)H(0,c_1(\ \alpha_0);x)+\bigg(\frac{d_1\alpha_0^4}{2}+\frac{1}{2}d_1\kappa\ \alpha_0^4+$$
$$\frac{d_1\kappa\alpha_0^4}{2(x-1)}+\frac{d_1\alpha_0^4}{2\ (x-1)}-\frac{8d_1\alpha_0^3}{3}-\frac{8}{3}d_1\kappa\alpha_0^3-\frac{2\ d_1\kappa\alpha_0^3}{x-1}+\frac{2d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{2\ d_1\alpha_0^3}{x-1}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+6d_1\alpha_0^2+6d_1\ \kappa\alpha_0^2+$$
$$\frac{3d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\ \alpha_0^2}{(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{3d_1\ \alpha_0^2}{x-1}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-8\ d_1\alpha_0-8d_1\kappa\alpha_0-\frac{2d_1\kappa\alpha_0}{x-1}+\frac{2d_1\ \kappa\alpha_0}{(x-1)^2}-$$
$$\frac{2d_1\kappa\alpha_0}{(x-1)^3}+\frac{2d_1\ \kappa\alpha_0}{(x-1)^4}-\frac{2d_1\alpha_0}{x-1}+\frac{2d_1\ \alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{2d_1\ \alpha_0}{(x-1)^4}+\frac{25d_1}{6}+\frac{25d_1\kappa}{6}+\frac{d_1\ \kappa}{2(x-1)}-\frac{2d_1\kappa}{3(x-1)^2}+\frac{d_1\kappa}{(x-1)^3}-$$
$$\frac{2d_1\kappa}{(x-1)^4}+\frac{d_1}{2(x-1)}-\frac{2\ d_1}{3(x-1)^2}+\frac{d_1}{(x-1)^3}-\frac{2d_1}{(x-1)^4}\bigg)H(1,0;\ \alpha_0)+\bigg(\frac{\kappa d_1}{x-1}-\frac{\kappa d_1}{2\ (x-1)^2}+\frac{\kappa d_1}{3(x-1)^3}-\frac{\kappa d_1}{4(x-1)^4}-$$
$$\frac{25\kappa d_1}{12(x-1)^5}+\frac{d_1}{x-1}-\frac{d_1}{2\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{d_1}{4(x-1)^4}-\frac{49d_1}{12\ (x-1)^5}-\frac{15\kappa}{8(x-1)}+\frac{5\kappa}{4\ (x-1)^2}-\frac{5\kappa}{4(x-1)^3}+\frac{15\kappa}{8\ (x-1)^4}+$$
$$\frac{33\kappa}{8(x-1)^5}-\frac{33\kappa}{8}-\frac{5}{8\ (x-1)}+\frac{5}{12(x-1)^2}-\frac{5}{12(x-1)^3}+\frac{5}{8(x-1)^4}+\frac{49}{24(x-1)^5}-\frac{49}{24}\bigg)H(1,0;x)+\bigg(\frac{d_1^2\ \alpha_0^4}{2}+$$
$$\frac{d_1^2\alpha_0^4}{2(x-1)}-\frac{8d_1^2\alpha_0^3}{3}-\frac{2\ d_1^2\alpha_0^3}{x-1}+\frac{2d_1^2\alpha_0^3}{3(x-1)^2}+6d_1^2\ \alpha_0^2+\frac{3d_1^2\alpha_0^2}{x-1}-\frac{2d_1^2\ \alpha_0^2}{(x-1)^2}+\frac{d_1^2\alpha_0^2}{(x-1)^3}-8d_1^2\alpha_0-\frac{2d_1^2\ \alpha_0}{x-1}+\frac{2d_1^2\alpha_0}{(x-1)^2}-$$
$$\frac{2d_1^2\ \alpha_0}{(x-1)^3}+\frac{2d_1^2\alpha_0}{(x-1)^4}+\frac{25\ d_1^2}{6}+\frac{d_1^2}{2(x-1)}-\frac{2d_1^2}{3\ (x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{2d_1^2}{(x-1)^4}\bigg)\ H(1,1;\alpha_0)+H(c_1(\alpha_0);x)\bigg(\frac{d_1\alpha_0^4}{16}+$$
$$\frac{1}{16}d_1\ \kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{16(x-1)}-\frac{7\kappa\ \alpha_0^4}{16(x-1)}-\frac{7\kappa\alpha_0^4}{16}+\frac{d_1\alpha_0^4}{16\ (x-1)}-\frac{5\alpha_0^4}{16(x-1)}-\frac{5\alpha_0^4}{16}-\frac{13d_1\ \alpha_0^3}{36}-\frac{13}{36}d_1\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{4\ (x-1)}+$$
$$\frac{7\kappa\alpha_0^3}{4(x-1)}+\frac{d_1\kappa\alpha_0^3}{9\ (x-1)^2}-\frac{19\kappa\alpha_0^3}{24(x-1)^2}+\frac{61\kappa\ \alpha_0^3}{24}-\frac{d_1\alpha_0^3}{4(x-1)}+\frac{5\alpha_0^3}{4\ (x-1)}+\frac{d_1\alpha_0^3}{9(x-1)^2}-\frac{35\alpha_0^3}{72\ (x-1)^2}+\frac{125\alpha_0^3}{72}+\frac{23d_1\alpha_0^2}{24}+$$
$$\frac{23}{24}\ d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{8(x-1)}-\frac{41\kappa\ \alpha_0^2}{16(x-1)}-\frac{d_1\kappa\alpha_0^2}{3(x-1)^2}+\frac{39\kappa\ \alpha_0^2}{16(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{4(x-1)^3}-\frac{27\ \kappa\alpha_0^2}{16(x-1)^3}-\frac{107\kappa\alpha_0^2}{16}+\frac{3d_1\ \alpha_0^2}{8(x-1)}-\frac{89\alpha_0^2}{48(x-1)}-$$
$$\frac{d_1\alpha_0^2}{3\ (x-1)^2}+\frac{71\alpha_0^2}{48(x-1)^2}+\frac{d_1\alpha_0^2}{4\ (x-1)^3}-\frac{43\alpha_0^2}{48(x-1)^3}-\frac{203\alpha_0^2}{48}-\frac{25\ d_1\alpha_0}{12}-\frac{25d_1\kappa\alpha_0}{12}-\frac{d_1\kappa\alpha_0}{4\ (x-1)}+\frac{5\kappa\alpha_0}{4(x-1)}+\frac{d_1\kappa\alpha_0}{3\ (x-1)^2}-$$
$$\frac{5\kappa\alpha_0}{2(x-1)^2}-\frac{d_1\kappa\alpha_0}{2\ (x-1)^3}+\frac{15\kappa\alpha_0}{4(x-1)^3}+\frac{d_1\kappa\ \alpha_0}{(x-1)^4}-\frac{45\kappa\alpha_0}{8(x-1)^4}+\frac{105\kappa\ \alpha_0}{8}-\frac{d_1\alpha_0}{4(x-1)}+\frac{13\alpha_0}{12(x-1)}+\frac{d_1\ \alpha_0}{3(x-1)^2}-\frac{3\alpha_0}{2(x-1)^2}-$$
$$\frac{d_1\alpha_0}{2\ (x-1)^3}+\frac{23\alpha_0}{12(x-1)^3}+\frac{d_1\alpha_0}{(x-1)^4}-\frac{61\ \alpha_0}{24(x-1)^4}+\frac{169\alpha_0}{24}+\frac{205d_1}{144}+\frac{205d_1\ \kappa}{144}+\frac{17d_1\kappa}{16(x-1)}-\frac{45\kappa}{8\ (x-1)}-\frac{13d_1\kappa}{36(x-1)^2}+$$
$$\frac{35\kappa}{12\ (x-1)^2}+\frac{13d_1\kappa}{36(x-1)^3}-\frac{35\kappa}{12\ (x-1)^3}-\frac{17d_1\kappa}{16(x-1)^4}+\frac{45\kappa}{8\ (x-1)^4}-\frac{205d_1\kappa}{144(x-1)^5}+\frac{205\kappa}{24\ (x-1)^5}-\frac{205\kappa}{24}+\bigg(\frac{3\kappa\alpha_0^4}{4(x-1)}+$$
$$\frac{3\kappa\alpha_0^4}{4}+\frac{\alpha_0^4}{4\ (x-1)}+\frac{\alpha_0^4}{4}-\frac{3\kappa\alpha_0^3}{x-1}+\frac{\kappa\ \alpha_0^3}{(x-1)^2}-4\kappa\alpha_0^3-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3\ (x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{9\kappa\alpha_0^2}{2(x-1)}-\frac{3\ \kappa\alpha_0^2}{(x-1)^2}+\frac{3\kappa\alpha_0^2}{2(x-1)^3}+$$
$$9\kappa\ \alpha_0^2+\frac{3\alpha_0^2}{2(x-1)}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{2\ (x-1)^3}+3\alpha_0^2-\frac{3\kappa\alpha_0}{x-1}+\frac{3\kappa\ \alpha_0}{(x-1)^2}-\frac{3\kappa\alpha_0}{(x-1)^3}+\frac{3\kappa\ \alpha_0}{(x-1)^4}-12\kappa\ \alpha_0-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-$$
$$\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{}(x-1)^4-4\alpha_0+\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2\ (x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4\ (x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{25\kappa}{4}+\frac{5}{4\ (x-1)}-$$
$$\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4\ (x-1)^4}-\frac{49}{12(x-1)^5}+\frac{25}{12}\bigg)\ H(0;\alpha_0)+\bigg(\frac{d_1\alpha_0^4}{4}+\frac{1}{4}d_1\kappa\ \alpha_0^4+\frac{d_1\kappa\alpha_0^4}{4(x-1)}+\frac{d_1\alpha_0^4}{4\ (x-1)}-$$
$$\frac{4d_1\alpha_0^3}{3}-\frac{4}{3}d_1\kappa\alpha_0^3-\frac{d_1\ \kappa\alpha_0^3}{x-1}+\frac{d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{d_1\ \alpha_0^3}{x-1}+\frac{d_1\alpha_0^3}{3(x-1)^2}+3d_1\alpha_0^2+3d_1\kappa\ \alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{2(x-1)}-\frac{d_1\kappa\ \alpha_0^2}{(x-1)^2}+$$
$$\frac{d_1\kappa\alpha_0^2}{2(x-1)^3}+\frac{3d_1\ \alpha_0^2}{2(x-1)}-\frac{d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{2\ (x-1)^3}-4d_1\alpha_0-4d_1\kappa\alpha_0-\frac{d_1\kappa\ \alpha_0}{x-1}+\frac{d_1\kappa\alpha_0}{(x-1)^2}-\frac{d_1\kappa\ \alpha_0}{(x-1)^3}+\frac{d_1\kappa\alpha_0}{(x-1)^4}-$$
$$\frac{d_1\ \alpha_0}{x-1}+\frac{d_1\alpha_0}{(x-1)^2}-\frac{d_1\alpha_0}{(x-1)^3}+\frac{d_1\ \alpha_0}{(x-1)^4}+\frac{25d_1}{12}+\frac{25d_1\kappa}{12}+\frac{5d_1\ \kappa}{4(x-1)}-\frac{5d_1\kappa}{6(x-1)^2}+\frac{5d_1\kappa}{6(x-1)^3}-\frac{5d_1\kappa}{4(x-1)^4}-\frac{25d_1\kappa}{12\ (x-1)^5}+$$
$$\frac{5d_1}{4(x-1)}-\frac{5d_1}{6(x-1)^2}+\frac{5d_1}{6\ (x-1)^3}-\frac{5d_1}{4(x-1)^4}-\frac{49d_1}{12(x-1)^5}\bigg)\ H(1;\alpha_0)+\bigg(\frac{6\kappa}{(x-1)^5}+\frac{2}{(x-1)^5}\bigg)H(0,0;\ \alpha_0)+$$
$$\bigg(\frac{2\kappa d_1}{(x-1)^5}+\frac{2d_1}{(x-1)^5}\bigg)\ H(0,1;\alpha_0)+\bigg(\frac{2\kappa d_1}{(x-1)^5}+\frac{2\ d_1}{(x-1)^5}\bigg)H(1,0;\alpha_0)+\frac{2d_1^2\ H(1,1;\alpha_0)}{(x-1)^5}+\frac{17d_1}{16(x-1)}-$$
$$\frac{65}{24\ (x-1)}-\frac{13d_1}{36(x-1)^2}+\frac{55}{36(x-1)^2}+\frac{13\ d_1}{36(x-1)^3}-\frac{55}{36(x-1)^3}-\frac{17d_1}{16\ (x-1)^4}+\frac{65}{24(x-1)^4}-\frac{205d_1}{144(x-1)^5}-$$
$$\frac{\pi^{\ 2}}{12(x-1)^5}+\frac{449}{72\ (x-1)^5}-\frac{305}{72}\bigg)+\bigg(\frac{2d_1^2}{(x-1)^5}-\frac{2\ \kappa d_1}{(x-1)^5}+\kappa d_1-\frac{2d_1}{(x-1)^5}+d_1+\frac{3\ \kappa}{2(x-1)^5}-\frac{3\kappa}{2}+\frac{1}{2\ (x-1)^5}-$$
$$\frac{1}{2}\bigg)H(0;\alpha_0)H(1,1;x)+\bigg(-\frac{\kappa\ d_1}{x-1}+\frac{\kappa d_1}{2(x-1)^2}-\frac{\kappa d_1}{3\ (x-1)^3}+\frac{\kappa d_1}{4(x-1)^4}+\frac{25\kappa d_1}{12\ (x-1)^5}-\frac{d_1}{x-1}+\frac{d_1}{2(x-1)^2}-$$
$$\frac{d_1}{3(x-1)^3}+\frac{d_1}{4(x-1)^4}+\frac{49d_1}{12(x-1)^5}+\frac{15\kappa}{8\ (x-1)}-\frac{5\kappa}{4(x-1)^2}+\frac{5\kappa}{4\ (x-1)^3}-\frac{15\kappa}{8(x-1)^4}-\frac{33\kappa}{8\ (x-1)^5}+\frac{33\kappa}{8}+\bigg(-\frac{2\kappa\ d_1}{(x-1)^5}-$$



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$$\frac{2d_1}{(x-1)^5}+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0;\alpha_0)+\Big(-\frac{2d_1^2}{(x-1)^5}+\frac{\kappa d_1}{(x-1)^5}-\kappa d_1+\frac{d_1}{(x-1)^5}-d_1\Big)H(1;\alpha_0)+$$
$$\frac{5}{8(x-1)}-\frac{5}{12(x-1)^2}+\frac{5}{12(x-1)^3}-\frac{5}{8(x-1)^4}-\frac{49}{24(x-1)^5}+\frac{49}{24}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{3\kappa\alpha_0^4}{8(x-1)}+\frac{3\kappa\alpha_0^4}{8}+$$
$$\frac{\alpha_0^4}{8(x-1)}+\frac{\alpha_0^4}{8}-\frac{3\kappa\alpha_0^3}{2(x-1)}+\frac{\kappa\alpha_0^3}{2(x-1)^2}-2\kappa\alpha_0^3-\frac{\alpha_0^3}{2(x-1)}+\frac{\alpha_0^3}{6(x-1)^2}-\frac{2\alpha_0^3}{3}+\frac{9\kappa\alpha_0^2}{4(x-1)}-\frac{3\kappa\alpha_0^2}{2(x-1)^2}+\frac{3\kappa\alpha_0^2}{4(x-1)^3}+$$
$$\frac{9\kappa\alpha_0^2}{2}+\frac{3\alpha_0^2}{4(x-1)}-\frac{\alpha_0^2}{2(x-1)^2}+\frac{\alpha_0^2}{4(x-1)^3}+\frac{3\alpha_0^2}{2}-\frac{3\kappa\alpha_0}{2(x-1)}+\frac{3\kappa\alpha_0}{2(x-1)^2}-\frac{3\kappa\alpha_0}{2(x-1)^3}+\frac{3\kappa\alpha_0}{2(x-1)^4}-6\kappa\alpha_0-$$
$$\frac{\alpha_0}{2(x-1)}+\frac{\alpha_0}{2(x-1)^2}-\frac{\alpha_0}{2(x-1)^3}+\frac{\alpha_0}{2(x-1)^4}-2\alpha_0+\frac{15\kappa}{8(x-1)}-\frac{5\kappa}{4(x-1)^2}+\frac{5\kappa}{4(x-1)^3}-\frac{15\kappa}{8(x-1)^4}-\frac{33\kappa}{8(x-1)^5}+$$
$$\frac{25\kappa}{8}+\Big(\frac{3\kappa}{(x-1)^5}+\frac{1}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(\frac{\kappa d_1}{(x-1)^5}+\frac{d_1}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{5}{8(x-1)}-\frac{5}{12(x-1)^2}+\frac{5}{12(x-1)^3}-$$
$$\frac{5}{8(x-1)^4}-\frac{49}{24(x-1)^5}+\frac{25}{24}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{6\kappa}{(x-1)^5}+6\kappa+\frac{2}{(x-1)^5}+2\Big)H(0,0,0;\alpha_0)+\Big(-$$
$$\frac{6\kappa}{(x-1)^5}+6\kappa-\frac{2}{(x-1)^5}+2\Big)H(0,0,0;x)+\Big(\frac{2\kappa d_1}{(x-1)^5}+2\kappa d_1+\frac{2d_1}{(x-1)^5}+2d_1\Big)H(0,0,1;\alpha_0)+\Big(\frac{3\kappa}{(x-1)^5}-$$
$$3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0,0,c_1(\alpha_0);x)+\Big(\frac{2\kappa d_1}{(x-1)^5}+2\kappa d_1+\frac{2d_1}{(x-1)^5}+2d_1\Big)H(0,1,0;\alpha_0)+\Big(\frac{\kappa d_1}{(x-1)^5}-$$
$$\kappa d_1+\frac{d_1}{(x-1)^5}-d_1-\frac{3\kappa}{(x-1)^5}+3\kappa-\frac{1}{(x-1)^5}+1\Big)H(0,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}+2d_1^2\Big)H(0,1,1;\alpha_0)+$$
$$\Big(-\frac{\kappa d_1}{(x-1)^5}+\kappa d_1-\frac{d_1}{(x-1)^5}+d_1+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0,1,c_1(\alpha_0);x)+\Big(\frac{3\kappa}{2(x-1)^5}-$$
$$\frac{3\kappa}{2}+\frac{1}{2(x-1)^5}-\frac{1}{2}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2\kappa d_1}{(x-1)^5}+\frac{2d_1}{(x-1)^5}-\frac{3\kappa}{(x-1)^5}+3\kappa-\frac{1}{(x-1)^5}+$$
$$1\Big)H(1,0,0;x)+\Big(-\frac{\kappa d_1}{(x-1)^5}-\frac{d_1}{(x-1)^5}+\frac{3\kappa}{2(x-1)^5}-\frac{3\kappa}{2}+\frac{1}{2(x-1)^5}-\frac{1}{2}\Big)H(1,0,c_1(\alpha_0);x)+$$
$$\Big(-\frac{2d_1^2}{(x-1)^5}+\frac{2\kappa d_1}{(x-1)^5}-\kappa d_1+\frac{2d_1}{(x-1)^5}-d_1-\frac{3\kappa}{2(x-1)^5}+\frac{3\kappa}{2}-\frac{1}{2(x-1)^5}+\frac{1}{2}\Big)H(1,1,0;x)+$$
$$\Big(\frac{2d_1^2}{(x-1)^5}-\frac{2\kappa d_1}{(x-1)^5}+\kappa d_1-\frac{2d_1}{(x-1)^5}+d_1+\frac{3\kappa}{2(x-1)^5}-\frac{3\kappa}{2}+\frac{1}{2(x-1)^5}-\frac{1}{2}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-$$
$$\frac{\kappa d_1}{(x-1)^5}-\frac{d_1}{(x-1)^5}+\frac{3\kappa}{2(x-1)^5}-\frac{3\kappa}{2}+\frac{1}{2(x-1)^5}-\frac{1}{2}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3\kappa}{2(x-1)^5}+$$
$$\frac{1}{2(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\frac{35\pi^2\kappa}{48(x-1)(\kappa+1)}+\frac{35\pi^2\kappa}{72(x-1)^2(\kappa+1)}-\frac{35\pi^2\kappa}{72(x-1)^3(\kappa+1)}+$$
$$\frac{35\pi^2\kappa}{48(x-1)^4(\kappa+1)}+\frac{247\pi^2\kappa}{144(x-1)^5(\kappa+1)}-\frac{247\pi^2\kappa}{144(\kappa+1)}-\frac{5\pi^2}{48(x-1)(\kappa+1)}+\frac{5\pi^2}{72(x-1)^2(\kappa+1)}-\frac{5\pi^2}{72(x-1)^3(\kappa+1)}+$$
$$\frac{5\pi^2}{48(x-1)^4(\kappa+1)}+\frac{49\pi^2}{144(x-1)^5(\kappa+1)}-\frac{25\pi^2}{144(\kappa+1)}-\frac{4}{\kappa+1}-\frac{7\kappa\zeta_3}{2(x-1)^5(\kappa+1)}+\frac{7\kappa\zeta_3}{2(\kappa+1)}-\frac{\zeta_3}{2(x-1)^5(\kappa+1)}+\frac{3\zeta_3}{2(\kappa+1)}.$$

### D.3 The $\mathcal{A}$ integral for $k=2$ and arbitrary $\kappa$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;\kappa,2,0,g_A) &= x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;\kappa,2)\\ &= \frac{1}{\varepsilon}a_{-1}^{(\kappa,2)}+a_0^{(\kappa,2)}+\varepsilon a_1^{(\kappa,2)}+\varepsilon a_2^{(\kappa,2)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned}\tag{D.3}$$

where

$$a_{-1}^{(\kappa,2)}=-\frac{1}{3(\kappa+1)},$$

$$a_0^{(\kappa,2)}=-\frac{\alpha_0^6}{3(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0^5}{3(x-2)}+\frac{5\alpha_0^5}{3(x\alpha_0-2\alpha_0-x)}-\frac{5\alpha_0^4}{4(x-2)}+\frac{\alpha_0^4}{12(x-1)}-\frac{10\alpha_0^4}{3(x\alpha_0-2\alpha_0-x)}+$$
$$\frac{\kappa\alpha_0^4}{12(\kappa+1)}+\frac{\alpha_0^4}{12(\kappa+1)}+\frac{5\alpha_0^4}{6(x-2)^2}+\frac{5\alpha_0^3}{3(x-2)}-\frac{\alpha_0^3}{3(x-1)}+\frac{10\alpha_0^3}{3(x\alpha_0-2\alpha_0-x)}-\frac{4\kappa\alpha_0^3}{9(\kappa+1)}-\frac{4\alpha_0^3}{9(\kappa+1)}-\frac{20\alpha_0^3}{9(x-2)^2}+$$
$$\frac{\alpha_0^3}{9(x-1)^2}+\frac{20\alpha_0^3}{9(x-2)^3}-\frac{5\alpha_0^2}{6(x-2)}+\frac{\alpha_0^2}{2(x-1)}-\frac{5\alpha_0^2}{3(x\alpha_0-2\alpha_0-x)}+\frac{\kappa\alpha_0^2}{\kappa+1}+\frac{\alpha_0^2}{\kappa+1}+\frac{5\alpha_0^2}{3(x-2)^2}-\frac{\alpha_0^2}{3(x-1)^2}-$$
$$\frac{10\alpha_0^2}{3(x-2)^3}+\frac{\alpha_0^2}{6(x-1)^3}+\frac{20\alpha_0^2}{3(x-2)^4}-\frac{\alpha_0}{3(x-1)}+\frac{\alpha_0}{3(x\alpha_0-2\alpha_0-x)}-\frac{4\kappa\alpha_0}{3(\kappa+1)}-\frac{4\alpha_0}{3(\kappa+1)}+\frac{\alpha_0}{3(x-1)^2}-\frac{\alpha_0}{3(x-1)^3}+$$
$$\frac{\alpha_0}{3(x-1)^4}+\frac{80\alpha_0}{3(x-2)^5}+\Big(\frac{1}{3(x-1)^5}+\frac{1}{3}+\frac{80}{3(x-2)^5}+\frac{160}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{1}{3(x-1)^5}+\frac{1}{3}-\frac{80}{3(x-2)^5}-$$
$$\frac{160}{3(x-2)^6}\Big)H(0;x)+\frac{H(c_1(\alpha_0);x)}{3(x-1)^5}+\Big(\frac{80}{3(x-2)^5}+\frac{160}{3(x-2)^6}\Big)H(c_2(\alpha_0);x)-\frac{13}{18(\kappa+1)}+\frac{80\ln 2}{3(x-2)^5}+\frac{160\ln 2}{3(x-2)^6},$$

$$a_1^{(\kappa,2)} = \frac{1}{\alpha_0(x-2)-x}\Big\{ -\frac{1}{24}d_1 x\alpha_0^5 - \frac{d_1\alpha_0^5}{12(x-2)} + \frac{d_1\alpha_0^5}{24(x-1)} + \frac{2x\alpha_0^5}{9(\kappa+1)} + \frac{11x\kappa\alpha_0^5}{36(\kappa+1)} + \frac{25\kappa\alpha_0^5}{36(x-2)(\kappa+1)} -$$

$$\frac{11\kappa\alpha_0^5}{36(x-1)(\kappa+1)} + \frac{\kappa\alpha_0^5}{24(\kappa+1)} + \frac{19\alpha_0^5}{36(x-2)(\kappa+1)} - \frac{2\alpha_0^5}{9(x-1)(\kappa+1)} + \frac{\alpha_0^5}{24(\kappa+1)} - \frac{7d_1\alpha_0^4}{108} + \frac{61}{216}d_1x\alpha_0^4 + \frac{11d_1\alpha_0^4}{54(x-2)} -$$

$$\frac{43d_1\alpha_0^4}{216(x-1)} - \frac{157x\alpha_0^4}{108(\kappa+1)} - \frac{56x\kappa\alpha_0^4}{27(\kappa+1)} - \frac{113\kappa\alpha_0^4}{54(x-2)(\kappa+1)} + \frac{149\kappa\alpha_0^4}{108(x-1)(\kappa+1)} + \frac{149\kappa\alpha_0^4}{54(x-2)^2(\kappa+1)} - \frac{59\kappa\alpha_0^4}{108(x-1)^2(\kappa+1)} +$$

$$\frac{41\kappa\alpha_0^4}{216(\kappa+1)} - \frac{91\alpha_0^4}{54(x-2)(\kappa+1)} + \frac{53\alpha_0^4}{54(x-1)(\kappa+1)} + \frac{103\alpha_0^4}{54(x-2)^2(\kappa+1)} - \frac{37\alpha_0^4}{108(x-1)^2(\kappa+1)} + \frac{\alpha_0^4}{216(\kappa+1)} - \frac{23d_1\alpha_0^4}{54(x-2)^2} +$$

$$\frac{2d_1\alpha_0^4}{27(x-1)^2} + \frac{4d_1\alpha_0^3}{9} - \frac{95}{108}d_1x\alpha_0^3 + \frac{d_1\alpha_0^3}{54(x-2)} + \frac{41d_1\alpha_0^3}{108(x-1)} + \frac{911x\alpha_0^3}{216(\kappa+1)} + \frac{1381x\kappa\alpha_0^3}{216(\kappa+1)} + \frac{25\kappa\alpha_0^3}{27(x-2)(\kappa+1)} -$$

$$\frac{239\kappa\alpha_0^3}{108(x-1)(\kappa+1)} - \frac{104\kappa\alpha_0^3}{27(x-2)^2(\kappa+1)} + \frac{467\kappa\alpha_0^3}{216(x-1)^2(\kappa+1)} + \frac{388\kappa\alpha_0^3}{27(x-2)^3(\kappa+1)} - \frac{83\kappa\alpha_0^3}{72(x-1)^3(\kappa+1)} - \frac{83\kappa\alpha_0^3}{36(\kappa+1)} +$$

$$\frac{35\alpha_0^3}{27(x-2)(\kappa+1)} - \frac{175\alpha_0^3}{108(x-1)(\kappa+1)} - \frac{88\alpha_0^3}{27(x-2)^2(\kappa+1)} + \frac{277\alpha_0^3}{216(x-1)^2(\kappa+1)} + \frac{236\alpha_0^3}{27(x-2)^3(\kappa+1)} - \frac{5\alpha_0^3}{8(x-1)^3(\kappa+1)} -$$

$$\frac{35\alpha_0^3}{36(\kappa+1)} + \frac{8d_1\alpha_0^3}{27(x-2)^2} - \frac{17d_1\alpha_0^3}{54(x-1)^2} - \frac{76d_1\alpha_0^3}{27(x-2)^3} + \frac{d_1\alpha_0^3}{6(x-1)^3} - \frac{35d_1\alpha_0^2}{18} + \frac{73}{36}d_1x\alpha_0^2 - \frac{4d_1\alpha_0^2}{9(x-2)} - \frac{13d_1\alpha_0^2}{36(x-1)} -$$

$$\frac{569x\alpha_0^2}{72(\kappa+1)} - \frac{979x\kappa\alpha_0^2}{72(\kappa+1)} + \frac{16\kappa\alpha_0^2}{3(x-2)(\kappa+1)} - \frac{2\kappa\alpha_0^2}{3(x-1)(\kappa+1)} - \frac{10\kappa\alpha_0^2}{(x-2)^2(\kappa+1)} - \frac{67\kappa\alpha_0^2}{24(x-1)^2(\kappa+1)} + \frac{80\kappa\alpha_0^2}{3(x-2)^3(\kappa+1)} +$$

$$\frac{119\kappa\alpha_0^2}{24(x-1)^3(\kappa+1)} + \frac{1256\kappa\alpha_0^2}{9(x-2)^4(\kappa+1)} - \frac{137\kappa\alpha_0^2}{36(x-1)^4(\kappa+1)} + \frac{32\kappa\alpha_0^2}{3(\kappa+1)} + \frac{16\alpha_0^2}{9(x-2)(\kappa+1)} + \frac{\alpha_0^2}{2(x-1)(\kappa+1)} -$$

$$\frac{10\alpha_0^2}{3(x-2)^2(\kappa+1)} - \frac{119\alpha_0^2}{72(x-1)^2(\kappa+1)} + \frac{80\alpha_0^2}{9(x-2)^3(\kappa+1)} + \frac{19\alpha_0^2}{8(x-1)^3(\kappa+1)} + \frac{632\alpha_0^2}{9(x-2)^4(\kappa+1)} - \frac{7\alpha_0^2}{4(x-1)^4(\kappa+1)} +$$

$$\frac{85\alpha_0^2}{18(\kappa+1)} + \frac{5d_1\alpha_0^2}{3(x-2)^2} + \frac{d_1\alpha_0^2}{2(x-1)^2} - \frac{80d_1\alpha_0^2}{9(x-2)^3} - \frac{5d_1\alpha_0^2}{6(x-1)^3} - \frac{104d_1\alpha_0^2}{3(x-2)^4} + \frac{2d_1\alpha_0^2}{3(x-1)^4} - \frac{d_1\alpha_0}{3(\kappa+1)} - \frac{25d_1x\alpha_0}{18(\kappa+1)} +$$

$$\frac{371x\alpha_0}{108(\kappa+1)} - \frac{d_1\kappa\alpha_0}{3(\kappa+1)} - \frac{25d_1x\kappa\alpha_0}{18(\kappa+1)} - \frac{\pi^2x\kappa\alpha_0}{6(\kappa+1)} + \frac{323x\kappa\alpha_0}{36(\kappa+1)} + \frac{2d_1\kappa\alpha_0}{9(x-2)(\kappa+1)} + \frac{4\kappa\alpha_0}{3(x-2)(\kappa+1)} + \frac{d_1\kappa\alpha_0}{18(x-1)(\kappa+1)} -$$

$$\frac{11\kappa\alpha_0}{4(x-1)(\kappa+1)} - \frac{10d_1\kappa\alpha_0}{9(x-2)^2(\kappa+1)} - \frac{d_1\kappa\alpha_0}{9(x-1)^2(\kappa+1)} + \frac{17\kappa\alpha_0}{12(x-1)^2(\kappa+1)} + \frac{80d_1\kappa\alpha_0}{9(x-2)^3(\kappa+1)} - \frac{40\kappa\alpha_0}{3(x-2)^3(\kappa+1)} +$$

$$\frac{d_1\kappa\alpha_0}{3(x-1)^3(\kappa+1)} - \frac{3\kappa\alpha_0}{2(x-1)^3(\kappa+1)} + \frac{208d_1\kappa\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{20\pi^2\kappa\alpha_0}{3(x-2)^4(\kappa+1)} - \frac{2512\kappa\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{2d_1\kappa\alpha_0}{3(x-1)^4(\kappa+1)} +$$

$$\frac{\pi^2\kappa\alpha_0}{6(x-1)^4(\kappa+1)} - \frac{137\kappa\alpha_0}{36(x-1)^4(\kappa+1)} + \frac{256d_1\kappa\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{40\pi^2\kappa\alpha_0}{3(x-2)^5(\kappa+1)} - \frac{3584\kappa\alpha_0}{9(x-2)^5(\kappa+1)} - \frac{\pi^2\kappa\alpha_0}{6(x-1)^5(\kappa+1)} +$$

$$\frac{\pi^2\kappa\alpha_0}{3(\kappa+1)} + \frac{109\kappa\alpha_0}{36(\kappa+1)} + \frac{2d_1\alpha_0}{9(x-2)(\kappa+1)} + \frac{4\alpha_0}{9(x-2)(\kappa+1)} + \frac{d_1\alpha_0}{18(x-1)(\kappa+1)} - \frac{11\alpha_0}{12(x-1)(\kappa+1)} - \frac{10d_1\alpha_0}{9(x-2)^2(\kappa+1)} -$$

$$\frac{d_1\alpha_0}{9(x-1)^2(\kappa+1)} + \frac{17\alpha_0}{36(x-1)^2(\kappa+1)} + \frac{80d_1\alpha_0}{9(x-2)^3(\kappa+1)} - \frac{40\alpha_0}{9(x-2)^3(\kappa+1)} + \frac{d_1\alpha_0}{3(x-1)^3(\kappa+1)} - \frac{\alpha_0}{2(x-1)^3(\kappa+1)} +$$

$$\frac{208d_1\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{20\pi^2\alpha_0}{9(x-2)^4(\kappa+1)} - \frac{1264\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{2d_1\alpha_0}{3(x-1)^4(\kappa+1)} + \frac{\pi^2\alpha_0}{18(x-1)^4(\kappa+1)} - \frac{7\alpha_0}{4(x-1)^4(\kappa+1)} +$$

$$\frac{256d_1\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{40\pi^2\alpha_0}{9(x-2)^5(\kappa+1)} - \frac{2048\alpha_0}{9(x-2)^5(\kappa+1)} - \frac{\pi^2\alpha_0}{18(x-1)^5(\kappa+1)} + \frac{545\alpha_0}{108(\kappa+1)} + \frac{80\kappa\ln^2 2\,\alpha_0}{(x-2)^4(\kappa+1)} +$$

$$\frac{160\kappa\ln^2 2\,\alpha_0}{(x-2)^5(\kappa+1)} + \frac{80\ln^2 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{160\ln^2 2\,\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{32d_1\kappa\ln 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{352\kappa\ln 2\,\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{64d_1\kappa\ln 2\,\alpha_0}{3(x-2)^5(\kappa+1)} +$$

$$\frac{704\kappa\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{32d_1\ln 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{544\ln 2\,\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{64d_1\ln 2\,\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{1088\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \Big(-\frac{x\alpha_0^5}{6} - \frac{1}{6}x\kappa\alpha_0^5 -$$

$$\frac{\kappa\alpha_0^5}{3(x-2)} + \frac{\kappa\alpha_0^5}{6(x-1)} - \frac{\alpha_0^5}{3(x-2)} + \frac{\alpha_0^5}{6(x-1)} + \frac{19x\alpha_0^4}{18} + \frac{19}{18}x\kappa\alpha_0^4 + \frac{10\kappa\alpha_0^4}{9(x-2)} - \frac{13\kappa\alpha_0^4}{18(x-1)} - \frac{10\kappa\alpha_0^4}{9(x-2)^2} + \frac{2\kappa\alpha_0^4}{9(x-1)^2} -$$

$$\frac{\kappa\alpha_0^4}{9} + \frac{10\alpha_0^4}{9(x-2)} - \frac{13\alpha_0^4}{18(x-1)} - \frac{10\alpha_0^4}{9(x-2)^2} + \frac{2\alpha_0^4}{9(x-1)^2} - \frac{\alpha_0^4}{9} - \frac{26x\alpha_0^3}{9} - \frac{26}{9}x\kappa\alpha_0^3 - \frac{10\kappa\alpha_0^3}{9(x-2)} + \frac{11\kappa\alpha_0^3}{9(x-1)} + \frac{20\kappa\alpha_0^3}{9(x-2)^2} -$$

$$\frac{7\kappa\alpha_0^3}{9(x-1)^2} - \frac{40\kappa\alpha_0^3}{9(x-2)^3} + \frac{\kappa\alpha_0^3}{3(x-1)^3} + \frac{2\kappa\alpha_0^3}{3} - \frac{10\alpha_0^3}{9(x-2)} + \frac{11\alpha_0^3}{9(x-1)} + \frac{20\alpha_0^3}{9(x-2)^2} - \frac{7\alpha_0^3}{9(x-1)^2} - \frac{40\alpha_0^3}{9(x-2)^3} + \frac{\alpha_0^3}{3(x-1)^3} +$$

$$\frac{2\alpha_0^3}{3} + \frac{14x\alpha_0^2}{3} + \frac{14}{3}x\kappa\alpha_0^2 - \frac{\kappa\alpha_0^2}{x-1} + \frac{\kappa\alpha_0^2}{(x-1)^2} - \frac{\kappa\alpha_0^2}{(x-1)^3} - \frac{80\kappa\alpha_0^2}{3(x-2)^4} + \frac{2\kappa\alpha_0^2}{3(x-1)^4} - 2\kappa\alpha_0^2 - \frac{\alpha_0^2}{x-1} + \frac{\alpha_0^2}{(x-1)^2} -$$

$$\frac{\alpha_0^2}{(x-1)^3} - \frac{80\alpha_0^2}{3(x-2)^4} + \frac{2\alpha_0^2}{3(x-1)^4} - 2\alpha_0^2 - \frac{95x\alpha_0}{36} - \frac{121x\kappa\alpha_0}{36} - \frac{40\kappa\alpha_0}{9(x-2)} + \frac{65\kappa\alpha_0}{12(x-1)} + \frac{40\kappa\alpha_0}{9(x-2)^2} - \frac{25\kappa\alpha_0}{18(x-1)^2} +$$

$$\frac{35\kappa\alpha_0}{36(x-1)^3} + \frac{96\kappa\alpha_0}{(x-2)^4} + \frac{31\kappa\alpha_0}{36(x-1)^4} + \frac{256\kappa\alpha_0}{3(x-2)^5} - \frac{25\kappa\alpha_0}{36(x-1)^5} - \frac{4\kappa\alpha_0}{9} - \frac{40\alpha_0}{9(x-2)} + \frac{65\alpha_0}{12(x-1)} + \frac{40\alpha_0}{9(x-2)^2} -$$

$$\frac{25\alpha_0}{18(x-1)^2} + \frac{35\alpha_0}{36(x-1)^3} + \frac{32d_1\alpha_0}{3(x-2)^4} + \frac{1504\alpha_0}{9(x-2)^4} + \frac{19\alpha_0}{12(x-1)^4} + \frac{64d_1\alpha_0}{3(x-2)^5} + \frac{2048\alpha_0}{9(x-2)^5} - \frac{17\alpha_0}{12(x-1)^5} - \frac{17\alpha_0}{9} - \frac{x}{36} +$$

$$\frac{25x\kappa}{36} - \frac{32\kappa}{9(x-2)} + \frac{43\kappa}{12(x-1)} + \frac{40\kappa}{9(x-2)^2} - \frac{4\kappa}{9(x-1)^2} - \frac{80\kappa}{9(x-2)^3} - \frac{\kappa}{36(x-1)^3} - \frac{128\kappa}{3(x-2)^4} - \frac{43\kappa}{36(x-1)^4} - \frac{64\kappa}{(x-2)^5} -$$

$$\frac{25\kappa}{36(x-1)^5} + \frac{128\kappa}{3(x-2)^6} + \frac{\kappa}{2} - \frac{32}{9(x-2)} + \frac{43}{12(x-1)} + \frac{40}{9(x-2)^2} - \frac{4}{9(x-1)^2} - \frac{80}{9(x-2)^3} - \frac{1}{36(x-1)^3} - \frac{32d_1}{3(x-2)^4} -$$

$$\frac{1024}{9(x-2)^4} - \frac{23}{12(x-1)^4} - \frac{128d_1}{3(x-2)^5} - \frac{3136}{9(x-2)^5} - \frac{17}{12(x-1)^5} - \frac{128d_1}{3(x-2)^6} - \frac{2176}{9(x-2)^6} + \frac{1}{2}\Big) H(0;\alpha_0) + \Big(-$$

$$\frac{1}{6}d_1x\alpha_0^5 - \frac{d_1\alpha_0^5}{3(x-2)} + \frac{d_1\alpha_0^5}{6(x-1)} - \frac{d_1\alpha_0^4}{9} + \frac{19}{18}d_1x\alpha_0^4 + \frac{10d_1\alpha_0^4}{9(x-2)} - \frac{13d_1\alpha_0^4}{18(x-1)} - \frac{10d_1\alpha_0^4}{9(x-2)^2} + \frac{2d_1\alpha_0^4}{9(x-1)^2} + \frac{2d_1\alpha_0^3}{3} -$$

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$$\frac{26}{9}d_1x\alpha_0^3-\frac{10d_1\alpha_0^3}{9(x-2)}+\frac{11d_1\alpha_0^3}{9(x-1)}+\frac{20d_1\alpha_0^3}{9(x-2)^2}-\frac{7d_1\alpha_0^3}{9(x-1)^2}-\frac{40d_1\alpha_0^3}{9(x-2)^3}+\frac{d_1\alpha_0^3}{3(x-1)^3}-2d_1\alpha_0^2+\frac{14}{3}d_1x\alpha_0^2-\frac{d_1\alpha_0^2}{x-1}+$$

$$\frac{d_1\alpha_0^2}{(x-1)^2}-\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{80d_1\alpha_0^2}{3(x-2)^4}+\frac{2d_1\alpha_0^2}{3(x-1)^4}+\frac{10d_1\alpha_0}{9}-\frac{73d_1x\alpha_0}{18}+\frac{5d_1\alpha_0}{9(x-2)}+\frac{7d_1\alpha_0}{18(x-1)}-\frac{20d_1\alpha_0}{9(x-2)^2}-\frac{5d_1\alpha_0}{9(x-1)^2}+$$

$$\frac{40d_1\alpha_0}{3(x-2)^3}+\frac{d_1\alpha_0}{(x-1)^3}+\frac{320d_1\alpha_0}{3(x-2)^4}+\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{d_1}{3}+\frac{25d_1x}{18}-\frac{2d_1}{9(x-2)}-\frac{d_1}{18(x-1)}+\frac{10d_1}{9(x-2)^2}+\frac{d_1}{9(x-1)^2}-$$

$$\frac{80d_1}{9(x-2)^3}-\frac{d_1}{3(x-1)^3}-\frac{80d_1}{(x-2)^4}-\frac{2d_1}{3(x-1)^4}-\frac{320d_1}{3(x-2)^5}\Big)H(1;\alpha_0)+\Big(\frac{x\alpha_0}{3}+\frac{x\kappa\alpha_0}{3}+\frac{80\kappa\alpha_0}{3(x-2)^4}-\frac{\kappa\alpha_0}{3(x-1)^4}+$$

$$\frac{160\kappa\alpha_0}{3(x-2)^5}+\frac{\kappa\alpha_0}{3(x-1)^5}-\frac{2\kappa\alpha_0}{3}+\frac{80\alpha_0}{3(x-2)^4}+\frac{2d_1\alpha_0}{3(x-1)^4}-\frac{\alpha_0}{3(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}-\frac{2d_1\alpha_0}{3(x-1)^5}+\frac{\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3}-\frac{x}{3}-$$

$$\frac{x\kappa}{3}-\frac{80\kappa}{3(x-2)^4}+\frac{\kappa}{3(x-1)^4}-\frac{320\kappa}{3(x-2)^5}+\frac{\kappa}{3(x-1)^5}-\frac{320\kappa}{3(x-2)^6}-\frac{80}{3(x-2)^4}-\frac{2d_1}{3(x-1)^4}+\frac{1}{3(x-1)^4}-\frac{320}{3(x-2)^5}-$$

$$\frac{2d_1}{3(x-1)^5}+\frac{1}{3(x-1)^5}-\frac{320}{3(x-2)^6}\Big)H(0;\alpha_0)H(1;x)+\Big(-\frac{x\alpha_0^5}{12}-\frac{1}{12}x\kappa\alpha_0^5-\frac{\kappa\alpha_0^5}{6(x-2)}+\frac{\kappa\alpha_0^5}{12(x-1)}-\frac{\alpha_0^5}{6(x-2)}+$$

$$\frac{\alpha_0^5}{12(x-1)}+\frac{19x\alpha_0^4}{36}+\frac{19}{36}x\kappa\alpha_0^4+\frac{5\kappa\alpha_0^4}{9(x-2)}-\frac{13\kappa\alpha_0^4}{36(x-1)}-\frac{5\kappa\alpha_0^4}{9(x-2)^2}+\frac{\kappa\alpha_0^4}{9(x-1)^2}-\frac{\kappa\alpha_0^4}{18}+\frac{5\alpha_0^4}{9(x-2)}-\frac{13\alpha_0^4}{36(x-1)}-$$

$$\frac{5\alpha_0^4}{9(x-2)^2}+\frac{\alpha_0^4}{9(x-1)^2}-\frac{\alpha_0^4}{18}-\frac{13x\alpha_0^3}{9}-\frac{13}{9}x\kappa\alpha_0^3-\frac{5\kappa\alpha_0^3}{9(x-2)}+\frac{11\kappa\alpha_0^3}{18(x-1)}+\frac{10\kappa\alpha_0^3}{9(x-2)^2}-\frac{7\kappa\alpha_0^3}{18(x-1)^2}-\frac{20\kappa\alpha_0^3}{9(x-2)^3}+$$

$$\frac{\kappa\alpha_0^3}{6(x-1)^3}+\frac{\kappa\alpha_0^3}{3}-\frac{5\alpha_0^3}{9(x-2)}+\frac{11\alpha_0^3}{18(x-1)}+\frac{10\alpha_0^3}{9(x-2)^2}-\frac{7\alpha_0^3}{18(x-1)^2}-\frac{20\alpha_0^3}{9(x-2)^3}+\frac{\alpha_0^3}{6(x-1)^3}+\frac{\alpha_0^3}{3}+\frac{7x\alpha_0^2}{3}+\frac{7}{3}x\kappa\alpha_0^2-$$

$$\frac{\kappa\alpha_0^2}{2(x-1)}+\frac{\kappa\alpha_0^2}{2(x-1)^2}-\frac{\kappa\alpha_0^2}{2(x-1)^3}-\frac{40\kappa\alpha_0^2}{3(x-2)^4}+\frac{\kappa\alpha_0^2}{3(x-1)^4}-\kappa\alpha_0^2-\frac{\alpha_0^2}{2(x-1)}+\frac{\alpha_0^2}{2(x-1)^2}-\frac{\alpha_0^2}{2(x-1)^3}-\frac{40\alpha_0^2}{3(x-2)^4}+$$

$$\frac{\alpha_0^2}{3(x-1)^4}-\alpha_0^2-\frac{73x\alpha_0}{36}-\frac{73x\kappa\alpha_0}{36}-\frac{40\kappa\alpha_0}{9(x-2)}+\frac{65\kappa\alpha_0}{12(x-1)}+\frac{40\kappa\alpha_0}{9(x-2)^2}-\frac{25\kappa\alpha_0}{18(x-1)^2}+\frac{35\kappa\alpha_0}{36(x-1)^3}+\frac{80\kappa\alpha_0}{(x-2)^4}+$$

$$\frac{19\kappa\alpha_0}{36(x-1)^4}+\frac{160\kappa\alpha_0}{3(x-2)^5}-\frac{25\kappa\alpha_0}{36(x-1)^5}+\frac{2\kappa\alpha_0}{9}-\frac{40\alpha_0}{9(x-2)}+\frac{65\alpha_0}{12(x-1)}+\frac{40\alpha_0}{9(x-2)^2}-\frac{25\alpha_0}{18(x-1)^2}+\frac{35\alpha_0}{36(x-1)^3}+$$

$$\frac{80\alpha_0}{(x-2)^4}+\frac{5\alpha_0}{4(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}-\frac{17\alpha_0}{12(x-1)^5}+\frac{2\alpha_0}{9}+\frac{25x}{36}+\frac{25x\kappa}{36}-\frac{32\kappa}{9(x-2)}+\frac{43\kappa}{12(x-1)}+\frac{40\kappa}{9(x-2)^2}-\frac{4\kappa}{9(x-1)^2}-$$

$$\frac{80\kappa}{9(x-2)^3}-\frac{\kappa}{36(x-1)^3}-\frac{160\kappa}{3(x-2)^4}-\frac{43\kappa}{36(x-1)^4}-\frac{320\kappa}{3(x-2)^5}-\frac{25\kappa}{36(x-1)^5}+\frac{\kappa}{2}+\Big(-\frac{2\kappa\alpha_0}{3(x-1)^4}+\frac{2\kappa\alpha_0}{3(x-1)^5}-$$

$$\frac{2\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3(x-1)^5}+\frac{2\kappa}{3(x-1)^4}+\frac{2\kappa}{3(x-1)^5}+\frac{2}{3(x-1)^4}+\frac{2}{3(x-1)^5}\Big)H(0;\alpha_0)+\Big(-\frac{2\alpha_0d_1}{3(x-1)^4}+\frac{2d_1}{3(x-1)^4}+$$

$$\frac{2\alpha_0d_1}{3(x-1)^5}+\frac{2d_1}{3(x-1)^5}\Big)H(1;\alpha_0)-\frac{32}{9(x-2)}+\frac{43}{12(x-1)}+\frac{40}{9(x-2)^2}-\frac{4}{9(x-1)^2}-\frac{80}{9(x-2)^3}-\frac{1}{36(x-1)^3}-$$

$$\frac{160}{3(x-2)^4}-\frac{23}{12(x-1)^4}-\frac{320}{3(x-2)^5}-\frac{17}{12(x-1)^5}+\frac{1}{2}\Big)H(c_1(\alpha_0);x)+\Big(-\frac{32\kappa\alpha_0}{3(x-2)^4}-\frac{64\kappa\alpha_0}{3(x-2)^5}+\frac{32d_1\alpha_0}{3(x-2)^4}+$$

$$\frac{544\alpha_0}{9(x-2)^4}+\frac{64d_1\alpha_0}{3(x-2)^5}+\frac{1088\alpha_0}{9(x-2)^5}+\frac{32\kappa}{3(x-2)^4}+\frac{128\kappa}{3(x-2)^5}+\frac{128\kappa}{3(x-2)^6}+\Big(-\frac{160\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{3(x-2)^5}-\frac{160\alpha_0}{3(x-2)^4}-$$

$$\frac{320\alpha_0}{3(x-2)^5}+\frac{160\kappa}{3(x-2)^4}+\frac{640\kappa}{3(x-2)^5}+\frac{640\kappa}{3(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{640}{3(x-2)^5}+\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{160\alpha_0d_1}{3(x-2)^4}+$$

$$\frac{160d_1}{3(x-2)^4}-\frac{320\alpha_0d_1}{3(x-2)^5}+\frac{640d_1}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}\Big)H(1;\alpha_0)-\frac{32d_1}{3(x-2)^4}-\frac{544}{9(x-2)^4}-\frac{128d_1}{3(x-2)^5}-\frac{2176}{9(x-2)^5}-$$

$$\frac{128d_1}{3(x-2)^6}-\frac{2176}{9(x-2)^6}\Big)H(c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-\frac{2x\kappa\alpha_0}{3}-\frac{160\kappa\alpha_0}{3(x-2)^4}-\frac{2\kappa\alpha_0}{3(x-1)^4}-\frac{320\kappa\alpha_0}{3(x-2)^5}+\frac{2\kappa\alpha_0}{3(x-1)^5}+$$

$$\frac{4\kappa\alpha_0}{3}-\frac{160\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+\frac{2x\kappa}{3}+\frac{160\kappa}{3(x-2)^4}+\frac{2\kappa}{3(x-1)^4}+\frac{640\kappa}{3(x-2)^5}+$$

$$\frac{2\kappa}{3(x-1)^5}+\frac{640\kappa}{3(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{2}{3(x-1)^4}+\frac{640}{3(x-2)^5}+\frac{2}{3(x-1)^5}+\frac{640}{3(x-2)^6}\Big)H(0,0;\alpha_0)+\Big(-\frac{2x\alpha_0}{3}-$$

$$\frac{2x\kappa\alpha_0}{3}+\frac{160\kappa\alpha_0}{3(x-2)^4}+\frac{2\kappa\alpha_0}{3(x-1)^4}+\frac{320\kappa\alpha_0}{3(x-2)^5}-\frac{2\kappa\alpha_0}{3(x-1)^5}+\frac{4\kappa\alpha_0}{3}+\frac{160\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+$$

$$\frac{4\alpha_0}{3}+\frac{2x}{3}+\frac{2x\kappa}{3}-\frac{160\kappa}{3(x-2)^4}-\frac{2\kappa}{3(x-1)^4}-\frac{640\kappa}{3(x-2)^5}-\frac{2\kappa}{3(x-1)^5}-\frac{640\kappa}{3(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{2}{3(x-1)^4}-\frac{640}{3(x-2)^5}-$$

$$\frac{2}{3(x-1)^5}-\frac{640}{3(x-2)^6}\Big)H(0,0;x)+\Big(\frac{4\alpha_0d_1}{3}-\frac{2\alpha_0xd_1}{3}+\frac{2xd_1}{3}-\frac{160\alpha_0d_1}{3(x-2)^4}+\frac{160d_1}{3(x-2)^4}-\frac{2\alpha_0d_1}{3(x-1)^4}+$$

$$\frac{2d_1}{3(x-1)^4}-\frac{320\alpha_0d_1}{3(x-2)^5}+\frac{640d_1}{3(x-2)^5}+\frac{2\alpha_0d_1}{3(x-1)^5}+\frac{2d_1}{3(x-1)^5}+\frac{640d_1}{3(x-2)^6}\Big)H(0,1;\alpha_0)+\Big(\frac{x\alpha_0}{3}+\frac{x\kappa\alpha_0}{3}+$$

$$\frac{80\kappa\alpha_0}{3(x-2)^4}-\frac{\kappa\alpha_0}{3(x-1)^4}+\frac{160\kappa\alpha_0}{3(x-2)^5}+\frac{\kappa\alpha_0}{3(x-1)^5}-\frac{2\kappa\alpha_0}{3}+\frac{80\alpha_0}{3(x-2)^4}-\frac{\alpha_0}{3(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}+\frac{\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3}-\frac{x}{3}-$$

$$\frac{x\kappa}{3}-\frac{80\kappa}{3(x-2)^4}+\frac{\kappa}{3(x-1)^4}-\frac{320\kappa}{3(x-2)^5}+\frac{\kappa}{3(x-1)^5}-\frac{320\kappa}{3(x-2)^6}-\frac{80}{3(x-2)^4}+\frac{1}{3(x-1)^4}-\frac{320}{3(x-2)^5}+\frac{1}{3(x-1)^5}-$$

$$\frac{320}{3(x-2)^6}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{160\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{3(x-2)^5}-\frac{160\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{160\kappa}{3(x-2)^4}+\frac{640\kappa}{3(x-2)^5}+$$

$$\frac{640\kappa}{3(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{640}{3(x-2)^5}+\frac{640}{3(x-2)^6}\Big)H(0,c_2(\alpha_0);x)+\Big(-\frac{x\alpha_0}{3}-\frac{x\kappa\alpha_0}{3}-\frac{80\kappa\alpha_0}{3(x-2)^4}+\frac{\kappa\alpha_0}{3(x-1)^4}-$$

$$\frac{160\kappa\alpha_0}{3(x-2)^5}-\frac{\kappa\alpha_0}{3(x-1)^5}+\frac{2\kappa\alpha_0}{3}-\frac{80\alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{2d_1\alpha_0}{3(x-1)^5}-\frac{\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3}+\frac{x}{3}+$$

$$
\frac{x\kappa}{3}+\frac{80\kappa}{3(x-2)^4}-\frac{\kappa}{3(x-1)^4}+\frac{320\kappa}{3(x-2)^5}-\frac{\kappa}{3(x-1)^5}+\frac{320\kappa}{3(x-2)^6}+\frac{80}{3(x-2)^4}+\frac{2d_1}{3(x-1)^4}-\frac{1}{3(x-1)^4}+\frac{320}{3(x-2)^5}+
$$

$$
\frac{2d_1}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(1,0;x)+\Big(\frac{x\alpha_0}{3}+\frac{x\kappa\alpha_0}{3}+\frac{80\kappa\alpha_0}{3(x-2)^4}-\frac{\kappa\alpha_0}{3(x-1)^4}+\frac{160\kappa\alpha_0}{3(x-2)^5}+\frac{\kappa\alpha_0}{3(x-1)^5}-
$$

$$
\frac{2\kappa\alpha_0}{3}+\frac{80\alpha_0}{3(x-2)^4}+\frac{2d_1\alpha_0}{3(x-1)^4}-\frac{\alpha_0}{3(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}-\frac{2d_1\alpha_0}{3(x-1)^5}+\frac{\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3}-\frac{x}{3}-\frac{x\kappa}{3}-\frac{80\kappa}{3(x-2)^4}+
$$

$$
\frac{\kappa}{3(x-1)^4}-\frac{320\kappa}{3(x-2)^5}+\frac{\kappa}{3(x-1)^5}-\frac{320\kappa}{3(x-2)^6}-\frac{80}{3(x-2)^4}-\frac{2d_1}{3(x-1)^4}+\frac{1}{3(x-1)^4}-\frac{320}{3(x-2)^5}-\frac{2d_1}{3(x-1)^5}+
$$

$$
\frac{1}{3(x-1)^5}-\frac{320}{3(x-2)^6}\Big)H(1,c_1(\alpha_0);x)+\Big(-\frac{160\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{3(x-2)^5}+\frac{160d_1\alpha_0}{3(x-2)^4}-\frac{160\alpha_0}{3(x-2)^4}+\frac{320d_1\alpha_0}{3(x-2)^5}-
$$

$$
\frac{320\alpha_0}{3(x-2)^5}+\frac{160\kappa}{3(x-2)^4}+\frac{640\kappa}{3(x-2)^5}+\frac{640\kappa}{3(x-2)^6}-\frac{160d_1}{3(x-2)^4}+\frac{160}{3(x-2)^4}-\frac{640d_1}{3(x-2)^5}+\frac{640}{3(x-2)^5}-\frac{640d_1}{3(x-2)^6}+
$$

$$
\frac{640}{3(x-2)^6}\Big)H(2,0;x)+\Big(\frac{160\kappa\alpha_0}{3(x-2)^4}+\frac{320\kappa\alpha_0}{3(x-2)^5}-\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\alpha_0}{3(x-2)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3(x-2)^5}-\frac{160\kappa}{3(x-2)^4}-
$$

$$
\frac{640\kappa}{3(x-2)^5}-\frac{640\kappa}{3(x-2)^6}+\frac{160d_1}{3(x-2)^4}-\frac{160}{3(x-2)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}-\frac{640}{3(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+
$$

$$
\Big(-\frac{\kappa\alpha_0}{3(x-1)^4}+\frac{\kappa\alpha_0}{3(x-1)^5}-\frac{\alpha_0}{3(x-1)^4}+\frac{\alpha_0}{3(x-1)^5}+\frac{\kappa}{3(x-1)^4}+\frac{\kappa}{3(x-1)^5}+\frac{1}{3(x-1)^4}+
$$

$$
\frac{1}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{80\kappa\alpha_0}{3(x-2)^4}-\frac{160\kappa\alpha_0}{3(x-2)^5}-\frac{80\alpha_0}{3(x-2)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{80\kappa}{3(x-2)^4}+\frac{320\kappa}{3(x-2)^5}+
$$

$$
\frac{320\kappa}{3(x-2)^6}+\frac{80}{3(x-2)^4}+\frac{320}{3(x-2)^5}+\frac{320}{3(x-2)^6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+H(0;x)\Big(\frac{17x\alpha_0}{12}+\frac{25x\kappa\alpha_0}{36}+
$$

$$
\frac{40\kappa\alpha_0}{9(x-2)}-\frac{65\kappa\alpha_0}{12(x-1)}-\frac{40\kappa\alpha_0}{9(x-2)^2}+\frac{25\kappa\alpha_0}{18(x-1)^2}-\frac{35\kappa\alpha_0}{36(x-1)^3}-\frac{128\kappa\alpha_0}{3(x-2)^4}-\frac{7\kappa\alpha_0}{36(x-1)^4}+\frac{64\kappa\alpha_0}{3(x-2)^5}+\frac{25\kappa\alpha_0}{36(x-1)^5}-\frac{8\kappa\alpha_0}{9}+
$$

$$
\frac{40\alpha_0}{9(x-2)}-\frac{65\alpha_0}{12(x-1)}-\frac{40\alpha_0}{9(x-2)^2}+\frac{25\alpha_0}{18(x-1)^2}-\frac{35\alpha_0}{36(x-1)^3}-\frac{32d_1\alpha_0}{3(x-2)^4}-\frac{1024\alpha_0}{9(x-2)^4}-\frac{11\alpha_0}{12(x-1)^4}-\frac{64d_1\alpha_0}{3(x-2)^5}-
$$

$$
\frac{1088\alpha_0}{9(x-2)^5}+\frac{17\alpha_0}{12(x-1)^5}-\frac{160\kappa\ln2\,\alpha_0}{3(x-2)^4}-\frac{320\kappa\ln2\,\alpha_0}{3(x-2)^5}-\frac{160\ln2\,\alpha_0}{3(x-2)^4}-\frac{320\ln2\,\alpha_0}{3(x-2)^5}-\frac{7\alpha_0}{3}-\frac{17x}{12}-\frac{25x\kappa}{36}+\frac{32\kappa}{9(x-2)}-
$$

$$
\frac{43\kappa}{12(x-1)}-\frac{40\kappa}{9(x-2)^2}+\frac{4\kappa}{9(x-1)^2}+\frac{80\kappa}{9(x-2)^3}+\frac{\kappa}{36(x-1)^3}+\frac{128\kappa}{3(x-2)^4}+\frac{43\kappa}{36(x-1)^4}+\frac{64\kappa}{(x-2)^5}+\frac{25\kappa}{36(x-1)^5}-
$$

$$
\frac{128\kappa}{3(x-2)^6}-\frac{\kappa}{2}+\frac{32}{9(x-2)}-\frac{43}{12(x-1)}-\frac{40}{9(x-2)^2}+\frac{4}{9(x-1)^2}+\frac{80}{9(x-2)^3}+\frac{1}{36(x-1)^3}+\frac{32d_1}{3(x-2)^4}+\frac{1024}{9(x-2)^4}+
$$

$$
\frac{23}{12(x-1)^4}+\frac{128d_1}{3(x-2)^5}+\frac{3136}{9(x-2)^5}+\frac{17}{12(x-1)^5}+\frac{128d_1}{3(x-2)^6}+\frac{2176}{9(x-2)^6}+\frac{160\kappa\ln2}{3(x-2)^4}+\frac{640\kappa\ln2}{3(x-2)^5}+\frac{640\kappa\ln2}{3(x-2)^6}+
$$

$$
\frac{160\ln2}{3(x-2)^4}+\frac{640\ln2}{3(x-2)^5}+\frac{640\ln2}{3(x-2)^6}-\frac{1}{2}\Big)+H(2;x)\Big(\frac{160\kappa\ln2\,\alpha_0}{3(x-2)^4}+\frac{320\kappa\ln2\,\alpha_0}{3(x-2)^5}-\frac{160d_1\ln2\,\alpha_0}{3(x-2)^4}+\frac{160\ln2\,\alpha_0}{3(x-2)^4}-
$$

$$
\frac{320d_1\ln2\,\alpha_0}{3(x-2)^5}+\frac{320\ln2\,\alpha_0}{3(x-2)^5}+\Big(\frac{160\kappa\alpha_0}{3(x-2)^4}+\frac{320\kappa\alpha_0}{3(x-2)^5}-\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\alpha_0}{3(x-2)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3(x-2)^5}-\frac{160\kappa}{3(x-2)^4}-
$$

$$
\frac{640\kappa}{3(x-2)^5}-\frac{640\kappa}{3(x-2)^6}+\frac{160d_1}{3(x-2)^4}-\frac{160}{3(x-2)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}-\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)-
$$

$$
\frac{160\kappa\ln2}{3(x-2)^4}-\frac{640\kappa\ln2}{3(x-2)^5}-\frac{640\kappa\ln2}{3(x-2)^6}+\frac{160d_1\ln2}{3(x-2)^4}-\frac{160\ln2}{3(x-2)^4}+\frac{640d_1\ln2}{3(x-2)^5}-\frac{640\ln2}{3(x-2)^5}+\frac{640d_1\ln2}{3(x-2)^6}-
$$

$$
\frac{640\ln2}{3(x-2)^6}\Big)+\frac{40x}{27(\kappa+1)}+\frac{\pi^2x\kappa}{6(\kappa+1)}-\frac{20\pi^2\kappa}{3(x-2)^4(\kappa+1)}-\frac{\pi^2\kappa}{6(x-1)^4(\kappa+1)}-\frac{80\pi^2\kappa}{3(x-2)^5(\kappa+1)}-\frac{\pi^2\kappa}{6(x-1)^5(\kappa+1)}-
$$

$$
\frac{80\pi^2\kappa}{3(x-2)^6(\kappa+1)}-\frac{20\pi^2}{9(x-2)^4(\kappa+1)}-\frac{\pi^2}{18(x-1)^4(\kappa+1)}-\frac{80\pi^2}{9(x-2)^5(\kappa+1)}-\frac{\pi^2}{18(x-1)^5(\kappa+1)}-\frac{80\pi^2}{9(x-2)^6(\kappa+1)}-
$$

$$
\frac{80\kappa\ln^22}{(x-2)^4(\kappa+1)}-\frac{320\kappa\ln^22}{(x-2)^5(\kappa+1)}-\frac{320\kappa\ln^22}{(x-2)^6(\kappa+1)}-\frac{80\ln^22}{3(x-2)^4(\kappa+1)}-\frac{320\ln^22}{3(x-2)^5(\kappa+1)}-\frac{320\ln^22}{3(x-2)^6(\kappa+1)}-
$$

$$
\frac{32d_1\kappa\ln2}{3(x-2)^4(\kappa+1)}-\frac{352\kappa\ln2}{9(x-2)^4(\kappa+1)}-\frac{128d_1\kappa\ln2}{3(x-2)^5(\kappa+1)}-\frac{1408\kappa\ln2}{9(x-2)^5(\kappa+1)}-\frac{128d_1\kappa\ln2}{3(x-2)^6(\kappa+1)}-\frac{1408\kappa\ln2}{9(x-2)^6(\kappa+1)}-
$$

$$
\frac{32d_1\ln2}{3(x-2)^4(\kappa+1)}-\frac{544\ln2}{9(x-2)^4(\kappa+1)}-\frac{128d_1\ln2}{3(x-2)^5(\kappa+1)}-\frac{2176\ln2}{9(x-2)^5(\kappa+1)}-\frac{128d_1\ln2}{3(x-2)^6(\kappa+1)}-\frac{2176\ln2}{9(x-2)^6(\kappa+1)}\Big\},
$$

$$
a_2^{(\kappa,2)} =
$$

$$
\frac{1}{\alpha_0(x-2)-x}\Big\{\frac{1}{48}d_1^2x\alpha_0^5-\frac{1}{72}\pi^2x\alpha_0^5+\frac{d_1^2\alpha_0^5}{24(x-2)}-\frac{\pi^2\alpha_0^5}{36(x-2)}-\frac{d_1^2\alpha_0^5}{48(x-1)}+\frac{\pi^2\alpha_0^5}{72(x-1)}-\frac{d_1\alpha_0^5}{48(\kappa+1)}-\frac{19d_1x\alpha_0^5}{144(\kappa+1)}+
$$

$$
\frac{13x\alpha_0^5}{27(\kappa+1)}-\frac{d_1\kappa\alpha_0^5}{48(\kappa+1)}-\frac{31d_1x\kappa\alpha_0^5}{144(\kappa+1)}+\frac{85x\kappa\alpha_0^5}{108(\kappa+1)}-\frac{17d_1\kappa\alpha_0^5}{36(x-2)(\kappa+1)}+\frac{415\kappa\alpha_0^5}{216(x-2)(\kappa+1)}+\frac{31d_1\kappa\alpha_0^5}{144(x-1)(\kappa+1)}-
$$

$$
\frac{85\kappa\alpha_0^5}{108(x-1)(\kappa+1)}+\frac{25\kappa\alpha_0^5}{144(\kappa+1)}-\frac{11d_1\alpha_0^5}{36(x-2)(\kappa+1)}+\frac{265\alpha_0^5}{216(x-2)(\kappa+1)}+\frac{19d_1\alpha_0^5}{144(x-1)(\kappa+1)}-\frac{13\alpha_0^5}{27(x-1)(\kappa+1)}+
$$

$$
\frac{19\alpha_0^5}{144(\kappa+1)}+\frac{37d_1^2\alpha_0^4}{648}-\frac{199d_1^2x\alpha_0^4}{1296}+\frac{19}{216}\pi^2x\alpha_0^4-\frac{17d_1^2\alpha_0^4}{324(x-2)}+\frac{5\pi^2\alpha_0^4}{54(x-2)}+\frac{145d_1^2\alpha_0^4}{1296(x-1)}-\frac{13\pi^2\alpha_0^4}{216(x-1)}-\frac{79d_1\alpha_0^4}{432(\kappa+1)}+
$$

$$
\frac{137d_1x\alpha_0^4}{144(\kappa+1)}-\frac{173x\alpha_0^4}{54(\kappa+1)}-\frac{617d_1\kappa\alpha_0^4}{1296(\kappa+1)}+\frac{2113d_1x\kappa\alpha_0^4}{1296(\kappa+1)}-\frac{1835x\kappa\alpha_0^4}{324(\kappa+1)}+\frac{139d_1\kappa\alpha_0^4}{162(x-2)(\kappa+1)}-\frac{1687\kappa\alpha_0^4}{324(x-2)(\kappa+1)}-
$$

$$
\frac{1429d_1\kappa\alpha_0^4}{1296(x-1)(\kappa+1)}+\frac{2359\kappa\alpha_0^4}{648(x-1)(\kappa+1)}-\frac{487d_1\kappa\alpha_0^4}{162(x-2)^2(\kappa+1)}+\frac{2851\kappa\alpha_0^4}{324(x-2)^2(\kappa+1)}+\frac{359d_1\kappa\alpha_0^4}{648(x-1)^2(\kappa+1)}-
$$

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$$\frac{140\kappa\alpha_0^4}{81(x-1)^2(\kappa+1)}+\frac{733\kappa\alpha_0^4}{1296(\kappa+1)}+\frac{35d_1\alpha_0^4}{54(x-2)(\kappa+1)}-\frac{137\alpha_0^4}{36(x-2)(\kappa+1)}-\frac{283d_1\alpha_0^4}{432(x-1)(\kappa+1)}+\frac{461\alpha_0^4}{216(x-1)(\kappa+1)}-$$

$$\frac{95d_1\alpha_0^4}{54(x-2)^2(\kappa+1)}+\frac{503\alpha_0^4}{108(x-2)^2(\kappa+1)}+\frac{7d_1\alpha_0^4}{24(x-1)^2(\kappa+1)}-\frac{43\alpha_0^4}{54(x-1)^2(\kappa+1)}-\frac{59\alpha_0^4}{432(\kappa+1)}+\frac{101d_1^2\alpha_0^4}{324(x-2)^2}-\frac{5\pi^2\alpha_0^4}{54(x-2)^2}-$$

$$\frac{4d_1^2\alpha_0^4}{81(x-1)^2}+\frac{\pi^2\alpha_0^4}{54(x-1)^2}-\frac{\pi^2\alpha_0^4}{108}-\frac{25d_1^2\alpha_0^3}{54}+\frac{371}{648}d_1^2x\alpha_0^3-\frac{13}{54}\pi^2x\alpha_0^3-\frac{67d_1^2\alpha_0^3}{324(x-2)}-\frac{5\pi^2\alpha_0^3}{54(x-2)}-\frac{155d_1^2\alpha_0^3}{648(x-1)}+$$

$$\frac{11\pi^2\alpha_0^3}{108(x-1)}+\frac{437d_1\alpha_0^3}{216(\kappa+1)}-\frac{1441d_1x\alpha_0^3}{432(\kappa+1)}+\frac{521x\alpha_0^3}{54(\kappa+1)}+\frac{985d_1\kappa\alpha_0^3}{216(\kappa+1)}-\frac{8029d_1x\kappa\alpha_0^3}{1296(\kappa+1)}+\frac{6347x\kappa\alpha_0^3}{324(\kappa+1)}+\frac{769d_1\kappa\alpha_0^3}{324(x-2)(\kappa+1)}-$$

$$\frac{182\kappa\alpha_0^3}{81(x-2)(\kappa+1)}+\frac{139d_1\kappa\alpha_0^3}{81(x-1)(\kappa+1)}-\frac{3085\kappa\alpha_0^3}{648(x-1)(\kappa+1)}-\frac{110d_1\kappa\alpha_0^3}{81(x-2)^2(\kappa+1)}-\frac{509\kappa\alpha_0^3}{81(x-2)^2(\kappa+1)}-\frac{3677d_1\kappa\alpha_0^3}{1296(x-1)^2(\kappa+1)}+$$

$$\frac{10099\kappa\alpha_0^3}{1296(x-1)^2(\kappa+1)}-\frac{2168d_1\kappa\alpha_0^3}{81(x-2)^3(\kappa+1)}+\frac{4684\kappa\alpha_0^3}{81(x-2)^3(\kappa+1)}+\frac{263d_1\kappa\alpha_0^3}{144(x-1)^3(\kappa+1)}-\frac{173\kappa\alpha_0^3}{36(x-1)^3(\kappa+1)}-\frac{4183\kappa\alpha_0^3}{432(\kappa+1)}+$$

$$\frac{89d_1\alpha_0^3}{108(x-2)(\kappa+1)}+\frac{58\alpha_0^3}{27(x-2)(\kappa+1)}+\frac{121d_1\alpha_0^3}{108(x-1)(\kappa+1)}-\frac{239\alpha_0^3}{72(x-1)(\kappa+1)}+\frac{2d_1\alpha_0^3}{27(x-2)^2(\kappa+1)}-\frac{185\alpha_0^3}{27(x-2)^2(\kappa+1)}-$$

$$\frac{605d_1\alpha_0^3}{432(x-1)^2(\kappa+1)}+\frac{1351\alpha_0^3}{432(x-1)^2(\kappa+1)}-\frac{376d_1\alpha_0^3}{27(x-2)^3(\kappa+1)}+\frac{212\alpha_0^3}{9(x-2)^3(\kappa+1)}+\frac{367d_1\alpha_0^3}{432(x-1)^3(\kappa+1)}-\frac{89\alpha_0^3}{54(x-1)^3(\kappa+1)}-$$

$$\frac{1021\alpha_0^3}{432(\kappa+1)}+\frac{29d_1^2\alpha_0^3}{81(x-2)^2}+\frac{5\pi^2\alpha_0^3}{27(x-2)^2}+\frac{43d_1^2\alpha_0^3}{162(x-1)^2}-\frac{7\pi^2\alpha_0^3}{108(x-1)^2}+\frac{260d_1^2\alpha_0^3}{81(x-2)^3}-\frac{10\pi^2\alpha_0^3}{27(x-2)^3}-\frac{d_1^2\alpha_0^3}{6(x-1)^3}+\frac{\pi^2\alpha_0^3}{36(x-1)^3}+$$

$$\frac{\pi^2\alpha_0^3}{18}+\frac{365d_1^2\alpha_0^2}{108}-\frac{505}{216}d_1^2x\alpha_0^2+\frac{7}{18}\pi^2x\alpha_0^2+\frac{14d_1^2\alpha_0^2}{27(x-2)}+\frac{55d_1^2\alpha_0^2}{216(x-1)}-\frac{\pi^2\alpha_0^2}{12(x-1)}-\frac{1445d_1\alpha_0^2}{108(\kappa+1)}+\frac{4637d_1x\alpha_0^2}{432(\kappa+1)}-$$

$$\frac{497x\alpha_0^2}{24(\kappa+1)}-\frac{1735d_1\kappa\alpha_0^2}{54(\kappa+1)}+\frac{10115d_1x\kappa\alpha_0^2}{432(\kappa+1)}-\frac{12541x\kappa\alpha_0^2}{216(\kappa+1)}-\frac{458d_1\kappa\alpha_0^2}{27(x-2)(\kappa+1)}+\frac{1280\kappa\alpha_0^2}{27(x-2)(\kappa+1)}+\frac{1619d_1\kappa\alpha_0^2}{216(x-1)(\kappa+1)}-$$

$$\frac{575\kappa\alpha_0^2}{24(x-1)(\kappa+1)}+\frac{737d_1\kappa\alpha_0^2}{18(x-2)^2(\kappa+1)}-\frac{821\kappa\alpha_0^2}{9(x-2)^2(\kappa+1)}+\frac{569d_1\kappa\alpha_0^2}{144(x-1)^2(\kappa+1)}-\frac{3731\kappa\alpha_0^2}{432(x-1)^2(\kappa+1)}-\frac{5344d_1\kappa\alpha_0^2}{27(x-2)^3(\kappa+1)}+$$

$$\frac{7408\kappa\alpha_0^2}{27(x-2)^3(\kappa+1)}-\frac{2093d_1\kappa\alpha_0^2}{144(x-1)^3(\kappa+1)}+\frac{743\kappa\alpha_0^2}{24(x-1)^3(\kappa+1)}-\frac{5008d_1\kappa\alpha_0^2}{9(x-2)^4(\kappa+1)}+\frac{24184\kappa\alpha_0^2}{27(x-2)^4(\kappa+1)}+\frac{299d_1\kappa\alpha_0^2}{24(x-1)^4(\kappa+1)}-$$

$$\frac{1829\kappa\alpha_0^2}{72(x-1)^4(\kappa+1)}+\frac{28453\kappa\alpha_0^2}{432(\kappa+1)}-\frac{58d_1\alpha_0^2}{9(x-2)(\kappa+1)}+\frac{256\alpha_0^2}{27(x-2)(\kappa+1)}+\frac{427d_1\alpha_0^2}{216(x-1)(\kappa+1)}-\frac{61\alpha_0^2}{24(x-1)(\kappa+1)}+$$

$$\frac{299d_1\alpha_0^2}{18(x-2)^2(\kappa+1)}-\frac{163\alpha_0^2}{9(x-2)^2(\kappa+1)}+\frac{881d_1\alpha_0^2}{432(x-1)^2(\kappa+1)}-\frac{1621\alpha_0^2}{432(x-1)^2(\kappa+1)}-\frac{736d_1\alpha_0^2}{9(x-2)^3(\kappa+1)}+\frac{1424\alpha_0^2}{27(x-2)^3(\kappa+1)}-$$

$$\frac{871d_1\alpha_0^2}{144(x-1)^3(\kappa+1)}+\frac{569\alpha_0^2}{72(x-1)^3(\kappa+1)}-\frac{2224d_1\alpha_0^2}{9(x-2)^4(\kappa+1)}+\frac{6664\alpha_0^2}{27(x-2)^4(\kappa+1)}+\frac{1105d_1\alpha_0^2}{216(x-1)^4(\kappa+1)}-\frac{1333\alpha_0^2}{216(x-1)^4(\kappa+1)}+$$

$$\frac{6791\alpha_0^2}{432(\kappa+1)}-\frac{53d_1^2\alpha_0^2}{18(x-2)^2}-\frac{d_1^2\alpha_0^2}{2(x-1)^2}+\frac{\pi^2\alpha_0^2}{12(x-1)^2}+\frac{784d_1^2\alpha_0^2}{27(x-2)^3}+\frac{3d_1^2\alpha_0^2}{2(x-1)^3}-\frac{\pi^2\alpha_0^2}{12(x-1)^3}+\frac{232d_1^2\alpha_0^2}{3(x-2)^4}-\frac{20\pi^2\alpha_0^2}{9(x-2)^4}-$$

$$\frac{4d_1^2\alpha_0^2}{3(x-1)^4}+\frac{\pi^2\alpha_0^2}{18(x-1)^4}-\frac{\pi^2\alpha_0^2}{6}+\frac{d_1^2\alpha_0}{6(\kappa+1)}-\frac{263d_1\alpha_0}{216(\kappa+1)}+\frac{205d_1^2x\alpha_0}{108(\kappa+1)}-\frac{1775d_1x\alpha_0}{216(\kappa+1)}-\frac{73\pi^2x\alpha_0}{216(\kappa+1)}+\frac{6995x\alpha_0}{648(\kappa+1)}+$$

$$\frac{d_1^2\kappa\alpha_0}{6(\kappa+1)}-\frac{49d_1\kappa\alpha_0}{24(\kappa+1)}+\frac{205d_1^2x\kappa\alpha_0}{108(\kappa+1)}-\frac{4025d_1x\kappa\alpha_0}{216(\kappa+1)}-\frac{301\pi^2x\kappa\alpha_0}{216(\kappa+1)}+\frac{3121x\kappa\alpha_0}{72(\kappa+1)}-\frac{7d_1^2\kappa\alpha_0}{27(x-2)(\kappa+1)}-\frac{86d_1\kappa\alpha_0}{27(x-2)(\kappa+1)}-$$

$$\frac{140\pi^2\kappa\alpha_0}{27(x-2)(\kappa+1)}+\frac{320\kappa\alpha_0}{27(x-2)(\kappa+1)}-\frac{7d_1^2\kappa\alpha_0}{108(x-1)(\kappa+1)}+\frac{1787d_1\kappa\alpha_0}{216(x-1)(\kappa+1)}+\frac{455\pi^2\kappa\alpha_0}{72(x-1)(\kappa+1)}-\frac{865\kappa\alpha_0}{36(x-1)(\kappa+1)}+$$

$$\frac{53d_1^2\kappa\alpha_0}{27(x-2)^2(\kappa+1)}-\frac{239d_1\kappa\alpha_0}{27(x-2)^2(\kappa+1)}+\frac{140\pi^2\kappa\alpha_0}{27(x-2)^2(\kappa+1)}+\frac{5d_1^2\kappa\alpha_0}{27(x-1)^2(\kappa+1)}-\frac{889d_1\kappa\alpha_0}{216(x-1)^2(\kappa+1)}-\frac{175\pi^2\kappa\alpha_0}{108(x-1)^2(\kappa+1)}+$$

$$\frac{1315\kappa\alpha_0}{108(x-1)^2(\kappa+1)}-\frac{784d_1^2\kappa\alpha_0}{27(x-2)^3(\kappa+1)}+\frac{4168d_1\kappa\alpha_0}{27(x-2)^3(\kappa+1)}-\frac{3704\kappa\alpha_0}{27(x-2)^3(\kappa+1)}-\frac{d_1^2\kappa\alpha_0}{(x-1)^3(\kappa+1)}+\frac{77d_1\kappa\alpha_0}{9(x-1)^3(\kappa+1)}+$$

$$\frac{245\pi^2\kappa\alpha_0}{216(x-1)^3(\kappa+1)}-\frac{361\kappa\alpha_0}{24(x-1)^3(\kappa+1)}-\frac{464d_1^2\kappa\alpha_0}{3(x-2)^4(\kappa+1)}+\frac{10016d_1\kappa\alpha_0}{9(x-2)^4(\kappa+1)}+\frac{8d_1\pi^2\kappa\alpha_0}{3(x-2)^4(\kappa+1)}+\frac{704\pi^2\kappa\alpha_0}{9(x-2)^4(\kappa+1)}-$$

$$\frac{48368\kappa\alpha_0}{27(x-2)^4(\kappa+1)}-\frac{4d_1^2\kappa\alpha_0}{3(x-1)^4(\kappa+1)}+\frac{299d_1\kappa\alpha_0}{24(x-1)^4(\kappa+1)}+\frac{139\pi^2\kappa\alpha_0}{216(x-1)^4(\kappa+1)}-\frac{1829\kappa\alpha_0}{72(x-1)^4(\kappa+1)}-\frac{512d_1^2\kappa\alpha_0}{3(x-2)^5(\kappa+1)}+$$

$$\frac{11264d_1\kappa\alpha_0}{9(x-2)^5(\kappa+1)}+\frac{16d_1\pi^2\kappa\alpha_0}{3(x-2)^5(\kappa+1)}+\frac{32\pi^2\kappa\alpha_0}{(x-2)^5(\kappa+1)}-\frac{59008\kappa\alpha_0}{27(x-2)^5(\kappa+1)}-\frac{253\pi^2\kappa\alpha_0}{216(x-1)^5(\kappa+1)}+\frac{89\pi^2\kappa\alpha_0}{54(\kappa+1)}+\frac{307\kappa\alpha_0}{36(\kappa+1)}-$$

$$\frac{7d_1^2\alpha_0}{27(x-2)(\kappa+1)}-\frac{2d_1\alpha_0}{3(x-2)(\kappa+1)}-\frac{20\pi^2\alpha_0}{27(x-2)(\kappa+1)}+\frac{64\alpha_0}{27(x-2)(\kappa+1)}-\frac{7d_1^2\alpha_0}{108(x-1)(\kappa+1)}+\frac{613d_1\alpha_0}{216(x-1)(\kappa+1)}+$$

$$\frac{65\pi^2\alpha_0}{72(x-1)(\kappa+1)}-\frac{19\alpha_0}{4(x-1)(\kappa+1)}+\frac{53d_1^2\alpha_0}{27(x-2)^2(\kappa+1)}-\frac{133d_1\alpha_0}{27(x-2)^2(\kappa+1)}+\frac{20\pi^2\alpha_0}{27(x-2)^2(\kappa+1)}+\frac{5d_1^2\alpha_0}{27(x-1)^2(\kappa+1)}-$$

$$\frac{331d_1\alpha_0}{216(x-1)^2(\kappa+1)}-\frac{25\pi^2\alpha_0}{108(x-1)^2(\kappa+1)}+\frac{257\alpha_0}{108(x-1)^2(\kappa+1)}-\frac{784d_1^2\alpha_0}{27(x-2)^3(\kappa+1)}+\frac{1816d_1\alpha_0}{27(x-2)^3(\kappa+1)}-\frac{712\alpha_0}{27(x-2)^3(\kappa+1)}-$$

$$\frac{d_1^2\alpha_0}{(x-1)^3(\kappa+1)}+\frac{10d_1\alpha_0}{3(x-1)^3(\kappa+1)}+\frac{35\pi^2\alpha_0}{216(x-1)^3(\kappa+1)}-\frac{67\alpha_0}{24(x-1)^3(\kappa+1)}-\frac{464d_1^2\alpha_0}{3(x-2)^4(\kappa+1)}+\frac{4448d_1\alpha_0}{9(x-2)^4(\kappa+1)}+$$

$$\frac{8d_1\pi^2\alpha_0}{9(x-2)^4(\kappa+1)}+\frac{496\pi^2\alpha_0}{27(x-2)^4(\kappa+1)}-\frac{13328\alpha_0}{27(x-2)^4(\kappa+1)}-\frac{4d_1^2\alpha_0}{3(x-1)^4(\kappa+1)}+\frac{1105d_1\alpha_0}{216(x-1)^4(\kappa+1)}+\frac{5\pi^2\alpha_0}{24(x-1)^4(\kappa+1)}-$$

$$\frac{1333\alpha_0}{216(x-1)^4(\kappa+1)}-\frac{512d_1^2\alpha_0}{3(x-2)^5(\kappa+1)}+\frac{5120d_1\alpha_0}{9(x-2)^5(\kappa+1)}+\frac{16d_1\pi^2\alpha_0}{9(x-2)^5(\kappa+1)}+\frac{512\pi^2\alpha_0}{27(x-2)^5(\kappa+1)}-\frac{19072\alpha_0}{27(x-2)^5(\kappa+1)}-$$

$$\frac{17\pi^2\alpha_0}{72(x-1)^5(\kappa+1)}+\frac{\pi^2\alpha_0}{27(\kappa+1)}+\frac{3505\alpha_0}{324(\kappa+1)}+\frac{x\zeta_3\alpha_0}{\kappa+1}+\frac{7x\kappa\zeta_3\alpha_0}{3(\kappa+1)}-\frac{7\kappa\zeta_3\alpha_0}{3(x-1)^4(\kappa+1)}+\frac{7\kappa\zeta_3\alpha_0}{3(x-1)^5(\kappa+1)}-\frac{14\kappa\zeta_3\alpha_0}{3(\kappa+1)}-$$

$$\frac{\zeta_3\alpha_0}{3(x-1)^4(\kappa+1)}+\frac{\zeta_3\alpha_0}{3(x-1)^5(\kappa+1)}-\frac{2\zeta_3\alpha_0}{\kappa+1}+\frac{1120\kappa\ln^3 2\,\alpha_0}{9(x-2)^4(\kappa+1)}+\frac{2240\kappa\ln^3 2\,\alpha_0}{9(x-2)^5(\kappa+1)}+\frac{160\ln^3 2\,\alpha_0}{9(x-2)^4(\kappa+1)}+\frac{320\ln^3 2\,\alpha_0}{9(x-2)^5(\kappa+1)}+$$



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$$\frac{32d_1\kappa\ln^2 2\,\alpha_0}{(x-2)^4(\kappa+1)}+\frac{416\kappa\ln^2 2\,\alpha_0}{3(x-2)^4(\kappa+1)}+\frac{64d_1\kappa\ln^2 2\,\alpha_0}{(x-2)^5(\kappa+1)}+\frac{832\kappa\ln^2 2\,\alpha_0}{3(x-2)^5(\kappa+1)}+\frac{32d_1\ln^2 2\,\alpha_0}{3(x-2)^4(\kappa+1)}+\frac{544\ln^2 2\,\alpha_0}{9(x-2)^4(\kappa+1)}+$$

$$\frac{64d_1\ln^2 2\,\alpha_0}{3(x-2)^5(\kappa+1)}+\frac{1088\ln^2 2\,\alpha_0}{9(x-2)^5(\kappa+1)}+\frac{256d_1\kappa\ln 2\,\alpha_0}{9(x-2)^4(\kappa+1)}+\frac{80\pi^2\kappa\ln 2\,\alpha_0}{3(x-2)^4(\kappa+1)}+\frac{1856\kappa\ln 2\,\alpha_0}{27(x-2)^4(\kappa+1)}+\frac{512d_1\kappa\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)}+$$

$$\frac{160\pi^2\kappa\ln 2\,\alpha_0}{3(x-2)^5(\kappa+1)}+\frac{3712\kappa\ln 2\,\alpha_0}{27(x-2)^5(\kappa+1)}+\frac{256d_1\ln 2\,\alpha_0}{9(x-2)^4(\kappa+1)}+\frac{3392\ln 2\,\alpha_0}{27(x-2)^4(\kappa+1)}+\frac{512d_1\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)}+\frac{6784\ln 2\,\alpha_0}{27(x-2)^5(\kappa+1)}+$$

$$\Big(\frac{1}{12}d_1x\alpha_0^5-\frac{4x\alpha_0^5}{9}+\frac{1}{12}d_1x\kappa\alpha_0^5-\frac{11}{18}x\kappa\alpha_0^5+\frac{d_1\kappa\alpha_0^5}{6(x-2)}-\frac{25\kappa\alpha_0^5}{18(x-2)}-\frac{d_1\kappa\alpha_0^5}{12(x-1)}+\frac{11\kappa\alpha_0^5}{18(x-1)}-\frac{\kappa\alpha_0^5}{12}+\frac{d_1\alpha_0^5}{6(x-2)}-$$

$$\frac{19\alpha_0^5}{18(x-2)}-\frac{d_1\alpha_0^5}{12(x-1)}+\frac{4\alpha_0^5}{9(x-1)}-\frac{\alpha_0^5}{12}+\frac{7d_1\alpha_0^4}{54}-\frac{61}{108}d_1x\alpha_0^4+\frac{157x\alpha_0^4}{54}+\frac{7}{54}d_1\kappa\alpha_0^4-\frac{61}{108}d_1x\kappa\alpha_0^4+$$

$$\frac{112}{27}x\kappa\alpha_0^4-\frac{11d_1\kappa\alpha_0^4}{27(x-2)}+\frac{113\kappa\alpha_0^4}{27(x-2)}+\frac{43d_1\kappa\alpha_0^4}{108(x-1)}-\frac{149\kappa\alpha_0^4}{54(x-1)}+\frac{23d_1\kappa\alpha_0^4}{27(x-2)^2}-\frac{149\kappa\alpha_0^4}{27(x-2)^2}-\frac{4d_1\kappa\alpha_0^4}{27(x-1)^2}+\frac{59\kappa\alpha_0^4}{54(x-1)^2}-$$

$$\frac{41\kappa\alpha_0^4}{108}-\frac{11d_1\alpha_0^4}{27(x-2)}+\frac{91\alpha_0^4}{27(x-2)}+\frac{43d_1\alpha_0^4}{108(x-1)}-\frac{53\alpha_0^4}{27(x-1)}+\frac{23d_1\alpha_0^4}{27(x-2)^2}-\frac{103\alpha_0^4}{27(x-2)^2}-\frac{4d_1\alpha_0^4}{27(x-1)^2}+\frac{37\alpha_0^4}{54(x-1)^2}-$$

$$\frac{\alpha_0^4}{108}-\frac{8d_1\alpha_0^3}{9}+\frac{95}{54}d_1x\alpha_0^3-\frac{911x\alpha_0^3}{108}-\frac{8}{9}d_1\kappa\alpha_0^3+\frac{95}{54}d_1x\kappa\alpha_0^3-\frac{1381}{108}x\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{27(x-2)}-\frac{50\kappa\alpha_0^3}{27(x-2)}-\frac{41d_1\kappa\alpha_0^3}{54(x-1)}+$$

$$\frac{239\kappa\alpha_0^3}{54(x-1)}-\frac{16d_1\kappa\alpha_0^3}{27(x-2)^2}+\frac{208\kappa\alpha_0^3}{27(x-2)^2}+\frac{17d_1\kappa\alpha_0^3}{27(x-1)^2}-\frac{467\kappa\alpha_0^3}{108(x-1)^2}+\frac{152d_1\kappa\alpha_0^3}{27(x-2)^3}-\frac{776\kappa\alpha_0^3}{27(x-2)^3}-\frac{d_1\kappa\alpha_0^3}{3(x-1)^3}+\frac{83\kappa\alpha_0^3}{36(x-1)^3}+$$

$$\frac{83\kappa\alpha_0^3}{18}-\frac{d_1\alpha_0^3}{27(x-2)}-\frac{70\alpha_0^3}{27(x-2)}-\frac{41d_1\alpha_0^3}{54(x-1)}+\frac{175\alpha_0^3}{54(x-1)}-\frac{16d_1\alpha_0^3}{27(x-2)^2}+\frac{176\alpha_0^3}{27(x-2)^2}+\frac{17d_1\alpha_0^3}{27(x-1)^2}-\frac{277\alpha_0^3}{108(x-1)^2}+$$

$$\frac{152d_1\alpha_0^3}{27(x-2)^3}-\frac{472\alpha_0^3}{27(x-2)^3}-\frac{d_1\alpha_0^3}{3(x-1)^3}+\frac{5\alpha_0^3}{4(x-1)^3}+\frac{35\alpha_0^3}{18}+\frac{35d_1\alpha_0^2}{9}-\frac{73}{18}d_1x\alpha_0^2+\frac{569x\alpha_0^2}{36}+\frac{35}{9}d_1\kappa\alpha_0^2-$$

$$\frac{73}{18}d_1x\kappa\alpha_0^2+\frac{979}{36}x\kappa\alpha_0^2+\frac{8d_1\kappa\alpha_0^2}{9(x-2)}-\frac{32\kappa\alpha_0^2}{3(x-2)}+\frac{13d_1\kappa\alpha_0^2}{18(x-1)}+\frac{4\kappa\alpha_0^2}{3(x-1)}-\frac{10d_1\kappa\alpha_0^2}{3(x-2)^2}+\frac{20\kappa\alpha_0^2}{(x-2)^2}-\frac{d_1\kappa\alpha_0^2}{(x-1)^2}+$$

$$\frac{67\kappa\alpha_0^2}{12(x-1)^2}+\frac{160d_1\kappa\alpha_0^2}{9(x-2)^3}-\frac{160\kappa\alpha_0^2}{3(x-2)^3}+\frac{5d_1\kappa\alpha_0^2}{3(x-1)^3}-\frac{119\kappa\alpha_0^2}{12(x-1)^3}+\frac{208d_1\kappa\alpha_0^2}{3(x-2)^4}-\frac{2512\kappa\alpha_0^2}{9(x-2)^4}-\frac{4d_1\kappa\alpha_0^2}{3(x-1)^4}+\frac{137\kappa\alpha_0^2}{18(x-1)^4}-$$

$$\frac{64\kappa\alpha_0^2}{3}+\frac{8d_1\alpha_0^2}{9(x-2)}-\frac{32\alpha_0^2}{9(x-2)}+\frac{13d_1\alpha_0^2}{18(x-1)}-\frac{\alpha_0^2}{x-1}-\frac{10d_1\alpha_0^2}{3(x-2)^2}+\frac{20\alpha_0^2}{3(x-2)^2}-\frac{d_1\alpha_0^2}{(x-1)^2}+\frac{119\alpha_0^2}{36(x-1)^2}+\frac{160d_1\alpha_0^2}{9(x-2)^3}-$$

$$\frac{160\alpha_0^2}{9(x-2)^3}+\frac{5d_1\alpha_0^2}{3(x-1)^3}-\frac{19\alpha_0^2}{4(x-1)^3}+\frac{208d_1\alpha_0^2}{3(x-2)^4}-\frac{1264\alpha_0^2}{9(x-2)^4}-\frac{4d_1\alpha_0^2}{3(x-1)^4}+\frac{7\alpha_0^2}{2(x-1)^4}-\frac{85\alpha_0^2}{9}-\frac{13d_1\alpha_0}{27}+\frac{805d_1x\alpha_0}{216}-$$

$$\frac{1}{18}\pi^2x\alpha_0-\frac{271x\alpha_0}{24}-\frac{13d_1\kappa\alpha_0}{27}+\frac{805}{216}d_1x\kappa\alpha_0-\frac{5131x\kappa\alpha_0}{216}+\frac{380d_1\kappa\alpha_0}{27(x-2)}-\frac{1208\kappa\alpha_0}{27(x-2)}-\frac{379d_1\kappa\alpha_0}{24(x-1)}+\frac{4009\kappa\alpha_0}{72(x-1)}-$$

$$\frac{332d_1\kappa\alpha_0}{27(x-2)^2}+\frac{1136\kappa\alpha_0}{27(x-2)^2}+\frac{205d_1\kappa\alpha_0}{108(x-1)^2}-\frac{713\kappa\alpha_0}{54(x-1)^2}-\frac{160d_1\kappa\alpha_0}{9(x-2)^3}+\frac{80\kappa\alpha_0}{3(x-2)^3}-\frac{395d_1\kappa\alpha_0}{216(x-1)^3}+\frac{2399\kappa\alpha_0}{216(x-1)^3}-$$

$$\frac{224d_1\kappa\alpha_0}{(x-2)^4}+\frac{928\kappa\alpha_0}{(x-2)^4}-\frac{331d_1\kappa\alpha_0}{216(x-1)^4}+\frac{475\kappa\alpha_0}{54(x-1)^4}-\frac{512d_1\kappa\alpha_0}{3(x-2)^5}+\frac{6656\kappa\alpha_0}{9(x-2)^5}+\frac{205d_1\kappa\alpha_0}{216(x-1)^5}-\frac{1255\kappa\alpha_0}{216(x-1)^5}+\frac{203\kappa\alpha_0}{216}+$$

$$\frac{380d_1\alpha_0}{27(x-2)}-\frac{616\alpha_0}{27(x-2)}-\frac{379d_1\alpha_0}{24(x-1)}+\frac{671\alpha_0}{24(x-1)}-\frac{332d_1\alpha_0}{27(x-2)^2}+\frac{592\alpha_0}{27(x-2)^2}+\frac{205d_1\alpha_0}{108(x-1)^2}-\frac{361\alpha_0}{54(x-1)^2}-\frac{160d_1\alpha_0}{9(x-2)^3}+$$

$$\frac{80\alpha_0}{9(x-2)^3}-\frac{395d_1\alpha_0}{216(x-1)^3}+\frac{1123\alpha_0}{216(x-1)^3}-\frac{1760d_1\alpha_0}{9(x-2)^4}-\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{17120\alpha_0}{27(x-2)^4}-\frac{331d_1\alpha_0}{216(x-1)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}+$$

$$\frac{152\alpha_0}{27(x-1)^4}-\frac{1024d_1\alpha_0}{9(x-2)^5}-\frac{80\pi^2\alpha_0}{9(x-2)^5}+\frac{19072\alpha_0}{27(x-2)^5}+\frac{205d_1\alpha_0}{216(x-1)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}-\frac{955\alpha_0}{216(x-1)^5}+\frac{\pi^2\alpha_0}{9}-\frac{85\alpha_0}{24}-\frac{3d_1}{4}-$$

$$\frac{205d_1x}{216}+\frac{\pi^2x}{18}+\frac{35x}{24}-\frac{3d_1\kappa}{4}-\frac{205d_1x\kappa}{216}+\frac{1255x\kappa}{216}+\frac{346d_1\kappa}{27(x-2)}-\frac{952\kappa}{27(x-2)}-\frac{947d_1\kappa}{72(x-1)}+\frac{2621\kappa}{72(x-1)}-\frac{392d_1\kappa}{27(x-2)^2}+$$

$$\frac{1136\kappa}{27(x-2)^2}+\frac{23d_1\kappa}{27(x-1)^2}-\frac{92\kappa}{27(x-1)^2}+\frac{784d_1\kappa}{27(x-2)^3}-\frac{2272\kappa}{27(x-2)^3}+\frac{73d_1\kappa}{216(x-1)^3}-\frac{247\kappa}{216(x-1)^3}+\frac{256d_1\kappa}{3(x-2)^4}-$$

$$\frac{3328\kappa}{9(x-2)^4}+\frac{367d_1\kappa}{216(x-1)^4}-\frac{1127\kappa}{108(x-1)^4}+\frac{512d_1\kappa}{3(x-2)^5}-\frac{2048\kappa}{3(x-2)^5}+\frac{205d_1\kappa}{216(x-1)^5}-\frac{1255\kappa}{216(x-1)^5}+\frac{1024\kappa}{9(x-2)^6}+\frac{37\kappa}{8}+$$

$$\frac{346d_1}{27(x-2)}-\frac{488}{27(x-2)}-\frac{947d_1}{72(x-1)}+\frac{443}{24(x-1)}-\frac{392d_1}{27(x-2)^2}+\frac{592}{27(x-2)^2}+\frac{23d_1}{27(x-1)^2}-\frac{52}{27(x-1)^2}+\frac{784d_1}{27(x-2)^3}-$$

$$\frac{1184}{27(x-2)^3}+\frac{73d_1}{216(x-1)^3}-\frac{83}{216(x-1)^3}+\frac{512d_1}{9(x-2)^4}+\frac{40\pi^2}{9(x-2)^4}-\frac{9536}{27(x-2)^4}+\frac{367d_1}{216(x-1)^4}+\frac{\pi^2}{18(x-1)^4}-$$

$$\frac{725}{108(x-1)^4}+\frac{512d_1}{9(x-2)^5}+\frac{160\pi^2}{9(x-2)^5}-\frac{25856}{27(x-2)^5}+\frac{205d_1}{216(x-1)^5}+\frac{\pi^2}{18(x-1)^5}-\frac{955}{216(x-1)^5}-\frac{1024d_1}{9(x-2)^6}+\frac{160\pi^2}{9(x-2)^6}-$$

$$\frac{13568}{27(x-2)^6}+\frac{55}{24}\Big)H(0;\alpha_0)+\Big(-\frac{d_1\alpha_0^5}{12}+\frac{1}{12}d_1^2x\alpha_0^5-\frac{4}{9}d_1x\alpha_0^5-\frac{1}{12}d_1x\kappa\alpha_0^5-\frac{d_1\kappa\alpha_0^5}{6(x-2)}+\frac{d_1\kappa\alpha_0^5}{12(x-1)}+$$

$$\frac{d_1^2\alpha_0^5}{6(x-2)}-\frac{19d_1\alpha_0^5}{18(x-2)}-\frac{d_1^2\alpha_0^5}{12(x-1)}+\frac{4d_1\alpha_0^5}{9(x-1)}+\frac{7d_1^2\alpha_0^4}{54}-\frac{d_1\alpha_0^4}{108}-\frac{61}{108}d_1^2x\alpha_0^4+\frac{157}{54}d_1x\alpha_0^4-\frac{5}{27}d_1\kappa\alpha_0^4+$$

$$\frac{67}{108}d_1x\kappa\alpha_0^4+\frac{11d_1\kappa\alpha_0^4}{27(x-2)}-\frac{43d_1\kappa\alpha_0^4}{108(x-1)}-\frac{23d_1\kappa\alpha_0^4}{27(x-2)^2}+\frac{11d_1\kappa\alpha_0^4}{54(x-1)^2}-\frac{11d_1^2\alpha_0^4}{27(x-2)}+\frac{91d_1\alpha_0^4}{27(x-2)}+\frac{43d_1^2\alpha_0^4}{108(x-1)}-\frac{53d_1\alpha_0^4}{27(x-1)}+$$

$$\frac{23d_1^2\alpha_0^4}{27(x-2)^2}-\frac{103d_1\alpha_0^4}{27(x-2)^2}-\frac{4d_1^2\alpha_0^4}{27(x-1)^2}+\frac{37d_1\alpha_0^4}{54(x-1)^2}-\frac{8d_1^2\alpha_0^3}{9}+\frac{35d_1\alpha_0^3}{18}+\frac{95}{54}d_1^2x\alpha_0^3-\frac{911}{108}d_1x\alpha_0^3+\frac{4}{3}d_1\kappa\alpha_0^3-$$

$$\frac{235}{108}d_1x\kappa\alpha_0^3+\frac{10d_1\kappa\alpha_0^3}{27(x-2)}+\frac{16d_1\kappa\alpha_0^3}{27(x-1)}+\frac{16d_1\kappa\alpha_0^3}{27(x-2)^2}-\frac{95d_1\kappa\alpha_0^3}{108(x-1)^2}-\frac{152d_1\kappa\alpha_0^3}{27(x-2)^3}+\frac{19d_1\kappa\alpha_0^3}{36(x-1)^3}-\frac{d_1^2\alpha_0^3}{27(x-2)}-$$

$$\frac{70d_1\alpha_0^3}{27(x-2)}-\frac{41d_1^2\alpha_0^3}{54(x-1)}+\frac{175d_1\alpha_0^3}{54(x-1)}-\frac{16d_1^2\alpha_0^3}{27(x-2)^2}+\frac{176d_1\alpha_0^3}{27(x-2)^2}+\frac{17d_1^2\alpha_0^3}{27(x-1)^2}-\frac{277d_1\alpha_0^3}{108(x-1)^2}+\frac{152d_1^2\alpha_0^3}{27(x-2)^3}-\frac{472d_1\alpha_0^3}{27(x-2)^3}-$$

$$\frac{d_1^2\alpha_0^3}{3(x-1)^3}+\frac{5d_1\alpha_0^3}{4(x-1)^3}+\frac{35d_1^2\alpha_0^2}{9}-\frac{85d_1\alpha_0^2}{9}-\frac{73}{18}d_1^2x\alpha_0^2+\frac{569}{36}d_1x\alpha_0^2-\frac{107}{18}d_1\kappa\alpha_0^2+\frac{205}{36}d_1x\kappa\alpha_0^2-$$

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$$\frac{32d_1\kappa\alpha_0^2}{9(x-2)}+\frac{7d_1\kappa\alpha_0^2}{6(x-1)}+\frac{20d_1\kappa\alpha_0^2}{3(x-2)^2}+\frac{41d_1\kappa\alpha_0^2}{36(x-1)^2}-\frac{160d_1\kappa\alpha_0^2}{9(x-2)^3}-\frac{31d_1\kappa\alpha_0^2}{12(x-1)^3}-\frac{208d_1\kappa\alpha_0^2}{3(x-2)^4}+\frac{37d_1\kappa\alpha_0^2}{18(x-1)^4}+\frac{8d_1^2\alpha_0^2}{9(x-2)}-$$

$$\frac{32d_1\alpha_0^2}{9(x-2)}+\frac{13d_1^2\alpha_0^2}{18(x-1)}-\frac{d_1\alpha_0^2}{x-1}-\frac{10d_1^2\alpha_0^2}{3(x-2)^2}+\frac{20d_1\alpha_0^2}{3(x-2)^2}-\frac{d_1^2\alpha_0^2}{(x-1)^2}+\frac{119d_1\alpha_0^2}{36(x-1)^2}+\frac{160d_1^2\alpha_0^2}{9(x-2)^3}-\frac{160d_1\alpha_0^2}{9(x-2)^3}+\frac{5d_1^2\alpha_0^2}{3(x-1)^3}-$$

$$\frac{19d_1\alpha_0^2}{4(x-1)^3}+\frac{208d_1^2\alpha_0^2}{3(x-2)^4}-\frac{1264d_1\alpha_0^2}{9(x-2)^4}-\frac{4d_1^2\alpha_0^2}{3(x-1)^4}+\frac{7d_1\alpha_0^2}{2(x-1)^4}-\frac{80d_1^2\alpha_0}{27}+\frac{703d_1\alpha_0}{108}+\frac{505}{108}d_1^2x\alpha_0-\frac{1697d_1x\alpha_0}{108}+$$

$$\frac{122d_1\kappa\alpha_0}{27}-\frac{187}{27}d_1x\kappa\alpha_0+\frac{125d_1\kappa\alpha_0}{54(x-2)}-\frac{5d_1\kappa\alpha_0}{108(x-1)}-\frac{196d_1\kappa\alpha_0}{27(x-2)^2}-\frac{133d_1\kappa\alpha_0}{108(x-1)^2}+\frac{392d_1\kappa\alpha_0}{9(x-2)^3}+\frac{43d_1\kappa\alpha_0}{12(x-1)^3}+$$

$$\frac{224d_1\kappa\alpha_0}{(x-2)^4}+\frac{512d_1\kappa\alpha_0}{3(x-2)^5}-\frac{47d_1^2\alpha_0}{54(x-2)}+\frac{205d_1\alpha_0}{54(x-2)}-\frac{37d_1^2\alpha_0}{108(x-1)}+\frac{43d_1\alpha_0}{54(x-1)}+\frac{136d_1^2\alpha_0}{27(x-2)^2}-\frac{356d_1\alpha_0}{27(x-2)^2}+\frac{19d_1^2\alpha_0}{27(x-1)^2}-$$

$$\frac{263d_1\alpha_0}{108(x-1)^2}-\frac{472d_1^2\alpha_0}{9(x-2)^3}+\frac{712d_1\alpha_0}{9(x-2)^3}-\frac{7d_1^2\alpha_0}{3(x-1)^3}+\frac{23d_1\alpha_0}{4(x-1)^3}-\frac{224d_1^2\alpha_0}{(x-2)^4}+\frac{4576d_1\alpha_0}{9(x-2)^4}-\frac{512d_1^2\alpha_0}{3(x-2)^5}+\frac{4096d_1\alpha_0}{9(x-2)^5}-$$

$$\frac{d_1^2}{6}+\frac{13d_1}{12}-\frac{205d_1^2x}{108}+\frac{635d_1x}{108}+\frac{5d_1\kappa}{18}+\frac{155d_1x\kappa}{54}+\frac{17d_1\kappa}{27(x-2)}-\frac{151d_1\kappa}{108(x-1)}+\frac{23d_1\kappa}{27(x-2)^2}+\frac{83d_1\kappa}{108(x-1)^2}-$$

$$\frac{544d_1\kappa}{27(x-2)^3}-\frac{55d_1\kappa}{36(x-1)^3}-\frac{464d_1\kappa}{3(x-2)^4}-\frac{37d_1\kappa}{18(x-1)^4}-\frac{512d_1\kappa}{3(x-2)^5}+\frac{7d_1^2}{27(x-2)}+\frac{d_1}{27(x-2)}+\frac{7d_1^2}{108(x-1)}-\frac{41d_1}{27(x-1)}-$$

$$\frac{53d_1^2}{27(x-2)^2}+\frac{103d_1}{27(x-2)^2}-\frac{5d_1^2}{27(x-1)^2}+\frac{109d_1}{108(x-1)^2}+\frac{784d_1^2}{27(x-2)^3}-\frac{1184d_1}{27(x-2)^3}+\frac{d_1^2}{(x-1)^3}-\frac{9d_1}{4(x-1)^3}+\frac{464d_1^2}{3(x-2)^4}-$$

$$\frac{368d_1}{(x-2)^4}+\frac{4d_1^2}{3(x-1)^4}-\frac{7d_1}{2(x-1)^4}+\frac{512d_1^2}{3(x-2)^5}-\frac{4096d_1}{9(x-2)^5}\Big)H(1;\alpha_0)+\Big(\frac{x\alpha_0^5}{3}+x\kappa\alpha_0^5+\frac{2\kappa\alpha_0^5}{x-2}-\frac{\kappa\alpha_0^5}{x-1}+\frac{2\alpha_0^5}{3(x-2)}-$$

$$\frac{\alpha_0^5}{3(x-1)}-\frac{19x\alpha_0^4}{9}-\frac{19}{3}x\kappa\alpha_0^4-\frac{20\kappa\alpha_0^4}{3(x-2)}+\frac{13\kappa\alpha_0^4}{3(x-1)}+\frac{20\kappa\alpha_0^4}{3(x-2)^2}-\frac{4\kappa\alpha_0^4}{3(x-1)^2}+\frac{2\kappa\alpha_0^4}{3}-\frac{20\alpha_0^4}{9(x-2)}+\frac{13\alpha_0^4}{9(x-1)}+$$

$$\frac{20\alpha_0^4}{9(x-2)^2}-\frac{4\alpha_0^4}{9(x-1)^2}+\frac{2\alpha_0^4}{9}+\frac{52x\alpha_0^3}{9}+\frac{52}{3}x\kappa\alpha_0^3+\frac{20\kappa\alpha_0^3}{3(x-2)}-\frac{22\kappa\alpha_0^3}{3(x-1)}-\frac{40\kappa\alpha_0^3}{3(x-2)^2}+\frac{14\kappa\alpha_0^3}{3(x-1)^2}+\frac{80\kappa\alpha_0^3}{3(x-2)^3}-$$

$$\frac{2\kappa\alpha_0^3}{(x-1)^3}-4\kappa\alpha_0^3+\frac{20\alpha_0^3}{9(x-2)}-\frac{22\alpha_0^3}{9(x-1)}-\frac{40\alpha_0^3}{9(x-2)^2}+\frac{14\alpha_0^3}{9(x-1)^2}+\frac{80\alpha_0^3}{9(x-2)^3}-\frac{2\alpha_0^3}{3(x-1)^3}-\frac{4\alpha_0^3}{3}-\frac{28x\alpha_0^2}{3}-$$

$$28x\kappa\alpha_0^2+\frac{6\kappa\alpha_0^2}{x-1}-\frac{6\kappa\alpha_0^2}{(x-1)^2}+\frac{6\kappa\alpha_0^2}{(x-1)^3}+\frac{160\kappa\alpha_0^2}{(x-2)^4}-\frac{4\kappa\alpha_0^2}{(x-1)^4}+12\kappa\alpha_0^2+\frac{2\alpha_0^2}{x-1}-\frac{2\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}+\frac{160\alpha_0^2}{3(x-2)^4}-$$

$$\frac{4\alpha_0^2}{3(x-1)^4}+4\alpha_0^2+\frac{95x\alpha_0}{18}+\frac{337x\kappa\alpha_0}{18}+\frac{80\kappa\alpha_0}{3(x-2)}-\frac{65\kappa\alpha_0}{2(x-1)}-\frac{80\kappa\alpha_0}{3(x-2)^2}+\frac{25\kappa\alpha_0}{3(x-1)^2}-\frac{35\kappa\alpha_0}{6(x-1)^3}-\frac{64d_1\kappa\alpha_0}{3(x-2)^4}-$$

$$\frac{6464\kappa\alpha_0}{9(x-2)^4}-\frac{119\kappa\alpha_0}{18(x-1)^4}-\frac{128d_1\kappa\alpha_0}{3(x-2)^5}-\frac{7168\kappa\alpha_0}{9(x-2)^5}+\frac{101\kappa\alpha_0}{18(x-1)^5}+\frac{50\kappa\alpha_0}{9}+\frac{80\alpha_0}{9(x-2)}-\frac{65\alpha_0}{6(x-1)}-\frac{80\alpha_0}{9(x-2)^2}+$$

$$\frac{25\alpha_0}{9(x-1)^2}-\frac{35\alpha_0}{18(x-1)^3}-\frac{64d_1\alpha_0}{3(x-2)^4}-\frac{3008\alpha_0}{9(x-2)^4}-\frac{19\alpha_0}{6(x-1)^4}-\frac{128d_1\alpha_0}{3(x-2)^5}-\frac{4096\alpha_0}{9(x-2)^5}+\frac{17\alpha_0}{6(x-1)^5}+\frac{34\alpha_0}{9}+\frac{x}{18}-$$

$$\frac{49x\kappa}{18}+\frac{64\kappa}{3(x-2)}-\frac{43\kappa}{2(x-1)}-\frac{80\kappa}{3(x-2)^2}+\frac{8\kappa}{3(x-1)^2}+\frac{160\kappa}{3(x-2)^3}+\frac{\kappa}{6(x-1)^3}+\frac{64d_1\kappa}{3(x-2)^4}+\frac{3584\kappa}{9(x-2)^4}+\frac{155\kappa}{18(x-1)^4}+$$

$$\frac{256d_1\kappa}{3(x-2)^5}+\frac{8576\kappa}{9(x-2)^5}+\frac{101\kappa}{18(x-1)^5}+\frac{256d_1\kappa}{3(x-2)^6}+\frac{2816\kappa}{9(x-2)^6}-3\kappa+\frac{64}{9(x-2)}-\frac{43}{6(x-1)}-\frac{80}{9(x-2)^2}+\frac{8}{9(x-1)^2}+$$

$$\frac{160}{9(x-2)^3}+\frac{1}{18(x-1)^3}+\frac{64d_1}{3(x-2)^4}+\frac{2048}{9(x-2)^4}+\frac{23}{6(x-1)^4}+\frac{256d_1}{3(x-2)^5}+\frac{6272}{9(x-2)^5}+\frac{17}{6(x-1)^5}+\frac{256d_1}{3(x-2)^6}+$$

$$\frac{4352}{9(x-2)^6}-1\Big)H(0,0;\alpha_0)+\Big(\frac{1}{3}d_1x\alpha_0^5+\frac{1}{3}d_1x\kappa\alpha_0^5+\frac{2d_1\kappa\alpha_0^5}{3(x-2)}-\frac{d_1\kappa\alpha_0^5}{3(x-1)}+\frac{2d_1\alpha_0^5}{3(x-2)}-\frac{d_1\alpha_0^5}{3(x-1)}+\frac{2d_1\alpha_0^4}{9}-$$

$$\frac{19}{9}d_1x\alpha_0^4+\frac{2}{9}d_1\kappa\alpha_0^4-\frac{19}{9}d_1x\kappa\alpha_0^4-\frac{20d_1\kappa\alpha_0^4}{9(x-2)}+\frac{13d_1\kappa\alpha_0^4}{9(x-1)}+\frac{20d_1\kappa\alpha_0^4}{9(x-2)^2}-\frac{4d_1\kappa\alpha_0^4}{9(x-1)^2}-\frac{20d_1\alpha_0^4}{9(x-2)}+\frac{13d_1\alpha_0^4}{9(x-1)}+$$

$$\frac{20d_1\alpha_0^4}{9(x-2)^2}-\frac{4d_1\alpha_0^4}{9(x-1)^2}-\frac{4d_1\alpha_0^3}{3}+\frac{52}{9}d_1x\alpha_0^3-\frac{4}{3}d_1\kappa\alpha_0^3+\frac{52}{9}d_1x\kappa\alpha_0^3+\frac{20d_1\kappa\alpha_0^3}{9(x-2)}-\frac{22d_1\kappa\alpha_0^3}{9(x-1)}-\frac{40d_1\kappa\alpha_0^3}{9(x-2)^2}+$$

$$\frac{14d_1\kappa\alpha_0^3}{9(x-1)^2}+\frac{80d_1\kappa\alpha_0^3}{9(x-2)^3}-\frac{2d_1\kappa\alpha_0^3}{3(x-1)^3}+\frac{20d_1\alpha_0^3}{9(x-2)}-\frac{22d_1\alpha_0^3}{9(x-1)}-\frac{40d_1\alpha_0^3}{9(x-2)^2}+\frac{14d_1\alpha_0^3}{9(x-1)^2}+\frac{80d_1\alpha_0^3}{9(x-2)^3}-\frac{2d_1\alpha_0^3}{3(x-1)^3}+4d_1\alpha_0^2-$$

$$\frac{28}{3}d_1x\alpha_0^2+4d_1\kappa\alpha_0^2-\frac{28}{3}d_1x\kappa\alpha_0^2+\frac{2d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{160d_1\kappa\alpha_0^2}{3(x-2)^4}-\frac{4d_1\kappa\alpha_0^2}{3(x-1)^4}+\frac{2d_1\alpha_0^2}{x-1}-$$

$$\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}+\frac{160d_1\alpha_0^2}{3(x-2)^4}-\frac{4d_1\alpha_0^2}{3(x-1)^4}+\frac{34d_1\alpha_0}{9}+\frac{95d_1x\alpha_0}{18}+\frac{8d_1\kappa\alpha_0}{9}+\frac{121}{18}d_1x\kappa\alpha_0+\frac{80d_1\kappa\alpha_0}{9(x-2)}-\frac{65d_1\kappa\alpha_0}{6(x-1)}-$$

$$\frac{80d_1\kappa\alpha_0}{9(x-2)^2}+\frac{25d_1\kappa\alpha_0}{9(x-1)^2}-\frac{35d_1\kappa\alpha_0}{18(x-1)^3}-\frac{192d_1\kappa\alpha_0}{(x-2)^4}-\frac{31d_1\kappa\alpha_0}{18(x-1)^4}-\frac{512d_1\kappa\alpha_0}{3(x-2)^5}+\frac{25d_1\kappa\alpha_0}{18(x-1)^5}+\frac{80d_1\alpha_0}{9(x-2)}-\frac{65d_1\alpha_0}{6(x-1)}-$$

$$\frac{80d_1\alpha_0}{9(x-2)^2}+\frac{25d_1\alpha_0}{9(x-1)^2}-\frac{35d_1\alpha_0}{18(x-1)^3}-\frac{64d_1^2\alpha_0}{3(x-2)^4}-\frac{3008d_1\alpha_0}{9(x-2)^4}-\frac{19d_1\alpha_0}{6(x-1)^4}-\frac{128d_1^2\alpha_0}{3(x-2)^5}-\frac{4096d_1\alpha_0}{9(x-2)^5}+\frac{17d_1\alpha_0}{6(x-1)^5}-$$

$$d_1+\frac{d_1x}{18}-d_1\kappa-\frac{25d_1x\kappa}{18}+\frac{64d_1\kappa}{9(x-2)}-\frac{43d_1\kappa}{6(x-1)}-\frac{80d_1\kappa}{9(x-2)^2}+\frac{8d_1\kappa}{9(x-1)^2}+\frac{160d_1\kappa}{9(x-2)^3}+\frac{d_1\kappa}{18(x-1)^3}+\frac{256d_1\kappa}{3(x-2)^4}+$$

$$\frac{43d_1\kappa}{18(x-1)^4}+\frac{128d_1\kappa}{(x-2)^5}+\frac{25d_1\kappa}{18(x-1)^5}-\frac{256d_1\kappa}{3(x-2)^6}+\frac{64d_1}{9(x-2)}-\frac{43d_1}{6(x-1)}-\frac{80d_1}{9(x-2)^2}+\frac{8d_1}{9(x-1)^2}+\frac{160d_1}{9(x-2)^3}+\frac{d_1}{18(x-1)^3}+$$

$$\frac{64d_1^2}{3(x-2)^4}+\frac{2048d_1}{9(x-2)^4}+\frac{23d_1}{6(x-1)^4}+\frac{256d_1^2}{3(x-2)^5}+\frac{6272d_1}{9(x-2)^5}+\frac{17d_1}{6(x-1)^5}+\frac{256d_1^2}{3(x-2)^6}+\frac{4352d_1}{9(x-2)^6}\Big)H(0,1;\alpha_0)+$$

$$H(1;x)\Big(\frac{1}{18}\pi^2x\alpha_0+\frac{1}{6}\pi^2x\kappa\alpha_0+\frac{40\pi^2\kappa\alpha_0}{3(x-2)^4}+\frac{d_1\pi^2\kappa\alpha_0}{9(x-1)^4}-\frac{\pi^2\kappa\alpha_0}{6(x-1)^4}+\frac{80\pi^2\kappa\alpha_0}{3(x-2)^5}-\frac{d_1\pi^2\kappa\alpha_0}{9(x-1)^5}+\frac{\pi^2\kappa\alpha_0}{6(x-1)^5}-$$

$$\frac{1}{3}\pi^2\kappa\alpha_0+\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{d_1\pi^2\alpha_0}{9(x-1)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{80\pi^2\alpha_0}{9(x-2)^5}-\frac{d_1\pi^2\alpha_0}{9(x-1)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}-\frac{\pi^2\alpha_0}{9}-\frac{\pi^2x}{18}-\frac{1}{6}\pi^2x\kappa-$$

$$\frac{40\pi^2\kappa}{3(x-2)^4} - \frac{d_1\pi^2\kappa}{9(x-1)^4} + \frac{\pi^2\kappa}{6(x-1)^4} - \frac{160\pi^2\kappa}{3(x-2)^5} - \frac{d_1\pi^2\kappa}{9(x-1)^5} + \frac{\pi^2\kappa}{6(x-1)^5} - \frac{160\pi^2\kappa}{3(x-2)^6} + \Big( -\frac{2d_1\alpha_0}{3} + \frac{17x\alpha_0}{12} - \frac{2d_1\kappa\alpha_0}{3} +$$

$$\frac{101x\kappa\alpha_0}{36} - \frac{85d_1\kappa\alpha_0}{9(x-2)} + \frac{40\kappa\alpha_0}{3(x-2)} + \frac{94d_1\kappa\alpha_0}{9(x-1)} - \frac{65\kappa\alpha_0}{4(x-1)} + \frac{100d_1\kappa\alpha_0}{9(x-2)^2} - \frac{40\kappa\alpha_0}{3(x-2)^2} - \frac{20d_1\kappa\alpha_0}{9(x-1)^2} + \frac{25\kappa\alpha_0}{6(x-1)^2} - \frac{40d_1\kappa\alpha_0}{3(x-2)^3} +$$

$$\frac{17d_1\kappa\alpha_0}{18(x-1)^3} - \frac{35\kappa\alpha_0}{12(x-1)^3} + \frac{64d_1\kappa\alpha_0}{(x-2)^4} - \frac{1088\kappa\alpha_0}{9(x-2)^4} + \frac{19d_1\kappa\alpha_0}{18(x-1)^4} - \frac{47\kappa\alpha_0}{36(x-1)^4} + \frac{64d_1\kappa\alpha_0}{3(x-2)^5} + \frac{704\kappa\alpha_0}{9(x-2)^5} - \frac{25d_1\kappa\alpha_0}{18(x-1)^5} +$$

$$\frac{101\kappa\alpha_0}{36(x-1)^5} - \frac{37\kappa\alpha_0}{9} - \frac{85d_1\alpha_0}{9(x-2)} + \frac{40\alpha_0}{9(x-2)} + \frac{94d_1\alpha_0}{9(x-1)} - \frac{65\alpha_0}{12(x-1)} + \frac{100d_1\alpha_0}{9(x-2)^2} - \frac{40\alpha_0}{9(x-2)^2} - \frac{20d_1\alpha_0}{9(x-1)^2} + \frac{25\alpha_0}{18(x-1)^2} -$$

$$\frac{40d_1\alpha_0}{3(x-2)^3} + \frac{17d_1\alpha_0}{18(x-1)^3} - \frac{35\alpha_0}{36(x-1)^3} + \frac{64d_1\alpha_0}{(x-2)^4} + \frac{64\alpha_0}{9(x-2)^4} + \frac{5d_1\alpha_0}{2(x-1)^4} - \frac{11\alpha_0}{12(x-1)^4} + \frac{64d_1\alpha_0}{3(x-2)^5} + \frac{1088\alpha_0}{9(x-2)^5} -$$

$$\frac{17d_1\alpha_0}{6(x-1)^5} + \frac{17\alpha_0}{12(x-1)^5} - \frac{7\alpha_0}{3} + \frac{2d_1}{3} - \frac{17x}{12} + \frac{2d_1\kappa}{3} - \frac{101x\kappa}{36} - \frac{62d_1\kappa}{9(x-2)} + \frac{32\kappa}{3(x-2)} + \frac{65d_1\kappa}{9(x-1)} - \frac{43\kappa}{4(x-1)} +$$

$$\frac{70d_1\kappa}{9(x-2)^2} - \frac{40\kappa}{3(x-2)^2} - \frac{d_1\kappa}{(x-1)^2} + \frac{4\kappa}{3(x-1)^2} - \frac{80d_1\kappa}{9(x-2)^3} + \frac{80\kappa}{3(x-2)^3} + \frac{5d_1\kappa}{18(x-1)^3} + \frac{\kappa}{12(x-1)^3} - \frac{112d_1\kappa}{3(x-2)^4} +$$

$$\frac{1088\kappa}{9(x-2)^4} - \frac{31d_1\kappa}{18(x-1)^4} + \frac{155\kappa}{36(x-1)^4} - \frac{448d_1\kappa}{3(x-2)^5} + \frac{1472\kappa}{9(x-2)^5} - \frac{25d_1\kappa}{18(x-1)^5} + \frac{101\kappa}{36(x-1)^5} - \frac{128d_1\kappa}{3(x-2)^6} - \frac{1408\kappa}{9(x-2)^6} -$$

$$\frac{3\kappa}{2} - \frac{62d_1}{9(x-2)} + \frac{32}{9(x-2)} + \frac{65d_1}{9(x-1)} - \frac{43}{12(x-1)} + \frac{70d_1}{9(x-2)^2} - \frac{40}{9(x-2)^2} - \frac{d_1}{(x-1)^2} + \frac{4}{9(x-1)^2} - \frac{80d_1}{9(x-2)^3} +$$

$$\frac{80}{9(x-2)^3} + \frac{5d_1}{18(x-1)^3} + \frac{1}{36(x-1)^3} - \frac{112d_1}{3(x-2)^4} - \frac{64}{9(x-2)^4} - \frac{19d_1}{6(x-1)^4} + \frac{23}{12(x-1)^4} - \frac{448d_1}{3(x-2)^5} - \frac{1216}{9(x-2)^5} -$$

$$\frac{17d_1}{6(x-1)^5} + \frac{17}{12(x-1)^5} - \frac{128d_1}{3(x-2)^6} - \frac{2176}{9(x-2)^6} - \frac{1}{2}\Big) H(0;\alpha_0) + \Big( -\frac{2x\alpha_0}{3} - 2x\kappa\alpha_0 - \frac{160\kappa\alpha_0}{(x-2)^4} - \frac{4d_1\kappa\alpha_0}{3(x-1)^4} +$$

$$\frac{2\kappa\alpha_0}{(x-1)^4} - \frac{320\kappa\alpha_0}{(x-2)^5} + \frac{4d_1\kappa\alpha_0}{3(x-1)^5} - \frac{2\kappa\alpha_0}{(x-1)^5} + 4\kappa\alpha_0 - \frac{160\alpha_0}{3(x-2)^4} - \frac{4d_1\alpha_0}{3(x-1)^4} + \frac{2\alpha_0}{3(x-1)^4} - \frac{320\alpha_0}{3(x-2)^5} + \frac{4d_1\alpha_0}{3(x-1)^5} -$$

$$\frac{2\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} + \frac{2x}{3} + 2x\kappa + \frac{160\kappa}{(x-2)^4} + \frac{4d_1\kappa}{3(x-1)^4} - \frac{2\kappa}{(x-1)^4} + \frac{640\kappa}{(x-2)^5} + \frac{4d_1\kappa}{3(x-1)^5} - \frac{2\kappa}{(x-1)^5} + \frac{640\kappa}{(x-2)^6} +$$

$$\frac{160}{3(x-2)^4} + \frac{4d_1}{3(x-1)^4} - \frac{2}{3(x-1)^4} + \frac{640}{3(x-2)^5} + \frac{4d_1}{3(x-1)^5} - \frac{2}{3(x-1)^5} + \frac{640}{3(x-2)^6}\Big) H(0,0;\alpha_0) + \Big( -\frac{4\alpha_0 d_1^2}{3(x-1)^4} +$$

$$\frac{4d_1^2}{3(x-1)^4} + \frac{4\alpha_0 d_1^2}{3(x-1)^5} + \frac{4d_1^2}{3(x-1)^5} + \frac{4\alpha_0 d_1}{3} - \frac{2\alpha_0 x d_1}{3} + \frac{2xd_1}{3} + \frac{4\alpha_0\kappa d_1}{3} - \frac{2}{3}\alpha_0 x\kappa d_1 + \frac{2x\kappa d_1}{3} - \frac{160\alpha_0\kappa d_1}{3(x-2)^4} +$$

$$\frac{160\kappa d_1}{3(x-2)^4} + \frac{2\alpha_0\kappa d_1}{3(x-1)^4} - \frac{2\kappa d_1}{3(x-1)^4} - \frac{320\alpha_0\kappa d_1}{3(x-2)^5} + \frac{640\kappa d_1}{3(x-2)^5} - \frac{2\alpha_0\kappa d_1}{3(x-1)^5} - \frac{2\kappa d_1}{3(x-1)^5} + \frac{640\kappa d_1}{3(x-2)^6} - \frac{160\alpha_0 d_1}{3(x-2)^4} +$$

$$\frac{160d_1}{3(x-2)^4} + \frac{2\alpha_0 d_1}{3(x-1)^4} - \frac{2d_1}{3(x-1)^4} - \frac{320\alpha_0 d_1}{3(x-2)^5} + \frac{640d_1}{3(x-2)^5} - \frac{2\alpha_0 d_1}{3(x-1)^5} - \frac{2d_1}{3(x-1)^5} + \frac{640d_1}{3(x-2)^6}\Big) H(0,1;\alpha_0) -$$

$$\frac{40\pi^2}{9(x-2)^4} - \frac{d_1\pi^2}{9(x-1)^4} + \frac{\pi^2}{18(x-1)^4} - \frac{160\pi^2}{9(x-2)^5} - \frac{d_1\pi^2}{9(x-1)^5} + \frac{\pi^2}{18(x-1)^5} - \frac{160\pi^2}{9(x-2)^6}\Big) + \Big( -\frac{4d_1\alpha_0}{3} + \frac{2d_1x\alpha_0}{3} -$$

$$\frac{2x\alpha_0}{3} - \frac{4d_1\kappa\alpha_0}{3} + \frac{2}{3}d_1x\kappa\alpha_0 - 2x\kappa\alpha_0 + \frac{160d_1\kappa\alpha_0}{3(x-2)^4} - \frac{160\kappa\alpha_0}{(x-2)^4} - \frac{2d_1\kappa\alpha_0}{3(x-1)^4} + \frac{2\kappa\alpha_0}{(x-1)^4} + \frac{320d_1\kappa\alpha_0}{3(x-2)^5} - \frac{320\kappa\alpha_0}{(x-2)^5} +$$

$$\frac{2d_1\kappa\alpha_0}{3(x-1)^5} - \frac{2\kappa\alpha_0}{(x-1)^5} + 4\kappa\alpha_0 + \frac{160d_1\alpha_0}{3(x-2)^4} - \frac{160\alpha_0}{3(x-2)^4} - \frac{2d_1\alpha_0}{3(x-1)^4} + \frac{2\alpha_0}{3(x-1)^4} + \frac{320d_1\alpha_0}{3(x-2)^5} - \frac{320\alpha_0}{3(x-2)^5} + \frac{2d_1\alpha_0}{3(x-1)^5} -$$

$$\frac{2\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} - \frac{2d_1x}{3} + \frac{2x}{3} - \frac{2d_1x\kappa}{3} + 2x\kappa - \frac{160d_1\kappa}{3(x-2)^4} + \frac{160\kappa}{(x-2)^4} + \frac{2d_1\kappa}{3(x-1)^4} - \frac{2\kappa}{(x-1)^4} - \frac{640d_1\kappa}{3(x-2)^5} + \frac{640\kappa}{(x-2)^5} +$$

$$\frac{2d_1\kappa}{3(x-1)^5} - \frac{2\kappa}{(x-1)^5} - \frac{640d_1\kappa}{3(x-2)^6} + \frac{640\kappa}{(x-2)^6} - \frac{160d_1}{3(x-2)^4} + \frac{160}{3(x-2)^4} + \frac{2d_1}{3(x-1)^4} - \frac{2}{3(x-1)^4} - \frac{640d_1}{3(x-2)^5} + \frac{640}{3(x-2)^5} +$$

$$\frac{2d_1}{3(x-1)^5} - \frac{2}{3(x-1)^5} - \frac{640d_1}{3(x-2)^6} + \frac{640}{3(x-2)^6}\Big) H(0;\alpha_0)H(0,1;x) + \Big( \frac{17x\alpha_0}{12} + \frac{101x\kappa\alpha_0}{36} + \frac{40\kappa\alpha_0}{3(x-2)} - \frac{65\kappa\alpha_0}{4(x-1)} -$$

$$\frac{40\kappa\alpha_0}{3(x-2)^2} + \frac{25\kappa\alpha_0}{6(x-1)^2} - \frac{35\kappa\alpha_0}{12(x-1)^3} + \frac{32d_1\kappa\alpha_0}{3(x-2)^4} - \frac{1088\kappa\alpha_0}{9(x-2)^4} - \frac{47\kappa\alpha_0}{36(x-1)^4} + \frac{64d_1\kappa\alpha_0}{3(x-2)^5} + \frac{704\kappa\alpha_0}{9(x-2)^5} + \frac{101\kappa\alpha_0}{36(x-1)^5} -$$

$$\frac{37\kappa\alpha_0}{9} + \frac{40\alpha_0}{9(x-2)} - \frac{65\alpha_0}{12(x-1)} - \frac{40\alpha_0}{9(x-2)^2} + \frac{25\alpha_0}{18(x-1)^2} - \frac{35\alpha_0}{36(x-1)^3} + \frac{32d_1\alpha_0}{3(x-2)^4} + \frac{64\alpha_0}{9(x-2)^4} - \frac{11\alpha_0}{12(x-1)^4} + \frac{64d_1\alpha_0}{3(x-2)^5} +$$

$$\frac{1088\alpha_0}{9(x-2)^5} + \frac{17\alpha_0}{12(x-1)^5} - \frac{7\alpha_0}{3} - \frac{17x}{12} - \frac{101x\kappa}{36} + \frac{32\kappa}{3(x-2)} - \frac{43\kappa}{4(x-1)} - \frac{40\kappa}{3(x-2)^2} + \frac{4\kappa}{3(x-1)^2} + \frac{80\kappa}{3(x-2)^3} + \frac{\kappa}{12(x-1)^3} -$$

$$\frac{32d_1\kappa}{3(x-2)^4} + \frac{1088\kappa}{9(x-2)^4} + \frac{155\kappa}{36(x-1)^4} - \frac{128d_1\kappa}{3(x-2)^5} + \frac{1472\kappa}{9(x-2)^5} + \frac{101\kappa}{36(x-1)^5} - \frac{128d_1\kappa}{3(x-2)^6} - \frac{1408\kappa}{9(x-2)^6} - \frac{3\kappa}{2} + \Big( -\frac{2x\alpha_0}{3} -$$

$$2x\kappa\alpha_0 - \frac{160\kappa\alpha_0}{(x-2)^4} + \frac{2\kappa\alpha_0}{(x-1)^4} - \frac{320\kappa\alpha_0}{(x-2)^5} - \frac{2\kappa\alpha_0}{(x-1)^5} + 4\kappa\alpha_0 - \frac{160\alpha_0}{3(x-2)^4} + \frac{2\alpha_0}{3(x-1)^4} - \frac{320\alpha_0}{3(x-2)^5} - \frac{2\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} +$$

$$\frac{2x}{3} + 2x\kappa + \frac{160\kappa}{(x-2)^4} - \frac{2\kappa}{(x-1)^4} + \frac{640\kappa}{(x-2)^5} - \frac{2\kappa}{(x-1)^5} + \frac{640\kappa}{(x-2)^6} + \frac{160}{3(x-2)^4} - \frac{2}{3(x-1)^4} + \frac{640}{3(x-2)^5} - \frac{2}{3(x-1)^5} +$$

$$\frac{640}{3(x-2)^6}\Big) H(0;\alpha_0) + \Big( \frac{4\alpha_0 d_1}{3} - \frac{2\alpha_0 x d_1}{3} + \frac{2xd_1}{3} + \frac{4\alpha_0\kappa d_1}{3} - \frac{2}{3}\alpha_0 x\kappa d_1 + \frac{2x\kappa d_1}{3} - \frac{160\alpha_0\kappa d_1}{3(x-2)^4} + \frac{160\kappa d_1}{3(x-2)^4} +$$

$$\frac{2\alpha_0\kappa d_1}{3(x-1)^4} - \frac{2\kappa d_1}{3(x-1)^4} - \frac{320\alpha_0\kappa d_1}{3(x-2)^5} + \frac{640\kappa d_1}{3(x-2)^5} - \frac{2\alpha_0\kappa d_1}{3(x-1)^5} - \frac{2\kappa d_1}{3(x-1)^5} + \frac{640\kappa d_1}{3(x-2)^6} - \frac{160\alpha_0 d_1}{3(x-2)^4} + \frac{160d_1}{3(x-2)^4} + \frac{2\alpha_0 d_1}{3(x-1)^4} -$$

$$\frac{2d_1}{3(x-1)^4} - \frac{320\alpha_0 d_1}{3(x-2)^5} + \frac{640d_1}{3(x-2)^5} - \frac{2\alpha_0 d_1}{3(x-1)^5} - \frac{2d_1}{3(x-1)^5} + \frac{640d_1}{3(x-2)^6}\Big) H(1;\alpha_0) + \frac{32}{9(x-2)} - \frac{43}{12(x-1)} -$$

$$\frac{40}{9(x-2)^2} + \frac{4}{9(x-1)^2} + \frac{80}{9(x-2)^3} + \frac{1}{36(x-1)^3} - \frac{32d_1}{3(x-2)^4} - \frac{64}{9(x-2)^4} + \frac{23}{12(x-1)^4} - \frac{128d_1}{3(x-2)^5} - \frac{1216}{9(x-2)^5} +$$

$$\frac{17}{12(x-1)^5} - \frac{128d_1}{3(x-2)^6} - \frac{2176}{9(x-2)^6} - \frac{1}{2}\Big) H(0,c_1(\alpha_0);x) + \Big( -\frac{64d_1\kappa\alpha_0}{3(x-2)^4} - \frac{704\kappa\alpha_0}{9(x-2)^4} - \frac{128d_1\kappa\alpha_0}{3(x-2)^5} - \frac{1408\kappa\alpha_0}{9(x-2)^5} -$$

$$\frac{64d_1\alpha_0}{3(x-2)^4} - \frac{1088\alpha_0}{9(x-2)^4} - \frac{128d_1\alpha_0}{3(x-2)^5} - \frac{2176\alpha_0}{9(x-2)^5} + \frac{64d_1\kappa}{3(x-2)^4} + \frac{704\kappa}{9(x-2)^4} + \frac{256d_1\kappa}{3(x-2)^5} + \frac{2816\kappa}{9(x-2)^5} + \frac{256d_1\kappa}{3(x-2)^6} +$$

$$\frac{2816\kappa}{9(x-2)^6}+\Big(\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320\alpha_0}{3(x-2)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{320\kappa}{(x-2)^4}-\frac{1280\kappa}{(x-2)^5}-\frac{1280\kappa}{(x-2)^6}-\frac{320}{3(x-2)^4}-\frac{1280}{3(x-2)^5}-$$

$$\frac{1280}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{320\alpha_0\kappa d_1}{3(x-2)^4}-\frac{320\kappa d_1}{3(x-2)^4}+\frac{640\alpha_0\kappa d_1}{3(x-2)^5}-\frac{1280\kappa d_1}{3(x-2)^5}-\frac{1280\kappa d_1}{3(x-2)^6}+\frac{320\alpha_0 d_1}{3(x-2)^4}-\frac{320 d_1}{3(x-2)^4}+$$

$$\frac{640\alpha_0 d_1}{3(x-2)^5}-\frac{1280 d_1}{3(x-2)^5}-\frac{1280 d_1}{3(x-2)^6}\Big)H(1;\alpha_0)+\frac{64 d_1}{3(x-2)^4}+\frac{1088}{9(x-2)^4}+\frac{256 d_1}{3(x-2)^5}+\frac{4352}{9(x-2)^5}+\frac{256 d_1}{3(x-2)^6}+$$

$$\frac{4352}{9(x-2)^6}\Big)H(0,c_2(\alpha_0);x)+\Big(\frac13 d_1x\alpha_0^5+\frac13 d_1x\kappa\alpha_0^5+\frac{2d_1\kappa\alpha_0^5}{3(x-2)}-\frac{d_1\kappa\alpha_0^5}{3(x-1)}+\frac{2d_1\alpha_0^5}{3(x-2)}-\frac{d_1\alpha_0^5}{3(x-1)}+\frac{2d_1\alpha_0^4}{9}-$$

$$\frac{19}{9}d_1x\alpha_0^4+\frac29 d_1\kappa\alpha_0^4-\frac{19}{9}d_1x\kappa\alpha_0^4-\frac{20d_1\kappa\alpha_0^4}{9(x-2)}+\frac{13d_1\kappa\alpha_0^4}{9(x-1)}+\frac{20d_1\kappa\alpha_0^4}{9(x-2)^2}-\frac{4d_1\kappa\alpha_0^4}{9(x-1)^2}-\frac{20d_1\alpha_0^4}{9(x-2)}+\frac{13d_1\alpha_0^4}{9(x-1)}+$$

$$\frac{20d_1\alpha_0^4}{9(x-2)^2}-\frac{4d_1\alpha_0^4}{9(x-1)^2}-\frac{4d_1\alpha_0^3}{3}+\frac{52}{9}d_1x\alpha_0^3-\frac43 d_1\kappa\alpha_0^3+\frac{52}{9}d_1x\kappa\alpha_0^3+\frac{20d_1\kappa\alpha_0^3}{9(x-2)}-\frac{22d_1\kappa\alpha_0^3}{9(x-1)}-\frac{40d_1\kappa\alpha_0^3}{9(x-2)^2}+$$

$$\frac{14d_1\kappa\alpha_0^3}{9(x-1)^2}+\frac{80d_1\kappa\alpha_0^3}{9(x-2)^3}-\frac{2d_1\kappa\alpha_0^3}{3(x-1)^3}+\frac{20d_1\alpha_0^3}{9(x-2)}-\frac{22d_1\alpha_0^3}{9(x-1)}-\frac{40d_1\alpha_0^3}{9(x-2)^2}+\frac{14d_1\alpha_0^3}{9(x-1)^2}+\frac{80d_1\alpha_0^3}{9(x-2)^3}-\frac{2d_1\alpha_0^3}{3(x-1)^3}+4d_1\alpha_0^2-$$

$$\frac{28}{3}d_1x\alpha_0^2+4d_1\kappa\alpha_0^2-\frac{28}{3}d_1x\kappa\alpha_0^2+\frac{2d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{160d_1\kappa\alpha_0^2}{3(x-2)^4}-\frac{4d_1\kappa\alpha_0^2}{3(x-1)^4}+\frac{2d_1\alpha_0^2}{x-1}-$$

$$\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}+\frac{160d_1\alpha_0^2}{3(x-2)^4}-\frac{4d_1\alpha_0^2}{3(x-1)^4}-\frac{20d_1\alpha_0}{9}+\frac{73d_1x\alpha_0}{9}-\frac{20d_1\kappa\alpha_0}{9}+\frac{73}{9}d_1x\kappa\alpha_0-\frac{10d_1\kappa\alpha_0}{9(x-2)}-\frac{7d_1\kappa\alpha_0}{9(x-1)}+$$

$$\frac{40d_1\kappa\alpha_0}{9(x-2)^2}+\frac{10d_1\kappa\alpha_0}{9(x-1)^2}-\frac{80d_1\kappa\alpha_0}{3(x-2)^3}-\frac{2d_1\kappa\alpha_0}{(x-1)^3}-\frac{640d_1\kappa\alpha_0}{3(x-2)^4}-\frac{640d_1\kappa\alpha_0}{3(x-2)^5}-\frac{10d_1\alpha_0}{9(x-2)}-\frac{7d_1\alpha_0}{9(x-1)}+\frac{40d_1\alpha_0}{9(x-2)^2}+$$

$$\frac{10d_1\alpha_0}{9(x-1)^2}-\frac{80d_1\alpha_0}{3(x-2)^3}-\frac{2d_1\alpha_0}{(x-1)^3}-\frac{640d_1\alpha_0}{3(x-2)^4}-\frac{640d_1\alpha_0}{3(x-2)^5}-\frac{2d_1}{3}-\frac{25d_1x}{9}-\frac{2d_1\kappa}{3}-\frac{25d_1x\kappa}{9}+\frac{4d_1\kappa}{9(x-2)}+\frac{d_1\kappa}{9(x-1)}-$$

$$\frac{20d_1\kappa}{9(x-2)^2}-\frac{2d_1\kappa}{9(x-1)^2}+\frac{160d_1\kappa}{9(x-2)^3}+\frac{2d_1\kappa}{3(x-1)^3}+\frac{160d_1\kappa}{(x-2)^4}+\frac{4d_1\kappa}{3(x-1)^4}+\frac{640d_1\kappa}{3(x-2)^5}+\frac{4d_1}{9(x-2)}+\frac{d_1}{9(x-1)}-\frac{20d_1}{9(x-2)^2}-$$

$$\frac{2d_1}{9(x-1)^2}+\frac{160d_1}{9(x-2)^3}+\frac{2d_1}{3(x-1)^3}+\frac{160d_1}{(x-2)^4}+\frac{4d_1}{3(x-1)^4}+\frac{640d_1}{3(x-2)^5}\Big)H(1,0;\alpha_0)+\Big(\frac{2d_1\alpha_0}{3}-\frac{17x\alpha_0}{12}+\frac{2d_1\kappa\alpha_0}{3}-$$

$$\frac{101x\kappa\alpha_0}{36}+\frac{85d_1\kappa\alpha_0}{9(x-2)}-\frac{40\kappa\alpha_0}{3(x-2)}-\frac{94d_1\kappa\alpha_0}{9(x-1)}+\frac{65\kappa\alpha_0}{4(x-1)}-\frac{100d_1\kappa\alpha_0}{9(x-2)^2}+\frac{40\kappa\alpha_0}{3(x-2)^2}+\frac{20d_1\kappa\alpha_0}{9(x-1)^2}-\frac{25\kappa\alpha_0}{6(x-1)^2}+\frac{40d_1\kappa\alpha_0}{3(x-2)^3}-$$

$$\frac{17d_1\kappa\alpha_0}{18(x-1)^3}+\frac{35\kappa\alpha_0}{12(x-1)^3}-\frac{64d_1\kappa\alpha_0}{(x-2)^4}+\frac{1088\kappa\alpha_0}{9(x-2)^4}-\frac{19d_1\kappa\alpha_0}{18(x-1)^4}+\frac{47\kappa\alpha_0}{36(x-1)^4}-\frac{64d_1\kappa\alpha_0}{3(x-2)^5}-\frac{704\kappa\alpha_0}{9(x-2)^5}+\frac{25d_1\kappa\alpha_0}{18(x-1)^5}-$$

$$\frac{101\kappa\alpha_0}{36(x-1)^5}+\frac{37\kappa\alpha_0}{9}+\frac{85d_1\alpha_0}{9(x-2)}-\frac{40\alpha_0}{9(x-2)}-\frac{94d_1\alpha_0}{9(x-1)}+\frac{65\alpha_0}{12(x-1)}-\frac{100d_1\alpha_0}{9(x-2)^2}+\frac{40\alpha_0}{9(x-2)^2}+\frac{20d_1\alpha_0}{9(x-1)^2}-\frac{25\alpha_0}{18(x-1)^2}+$$

$$\frac{40d_1\alpha_0}{3(x-2)^3}-\frac{17d_1\alpha_0}{18(x-1)^3}+\frac{35\alpha_0}{36(x-1)^3}-\frac{64d_1\alpha_0}{(x-2)^4}-\frac{64\alpha_0}{9(x-2)^4}-\frac{5d_1\alpha_0}{2(x-1)^4}+\frac{11\alpha_0}{12(x-1)^4}-\frac{64d_1\alpha_0}{3(x-2)^5}-\frac{1088\alpha_0}{9(x-2)^5}+$$

$$\frac{17d_1\alpha_0}{6(x-1)^5}-\frac{17\alpha_0}{12(x-1)^5}+\frac{7\alpha_0}{3}-\frac{2d_1}{3}+\frac{17x}{12}-\frac{2d_1\kappa}{3}+\frac{101x\kappa}{36}+\frac{62d_1\kappa}{9(x-2)}-\frac{32\kappa}{3(x-2)}-\frac{65d_1\kappa}{9(x-1)}+\frac{43\kappa}{4(x-1)}-$$

$$\frac{70d_1\kappa}{9(x-2)^2}+\frac{40\kappa}{3(x-2)^2}+\frac{d_1\kappa}{(x-1)^2}-\frac{4\kappa}{3(x-1)^2}+\frac{80d_1\kappa}{9(x-2)^3}-\frac{80\kappa}{3(x-2)^3}-\frac{5d_1\kappa}{18(x-1)^3}-\frac{\kappa}{12(x-1)^3}+\frac{112d_1\kappa}{3(x-2)^4}-\frac{1088\kappa}{9(x-2)^4}+$$

$$\frac{31d_1\kappa}{18(x-1)^4}-\frac{155\kappa}{36(x-1)^4}+\frac{448d_1\kappa}{3(x-2)^5}-\frac{1472\kappa}{9(x-2)^5}+\frac{25d_1\kappa}{18(x-1)^5}-\frac{101\kappa}{36(x-1)^5}+\frac{128d_1\kappa}{3(x-2)^6}+\frac{1408\kappa}{9(x-2)^6}+\frac{3\kappa}{2}+\frac{62d_1}{9(x-2)}-$$

$$\frac{32}{9(x-2)}-\frac{65d_1}{9(x-1)}+\frac{43}{12(x-1)}-\frac{70d_1}{9(x-2)^2}+\frac{40}{9(x-2)^2}+\frac{d_1}{(x-1)^2}-\frac{4}{9(x-1)^2}+\frac{80d_1}{9(x-2)^3}-\frac{80}{9(x-2)^3}-\frac{5d_1}{18(x-1)^3}-$$

$$\frac{1}{36(x-1)^3}+\frac{112d_1}{3(x-2)^4}+\frac{64}{9(x-2)^4}+\frac{19d_1}{6(x-1)^4}-\frac{23}{12(x-1)^4}+\frac{448d_1}{3(x-2)^5}+\frac{1216}{9(x-2)^5}+\frac{17d_1}{6(x-1)^5}-\frac{17}{12(x-1)^5}+$$

$$\frac{128d_1}{3(x-2)^6}+\frac{2176}{9(x-2)^6}+\frac12\Big)H(1,0;x)+\Big(\frac13 d_1^2x\alpha_0^5+\frac{2d_1^2\alpha_0^5}{3(x-2)}-\frac{d_1^2\alpha_0^5}{3(x-1)}+\frac{2d_1^2\alpha_0^4}{9}-\frac{19}{9}d_1^2x\alpha_0^4-\frac{20d_1^2\alpha_0^4}{9(x-2)}+$$

$$\frac{13d_1^2\alpha_0^4}{9(x-1)}+\frac{20d_1^2\alpha_0^4}{9(x-2)^2}-\frac{4d_1^2\alpha_0^4}{9(x-1)^2}-\frac{4d_1^2\alpha_0^3}{3}+\frac{52}{9}d_1^2x\alpha_0^3+\frac{20d_1^2\alpha_0^3}{9(x-2)}-\frac{22d_1^2\alpha_0^3}{9(x-1)}-\frac{40d_1^2\alpha_0^3}{9(x-2)^2}+\frac{14d_1^2\alpha_0^3}{9(x-1)^2}+\frac{80d_1^2\alpha_0^3}{9(x-2)^3}-$$

$$\frac{2d_1^2\alpha_0^3}{3(x-1)^3}+4d_1^2\alpha_0^2-\frac{28}{3}d_1^2x\alpha_0^2+\frac{2d_1^2\alpha_0^2}{x-1}-\frac{2d_1^2\alpha_0^2}{(x-1)^2}+\frac{2d_1^2\alpha_0^2}{(x-1)^3}+\frac{160d_1^2\alpha_0^2}{3(x-2)^4}-\frac{4d_1^2\alpha_0^2}{3(x-1)^4}-\frac{20d_1^2\alpha_0}{9}+\frac{73}{9}d_1^2x\alpha_0-$$

$$\frac{10d_1^2\alpha_0}{9(x-2)}-\frac{7d_1^2\alpha_0}{9(x-1)}+\frac{40d_1^2\alpha_0}{9(x-2)^2}+\frac{10d_1^2\alpha_0}{9(x-1)^2}-\frac{80d_1^2\alpha_0}{3(x-2)^3}-\frac{2d_1^2\alpha_0}{(x-1)^3}-\frac{640d_1^2\alpha_0}{3(x-2)^4}-\frac{640d_1^2\alpha_0}{3(x-2)^5}-\frac{2d_1^2}{3}-\frac{25d_1^2x}{9}+\frac{4d_1^2}{9(x-2)}+$$

$$\frac{d_1^2}{9(x-1)}-\frac{20d_1^2}{9(x-2)^2}-\frac{2d_1^2}{9(x-1)^2}+\frac{160d_1^2}{9(x-2)^3}+\frac{2d_1^2}{3(x-1)^3}+\frac{160d_1^2}{(x-2)^4}+\frac{4d_1^2}{3(x-1)^4}+\frac{640d_1^2}{3(x-2)^5}\Big)H(1,1;\alpha_0)+$$

$$H(c_2(\alpha_0);x)\Big(-\frac{256\kappa\alpha_0}{9(x-2)^4}-\frac{512\kappa\alpha_0}{9(x-2)^5}+\frac{256d_1\alpha_0}{9(x-2)^4}-\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{3392\alpha_0}{27(x-2)^4}+\frac{512d_1\alpha_0}{9(x-2)^5}-\frac{80\pi^2\alpha_0}{9(x-2)^5}+\frac{6784\alpha_0}{27(x-2)^5}+$$

$$\frac{256\kappa}{9(x-2)^4}+\frac{1024\kappa}{9(x-2)^5}+\frac{1024\kappa}{9(x-2)^6}+\Big(-\frac{64d_1\kappa\alpha_0}{3(x-2)^4}-\frac{704\kappa\alpha_0}{9(x-2)^4}-\frac{128d_1\kappa\alpha_0}{3(x-2)^5}-\frac{1408\kappa\alpha_0}{9(x-2)^5}-\frac{64d_1\alpha_0}{3(x-2)^4}-\frac{1088\alpha_0}{9(x-2)^4}-$$

$$\frac{128d_1\alpha_0}{3(x-2)^5}-\frac{2176\alpha_0}{9(x-2)^5}+\frac{64d_1\kappa}{3(x-2)^4}+\frac{704\kappa}{9(x-2)^4}+\frac{256d_1\kappa}{3(x-2)^5}+\frac{2816\kappa}{9(x-2)^5}+\frac{256d_1\kappa}{3(x-2)^6}+\frac{2816\kappa}{9(x-2)^6}+\frac{64d_1}{3(x-2)^4}+$$

$$\frac{1088}{9(x-2)^4}+\frac{256d_1}{3(x-2)^5}+\frac{4352}{9(x-2)^5}+\frac{256d_1}{3(x-2)^6}+\frac{4352}{9(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{64\alpha_0d_1^2}{3(x-2)^4}+\frac{64d_1^2}{3(x-2)^4}-\frac{128\alpha_0d_1^2}{3(x-2)^5}+$$

$$\frac{256d_1^2}{3(x-2)^5}+\frac{256d_1^2}{3(x-2)^6}+\frac{64\alpha_0\kappa d_1}{3(x-2)^4}-\frac{64\kappa d_1}{3(x-2)^4}+\frac{128\alpha_0\kappa d_1}{3(x-2)^5}-\frac{256\kappa d_1}{3(x-2)^5}-\frac{256\kappa d_1}{3(x-2)^6}-\frac{1088\alpha_0d_1}{9(x-2)^4}+\frac{1088d_1}{9(x-2)^4}-$$

$$\frac{2176\alpha_0d_1}{9(x-2)^5}+\frac{4352d_1}{9(x-2)^5}+\frac{4352d_1}{9(x-2)^6}\Big)H(1;\alpha_0)+\Big(\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320\alpha_0}{3(x-2)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{320\kappa}{(x-2)^4}-\frac{1280\kappa}{(x-2)^5}-$$

$$\frac{1280\kappa}{(x-2)^6} - \frac{320}{3(x-2)^4} - \frac{1280}{3(x-2)^5} - \frac{1280}{3(x-2)^6}\Big) H(0,0;\alpha_0) + \Big(\frac{320\alpha_0\kappa d_1}{3(x-2)^4} - \frac{320\kappa d_1}{3(x-2)^4} + \frac{640\alpha_0\kappa d_1}{3(x-2)^5} - \frac{1280\kappa d_1}{3(x-2)^5} -$$

$$\frac{1280\kappa d_1}{3(x-2)^6} + \frac{320\alpha_0 d_1}{3(x-2)^4} - \frac{320 d_1}{3(x-2)^4} + \frac{640\alpha_0 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^6}\Big) H(0,1;\alpha_0) + \Big(\frac{320\alpha_0\kappa d_1}{3(x-2)^4} - \frac{320\kappa d_1}{3(x-2)^4} +$$

$$\frac{640\alpha_0\kappa d_1}{3(x-2)^5} - \frac{1280\kappa d_1}{3(x-2)^5} - \frac{1280\kappa d_1}{3(x-2)^6} + \frac{320\alpha_0 d_1}{3(x-2)^4} - \frac{320 d_1}{3(x-2)^4} + \frac{640\alpha_0 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^6}\Big) H(1,0;\alpha_0) +$$

$$\Big(\frac{320\alpha_0 d_1^2}{3(x-2)^4} - \frac{320 d_1^2}{3(x-2)^4} + \frac{640\alpha_0 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^6}\Big) H(1,1;\alpha_0) - \frac{256 d_1}{9(x-2)^4} + \frac{40\pi^2}{9(x-2)^4} - \frac{3392}{27(x-2)^4} -$$

$$\frac{1024 d_1}{9(x-2)^5} + \frac{160\pi^2}{9(x-2)^5} - \frac{13568}{27(x-2)^5} - \frac{1024 d_1}{9(x-2)^6} + \frac{160\pi^2}{9(x-2)^6} - \frac{13568}{27(x-2)^6}\Big) + H(c_1(\alpha_0);x)\Big(\frac{1}{24} d_1 x\alpha_0^5 -$$

$$\frac{2x\alpha_0^5}{9} + \frac{1}{24} d_1 x\kappa\alpha_0^5 - \frac{11}{36} x\kappa\alpha_0^5 + \frac{d_1\kappa\alpha_0^5}{12(x-2)} - \frac{25\kappa\alpha_0^5}{36(x-2)} - \frac{d_1\kappa\alpha_0^5}{24(x-1)} + \frac{11\kappa\alpha_0^5}{36(x-1)} - \frac{\kappa\alpha_0^5}{24} + \frac{d_1\alpha_0^5}{12(x-2)} - \frac{19\alpha_0^5}{36(x-2)} -$$

$$\frac{d_1\alpha_0^5}{24(x-1)} + \frac{2\alpha_0^5}{9(x-1)} - \frac{\alpha_0^5}{24} + \frac{7 d_1\alpha_0^4}{108} - \frac{61}{216} d_1 x\alpha_0^4 + \frac{157 x\alpha_0^4}{108} + \frac{7}{108} d_1\kappa\alpha_0^4 - \frac{61}{216} d_1 x\kappa\alpha_0^4 + \frac{56}{27} x\kappa\alpha_0^4 -$$

$$\frac{11 d_1\kappa\alpha_0^4}{54(x-2)} + \frac{113\kappa\alpha_0^4}{54(x-2)} + \frac{43 d_1\kappa\alpha_0^4}{216(x-1)} - \frac{149\kappa\alpha_0^4}{108(x-1)} + \frac{23 d_1\kappa\alpha_0^4}{54(x-2)^2} - \frac{149\kappa\alpha_0^4}{54(x-2)^2} - \frac{2 d_1\kappa\alpha_0^4}{27(x-1)^2} + \frac{59\kappa\alpha_0^4}{108(x-1)^2} - \frac{41\kappa\alpha_0^4}{216} -$$

$$\frac{11 d_1\alpha_0^4}{54(x-2)} + \frac{91\alpha_0^4}{54(x-2)} + \frac{43 d_1\alpha_0^4}{216(x-1)} - \frac{53\alpha_0^4}{54(x-1)} + \frac{23 d_1\alpha_0^4}{54(x-2)^2} - \frac{103\alpha_0^4}{54(x-2)^2} - \frac{2 d_1\alpha_0^4}{27(x-1)^2} + \frac{37\alpha_0^4}{108(x-1)^2} - \frac{\alpha_0^4}{216} -$$

$$\frac{4 d_1\alpha_0^3}{9} + \frac{95}{108} d_1 x\alpha_0^3 - \frac{911 x\alpha_0^3}{216} - \frac{4}{9} d_1\kappa\alpha_0^3 + \frac{95}{108} d_1 x\kappa\alpha_0^3 - \frac{1381}{216} x\kappa\alpha_0^3 - \frac{d_1\kappa\alpha_0^3}{54(x-2)} - \frac{25\kappa\alpha_0^3}{27(x-2)} - \frac{41 d_1\kappa\alpha_0^3}{108(x-1)} +$$

$$\frac{239\kappa\alpha_0^3}{108(x-1)} - \frac{8 d_1\kappa\alpha_0^3}{27(x-2)^2} + \frac{104\kappa\alpha_0^3}{27(x-2)^2} + \frac{17 d_1\kappa\alpha_0^3}{54(x-1)^2} - \frac{467\kappa\alpha_0^3}{216(x-1)^2} + \frac{76 d_1\kappa\alpha_0^3}{27(x-2)^3} - \frac{388\kappa\alpha_0^3}{27(x-2)^3} - \frac{d_1\kappa\alpha_0^3}{6(x-1)^3} + \frac{83\kappa\alpha_0^3}{72(x-1)^3} +$$

$$\frac{83\kappa\alpha_0^3}{36} - \frac{d_1\alpha_0^3}{54(x-2)} - \frac{35\alpha_0^3}{27(x-2)} - \frac{41 d_1\alpha_0^3}{108(x-1)} + \frac{175\alpha_0^3}{108(x-1)} - \frac{8 d_1\alpha_0^3}{27(x-2)^2} + \frac{88\alpha_0^3}{27(x-2)^2} + \frac{17 d_1\alpha_0^3}{54(x-1)^2} - \frac{277\alpha_0^3}{216(x-1)^2} +$$

$$\frac{76 d_1\alpha_0^3}{27(x-2)^3} - \frac{236\alpha_0^3}{27(x-2)^3} - \frac{d_1\alpha_0^3}{6(x-1)^3} + \frac{5\alpha_0^3}{8(x-1)^3} + \frac{35\alpha_0^3}{36} + \frac{35 d_1\alpha_0^2}{18} - \frac{73}{36} d_1 x\alpha_0^2 + \frac{569 x\alpha_0^2}{72} + \frac{35}{18} d_1\kappa\alpha_0^2 -$$

$$\frac{73}{36} d_1 x\kappa\alpha_0^2 + \frac{979}{72} x\kappa\alpha_0^2 + \frac{4 d_1\kappa\alpha_0^2}{9(x-2)} - \frac{16\kappa\alpha_0^2}{3(x-2)} + \frac{13 d_1\kappa\alpha_0^2}{36(x-1)} + \frac{2\kappa\alpha_0^2}{3(x-1)} - \frac{5 d_1\kappa\alpha_0^2}{3(x-2)^2} + \frac{10\kappa\alpha_0^2}{(x-2)^2} - \frac{d_1\kappa\alpha_0^2}{2(x-1)^2} +$$

$$\frac{67\kappa\alpha_0^2}{24(x-1)^2} + \frac{80 d_1\kappa\alpha_0^2}{9(x-2)^3} - \frac{80\kappa\alpha_0^2}{3(x-2)^3} + \frac{5 d_1\kappa\alpha_0^2}{6(x-1)^3} - \frac{119\kappa\alpha_0^2}{24(x-1)^3} + \frac{104 d_1\kappa\alpha_0^2}{3(x-2)^4} - \frac{1256\kappa\alpha_0^2}{9(x-2)^4} - \frac{2 d_1\kappa\alpha_0^2}{3(x-1)^4} + \frac{137\kappa\alpha_0^2}{36(x-1)^4} -$$

$$\frac{32\kappa\alpha_0^2}{3} + \frac{4 d_1\alpha_0^2}{9(x-2)} - \frac{16\alpha_0^2}{9(x-2)} + \frac{13 d_1\alpha_0^2}{36(x-1)} - \frac{\alpha_0^2}{2(x-1)} - \frac{5 d_1\alpha_0^2}{3(x-2)^2} + \frac{10\alpha_0^2}{3(x-2)^2} - \frac{d_1\alpha_0^2}{2(x-1)^2} + \frac{119\alpha_0^2}{72(x-1)^2} + \frac{80 d_1\alpha_0^2}{9(x-2)^3} -$$

$$\frac{80\alpha_0^2}{9(x-2)^3} + \frac{5 d_1\alpha_0^2}{6(x-1)^3} - \frac{19\alpha_0^2}{8(x-1)^3} + \frac{104 d_1\alpha_0^2}{3(x-2)^4} - \frac{632\alpha_0^2}{9(x-2)^4} - \frac{2 d_1\alpha_0^2}{3(x-1)^4} + \frac{7\alpha_0^2}{4(x-1)^4} - \frac{85\alpha_0^2}{18} - \frac{22 d_1\alpha_0}{27} + \frac{505 d_1 x\alpha_0}{216} -$$

$$\frac{1697 x\alpha_0}{216} - \frac{22 d_1\kappa\alpha_0}{27} + \frac{505}{216} d_1 x\kappa\alpha_0 - \frac{3193 x\kappa\alpha_0}{216} + \frac{386 d_1\kappa\alpha_0}{27(x-2)} - \frac{1172\kappa\alpha_0}{27(x-2)} - \frac{1133 d_1\kappa\alpha_0}{72(x-1)} + \frac{3811\kappa\alpha_0}{72(x-1)} -$$

$$\frac{362 d_1\kappa\alpha_0}{27(x-2)^2} + \frac{1136\kappa\alpha_0}{27(x-2)^2} + \frac{193 d_1\kappa\alpha_0}{108(x-1)^2} - \frac{1273\kappa\alpha_0}{108(x-1)^2} - \frac{80 d_1\kappa\alpha_0}{9(x-2)^3} + \frac{40\kappa\alpha_0}{3(x-2)^3} - \frac{323 d_1\kappa\alpha_0}{216(x-1)^3} + \frac{2075\kappa\alpha_0}{216(x-1)^3} -$$

$$\frac{464 d_1\kappa\alpha_0}{3(x-2)^4} + \frac{2032\kappa\alpha_0}{3(x-2)^4} - \frac{187 d_1\kappa\alpha_0}{216(x-1)^4} + \frac{539\kappa\alpha_0}{108(x-1)^4} - \frac{256 d_1\kappa\alpha_0}{3(x-2)^5} + \frac{3584\kappa\alpha_0}{9(x-2)^5} + \frac{205 d_1\kappa\alpha_0}{216(x-1)^5} - \frac{1255\kappa\alpha_0}{216(x-1)^5} + \frac{857\kappa\alpha_0}{216} +$$

$$\frac{386 d_1\alpha_0}{27(x-2)} - \frac{604\alpha_0}{27(x-2)} - \frac{1133 d_1\alpha_0}{72(x-1)} + \frac{649\alpha_0}{24(x-1)} - \frac{362 d_1\alpha_0}{27(x-2)^2} + \frac{592\alpha_0}{27(x-2)^2} + \frac{193 d_1\alpha_0}{108(x-1)^2} - \frac{671\alpha_0}{108(x-1)^2} - \frac{80 d_1\alpha_0}{9(x-2)^3} +$$

$$\frac{40\alpha_0}{9(x-2)^3} - \frac{323 d_1\alpha_0}{216(x-1)^3} + \frac{1015\alpha_0}{216(x-1)^3} - \frac{464 d_1\alpha_0}{3(x-2)^4} + \frac{368\alpha_0}{(x-2)^4} - \frac{187 d_1\alpha_0}{216(x-1)^4} - \frac{\pi^2\alpha_0}{18(x-1)^4} + \frac{419\alpha_0}{108(x-1)^4} - \frac{256 d_1\alpha_0}{3(x-2)^5} +$$

$$\frac{2048\alpha_0}{9(x-2)^5} + \frac{205 d_1\alpha_0}{216(x-1)^5} + \frac{\pi^2\alpha_0}{18(x-1)^5} - \frac{955\alpha_0}{216(x-1)^5} + \frac{325\alpha_0}{216} - \frac{3 d_1}{4} - \frac{205 d_1 x}{216} + \frac{635 x}{216} - \frac{3 d_1\kappa}{4} - \frac{205 d_1 x\kappa}{216} +$$

$$\frac{1255 x\kappa}{216} + \frac{346 d_1\kappa}{27(x-2)} - \frac{952\kappa}{27(x-2)} - \frac{947 d_1\kappa}{72(x-1)} + \frac{2621\kappa}{72(x-1)} - \frac{392 d_1\kappa}{27(x-2)^2} + \frac{1136\kappa}{27(x-2)^2} + \frac{23 d_1\kappa}{27(x-1)^2} - \frac{92\kappa}{27(x-1)^2} +$$

$$\frac{784 d_1\kappa}{27(x-2)^3} - \frac{2272\kappa}{27(x-2)^3} + \frac{73 d_1\kappa}{216(x-1)^3} - \frac{247\kappa}{216(x-1)^3} + \frac{256 d_1\kappa}{3(x-2)^4} - \frac{3584\kappa}{9(x-2)^4} + \frac{367 d_1\kappa}{216(x-1)^4} - \frac{1127\kappa}{108(x-1)^4} +$$

$$\frac{512 d_1\kappa}{3(x-2)^5} - \frac{7168\kappa}{9(x-2)^5} + \frac{205 d_1\kappa}{216(x-1)^5} - \frac{1255\kappa}{216(x-1)^5} + \frac{37\kappa}{8} + \Big(\frac{x\alpha_0^5}{6} + \frac{1}{2} x\kappa\alpha_0^5 + \frac{\kappa\alpha_0^5}{x-2} - \frac{\kappa\alpha_0^5}{2(x-1)} + \frac{\alpha_0^5}{3(x-2)} -$$

$$\frac{\alpha_0^5}{6(x-1)} - \frac{19 x\alpha_0^4}{18} - \frac{19}{6} x\kappa\alpha_0^4 - \frac{10\kappa\alpha_0^4}{3(x-2)} + \frac{13\kappa\alpha_0^4}{6(x-1)} + \frac{10\kappa\alpha_0^4}{3(x-2)^2} - \frac{2\kappa\alpha_0^4}{3(x-1)^2} + \frac{\kappa\alpha_0^4}{3} - \frac{10\alpha_0^4}{9(x-2)} + \frac{13\alpha_0^4}{18(x-1)} +$$

$$\frac{10\alpha_0^4}{9(x-2)^2} - \frac{2\alpha_0^4}{9(x-1)^2} + \frac{\alpha_0^4}{9} + \frac{26 x\alpha_0^3}{9} + \frac{26}{3} x\kappa\alpha_0^3 + \frac{10\kappa\alpha_0^3}{3(x-2)} - \frac{11\kappa\alpha_0^3}{3(x-1)} - \frac{20\kappa\alpha_0^3}{3(x-2)^2} + \frac{7\kappa\alpha_0^3}{3(x-1)^2} + \frac{40\kappa\alpha_0^3}{3(x-2)^3} -$$

$$\frac{\kappa\alpha_0^3}{(x-1)^3} - 2\kappa\alpha_0^3 + \frac{10\alpha_0^3}{9(x-2)} - \frac{11\alpha_0^3}{9(x-1)} - \frac{20\alpha_0^3}{9(x-2)^2} + \frac{7\alpha_0^3}{9(x-1)^2} + \frac{40\alpha_0^3}{9(x-2)^3} - \frac{\alpha_0^3}{3(x-1)^3} - \frac{2\alpha_0^3}{3} - \frac{14x\alpha_0^2}{3} - 14x\kappa\alpha_0^2 +$$

$$\frac{3\kappa\alpha_0^2}{x-1} - \frac{3\kappa\alpha_0^2}{(x-1)^2} + \frac{3\kappa\alpha_0^2}{(x-1)^3} + \frac{80\kappa\alpha_0^2}{(x-2)^4} - \frac{2\kappa\alpha_0^2}{(x-1)^4} + 6\kappa\alpha_0^2 + \frac{\alpha_0^2}{x-1} - \frac{\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} + \frac{80\alpha_0^2}{3(x-2)^4} - \frac{2\alpha_0^2}{3(x-1)^4} + 2\alpha_0^2 +$$

$$\frac{73x\alpha_0}{18} + \frac{73x\kappa\alpha_0}{6} + \frac{80\kappa\alpha_0}{3(x-2)} - \frac{65\kappa\alpha_0}{2(x-1)} - \frac{80\kappa\alpha_0}{3(x-2)^2} + \frac{25\kappa\alpha_0}{3(x-1)^2} - \frac{35\kappa\alpha_0}{6(x-1)^3} - \frac{480\kappa\alpha_0}{(x-2)^4} - \frac{83\kappa\alpha_0}{18(x-1)^4} - \frac{320\kappa\alpha_0}{(x-2)^5} +$$

$$\frac{101\kappa\alpha_0}{18(x-1)^5} - \frac{4\kappa\alpha_0}{3} + \frac{80\alpha_0}{9(x-2)} - \frac{65\alpha_0}{6(x-1)} - \frac{80\alpha_0}{9(x-2)^2} + \frac{25\alpha_0}{9(x-1)^2} - \frac{35\alpha_0}{18(x-1)^3} - \frac{160\alpha_0}{(x-2)^4} - \frac{5\alpha_0}{2(x-1)^4} - \frac{320\alpha_0}{3(x-2)^5} +$$

$$\frac{17\alpha_0}{6(x-1)^5} - \frac{4\alpha_0}{9} - \frac{25x}{18} - \frac{25x\kappa}{6} + \frac{64\kappa}{3(x-2)} - \frac{43\kappa}{2(x-1)} - \frac{80\kappa}{3(x-2)^2} + \frac{8\kappa}{3(x-1)^2} + \frac{160\kappa}{3(x-2)^3} + \frac{\kappa}{6(x-1)^3} + \frac{320\kappa}{(x-2)^4} +$$

$$\frac{155\kappa}{18(x-1)^4} + \frac{640\kappa}{(x-2)^5} + \frac{101\kappa}{18(x-1)^5} - 3\kappa + \frac{64}{9(x-2)} - \frac{43}{6(x-1)} - \frac{80}{9(x-2)^2} + \frac{8}{9(x-1)^2} + \frac{160}{9(x-2)^3} + \frac{1}{18(x-1)^3} +$$

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$$\frac{320}{3(x-2)^4}+\frac{23}{6(x-1)^4}+\frac{640}{3(x-2)^5}+\frac{17}{6(x-1)^5}-1\Big)H(0;\alpha_0)+\Big(\frac{1}{6}d_1x\alpha_0^5+\frac{1}{6}d_1x\kappa\alpha_0^5+\frac{d_1\kappa\alpha_0^5}{3(x-2)}-\frac{d_1\kappa\alpha_0^5}{6(x-1)}+$$

$$\frac{d_1\alpha_0^5}{3(x-2)}-\frac{d_1\alpha_0^5}{6(x-1)}+\frac{d_1\alpha_0^4}{9}-\frac{19}{18}d_1x\alpha_0^4+\frac{1}{9}d_1\kappa\alpha_0^4-\frac{19}{18}d_1x\kappa\alpha_0^4-\frac{10d_1\kappa\alpha_0^4}{9(x-2)}+\frac{13d_1\kappa\alpha_0^4}{18(x-1)}+\frac{10d_1\kappa\alpha_0^4}{9(x-2)^2}-$$

$$\frac{2d_1\kappa\alpha_0^4}{9(x-1)^2}-\frac{10d_1\alpha_0^4}{9(x-2)}+\frac{13d_1\alpha_0^4}{18(x-1)}+\frac{10d_1\alpha_0^4}{9(x-2)^2}-\frac{2d_1\alpha_0^4}{9(x-1)^2}-\frac{2d_1\alpha_0^3}{3}+\frac{26}{9}d_1x\alpha_0^3-\frac{2}{3}d_1\kappa\alpha_0^3+\frac{26}{9}d_1x\kappa\alpha_0^3+$$

$$\frac{10d_1\kappa\alpha_0^3}{9(x-2)}-\frac{11d_1\kappa\alpha_0^3}{9(x-1)}-\frac{20d_1\kappa\alpha_0^3}{9(x-2)^2}+\frac{7d_1\kappa\alpha_0^3}{9(x-1)^2}+\frac{40d_1\kappa\alpha_0^3}{9(x-2)^3}-\frac{d_1\kappa\alpha_0^3}{3(x-1)^3}+\frac{10d_1\alpha_0^3}{9(x-2)}-\frac{11d_1\alpha_0^3}{9(x-1)}-\frac{20d_1\alpha_0^3}{9(x-2)^2}+\frac{7d_1\alpha_0^3}{9(x-1)^2}+$$

$$\frac{40d_1\alpha_0^3}{9(x-2)^3}-\frac{d_1\alpha_0^3}{3(x-1)^3}+2d_1\alpha_0^2-\frac{14}{3}d_1x\alpha_0^2+2d_1\kappa\alpha_0^2-\frac{14}{3}d_1x\kappa\alpha_0^2+\frac{d_1\kappa\alpha_0^2}{x-1}-\frac{d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{80d_1\kappa\alpha_0^2}{3(x-2)^4}-$$

$$\frac{2d_1\kappa\alpha_0^2}{3(x-1)^4}+\frac{d_1\alpha_0^2}{x-1}-\frac{d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}+\frac{80d_1\alpha_0^2}{3(x-2)^4}-\frac{2d_1\alpha_0^2}{3(x-1)^4}-\frac{4d_1\alpha_0}{9}+\frac{73d_1x\alpha_0}{18}-\frac{4d_1\kappa\alpha_0}{9}+\frac{73}{18}d_1x\kappa\alpha_0+$$

$$\frac{80d_1\kappa\alpha_0}{9(x-2)}-\frac{65d_1\kappa\alpha_0}{6(x-1)}-\frac{80d_1\kappa\alpha_0}{9(x-2)^2}+\frac{25d_1\kappa\alpha_0}{9(x-1)^2}-\frac{35d_1\kappa\alpha_0}{18(x-1)^3}-\frac{160d_1\kappa\alpha_0}{(x-2)^4}-\frac{19d_1\kappa\alpha_0}{18(x-1)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{25d_1\kappa\alpha_0}{18(x-1)^5}+$$

$$\frac{80d_1\alpha_0}{9(x-2)}-\frac{65d_1\alpha_0}{6(x-1)}-\frac{80d_1\alpha_0}{9(x-2)^2}+\frac{25d_1\alpha_0}{9(x-1)^2}-\frac{35d_1\alpha_0}{18(x-1)^3}-\frac{160d_1\alpha_0}{(x-2)^4}-\frac{5d_1\alpha_0}{2(x-1)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{17d_1\alpha_0}{6(x-1)^5}-d_1-$$

$$\frac{25d_1x}{18}-d_1\kappa-\frac{25d_1x\kappa}{18}+\frac{64d_1\kappa}{9(x-2)}-\frac{43d_1\kappa}{6(x-1)}-\frac{80d_1\kappa}{9(x-2)^2}+\frac{8d_1\kappa}{9(x-1)^2}+\frac{160d_1\kappa}{9(x-2)^3}+\frac{d_1\kappa}{18(x-1)^3}+\frac{320d_1\kappa}{3(x-2)^4}+$$

$$\frac{43d_1\kappa}{18(x-1)^4}+\frac{640d_1\kappa}{3(x-2)^5}+\frac{25d_1\kappa}{18(x-1)^5}+\frac{64d_1}{9(x-2)}-\frac{43d_1}{6(x-1)}-\frac{80d_1}{9(x-2)^2}+\frac{8d_1}{9(x-1)^2}+\frac{160d_1}{9(x-2)^3}+\frac{d_1}{18(x-1)^3}+$$

$$\frac{320d_1}{3(x-2)^4}+\frac{23d_1}{6(x-1)^4}+\frac{640d_1}{3(x-2)^5}+\frac{17d_1}{6(x-1)^5}\Big)H(1;\alpha_0)+\Big(\frac{4\kappa\alpha_0}{(x-1)^4}-\frac{4\kappa\alpha_0}{(x-1)^5}+\frac{4\alpha_0}{3(x-1)^4}-\frac{4\alpha_0}{3(x-1)^5}-\frac{4\kappa}{(x-1)^4}-$$

$$\frac{4\kappa}{(x-1)^5}-\frac{4}{3(x-1)^4}-\frac{4}{3(x-1)^5}\Big)H(0,0;\alpha_0)+\Big(\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-\frac{4\kappa d_1}{3(x-1)^4}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}+\frac{4\alpha_0d_1}{3(x-1)^4}-$$

$$\frac{4d_1}{3(x-1)^4}-\frac{4\alpha_0d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-\frac{4\kappa d_1}{3(x-1)^4}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}+\frac{4\alpha_0d_1}{3(x-1)^4}-$$

$$\frac{4d_1}{3(x-1)^4}-\frac{4\alpha_0d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(\frac{4\alpha_0d_1^2}{3(x-1)^4}-\frac{4d_1^2}{3(x-1)^4}-\frac{4\alpha_0d_1^2}{3(x-1)^5}-\frac{4d_1^2}{3(x-1)^5}\Big)H(1,1;\alpha_0)+$$

$$\frac{346d_1}{27(x-2)}-\frac{488}{27(x-2)}-\frac{947d_1}{72(x-1)}+\frac{443}{24(x-1)}-\frac{392d_1}{27(x-2)^2}+\frac{592}{27(x-2)^2}+\frac{23d_1}{27(x-1)^2}-\frac{52}{27(x-1)^2}+\frac{784d_1}{27(x-2)^3}-$$

$$\frac{1184}{27(x-2)^3}+\frac{73d_1}{216(x-1)^3}-\frac{83}{216(x-1)^3}+\frac{256d_1}{3(x-2)^4}-\frac{2048}{9(x-2)^4}+\frac{367d_1}{216(x-1)^4}+\frac{\pi^2}{18(x-1)^4}-\frac{725}{108(x-1)^4}+$$

$$\frac{512d_1}{3(x-2)^5}-\frac{4096}{9(x-2)^5}+\frac{205d_1}{216(x-1)^5}+\frac{\pi^2}{18(x-1)^5}-\frac{955}{216(x-1)^5}+\frac{55}{24}\Big)+\Big(\frac{4\alpha_0d_1^2}{3(x-1)^4}-\frac{4d_1^2}{3(x-1)^4}-\frac{4\alpha_0d_1^2}{3(x-1)^5}-$$

$$\frac{4d_1^2}{3(x-1)^5}-\frac{4\alpha_0d_1}{3}+\frac{2\alpha_0xd_1}{3}-\frac{2xd_1}{3}-\frac{4\alpha_0\kappa d_1}{3}+\frac{2}{3}\alpha_0x\kappa d_1-\frac{2x\kappa d_1}{3}+\frac{160\alpha_0\kappa d_1}{3(x-2)^4}-\frac{160\kappa d_1}{3(x-2)^4}-\frac{4\alpha_0\kappa d_1}{3(x-1)^4}+$$

$$\frac{4\kappa d_1}{3(x-1)^4}+\frac{320\alpha_0\kappa d_1}{3(x-2)^5}-\frac{640\kappa d_1}{3(x-2)^5}+\frac{4\alpha_0\kappa d_1}{3(x-1)^5}+\frac{4\kappa d_1}{3(x-1)^5}-\frac{640\kappa d_1}{3(x-2)^6}+\frac{160\alpha_0d_1}{3(x-2)^4}-\frac{160d_1}{3(x-2)^4}-\frac{4\alpha_0d_1}{3(x-1)^4}+$$

$$\frac{4d_1}{3(x-1)^4}+\frac{320\alpha_0d_1}{3(x-2)^5}-\frac{640d_1}{3(x-2)^5}+\frac{4\alpha_0d_1}{3(x-1)^5}+\frac{4d_1}{3(x-1)^5}-\frac{640d_1}{3(x-2)^6}+\frac{2\alpha_0}{3}-\frac{\alpha_0x}{3}+\frac{x}{3}+2\alpha_0\kappa-\alpha_0x\kappa+x\kappa-$$

$$\frac{80\alpha_0\kappa}{(x-2)^4}+\frac{80\kappa}{(x-2)^4}+\frac{\alpha_0\kappa}{(x-1)^4}-\frac{\kappa}{(x-1)^4}-\frac{160\alpha_0\kappa}{(x-2)^5}+\frac{320\kappa}{(x-2)^5}-\frac{\alpha_0\kappa}{(x-1)^5}-\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}-\frac{80\alpha_0}{3(x-2)^4}+\frac{80}{3(x-2)^4}+$$

$$\frac{\alpha_0}{3(x-1)^4}-\frac{1}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{320}{3(x-2)^5}-\frac{\alpha_0}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(0;\alpha_0)H(1,1;x)+\Big(-$$

$$\frac{2d_1\alpha_0}{3}+\frac{17x\alpha_0}{12}-\frac{2d_1\kappa\alpha_0}{3}+\frac{101x\kappa\alpha_0}{36}-\frac{85d_1\kappa\alpha_0}{9(x-2)}+\frac{40\kappa\alpha_0}{3(x-2)}+\frac{94d_1\kappa\alpha_0}{9(x-1)}-\frac{65\kappa\alpha_0}{4(x-1)}+\frac{100d_1\kappa\alpha_0}{9(x-2)^2}-\frac{40\kappa\alpha_0}{3(x-2)^2}-$$

$$\frac{20d_1\kappa\alpha_0}{9(x-1)^2}+\frac{25\kappa\alpha_0}{6(x-1)^2}-\frac{40d_1\kappa\alpha_0}{3(x-2)^3}+\frac{17d_1\kappa\alpha_0}{18(x-1)^3}-\frac{35\kappa\alpha_0}{12(x-1)^3}+\frac{64d_1\kappa\alpha_0}{(x-2)^4}-\frac{1088\kappa\alpha_0}{9(x-2)^4}+\frac{19d_1\kappa\alpha_0}{18(x-1)^4}-\frac{47\kappa\alpha_0}{36(x-1)^4}+$$

$$\frac{64d_1\kappa\alpha_0}{3(x-2)^5}+\frac{704\kappa\alpha_0}{9(x-2)^5}-\frac{25d_1\kappa\alpha_0}{18(x-1)^5}+\frac{101\kappa\alpha_0}{36(x-1)^5}-\frac{37\kappa\alpha_0}{9}-\frac{85d_1\alpha_0}{9(x-2)}+\frac{40\alpha_0}{9(x-2)}+\frac{94d_1\alpha_0}{9(x-1)}-\frac{65\alpha_0}{12(x-1)}+\frac{100d_1\alpha_0}{9(x-2)^2}-$$

$$\frac{40\alpha_0}{9(x-2)^2}-\frac{20d_1\alpha_0}{9(x-1)^2}+\frac{25\alpha_0}{18(x-1)^2}-\frac{40d_1\alpha_0}{3(x-2)^3}+\frac{17d_1\alpha_0}{18(x-1)^3}-\frac{35\alpha_0}{36(x-1)^3}+\frac{64d_1\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{9(x-2)^4}+\frac{5d_1\alpha_0}{2(x-1)^4}-$$

$$\frac{11\alpha_0}{12(x-1)^4}+\frac{64d_1\alpha_0}{3(x-2)^5}+\frac{1088\alpha_0}{9(x-2)^5}-\frac{17d_1\alpha_0}{6(x-1)^5}+\frac{17\alpha_0}{12(x-1)^5}-\frac{7\alpha_0}{3}+\frac{2d_1}{3}-\frac{17x}{12}+\frac{2d_1\kappa}{3}-\frac{101x\kappa}{36}-\frac{62d_1\kappa}{9(x-2)}+$$

$$\frac{32\kappa}{3(x-2)}+\frac{65d_1\kappa}{9(x-1)}-\frac{43\kappa}{4(x-1)}+\frac{70d_1\kappa}{9(x-2)^2}-\frac{40\kappa}{3(x-2)^2}-\frac{d_1\kappa}{(x-1)^2}+\frac{4\kappa}{3(x-1)^2}-\frac{80d_1\kappa}{9(x-2)^3}+\frac{80\kappa}{3(x-2)^3}+\frac{5d_1\kappa}{18(x-1)^3}+$$

$$\frac{\kappa}{12(x-1)^3}-\frac{112d_1\kappa}{3(x-2)^4}+\frac{1088\kappa}{9(x-2)^4}-\frac{31d_1\kappa}{18(x-1)^4}+\frac{155\kappa}{36(x-1)^4}-\frac{448d_1\kappa}{3(x-2)^5}+\frac{1472\kappa}{9(x-2)^5}-\frac{25d_1\kappa}{18(x-1)^5}+\frac{101\kappa}{36(x-1)^5}-$$

$$\frac{128d_1\kappa}{3(x-2)^6}-\frac{1408\kappa}{9(x-2)^6}-\frac{3\kappa}{2}+\Big(-\frac{2x\alpha_0}{3}-2x\kappa\alpha_0-\frac{160\kappa\alpha_0}{(x-2)^4}-\frac{4d_1\kappa\alpha_0}{3(x-1)^4}+\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{4d_1\kappa\alpha_0}{3(x-1)^5}-$$

$$\frac{2\kappa\alpha_0}{(x-1)^5}+4\kappa\alpha_0-\frac{160\alpha_0}{3(x-2)^4}-\frac{4d_1\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{4d_1\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+2x\kappa+$$

$$\frac{160\kappa}{(x-2)^4}+\frac{4d_1\kappa}{3(x-1)^4}-\frac{2\kappa}{(x-1)^4}+\frac{640\kappa}{(x-2)^5}+\frac{4d_1\kappa}{3(x-1)^5}-\frac{2\kappa}{(x-1)^5}+\frac{640\kappa}{(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{4d_1}{3(x-1)^4}-\frac{2}{3(x-1)^4}+$$

$$\frac{640}{3(x-2)^5}+\frac{4d_1}{3(x-1)^5}-\frac{2}{3(x-1)^5}+\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{4\alpha_0d_1^2}{3(x-1)^4}+\frac{4d_1^2}{3(x-1)^4}+\frac{4\alpha_0d_1^2}{3(x-1)^5}+\frac{4d_1^2}{3(x-1)^5}+$$

$$\frac{4\alpha_0d_1}{3}-\frac{2\alpha_0xd_1}{3}+\frac{2xd_1}{3}+\frac{4\alpha_0\kappa d_1}{3}-\frac{2}{3}\alpha_0x\kappa d_1+\frac{2x\kappa d_1}{3}-\frac{160\alpha_0\kappa d_1}{3(x-2)^4}+\frac{160\kappa d_1}{3(x-2)^4}+\frac{2\alpha_0\kappa d_1}{3(x-1)^4}-\frac{2\kappa d_1}{3(x-1)^4}-$$

$$\frac{320\alpha_0\kappa d_1}{3(x-2)^5}+\frac{640\kappa d_1}{3(x-2)^5}-\frac{2\alpha_0\kappa d_1}{3(x-1)^5}-\frac{2\kappa d_1}{3(x-1)^5}+\frac{640\kappa d_1}{3(x-2)^6}-\frac{160\alpha_0 d_1}{3(x-2)^4}+\frac{160 d_1}{3(x-2)^4}+\frac{2\alpha_0 d_1}{3(x-1)^4}-\frac{2d_1}{3(x-1)^4}-$$

$$\frac{320\alpha_0 d_1}{3(x-2)^5}+\frac{640 d_1}{3(x-2)^5}-\frac{2\alpha_0 d_1}{3(x-1)^5}-\frac{2d_1}{3(x-1)^5}+\frac{640 d_1}{3(x-2)^6}\Big)H(1;\alpha_0)-\frac{62d_1}{9(x-2)}+\frac{32}{9(x-2)}+\frac{65d_1}{9(x-1)}-\frac{43}{12(x-1)}+$$

$$\frac{70d_1}{9(x-2)^2}-\frac{40}{9(x-2)^2}-\frac{d_1}{(x-1)^2}+\frac{4}{9(x-1)^2}-\frac{80d_1}{9(x-2)^3}+\frac{80}{9(x-2)^3}+\frac{5d_1}{18(x-1)^3}+\frac{1}{36(x-1)^3}-\frac{112d_1}{3(x-2)^4}-$$

$$\frac{64}{9(x-2)^4}-\frac{19d_1}{6(x-1)^4}+\frac{23}{12(x-1)^4}-\frac{448d_1}{3(x-2)^5}-\frac{1216}{9(x-2)^5}-\frac{17d_1}{6(x-1)^5}+\frac{17}{12(x-1)^5}-\frac{128d_1}{3(x-2)^6}-\frac{2176}{9(x-2)^6}-$$

$$\frac{1}{2}\Big)H(1,c_1(\alpha_0);x)+\Big(-\frac{160d_1\kappa\alpha_0}{3(x-2)^4}+\frac{160\kappa\alpha_0}{(x-2)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{320\kappa\alpha_0}{(x-2)^5}-\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\alpha_0}{3(x-2)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+$$

$$\frac{320\alpha_0}{3(x-2)^5}+\frac{160d_1\kappa}{3(x-2)^4}-\frac{160\kappa}{(x-2)^4}+\frac{640d_1\kappa}{3(x-2)^5}-\frac{640\kappa}{(x-2)^5}+\frac{640d_1\kappa}{3(x-2)^6}-\frac{640\kappa}{(x-2)^6}+\frac{160d_1}{3(x-2)^4}-\frac{160}{3(x-2)^4}+\frac{640d_1}{3(x-2)^5}-$$

$$\frac{640}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}-\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)H(2,1;x)+\Big(-\frac{64\alpha_0 d_1^2}{3(x-2)^4}+\frac{64d_1^2}{3(x-2)^4}-\frac{128\alpha_0 d_1^2}{3(x-2)^5}+\frac{256d_1^2}{3(x-2)^5}+$$

$$\frac{256d_1^2}{3(x-2)^6}+\frac{128\alpha_0\kappa d_1}{3(x-2)^4}-\frac{128\kappa d_1}{3(x-2)^4}+\frac{256\alpha_0\kappa d_1}{3(x-2)^5}-\frac{512\kappa d_1}{3(x-2)^5}-\frac{512\kappa d_1}{3(x-2)^6}-\frac{896\alpha_0 d_1}{9(x-2)^4}+\frac{896d_1}{9(x-2)^4}-\frac{1792\alpha_0 d_1}{9(x-2)^5}+$$

$$\frac{3584d_1}{9(x-2)^5}+\frac{3584d_1}{9(x-2)^6}+\frac{704\alpha_0\kappa}{9(x-2)^4}-\frac{704\kappa}{9(x-2)^4}+\frac{1408\alpha_0\kappa}{9(x-2)^5}-\frac{2816\kappa}{9(x-2)^5}-\frac{2816\kappa}{9(x-2)^6}+\Big(\frac{320d_1\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+$$

$$\frac{640d_1\kappa\alpha_0}{3(x-2)^5}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320d_1\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+\frac{640d_1\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{3(x-2)^5}-\frac{320d_1\kappa}{3(x-2)^4}+\frac{320\kappa}{(x-2)^4}-\frac{1280d_1\kappa}{3(x-2)^5}+$$

$$\frac{1280\kappa}{(x-2)^5}-\frac{1280d_1\kappa}{3(x-2)^6}+\frac{1280\kappa}{(x-2)^6}-\frac{320d_1}{3(x-2)^4}+\frac{320}{3(x-2)^4}-\frac{1280d_1}{3(x-2)^5}+\frac{1280}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^6}+\frac{1280}{3(x-2)^6}\Big)H(0;\alpha_0)+$$

$$\Big(\frac{320\alpha_0 d_1^2}{3(x-2)^4}-\frac{320d_1^2}{3(x-2)^4}+\frac{640\alpha_0 d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^6}-\frac{320\alpha_0\kappa d_1}{3(x-2)^4}+\frac{320\kappa d_1}{3(x-2)^4}-\frac{640\alpha_0\kappa d_1}{3(x-2)^5}+\frac{1280\kappa d_1}{3(x-2)^5}+$$

$$\frac{1280\kappa d_1}{3(x-2)^6}-\frac{320\alpha_0 d_1}{3(x-2)^4}+\frac{320d_1}{3(x-2)^4}-\frac{640\alpha_0 d_1}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^6}\Big)H(1;\alpha_0)+\frac{1088\alpha_0}{9(x-2)^4}-\frac{1088}{9(x-2)^4}+$$

$$\frac{2176\alpha_0}{9(x-2)^5}-\frac{4352}{9(x-2)^5}-\frac{4352}{9(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+\Big(\frac{x\alpha_0^5}{12}+\frac{1}{4}x\kappa\alpha_0^5+\frac{\kappa\alpha_0^5}{2(x-2)}-\frac{\kappa\alpha_0^5}{4(x-1)}+\frac{\alpha_0^5}{6(x-2)}-$$

$$\frac{\alpha_0^5}{12(x-1)}-\frac{19x\alpha_0^4}{36}-\frac{19}{12}x\kappa\alpha_0^4-\frac{5\kappa\alpha_0^4}{3(x-2)}+\frac{13\kappa\alpha_0^4}{12(x-1)}+\frac{5\kappa\alpha_0^4}{3(x-2)^2}-\frac{\kappa\alpha_0^4}{3(x-1)^2}+\frac{\kappa\alpha_0^4}{6}-\frac{5\alpha_0^4}{9(x-2)}+\frac{13\alpha_0^4}{36(x-1)}+$$

$$\frac{5\alpha_0^4}{9(x-2)^2}-\frac{\alpha_0^4}{9(x-1)^2}+\frac{\alpha_0^4}{18}+\frac{13x\alpha_0^3}{9}+\frac{13}{3}x\kappa\alpha_0^3+\frac{5\kappa\alpha_0^3}{3(x-2)}-\frac{11\kappa\alpha_0^3}{6(x-1)}-\frac{10\kappa\alpha_0^3}{3(x-2)^2}+\frac{7\kappa\alpha_0^3}{6(x-1)^2}+\frac{20\kappa\alpha_0^3}{3(x-2)^3}-$$

$$\frac{\kappa\alpha_0^3}{2(x-1)^3}-\kappa\alpha_0^3+\frac{5\alpha_0^3}{9(x-2)}-\frac{11\alpha_0^3}{18(x-1)}-\frac{10\alpha_0^3}{9(x-2)^2}+\frac{7\alpha_0^3}{18(x-1)^2}+\frac{20\alpha_0^3}{9(x-2)^3}-\frac{\alpha_0^3}{6(x-1)^3}-\frac{\alpha_0^3}{3}-\frac{7x\alpha_0^2}{3}-7x\kappa\alpha_0^2+$$

$$\frac{3\kappa\alpha_0^2}{2(x-1)}-\frac{3\kappa\alpha_0^2}{2(x-1)^2}+\frac{3\kappa\alpha_0^2}{2(x-1)^3}+\frac{40\kappa\alpha_0^2}{(x-2)^4}-\frac{\kappa\alpha_0^2}{(x-1)^4}+3\kappa\alpha_0^2+\frac{\alpha_0^2}{2(x-1)}-\frac{\alpha_0^2}{2(x-1)^2}+\frac{\alpha_0^2}{2(x-1)^3}+\frac{40\alpha_0^2}{3(x-2)^4}-$$

$$\frac{\alpha_0^2}{3(x-1)^4}+\alpha_0^2+\frac{73x\alpha_0}{36}+\frac{73x\kappa\alpha_0}{12}+\frac{40\kappa\alpha_0}{3(x-2)}-\frac{65\kappa\alpha_0}{4(x-1)}-\frac{40\kappa\alpha_0}{3(x-2)^2}+\frac{25\kappa\alpha_0}{6(x-1)^2}-\frac{35\kappa\alpha_0}{12(x-1)^3}-\frac{240\kappa\alpha_0}{(x-2)^4}-$$

$$\frac{83\kappa\alpha_0}{36(x-1)^4}-\frac{160\kappa\alpha_0}{(x-2)^5}+\frac{101\kappa\alpha_0}{36(x-1)^5}-\frac{2\kappa\alpha_0}{3}+\frac{40\alpha_0}{9(x-2)}-\frac{65\alpha_0}{12(x-1)}-\frac{40\alpha_0}{9(x-2)^2}+\frac{25\alpha_0}{18(x-1)^2}-\frac{35\alpha_0}{36(x-1)^3}-\frac{80\alpha_0}{(x-2)^4}-$$

$$\frac{5\alpha_0}{4(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{17\alpha_0}{12(x-1)^5}-\frac{2\alpha_0}{9}-\frac{25x}{36}-\frac{25x\kappa}{12}+\frac{32\kappa}{3(x-2)}-\frac{43\kappa}{4(x-1)}-\frac{40\kappa}{3(x-2)^2}+\frac{4\kappa}{3(x-1)^2}+\frac{80\kappa}{3(x-2)^3}+$$

$$\frac{\kappa}{12(x-1)^3}+\frac{160\kappa}{(x-2)^4}+\frac{155\kappa}{36(x-1)^4}+\frac{320\kappa}{(x-2)^5}+\frac{101\kappa}{36(x-1)^5}-\frac{3\kappa}{2}+\Big(\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{2\kappa\alpha_0}{(x-1)^5}+\frac{2\alpha_0}{3(x-1)^4}-\frac{2\alpha_0}{3(x-1)^5}-$$

$$\frac{2\kappa}{(x-1)^4}-\frac{2\kappa}{(x-1)^5}-\frac{2}{3(x-1)^4}-\frac{2}{3(x-1)^5}\Big)H(0;\alpha_0)+\Big(\frac{2\alpha_0\kappa d_1}{3(x-1)^4}-\frac{2\kappa d_1}{3(x-1)^4}-\frac{2\alpha_0\kappa d_1}{3(x-1)^5}-\frac{2\kappa d_1}{3(x-1)^5}+\frac{2\alpha_0 d_1}{3(x-1)^4}-$$

$$\frac{2d_1}{3(x-1)^4}-\frac{2\alpha_0 d_1}{3(x-1)^5}-\frac{2d_1}{3(x-1)^5}\Big)H(1;\alpha_0)+\frac{32}{9(x-2)}-\frac{43}{12(x-1)}-\frac{40}{9(x-2)^2}+\frac{4}{9(x-1)^2}+\frac{80}{9(x-2)^3}+$$

$$\frac{1}{36(x-1)^3}+\frac{160}{3(x-2)^4}+\frac{23}{12(x-1)^4}+\frac{320}{3(x-2)^5}+\frac{17}{12(x-1)^5}-\frac{1}{2}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{32d_1\kappa\alpha_0}{3(x-2)^4}-$$

$$\frac{352\kappa\alpha_0}{9(x-2)^4}-\frac{64d_1\kappa\alpha_0}{3(x-2)^5}-\frac{704\kappa\alpha_0}{9(x-2)^5}-\frac{32d_1\alpha_0}{3(x-2)^4}-\frac{544\alpha_0}{9(x-2)^4}-\frac{64d_1\alpha_0}{3(x-2)^5}-\frac{1088\alpha_0}{9(x-2)^5}+\frac{32d_1\kappa}{3(x-2)^4}+\frac{352\kappa}{9(x-2)^4}+$$

$$\frac{128d_1\kappa}{3(x-2)^5}+\frac{1408\kappa}{9(x-2)^5}+\frac{128d_1\kappa}{3(x-2)^6}+\frac{1408\kappa}{9(x-2)^6}+\Big(\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{160\alpha_0}{3(x-2)^4}+\frac{320\alpha_0}{3(x-2)^5}-\frac{160\kappa}{(x-2)^4}-\frac{640\kappa}{(x-2)^5}-$$

$$\frac{640\kappa}{(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{640}{3(x-2)^5}-\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{160\alpha_0\kappa d_1}{3(x-2)^4}-\frac{160\kappa d_1}{3(x-2)^4}+\frac{320\alpha_0\kappa d_1}{3(x-2)^5}-\frac{640\kappa d_1}{3(x-2)^5}-$$

$$\frac{640\kappa d_1}{3(x-2)^6}+\frac{160\alpha_0 d_1}{3(x-2)^4}-\frac{160d_1}{3(x-2)^4}+\frac{320\alpha_0 d_1}{3(x-2)^5}-\frac{640d_1}{3(x-2)^5}-\frac{640d_1}{3(x-2)^6}\Big)H(1;\alpha_0)+\frac{32d_1}{3(x-2)^4}+\frac{544}{9(x-2)^4}+$$

$$\frac{128d_1}{3(x-2)^5}+\frac{2176}{9(x-2)^5}+\frac{128d_1}{3(x-2)^6}+\frac{2176}{9(x-2)^6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4x\alpha_0}{3}+4x\kappa\alpha_0+\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{4\kappa\alpha_0}{(x-1)^4}+$$

$$\frac{640\kappa\alpha_0}{(x-2)^5}-\frac{4\kappa\alpha_0}{(x-1)^5}-8\kappa\alpha_0+\frac{320\alpha_0}{3(x-2)^4}+\frac{4\alpha_0}{3(x-1)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3(x-1)^5}-\frac{8\alpha_0}{3}-\frac{4x}{3}-4x\kappa-\frac{320\kappa}{(x-2)^4}-\frac{4\kappa}{(x-1)^4}-$$

$$\frac{1280\kappa}{(x-2)^5}-\frac{4\kappa}{(x-1)^5}-\frac{1280\kappa}{(x-2)^6}-\frac{320}{3(x-2)^4}-\frac{4}{3(x-1)^4}-\frac{1280}{3(x-2)^5}-\frac{4}{3(x-1)^5}-\frac{1280}{3(x-2)^6}\Big)H(0,0,0;\alpha_0)+$$

$$\bigg(\frac{4x\ \alpha_0}{3}+4x\kappa\alpha_0-\frac{320\kappa\alpha_0}{(x-2)^4}-\frac{4\ \kappa\alpha_0}{(x-1)^4}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{4\kappa\ \alpha_0}{(x-1)^5}-8\kappa\alpha_0-\frac{320\alpha_0}{3(x-2)^4}-\frac{4\alpha_0}{3\ (x-1)^4}-\frac{640\alpha_0}{3(x-2)^5}+$$
$$\frac{4\alpha_0}{3(x-1)^5}-\frac{8\ \alpha_0}{3}-\frac{4x}{3}-4x\kappa+\frac{320\kappa}{(x-2)^4}+\frac{4\ \kappa}{(x-1)^4}+\frac{1280\kappa}{(x-2)^5}+\frac{4\kappa}{(x-1)^5}+\frac{1280\kappa}{(x-2)^6}+\frac{320}{3\ (x-2)^4}+\frac{4}{3(x-1)^4}+$$
$$\frac{1280}{3(x-2)^5}+\frac{4}{3\ (x-1)^5}+\frac{1280}{3(x-2)^6}\bigg)H(0,0,0;x)+\bigg(-\frac{8\alpha_0\ d_1}{3}+\frac{4\alpha_0 xd_1}{3}-\frac{4xd_1}{3}-\frac{8\alpha_0\kappa\ d_1}{3}+\frac{4}{3}\alpha_0 x\kappa d_1-$$
$$\frac{4x\kappa\ d_1}{3}+\frac{320\alpha_0\kappa d_1}{3(x-2)^4}-\frac{320\kappa\ d_1}{3(x-2)^4}+\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-\frac{4\kappa\ d_1}{3(x-1)^4}+\frac{640\alpha_0\kappa d_1}{3(x-2)^5}-\frac{1280\ \kappa d_1}{3(x-2)^5}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\ \kappa d_1}{3(x-1)^5}-$$
$$\frac{1280\kappa d_1}{3(x-2)^6}+\frac{320\ \alpha_0 d_1}{3(x-2)^4}-\frac{320d_1}{3(x-2)^4}+\frac{4\alpha_0 d_1}{3\ (x-1)^4}-\frac{4d_1}{3(x-1)^4}+\frac{640\alpha_0 d_1}{3\ (x-2)^5}-\frac{1280d_1}{3(x-2)^5}-\frac{4\alpha_0 d_1}{3\ (x-1)^5}-\frac{4d_1}{3(x-1)^5}-$$
$$\frac{1280d_1}{3(x-2)^6}\bigg)\ H(0,0,1;\alpha_0)+\bigg(-\frac{2x\alpha_0}{3}-2x\kappa\alpha_0-\frac{160\kappa\ \alpha_0}{(x-2)^4}+\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{320\kappa\ \alpha_0}{(x-2)^5}-\frac{2\kappa\alpha_0}{(x-1)^5}+4\kappa\alpha_0-\frac{160\ \alpha_0}{3(x-2)^4}+$$
$$\frac{2\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3\ (x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+2x\ \kappa+\frac{160\kappa}{(x-2)^4}-\frac{2\kappa}{(x-1)^4}+\frac{640\kappa}{(x-2)^5}-\frac{2\kappa}{(x-1)^5}+\frac{640\kappa}{(x-2)^6}+$$
$$\frac{160}{3\ (x-2)^4}-\frac{2}{3(x-1)^4}+\frac{640}{3(x-2)^5}-\frac{2}{3\ (x-1)^5}+\frac{640}{3(x-2)^6}\bigg)H(0,0,c_1(\alpha_0);x)+\bigg(\frac{320\ \kappa\alpha_0}{(x-2)^4}+\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320\ \alpha_0}{3(x-2)^4}+$$
$$\frac{640\alpha_0}{3(x-2)^5}-\frac{320\kappa}{(x-2)^4}-\frac{1280\kappa}{(x-2)^5}-\frac{1280\kappa}{(x-2)^6}-\frac{320}{3(x-2)^4}-\frac{1280}{3(x-2)^5}-\frac{1280}{3\ (x-2)^6}\bigg)H(0,0,c_2(\alpha_0);x)+\bigg(-\frac{8\alpha_0 d_1}{3}+$$
$$\frac{4\alpha_0\ xd_1}{3}-\frac{4xd_1}{3}-\frac{8\alpha_0\kappa d_1}{3}+\frac{4}{3}\ \alpha_0 x\kappa d_1-\frac{4x\kappa d_1}{3}+\frac{320\alpha_0\kappa\ d_1}{3(x-2)^4}-\frac{320\kappa d_1}{3(x-2)^4}+\frac{4\alpha_0\kappa\ d_1}{3(x-1)^4}-\frac{4\kappa d_1}{3(x-1)^4}+\frac{640\alpha_0\kappa\ d_1}{3(x-2)^5}-$$
$$\frac{1280\kappa d_1}{3(x-2)^5}-\frac{4\alpha_0\kappa\ d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}-\frac{1280\kappa\ d_1}{3(x-2)^6}+\frac{320\alpha_0 d_1}{3(x-2)^4}-\frac{320d_1}{3\ (x-2)^4}+\frac{4\alpha_0 d_1}{3(x-1)^4}-\frac{4d_1}{3\ (x-1)^4}+\frac{640\alpha_0 d_1}{3(x-2)^5}-$$
$$\frac{1280d_1}{3\ (x-2)^5}-\frac{4\alpha_0 d_1}{3(x-1)^5}-\frac{4d_1}{3\ (x-1)^5}-\frac{1280d_1}{3(x-2)^6}\bigg)H(0,1,0;\alpha_0)+\bigg(\frac{4\ d_1\alpha_0}{3}-\frac{2d_1 x\alpha_0}{3}+\frac{2x\alpha_0}{3}+\frac{4d_1\ \kappa\alpha_0}{3}-$$
$$\frac{2}{3}d_1 x\kappa\alpha_0+2x\kappa\ \alpha_0-\frac{160d_1\kappa\alpha_0}{3(x-2)^4}+\frac{160\kappa\ \alpha_0}{(x-2)^4}+\frac{2d_1\kappa\alpha_0}{3(x-1)^4}-\frac{2\kappa\ \alpha_0}{(x-1)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{320\kappa\ \alpha_0}{(x-2)^5}-\frac{2d_1\kappa\alpha_0}{3(x-1)^5}+$$
$$\frac{2\kappa\ \alpha_0}{(x-1)^5}-4\kappa\alpha_0-\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\ \alpha_0}{3(x-2)^4}+\frac{2d_1\alpha_0}{3(x-1)^4}-\frac{2\alpha_0}{3\ (x-1)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3\ (x-2)^5}-\frac{2d_1\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3(x-1)^5}-$$
$$\frac{4\ \alpha_0}{3}+\frac{2d_1 x}{3}-\frac{2x}{3}+\frac{2d_1 x\kappa}{3}-2x\ \kappa+\frac{160d_1\kappa}{3(x-2)^4}-\frac{160\kappa}{(x-2)^4}-\frac{2d_1\kappa}{3(x-1)^4}+\frac{2\kappa}{(x-1)^4}+\frac{640d_1\kappa}{3(x-2)^5}-\frac{640\kappa}{(x-2)^5}-\frac{2\ d_1\kappa}{3(x-1)^5}+$$
$$\frac{2\kappa}{(x-1)^5}+\frac{640d_1\ \kappa}{3(x-2)^6}-\frac{640\kappa}{(x-2)^6}+\frac{160d_1}{3\ (x-2)^4}-\frac{160}{3(x-2)^4}-\frac{2d_1}{3(x-1)^4}+\frac{2}{3\ (x-1)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}-\frac{2\ d_1}{3(x-1)^5}+$$
$$\frac{2}{3(x-1)^5}+\frac{640d_1}{3\ (x-2)^6}-\frac{640}{3(x-2)^6}\bigg)H(0,1,0;x)+\bigg(-\frac{8\alpha_0\ d_1^2}{3}+\frac{4}{3}\alpha_0 xd_1^2-\frac{4xd_1^2}{3}+\frac{320\alpha_0\ d_1^2}{3(x-2)^4}-\frac{320d_1^2}{3(x-2)^4}+$$
$$\frac{4\alpha_0 d_1^2}{3\ (x-1)^4}-\frac{4d_1^2}{3(x-1)^4}+\frac{640\alpha_0 d_1^2}{3\ (x-2)^5}-\frac{1280d_1^2}{3(x-2)^5}-\frac{4\alpha_0 d_1^2}{3\ (x-1)^5}-\frac{4d_1^2}{3(x-1)^5}-\frac{1280d_1^2}{3(x-2)^6}\bigg)\ H(0,1,1;\alpha_0)+\bigg(-\frac{4d_1\alpha_0}{3}+$$
$$\frac{2d_1 x\alpha_0}{3}-\frac{2\ x\alpha_0}{3}-\frac{4d_1\kappa\alpha_0}{3}+\frac{2}{3}d_1 x\kappa\alpha_0-2\ x\kappa\alpha_0+\frac{160d_1\kappa\alpha_0}{3(x-2)^4}-\frac{160\kappa\ \alpha_0}{(x-2)^4}-\frac{2d_1\kappa\alpha_0}{3(x-1)^4}+\frac{2\kappa\ \alpha_0}{(x-1)^4}+\frac{320d_1\kappa\alpha_0}{3(x-2)^5}-$$
$$\frac{320\kappa\ \alpha_0}{(x-2)^5}+\frac{2d_1\kappa\alpha_0}{3(x-1)^5}-\frac{2\kappa\ \alpha_0}{(x-1)^5}+4\kappa\alpha_0+\frac{160d_1\alpha_0}{3(x-2)^4}-\frac{160\ \alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3\ (x-1)^4}+\frac{320d_1\alpha_0}{3(x-2)^5}-\frac{320\alpha_0}{3\ (x-2)^5}+$$
$$\frac{2d_1\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\ \alpha_0}{3}-\frac{2d_1 x}{3}+\frac{2x}{3}-\frac{2d_1 x\kappa}{3}+2x\ \kappa-\frac{160d_1\kappa}{3(x-2)^4}+\frac{160\kappa}{(x-2)^4}+\frac{2d_1\kappa}{3(x-1)^4}-\frac{2\kappa}{(x-1)^4}-\frac{640d_1\kappa}{3(x-2)^5}+$$
$$\frac{640\kappa}{(x-2)^5}+\frac{2\ d_1\kappa}{3(x-1)^5}-\frac{2\kappa}{(x-1)^5}-\frac{640d_1\ \kappa}{3(x-2)^6}+\frac{640\kappa}{(x-2)^6}-\frac{160d_1}{3\ (x-2)^4}+\frac{160}{3(x-2)^4}+\frac{2d_1}{3(x-1)^4}-\frac{2}{3\ (x-1)^4}-\frac{640d_1}{3(x-2)^5}+$$
$$\frac{640}{3(x-2)^5}+\frac{2\ d_1}{3(x-1)^5}-\frac{2}{3(x-1)^5}-\frac{640d_1}{3\ (x-2)^6}+\frac{640}{3(x-2)^6}\bigg)H(0,1,c_1(\alpha_0);x)+\bigg(-\frac{320\ d_1\kappa\alpha_0}{3(x-2)^4}+\frac{320\kappa\alpha_0}{(x-2)^4}-$$
$$\frac{640\ d_1\kappa\alpha_0}{3(x-2)^5}+\frac{640\kappa\alpha_0}{(x-2)^5}-\frac{320\ d_1\alpha_0}{3(x-2)^4}+\frac{320\alpha_0}{3(x-2)^4}-\frac{640d_1\alpha_0}{3\ (x-2)^5}+\frac{640\alpha_0}{3(x-2)^5}+\frac{320d_1\kappa}{3(x-2)^4}-\frac{320\kappa}{(x-2)^4}+\frac{1280d_1\kappa}{3\ (x-2)^5}-\frac{1280\kappa}{(x-2)^5}+$$
$$\frac{1280d_1\kappa}{3\ (x-2)^6}-\frac{1280\kappa}{(x-2)^6}+\frac{320d_1}{3\ (x-2)^4}-\frac{320}{3(x-2)^4}+\frac{1280d_1}{3\ (x-2)^5}-\frac{1280}{3(x-2)^5}+\frac{1280d_1}{3\ (x-2)^6}-\frac{1280}{3(x-2)^6}\bigg)H(0,2,0;x)+$$
$$\bigg(\frac{320d_1\ \kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640d_1\ \kappa\alpha_0}{3(x-2)^5}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320d_1\ \alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+\frac{640d_1\alpha_0}{3\ (x-2)^5}-\frac{640\alpha_0}{3(x-2)^5}-\frac{320d_1\kappa}{3(x-2)^4}+$$
$$\frac{320\kappa}{(x-2)^4}-\frac{1280d_1\kappa}{3\ (x-2)^5}+\frac{1280\kappa}{(x-2)^5}-\frac{1280d_1\kappa}{3\ (x-2)^6}+\frac{1280\kappa}{(x-2)^6}-\frac{320d_1}{3\ (x-2)^4}+\frac{320}{3(x-2)^4}-\frac{1280d_1}{3\ (x-2)^5}+\frac{1280}{3(x-2)^5}-\frac{1280d_1}{3\ (x-2)^6}+$$
$$\frac{1280}{3(x-2)^6}\bigg)H(0,2,c_2(\alpha_0);x)+\bigg(-\frac{x\ \alpha_0}{3}-x\kappa\alpha_0-\frac{80\kappa\alpha_0}{(x-2)^4}+\frac{\kappa\ \alpha_0}{(x-1)^4}-\frac{160\kappa\alpha_0}{(x-2)^5}-\frac{\kappa\ \alpha_0}{(x-1)^5}+2\kappa\alpha_0-\frac{80\alpha_0}{3(x-2)^4}+$$
$$\frac{\alpha_0}{3\ (x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}-\frac{\alpha_0}{3(x-1)^5}+\frac{2\ \alpha_0}{3}+\frac{x}{3}+x\kappa+\frac{80\kappa}{(x-2)^4}-\frac{\kappa}{(x-1)^4}+\frac{320\kappa}{(x-2)^5}-\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}+\frac{80}{3\ (x-2)^4}-$$
$$\frac{1}{3(x-1)^4}+\frac{320}{3(x-2)^5}-\frac{1}{3\ (x-1)^5}+\frac{320}{3(x-2)^6}\bigg)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\bigg(\frac{160\kappa\ \alpha_0}{(x-2)^4}+\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{160\alpha_0}{3\ (x-2)^4}+$$
$$\frac{320\alpha_0}{3(x-2)^5}-\frac{160\kappa}{(x-2)^4}-\frac{640\kappa}{(x-2)^5}-\frac{640\kappa}{(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{640}{3(x-2)^5}-\frac{640}{3\ (x-2)^6}\bigg)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+$$
$$\bigg(\frac{2x\alpha_0}{3}+2x\ \kappa\alpha_0+\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{4d_1\kappa\ \alpha_0}{3(x-1)^4}-\frac{2\kappa\alpha_0}{(x-1)^4}+\frac{320\kappa\ \alpha_0}{(x-2)^5}-\frac{4d_1\kappa\alpha_0}{3(x-1)^5}+\frac{2\kappa\ \alpha_0}{(x-1)^5}-4\kappa\alpha_0+\frac{160\alpha_0}{3(x-2)^4}+$$
$$\frac{4d_1\ \alpha_0}{3(x-1)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3\ (x-2)^5}-\frac{4d_1\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\ \alpha_0}{3}-\frac{2x}{3}-2x\kappa-\frac{160\kappa}{(x-2)^4}-\frac{4\ d_1\kappa}{3(x-1)^4}+\frac{2\kappa}{(x-1)^4}-$$
$$\frac{640\kappa}{(x-2)^5}-\frac{4d_1\kappa}{3(x-1)^5}+\frac{2\kappa}{(x-1)^5}-\frac{640\kappa}{(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{4d_1}{3\ (x-1)^4}+\frac{2}{3(x-1)^4}-\frac{640}{3(x-2)^5}-\frac{4d_1}{3\ (x-1)^5}+\frac{2}{3(x-1)^5}-$$

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$$\frac{640}{3(x-2)^6}\Big) H(1,0,0;x)+\Big(-\frac{x\alpha_0}{3}-x\kappa\alpha_0-\frac{80\kappa\alpha_0}{(x-2)^4}-\frac{2d_1\kappa\alpha_0}{3(x-1)^4}+\frac{\kappa\alpha_0}{(x-1)^4}-\frac{160\kappa\alpha_0}{(x-2)^5}+\frac{2d_1\kappa\alpha_0}{3(x-1)^5}-$$
$$\frac{\kappa\alpha_0}{(x-1)^5}+2\kappa\alpha_0-\frac{80\alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{2d_1\alpha_0}{3(x-1)^5}-\frac{\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3}+\frac{x}{3}+x\kappa+$$
$$\frac{80\kappa}{(x-2)^4}+\frac{2d_1\kappa}{3(x-1)^4}-\frac{\kappa}{(x-1)^4}+\frac{320\kappa}{(x-2)^5}+\frac{2d_1\kappa}{3(x-1)^5}-\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}+\frac{80}{3(x-2)^4}+\frac{2d_1}{3(x-1)^4}-\frac{1}{3(x-1)^4}+$$
$$\frac{320}{3(x-2)^5}+\frac{2d_1}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4\alpha_0d_1^2}{3(x-1)^4}+\frac{4d_1^2}{3(x-1)^4}+\frac{4\alpha_0d_1^2}{3(x-1)^5}+$$
$$\frac{4d_1^2}{3(x-1)^5}+\frac{4\alpha_0d_1}{3}-\frac{2\alpha_0xd_1}{3}+\frac{2xd_1}{3}+\frac{4\alpha_0\kappa d_1}{3}-\frac{2}{3}\alpha_0x\kappa d_1+\frac{2x\kappa d_1}{3}-\frac{160\alpha_0\kappa d_1}{3(x-2)^4}+\frac{160\kappa d_1}{3(x-2)^4}+\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-$$
$$\frac{4\kappa d_1}{3(x-1)^4}-\frac{320\alpha_0\kappa d_1}{3(x-2)^5}+\frac{640\kappa d_1}{3(x-2)^5}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}+\frac{640\kappa d_1}{3(x-2)^6}-\frac{160\alpha_0d_1}{3(x-2)^4}+\frac{160d_1}{3(x-2)^4}+\frac{4\alpha_0d_1}{3(x-1)^4}-$$
$$\frac{4d_1}{3(x-1)^4}-\frac{320\alpha_0d_1}{3(x-2)^5}+\frac{640d_1}{3(x-2)^5}-\frac{4\alpha_0d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}+\frac{640d_1}{3(x-2)^6}-\frac{2\alpha_0}{3}+\frac{\alpha_0x}{3}-\frac{x}{3}-2\alpha_0\kappa+\alpha_0x\kappa-$$
$$x\kappa+\frac{80\alpha_0\kappa}{(x-2)^4}-\frac{80\kappa}{(x-2)^4}-\frac{\alpha_0\kappa}{(x-1)^4}+\frac{\kappa}{(x-1)^4}+\frac{160\alpha_0\kappa}{(x-2)^5}-\frac{320\kappa}{(x-2)^5}+\frac{\alpha_0\kappa}{(x-1)^5}+\frac{\kappa}{(x-1)^5}-\frac{320\kappa}{(x-2)^6}+\frac{80\alpha_0}{3(x-2)^4}-$$
$$\frac{80}{3(x-2)^4}-\frac{\alpha_0}{3(x-1)^4}+\frac{1}{3(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}-\frac{320}{3(x-2)^5}+\frac{\alpha_0}{3(x-1)^5}+\frac{1}{3(x-1)^5}-\frac{320}{3(x-2)^6}\Big)H(1,1,0;x)+$$
$$\Big(\frac{4\alpha_0d_1^2}{3(x-1)^4}-\frac{4d_1^2}{3(x-1)^4}-\frac{4\alpha_0d_1^2}{3(x-1)^5}-\frac{4d_1^2}{3(x-1)^5}-\frac{4\alpha_0d_1}{3}+\frac{2\alpha_0xd_1}{3}-\frac{2xd_1}{3}-\frac{4\alpha_0\kappa d_1}{3}+\frac{2}{3}\alpha_0x\kappa d_1-\frac{2x\kappa d_1}{3}+$$
$$\frac{160\alpha_0\kappa d_1}{3(x-2)^4}-\frac{160\kappa d_1}{3(x-2)^4}-\frac{4\alpha_0\kappa d_1}{3(x-1)^4}+\frac{4\kappa d_1}{3(x-1)^4}+\frac{320\alpha_0\kappa d_1}{3(x-2)^5}-\frac{640\kappa d_1}{3(x-2)^5}+\frac{4\alpha_0\kappa d_1}{3(x-1)^5}+\frac{4\kappa d_1}{3(x-1)^5}-\frac{640\kappa d_1}{3(x-2)^6}+$$
$$\frac{160\alpha_0d_1}{3(x-2)^4}-\frac{160d_1}{3(x-2)^4}-\frac{4\alpha_0d_1}{3(x-1)^4}+\frac{4d_1}{3(x-1)^4}+\frac{320\alpha_0d_1}{3(x-2)^5}-\frac{640d_1}{3(x-2)^5}+\frac{4\alpha_0d_1}{3(x-1)^5}+\frac{4d_1}{3(x-1)^5}-\frac{640d_1}{3(x-2)^6}+\frac{2\alpha_0}{3}-$$
$$\frac{\alpha_0x}{3}+\frac{x}{3}+2\alpha_0\kappa-\alpha_0x\kappa+x\kappa-\frac{80\alpha_0\kappa}{(x-2)^4}+\frac{80\kappa}{(x-2)^4}+\frac{\alpha_0\kappa}{(x-1)^4}-\frac{\kappa}{(x-1)^4}-\frac{160\alpha_0\kappa}{(x-2)^5}+\frac{320\kappa}{(x-2)^5}-\frac{\alpha_0\kappa}{(x-1)^5}-$$
$$\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}-\frac{80\alpha_0}{3(x-2)^4}+\frac{80}{3(x-2)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{1}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{320}{3(x-2)^5}-\frac{\alpha_0}{3(x-1)^5}-\frac{1}{3(x-1)^5}+$$
$$\frac{320}{3(x-2)^6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{x\alpha_0}{3}-x\kappa\alpha_0-\frac{80\kappa\alpha_0}{(x-2)^4}-\frac{2d_1\kappa\alpha_0}{3(x-1)^4}+\frac{\kappa\alpha_0}{(x-1)^4}-\frac{160\kappa\alpha_0}{(x-2)^5}+\frac{2d_1\kappa\alpha_0}{3(x-1)^5}-$$
$$\frac{\kappa\alpha_0}{(x-1)^5}+2\kappa\alpha_0-\frac{80\alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{2d_1\alpha_0}{3(x-1)^5}-\frac{\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3}+\frac{x}{3}+x\kappa+\frac{80\kappa}{(x-2)^4}+$$
$$\frac{2d_1\kappa}{3(x-1)^4}-\frac{\kappa}{(x-1)^4}+\frac{320\kappa}{(x-2)^5}+\frac{2d_1\kappa}{3(x-1)^5}-\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}+\frac{80}{3(x-2)^4}+\frac{2d_1}{3(x-1)^4}-\frac{1}{3(x-1)^4}+\frac{320}{3(x-2)^5}+$$
$$\frac{2d_1}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{320d_1\kappa\alpha_0}{3(x-2)^4}+\frac{320\kappa\alpha_0}{(x-2)^4}-\frac{640d_1\kappa\alpha_0}{3(x-2)^5}+\frac{640\kappa\alpha_0}{(x-2)^5}-$$
$$\frac{320d_1\alpha_0}{3(x-2)^4}+\frac{320\alpha_0}{3(x-2)^4}-\frac{640d_1\alpha_0}{3(x-2)^5}+\frac{640\alpha_0}{3(x-2)^5}+\frac{320d_1\kappa}{3(x-2)^4}-\frac{320\kappa}{(x-2)^4}+\frac{1280d_1\kappa}{3(x-2)^5}-\frac{1280\kappa}{(x-2)^5}+\frac{1280d_1\kappa}{3(x-2)^6}-\frac{1280\kappa}{(x-2)^6}+$$
$$\frac{320d_1}{3(x-2)^4}-\frac{320}{3(x-2)^4}+\frac{1280d_1}{3(x-2)^5}-\frac{1280}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^6}-\frac{1280}{3(x-2)^6}\Big)H(2,0,0;x)+\Big(-\frac{160d_1\kappa\alpha_0}{3(x-2)^4}+\frac{160\kappa\alpha_0}{(x-2)^4}-$$
$$\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{320\kappa\alpha_0}{(x-2)^5}-\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\alpha_0}{3(x-2)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3(x-2)^5}+\frac{160d_1\kappa}{3(x-2)^4}-\frac{160\kappa}{(x-2)^4}+\frac{640d_1\kappa}{3(x-2)^5}-\frac{640\kappa}{(x-2)^5}+$$
$$\frac{640d_1\kappa}{3(x-2)^6}-\frac{640\kappa}{(x-2)^6}+\frac{160d_1}{3(x-2)^4}-\frac{160}{3(x-2)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}-\frac{640}{3(x-2)^6}\Big)H(2,0,c_1(\alpha_0);x)+$$
$$\Big(\frac{320d_1\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640d_1\kappa\alpha_0}{3(x-2)^5}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320d_1\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+\frac{640d_1\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{3(x-2)^5}-\frac{320d_1\kappa}{3(x-2)^4}+$$
$$\frac{320\kappa}{(x-2)^4}-\frac{1280d_1\kappa}{3(x-2)^5}+\frac{1280\kappa}{(x-2)^5}-\frac{1280d_1\kappa}{3(x-2)^6}+\frac{1280\kappa}{(x-2)^6}-\frac{320d_1}{3(x-2)^4}+\frac{320}{3(x-2)^4}-\frac{1280d_1}{3(x-2)^5}+\frac{1280}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^6}+$$
$$\frac{1280}{3(x-2)^6}\Big)H(2,0,c_2(\alpha_0);x)+\Big(\frac{160d_1\kappa\alpha_0}{3(x-2)^4}-\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{320d_1\kappa\alpha_0}{3(x-2)^5}-\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{160d_1\alpha_0}{3(x-2)^4}-\frac{160\alpha_0}{3(x-2)^4}+$$
$$\frac{320d_1\alpha_0}{3(x-2)^5}-\frac{320\alpha_0}{3(x-2)^5}-\frac{160d_1\kappa}{3(x-2)^4}+\frac{160\kappa}{(x-2)^4}-\frac{640d_1\kappa}{3(x-2)^5}+\frac{640\kappa}{(x-2)^5}-\frac{640d_1\kappa}{3(x-2)^6}+\frac{640\kappa}{(x-2)^6}-\frac{160d_1}{3(x-2)^4}+\frac{160}{3(x-2)^4}-$$
$$\frac{640d_1}{3(x-2)^5}+\frac{640}{3(x-2)^5}-\frac{640d_1}{3(x-2)^6}+\frac{640}{3(x-2)^6}\Big)H(2,1,0;x)+\Big(-\frac{160d_1\kappa\alpha_0}{3(x-2)^4}+\frac{160\kappa\alpha_0}{(x-2)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{320\kappa\alpha_0}{(x-2)^5}-$$
$$\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\alpha_0}{3(x-2)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3(x-2)^5}+\frac{160d_1\kappa}{3(x-2)^4}-\frac{160\kappa}{(x-2)^4}+\frac{640d_1\kappa}{3(x-2)^5}-\frac{640\kappa}{(x-2)^5}+\frac{640d_1\kappa}{3(x-2)^6}-\frac{640\kappa}{(x-2)^6}+$$
$$\frac{160d_1}{3(x-2)^4}-\frac{160}{3(x-2)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}-\frac{640}{3(x-2)^6}\Big)H(2,1,c_1(\alpha_0);x)+\Big(-\frac{320\alpha_0d_1^2}{3(x-2)^4}+$$
$$\frac{320d_1^2}{3(x-2)^4}-\frac{640\alpha_0d_1^2}{3(x-2)^5}+\frac{1280d_1^2}{3(x-2)^5}+\frac{1280d_1^2}{3(x-2)^6}+\frac{640\alpha_0\kappa d_1}{3(x-2)^4}-\frac{640\kappa d_1}{3(x-2)^4}+\frac{1280\alpha_0\kappa d_1}{3(x-2)^5}-\frac{2560\kappa d_1}{3(x-2)^5}-\frac{2560\kappa d_1}{3(x-2)^6}+$$
$$\frac{640\alpha_0d_1}{3(x-2)^4}-\frac{640d_1}{3(x-2)^4}+\frac{1280\alpha_0d_1}{3(x-2)^5}-\frac{2560d_1}{3(x-2)^5}-\frac{2560d_1}{3(x-2)^6}-\frac{320\alpha_0\kappa}{(x-2)^4}+\frac{320\kappa}{(x-2)^4}-\frac{640\alpha_0\kappa}{(x-2)^5}+\frac{1280\kappa}{(x-2)^5}+\frac{1280\kappa}{(x-2)^6}-$$
$$\frac{320\alpha_0}{3(x-2)^4}+\frac{320}{3(x-2)^4}-\frac{640\alpha_0}{3(x-2)^5}+\frac{1280}{3(x-2)^5}+\frac{1280}{3(x-2)^6}\Big)H(2,2,0;x)+\Big(\frac{320\alpha_0d_1^2}{3(x-2)^4}-\frac{320d_1^2}{3(x-2)^4}+\frac{640\alpha_0d_1^2}{3(x-2)^5}-$$
$$\frac{1280d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^6}-\frac{640\alpha_0\kappa d_1}{3(x-2)^4}+\frac{640\kappa d_1}{3(x-2)^4}-\frac{1280\alpha_0\kappa d_1}{3(x-2)^5}+\frac{2560\kappa d_1}{3(x-2)^5}+\frac{2560\kappa d_1}{3(x-2)^6}-\frac{640\alpha_0d_1}{3(x-2)^4}+\frac{640d_1}{3(x-2)^4}-$$
$$\frac{1280\alpha_0d_1}{3(x-2)^5}+\frac{2560d_1}{3(x-2)^5}+\frac{2560d_1}{3(x-2)^6}+\frac{320\alpha_0\kappa}{(x-2)^4}-\frac{320\kappa}{(x-2)^4}+\frac{640\alpha_0\kappa}{(x-2)^5}-\frac{1280\kappa}{(x-2)^5}-\frac{1280\kappa}{(x-2)^6}+\frac{320\alpha_0}{3(x-2)^4}-\frac{320}{3(x-2)^4}+$$

$$\frac{640\alpha_0}{3(x-2)^5} - \frac{1280}{3(x-2)^5} - \frac{1280}{3(x-2)^6}\Big) H(2,2,c_2(\alpha_0);x) + \Big(\frac{160 d_1\kappa\alpha_0}{3(x-2)^4} - \frac{160\kappa\alpha_0}{(x-2)^4} + \frac{320 d_1\kappa\alpha_0}{3(x-2)^5} - \frac{320\kappa\alpha_0}{(x-2)^5} +$$

$$\frac{160 d_1\alpha_0}{3(x-2)^4} - \frac{160\alpha_0}{3(x-2)^4} + \frac{320 d_1\alpha_0}{3(x-2)^5} - \frac{320\alpha_0}{3(x-2)^5} - \frac{160 d_1\kappa}{3(x-2)^4} + \frac{160\kappa}{(x-2)^4} - \frac{640 d_1\kappa}{3(x-2)^5} + \frac{640\kappa}{(x-2)^5} - \frac{640 d_1\kappa}{3(x-2)^6} + \frac{640\kappa}{(x-2)^6} -$$

$$\frac{160 d_1}{3(x-2)^4} + \frac{160}{3(x-2)^4} - \frac{640 d_1}{3(x-2)^5} + \frac{640}{3(x-2)^5} - \frac{640 d_1}{3(x-2)^6} + \frac{640}{3(x-2)^6}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{\kappa\alpha_0}{(x-1)^4} -$$

$$\frac{\kappa\alpha_0}{(x-1)^5} + \frac{\alpha_0}{3(x-1)^4} - \frac{\alpha_0}{3(x-1)^5} - \frac{\kappa}{(x-1)^4} - \frac{\kappa}{(x-1)^5} - \frac{1}{3(x-1)^4} - \frac{1}{3(x-1)^5}\Big) H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) +$$

$$\Big(\frac{80\kappa\alpha_0}{(x-2)^4} + \frac{160\kappa\alpha_0}{(x-2)^5} + \frac{80\alpha_0}{3(x-2)^4} + \frac{160\alpha_0}{3(x-2)^5} - \frac{80\kappa}{(x-2)^4} - \frac{320\kappa}{(x-2)^5} - \frac{320\kappa}{(x-2)^6} - \frac{80}{3(x-2)^4} - \frac{320}{3(x-2)^5} -$$

$$\frac{320}{3(x-2)^6}\Big) H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + H(0,0;x)\Big(-\frac{17x\alpha_0}{6} - \frac{101x\kappa\alpha_0}{18} - \frac{80\kappa\alpha_0}{3(x-2)} + \frac{65\kappa\alpha_0}{2(x-1)} +$$

$$\frac{80\kappa\alpha_0}{3(x-2)^2} - \frac{25\kappa\alpha_0}{3(x-1)^2} + \frac{35\kappa\alpha_0}{6(x-1)^3} + \frac{64 d_1\kappa\alpha_0}{3(x-2)^4} + \frac{3584\kappa\alpha_0}{9(x-2)^4} + \frac{47\kappa\alpha_0}{18(x-1)^4} + \frac{128 d_1\kappa\alpha_0}{3(x-2)^5} + \frac{1408\kappa\alpha_0}{9(x-2)^5} - \frac{101\kappa\alpha_0}{18(x-1)^5} +$$

$$\frac{74\kappa\alpha_0}{9} - \frac{80\alpha_0}{9(x-2)} + \frac{65\alpha_0}{6(x-1)} + \frac{80\alpha_0}{9(x-2)^2} - \frac{25\alpha_0}{9(x-1)^2} + \frac{35\alpha_0}{18(x-1)^3} + \frac{64 d_1\alpha_0}{3(x-2)^4} + \frac{2048\alpha_0}{9(x-2)^4} + \frac{11\alpha_0}{6(x-1)^4} +$$

$$\frac{128 d_1\alpha_0}{3(x-2)^5} + \frac{2176\alpha_0}{9(x-2)^5} - \frac{17\alpha_0}{6(x-1)^5} + \frac{320\kappa\ln 2\,\alpha_0}{(x-2)^4} + \frac{640\kappa\ln 2\,\alpha_0}{(x-2)^5} + \frac{320\ln 2\,\alpha_0}{3(x-2)^4} + \frac{640\ln 2\,\alpha_0}{3(x-2)^5} + \frac{14\alpha_0}{3} + \frac{17x}{6} +$$

$$\frac{101x\kappa}{18} - \frac{64\kappa}{3(x-2)} + \frac{43\kappa}{2(x-1)} + \frac{80\kappa}{3(x-2)^2} - \frac{8\kappa}{3(x-1)^2} - \frac{160\kappa}{3(x-2)^3} - \frac{\kappa}{6(x-1)^3} - \frac{64 d_1\kappa}{3(x-2)^4} - \frac{3584\kappa}{9(x-2)^4} -$$

$$\frac{155\kappa}{18(x-1)^4} - \frac{256 d_1\kappa}{3(x-2)^5} - \frac{8576\kappa}{9(x-2)^5} - \frac{101\kappa}{18(x-1)^5} - \frac{256 d_1\kappa}{3(x-2)^6} - \frac{2816\kappa}{9(x-2)^6} + 3\kappa - \frac{64}{9(x-2)} + \frac{43}{6(x-1)} +$$

$$\frac{80}{9(x-2)^2} - \frac{8}{9(x-1)^2} - \frac{160}{9(x-2)^3} - \frac{1}{18(x-1)^3} - \frac{64 d_1}{3(x-2)^4} - \frac{2048}{9(x-2)^4} - \frac{23}{6(x-1)^4} - \frac{256 d_1}{3(x-2)^5} - \frac{6272}{9(x-2)^5} -$$

$$\frac{17}{6(x-1)^5} - \frac{256 d_1}{3(x-2)^6} - \frac{4352}{9(x-2)^6} - \frac{320\kappa\ln 2}{(x-2)^4} - \frac{1280\kappa\ln 2}{(x-2)^5} - \frac{1280\kappa\ln 2}{(x-2)^6} - \frac{320\ln 2}{3(x-2)^4} - \frac{1280\ln 2}{3(x-2)^5} - \frac{1280\ln 2}{3(x-2)^6} +$$

$$1\Big) + H(2,2;x)\Big(\frac{320\alpha_0\ln 2\, d_1^2}{3(x-2)^4} - \frac{320\ln 2\, d_1^2}{3(x-2)^4} + \frac{640\alpha_0\ln 2\, d_1^2}{3(x-2)^5} - \frac{1280\ln 2\, d_1^2}{3(x-2)^5} - \frac{1280\ln 2\, d_1^2}{3(x-2)^6} - \frac{640\alpha_0\kappa\ln 2\, d_1}{3(x-2)^4} +$$

$$\frac{640\kappa\ln 2\, d_1}{3(x-2)^4} - \frac{1280\alpha_0\kappa\ln 2\, d_1}{3(x-2)^5} + \frac{2560\kappa\ln 2\, d_1}{3(x-2)^5} + \frac{2560\kappa\ln 2\, d_1}{3(x-2)^6} - \frac{640\alpha_0\ln 2\, d_1}{3(x-2)^4} + \frac{640\ln 2\, d_1}{3(x-2)^4} - \frac{1280\alpha_0\ln 2\, d_1}{3(x-2)^5} +$$

$$\frac{2560\ln 2\, d_1}{3(x-2)^5} + \frac{2560\ln 2\, d_1}{3(x-2)^6} + \Big(\frac{320\alpha_0 d_1^2}{3(x-2)^4} - \frac{320 d_1^2}{3(x-2)^4} + \frac{640\alpha_0 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^6} - \frac{640\alpha_0\kappa d_1}{3(x-2)^4} + \frac{640\kappa d_1}{3(x-2)^4} -$$

$$\frac{1280\alpha_0\kappa d_1}{3(x-2)^5} + \frac{2560\kappa d_1}{3(x-2)^5} + \frac{2560\kappa d_1}{3(x-2)^6} - \frac{640\alpha_0 d_1}{3(x-2)^4} + \frac{640 d_1}{3(x-2)^4} - \frac{1280\alpha_0 d_1}{3(x-2)^5} + \frac{2560 d_1}{3(x-2)^5} + \frac{2560 d_1}{3(x-2)^6} + \frac{320\alpha_0\kappa}{(x-2)^4} -$$

$$\frac{320\kappa}{(x-2)^4} + \frac{640\alpha_0\kappa}{(x-2)^5} - \frac{1280\kappa}{(x-2)^5} - \frac{1280\kappa}{(x-2)^6} + \frac{320\alpha_0}{3(x-2)^4} - \frac{320}{3(x-2)^4} + \frac{640\alpha_0}{3(x-2)^5} - \frac{1280}{3(x-2)^5} - \frac{1280}{3(x-2)^6}\Big) H(0;\alpha_0) +$$

$$\frac{320\alpha_0\kappa\ln 2}{(x-2)^4} - \frac{320\kappa\ln 2}{(x-2)^4} + \frac{640\alpha_0\kappa\ln 2}{(x-2)^5} - \frac{1280\kappa\ln 2}{(x-2)^5} - \frac{1280\kappa\ln 2}{(x-2)^6} + \frac{320\alpha_0\ln 2}{3(x-2)^4} - \frac{320\ln 2}{3(x-2)^4} + \frac{640\alpha_0\ln 2}{3(x-2)^5} -$$

$$\frac{1280\ln 2}{3(x-2)^5} - \frac{1280\ln 2}{3(x-2)^6}\Big) + H(2,0;x)\Big(\frac{64\alpha_0 d_1^2}{3(x-2)^4} - \frac{64 d_1^2}{3(x-2)^4} + \frac{128\alpha_0 d_1^2}{3(x-2)^5} - \frac{256 d_1^2}{3(x-2)^5} - \frac{256 d_1^2}{3(x-2)^6} - \frac{128\alpha_0\kappa d_1}{3(x-2)^4} +$$

$$\frac{128\kappa d_1}{3(x-2)^4} - \frac{256\alpha_0\kappa d_1}{3(x-2)^5} + \frac{512\kappa d_1}{3(x-2)^5} + \frac{512\kappa d_1}{3(x-2)^6} + \frac{896\alpha_0 d_1}{9(x-2)^4} - \frac{896 d_1}{9(x-2)^4} + \frac{1792\alpha_0 d_1}{9(x-2)^5} - \frac{3584 d_1}{9(x-2)^5} - \frac{3584 d_1}{9(x-2)^6} +$$

$$\frac{320\alpha_0\kappa\ln 2\, d_1}{3(x-2)^4} - \frac{320\kappa\ln 2\, d_1}{3(x-2)^4} + \frac{640\alpha_0\kappa\ln 2\, d_1}{3(x-2)^5} - \frac{1280\kappa\ln 2\, d_1}{3(x-2)^5} - \frac{1280\kappa\ln 2\, d_1}{3(x-2)^6} + \frac{320\alpha_0\ln 2\, d_1}{3(x-2)^4} - \frac{320\ln 2\, d_1}{3(x-2)^4} +$$

$$\frac{640\alpha_0\ln 2\, d_1}{3(x-2)^5} - \frac{1280\ln 2\, d_1}{3(x-2)^5} - \frac{1280\ln 2\, d_1}{3(x-2)^6} - \frac{704\alpha_0\kappa}{9(x-2)^4} + \frac{704\kappa}{9(x-2)^4} - \frac{1408\alpha_0\kappa}{9(x-2)^5} + \frac{2816\kappa}{9(x-2)^5} + \frac{2816\kappa}{9(x-2)^6} -$$

$$\frac{1088\alpha_0}{9(x-2)^4} + \frac{1088}{9(x-2)^4} - \frac{2176\alpha_0}{9(x-2)^5} + \frac{4352}{9(x-2)^5} + \frac{4352}{9(x-2)^6} - \frac{320\alpha_0\kappa\ln 2}{(x-2)^4} + \frac{320\kappa\ln 2}{(x-2)^4} - \frac{640\alpha_0\kappa\ln 2}{(x-2)^5} + \frac{1280\kappa\ln 2}{(x-2)^5} +$$

$$\frac{1280\kappa\ln 2}{(x-2)^6} - \frac{320\alpha_0\ln 2}{3(x-2)^4} + \frac{320\ln 2}{3(x-2)^4} - \frac{640\alpha_0\ln 2}{3(x-2)^5} + \frac{1280\ln 2}{3(x-2)^5} + \frac{1280\ln 2}{3(x-2)^6}\Big) + H(0,2;x)\Big(\frac{320 d_1\kappa\ln 2\,\alpha_0}{3(x-2)^4} -$$

$$\frac{320\kappa\ln 2\,\alpha_0}{(x-2)^4} + \frac{640 d_1\kappa\ln 2\,\alpha_0}{3(x-2)^5} - \frac{640\kappa\ln 2\,\alpha_0}{(x-2)^5} + \frac{320 d_1\ln 2\,\alpha_0}{3(x-2)^4} - \frac{320\ln 2\,\alpha_0}{3(x-2)^4} + \frac{640 d_1\ln 2\,\alpha_0}{3(x-2)^5} - \frac{640\ln 2\,\alpha_0}{3(x-2)^5} +$$

$$\Big(\frac{320 d_1\kappa\alpha_0}{3(x-2)^4} - \frac{320\kappa\alpha_0}{(x-2)^4} + \frac{640 d_1\kappa\alpha_0}{3(x-2)^5} - \frac{640\kappa\alpha_0}{(x-2)^5} + \frac{320 d_1\alpha_0}{3(x-2)^4} - \frac{320\alpha_0}{3(x-2)^4} + \frac{640 d_1\alpha_0}{3(x-2)^5} - \frac{640\alpha_0}{3(x-2)^5} - \frac{320 d_1\kappa}{3(x-2)^4} +$$

$$\frac{320\kappa}{(x-2)^4} - \frac{1280 d_1\kappa}{3(x-2)^5} + \frac{1280\kappa}{(x-2)^5} - \frac{1280 d_1\kappa}{3(x-2)^6} + \frac{1280\kappa}{(x-2)^6} - \frac{320 d_1}{3(x-2)^4} + \frac{320}{3(x-2)^4} - \frac{1280 d_1}{3(x-2)^5} + \frac{1280}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^6} +$$

$$\frac{1280}{3(x-2)^6}\Big) H(0;\alpha_0) - \frac{320 d_1\kappa\ln 2}{3(x-2)^4} + \frac{320\kappa\ln 2}{(x-2)^4} - \frac{1280 d_1\kappa\ln 2}{3(x-2)^5} + \frac{1280\kappa\ln 2}{(x-2)^5} - \frac{1280 d_1\kappa\ln 2}{3(x-2)^6} + \frac{1280\kappa\ln 2}{(x-2)^6} -$$

$$\frac{320 d_1\ln 2}{3(x-2)^4} + \frac{320\ln 2}{3(x-2)^4} - \frac{1280 d_1\ln 2}{3(x-2)^5} + \frac{1280\ln 2}{3(x-2)^5} - \frac{1280 d_1\ln 2}{3(x-2)^6} + \frac{1280\ln 2}{3(x-2)^6}\Big) + H(0;x)\Big(\frac{31 d_1\alpha_0}{27} - \frac{205 d_1 x\alpha_0}{216} +$$

$$\frac{1}{18}\pi^2 x\alpha_0 + \frac{955x\alpha_0}{216} + \frac{31 d_1\kappa\alpha_0}{27} - \frac{205}{216} d_1 x\kappa\alpha_0 + \frac{1}{3}\pi^2 x\kappa\alpha_0 + \frac{1255x\kappa\alpha_0}{216} - \frac{392 d_1\kappa\alpha_0}{27(x-2)} + \frac{1136\kappa\alpha_0}{27(x-2)} +$$

$$\frac{1129 d_1\kappa\alpha_0}{72(x-1)} - \frac{3613\kappa\alpha_0}{72(x-1)} + \frac{392 d_1\kappa\alpha_0}{27(x-2)^2} - \frac{1136\kappa\alpha_0}{27(x-2)^2} - \frac{181 d_1\kappa\alpha_0}{108(x-1)^2} + \frac{280\kappa\alpha_0}{27(x-1)^2} + \frac{251 d_1\kappa\alpha_0}{216(x-1)^3} - \frac{1751\kappa\alpha_0}{216(x-1)^3} +$$

$$\frac{256 d_1\kappa\alpha_0}{3(x-2)^4} - \frac{40\pi^2\kappa\alpha_0}{3(x-2)^4} - \frac{3328\kappa\alpha_0}{9(x-2)^4} + \frac{43 d_1\kappa\alpha_0}{216(x-1)^4} - \frac{\pi^2\kappa\alpha_0}{3(x-1)^4} - \frac{32\kappa\alpha_0}{27(x-1)^4} - \frac{80\pi^2\kappa\alpha_0}{3(x-2)^5} + \frac{512\kappa\alpha_0}{9(x-2)^5} - \frac{205 d_1\kappa\alpha_0}{216(x-1)^5} +$$

$$\frac{\pi^2\kappa\alpha_0}{3(x-1)^5} + \frac{1255\kappa\alpha_0}{216(x-1)^5} - \frac{2}{3}\pi^2\kappa\alpha_0 - \frac{1511\kappa\alpha_0}{216} - \frac{392 d_1\alpha_0}{27(x-2)} + \frac{592\alpha_0}{27(x-2)} + \frac{1129 d_1\alpha_0}{72(x-1)} - \frac{209\alpha_0}{8(x-1)} + \frac{392 d_1\alpha_0}{27(x-2)^2} -$$

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$$\frac{592\alpha_0}{27(x-2)^2}-\frac{181d_1\alpha_0}{108(x-1)^2}+\frac{155\alpha_0}{27(x-1)^2}+\frac{251d_1\alpha_0}{216(x-1)^3}-\frac{907\alpha_0}{216(x-1)^3}+\frac{512d_1\alpha_0}{9(x-2)^4}-\frac{9536\alpha_0}{27(x-2)^4}+\frac{43d_1\alpha_0}{216(x-1)^4}-$$

$$\frac{\pi^2\alpha_0}{18(x-1)^4}-\frac{115\alpha_0}{54(x-1)^4}-\frac{512d_1\alpha_0}{9(x-2)^5}-\frac{6784\alpha_0}{27(x-2)^5}-\frac{205d_1\alpha_0}{216(x-1)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}+\frac{955\alpha_0}{216(x-1)^5}-\frac{160\kappa\ln^2 2\,\alpha_0}{(x-2)^4}-$$

$$\frac{320\kappa\ln^2 2\,\alpha_0}{(x-2)^5}-\frac{160\ln^2 2\,\alpha_0}{3(x-2)^4}-\frac{320\ln^2 2\,\alpha_0}{3(x-2)^5}-\frac{64d_1\kappa\ln 2\,\alpha_0}{3(x-2)^4}-\frac{704\kappa\ln 2\,\alpha_0}{9(x-2)^4}-\frac{128d_1\kappa\ln 2\,\alpha_0}{3(x-2)^5}-\frac{1408\kappa\ln 2\,\alpha_0}{9(x-2)^5}-$$

$$\frac{64d_1\ln 2\,\alpha_0}{3(x-2)^4}-\frac{1088\ln 2\,\alpha_0}{9(x-2)^4}-\frac{128d_1\ln 2\,\alpha_0}{3(x-2)^5}-\frac{2176\ln 2\,\alpha_0}{9(x-2)^5}-\frac{\pi^2\alpha_0}{9}-\frac{1415\alpha_0}{216}+\frac{3d_1}{4}+\frac{205d_1x}{216}-\frac{\pi^2x}{18}-$$

$$\frac{955x}{216}+\frac{3d_1\kappa}{4}+\frac{205d_1x\kappa}{216}-\frac{1}{3}\pi^2x\kappa-\frac{1255x\kappa}{216}-\frac{346d_1\kappa}{27(x-2)}+\frac{952\kappa}{27(x-2)}+\frac{947d_1\kappa}{72(x-1)}-\frac{2621\kappa}{72(x-1)}+\frac{392d_1\kappa}{27(x-2)^2}-$$

$$\frac{1136\kappa}{27(x-2)^2}-\frac{23d_1\kappa}{27(x-1)^2}+\frac{92\kappa}{27(x-1)^2}-\frac{784d_1\kappa}{27(x-2)^3}+\frac{2272\kappa}{27(x-2)^3}-\frac{73d_1\kappa}{216(x-1)^3}+\frac{247\kappa}{216(x-1)^3}-\frac{256d_1\kappa}{3(x-2)^4}+$$

$$\frac{40\pi^2\kappa}{3(x-2)^4}+\frac{3328\kappa}{9(x-2)^4}-\frac{367d_1\kappa}{216(x-1)^4}+\frac{\pi^2\kappa}{3(x-1)^4}+\frac{1127\kappa}{108(x-1)^4}-\frac{512d_1\kappa}{3(x-2)^5}+\frac{160\pi^2\kappa}{3(x-2)^5}+\frac{2048\kappa}{3(x-2)^5}-\frac{205d_1\kappa}{216(x-1)^5}+$$

$$\frac{\pi^2\kappa}{3(x-1)^5}+\frac{1255\kappa}{216(x-1)^5}+\frac{160\pi^2\kappa}{3(x-2)^6}-\frac{1024\kappa}{9(x-2)^6}-\frac{37\kappa}{8}-\frac{346d_1}{27(x-2)}+\frac{488}{27(x-2)}+\frac{947d_1}{72(x-1)}-\frac{443}{24(x-1)}+$$

$$\frac{392d_1}{27(x-2)^2}-\frac{592}{27(x-2)^2}-\frac{23d_1}{27(x-1)^2}+\frac{52}{27(x-1)^2}-\frac{784d_1}{27(x-2)^3}+\frac{1184}{27(x-2)^3}-\frac{73d_1}{216(x-1)^3}+\frac{83}{216(x-1)^3}-$$

$$\frac{512d_1}{9(x-2)^4}+\frac{9536}{27(x-2)^4}-\frac{367d_1}{216(x-1)^4}+\frac{\pi^2}{18(x-1)^4}+\frac{725}{108(x-1)^4}-\frac{512d_1}{9(x-2)^5}+\frac{25856}{27(x-2)^5}-\frac{205d_1}{216(x-1)^5}+$$

$$\frac{\pi^2}{18(x-1)^5}+\frac{955}{216(x-1)^5}+\frac{1024d_1}{9(x-2)^6}+\frac{13568}{27(x-2)^6}+\frac{160\kappa\ln^2 2}{(x-2)^4}+\frac{640\kappa\ln^2 2}{(x-2)^5}+\frac{640\kappa\ln^2 2}{(x-2)^6}+\frac{160\ln^2 2}{3(x-2)^4}+$$

$$\frac{640\ln^2 2}{3(x-2)^5}+\frac{640\ln^2 2}{3(x-2)^6}+\frac{64d_1\kappa\ln 2}{3(x-2)^4}+\frac{704\kappa\ln 2}{9(x-2)^4}+\frac{256d_1\kappa\ln 2}{3(x-2)^5}+\frac{2816\kappa\ln 2}{9(x-2)^5}+\frac{256d_1\kappa\ln 2}{3(x-2)^6}+\frac{2816\kappa\ln 2}{9(x-2)^6}+$$

$$\frac{64d_1\ln 2}{3(x-2)^4}+\frac{1088\ln 2}{9(x-2)^4}+\frac{256d_1\ln 2}{3(x-2)^5}+\frac{4352\ln 2}{9(x-2)^5}+\frac{256d_1\ln 2}{3(x-2)^6}+\frac{4352\ln 2}{9(x-2)^6}-\frac{55}{24}\Bigg)+H(2;x)\Bigg(-\frac{64\alpha_0\ln 2\,d_1^2}{3(x-2)^4}+$$

$$\frac{64\ln 2\,d_1^2}{3(x-2)^4}-\frac{128\alpha_0\ln 2\,d_1^2}{3(x-2)^5}+\frac{256\ln 2\,d_1^2}{3(x-2)^5}+\frac{256\ln 2\,d_1^2}{3(x-2)^6}-\frac{40\alpha_0\pi^2\kappa d_1}{9(x-2)^4}+\frac{40\pi^2\kappa d_1}{9(x-2)^4}-\frac{80\alpha_0\pi^2\kappa d_1}{9(x-2)^5}+\frac{160\pi^2\kappa d_1}{9(x-2)^5}+$$

$$\frac{160\pi^2\kappa d_1}{9(x-2)^6}-\frac{40\alpha_0\pi^2 d_1}{9(x-2)^4}+\frac{40\pi^2 d_1}{9(x-2)^4}-\frac{80\alpha_0\pi^2 d_1}{9(x-2)^5}+\frac{160\pi^2 d_1}{9(x-2)^5}+\frac{160\pi^2 d_1}{9(x-2)^6}-\frac{160\alpha_0\kappa\ln^2 2\,d_1}{3(x-2)^4}+\frac{160\kappa\ln^2 2\,d_1}{3(x-2)^4}-$$

$$\frac{320\alpha_0\kappa\ln^2 2\,d_1}{3(x-2)^5}+\frac{640\kappa\ln^2 2\,d_1}{3(x-2)^5}+\frac{640\kappa\ln^2 2\,d_1}{3(x-2)^6}-\frac{160\alpha_0\ln^2 2\,d_1}{3(x-2)^4}+\frac{160\ln^2 2\,d_1}{3(x-2)^4}-\frac{320\alpha_0\ln^2 2\,d_1}{3(x-2)^5}+\frac{640\ln^2 2\,d_1}{3(x-2)^5}+$$

$$\frac{640\ln^2 2\,d_1}{3(x-2)^6}+\frac{128\alpha_0\kappa\ln 2\,d_1}{3(x-2)^4}-\frac{128\kappa\ln 2\,d_1}{3(x-2)^4}+\frac{256\alpha_0\kappa\ln 2\,d_1}{3(x-2)^5}-\frac{512\kappa\ln 2\,d_1}{3(x-2)^5}-\frac{512\kappa\ln 2\,d_1}{3(x-2)^6}-\frac{896\alpha_0\ln 2\,d_1}{9(x-2)^4}+$$

$$\frac{896\ln 2\,d_1}{9(x-2)^4}-\frac{1792\alpha_0\ln 2\,d_1}{9(x-2)^5}+\frac{3584\ln 2\,d_1}{9(x-2)^5}+\frac{3584\ln 2\,d_1}{9(x-2)^6}+\frac{40\alpha_0\pi^2\kappa}{3(x-2)^4}-\frac{40\pi^2\kappa}{3(x-2)^4}+\frac{80\alpha_0\pi^2\kappa}{3(x-2)^5}-\frac{160\pi^2\kappa}{3(x-2)^5}-$$

$$\frac{160\pi^2\kappa}{3(x-2)^6}+\Bigg(-\frac{64\alpha_0 d_1^2}{3(x-2)^4}+\frac{64d_1^2}{3(x-2)^4}-\frac{128\alpha_0d_1^2}{3(x-2)^5}+\frac{256d_1^2}{3(x-2)^5}+\frac{256d_1^2}{3(x-2)^6}+\frac{128\alpha_0\kappa d_1}{3(x-2)^4}-\frac{128\kappa d_1}{3(x-2)^4}+\frac{256\alpha_0\kappa d_1}{3(x-2)^5}-$$

$$\frac{512\kappa d_1}{3(x-2)^5}-\frac{512\kappa d_1}{3(x-2)^6}-\frac{896\alpha_0d_1}{9(x-2)^4}+\frac{896d_1}{9(x-2)^4}-\frac{1792\alpha_0d_1}{9(x-2)^5}+\frac{3584d_1}{9(x-2)^5}+\frac{3584d_1}{9(x-2)^6}+\frac{704\alpha_0\kappa}{9(x-2)^4}-\frac{704\kappa}{9(x-2)^4}+$$

$$\frac{1408\alpha_0\kappa}{9(x-2)^5}-\frac{2816\kappa}{9(x-2)^5}-\frac{2816\kappa}{9(x-2)^6}+\frac{1088\alpha_0}{9(x-2)^4}-\frac{1088}{9(x-2)^4}+\frac{2176\alpha_0}{9(x-2)^5}-\frac{4352}{9(x-2)^5}-\frac{4352}{9(x-2)^6}\Bigg)H(0;\alpha_0)+$$

$$\Bigg(\frac{320d_1\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640d_1\kappa\alpha_0}{3(x-2)^5}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320d_1\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+\frac{640d_1\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{3(x-2)^5}-\frac{320d_1\kappa}{3(x-2)^4}+$$

$$\frac{320\kappa}{(x-2)^4}-\frac{1280d_1\kappa}{3(x-2)^5}+\frac{1280\kappa}{(x-2)^5}-\frac{1280d_1\kappa}{3(x-2)^6}+\frac{1280\kappa}{(x-2)^6}-\frac{320d_1}{3(x-2)^4}+\frac{320}{3(x-2)^4}-\frac{1280d_1}{3(x-2)^5}+\frac{1280}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^6}+$$

$$\frac{1280}{3(x-2)^6}\Bigg)H(0,0;\alpha_0)+\Bigg(\frac{320\alpha_0d_1^2}{3(x-2)^4}-\frac{320d_1^2}{3(x-2)^4}+\frac{640\alpha_0d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^6}-\frac{320\alpha_0\kappa d_1}{3(x-2)^4}+\frac{320\kappa d_1}{3(x-2)^4}-$$

$$\frac{640\alpha_0\kappa d_1}{3(x-2)^5}+\frac{1280\kappa d_1}{3(x-2)^5}+\frac{1280\kappa d_1}{3(x-2)^6}-\frac{320\alpha_0d_1}{3(x-2)^4}+\frac{320d_1}{3(x-2)^4}-\frac{640\alpha_0d_1}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^6}\Bigg)H(0,1;\alpha_0)+$$

$$\frac{40\alpha_0\pi^2}{9(x-2)^4}-\frac{40\pi^2}{9(x-2)^4}+\frac{80\alpha_0\pi^2}{9(x-2)^5}-\frac{160\pi^2}{9(x-2)^5}-\frac{160\pi^2}{9(x-2)^6}+\frac{160\alpha_0\kappa\ln^2 2}{(x-2)^4}-\frac{160\kappa\ln^2 2}{(x-2)^4}+\frac{320\alpha_0\kappa\ln^2 2}{(x-2)^5}-$$

$$\frac{640\kappa\ln^2 2}{(x-2)^5}-\frac{640\kappa\ln^2 2}{(x-2)^6}+\frac{160\alpha_0\ln^2 2}{3(x-2)^4}-\frac{160\ln^2 2}{3(x-2)^4}+\frac{320\alpha_0\ln^2 2}{3(x-2)^5}-\frac{640\ln^2 2}{3(x-2)^5}-\frac{640\ln^2 2}{3(x-2)^6}+\frac{704\alpha_0\kappa\ln 2}{9(x-2)^4}-$$

$$\frac{704\kappa\ln 2}{9(x-2)^4}+\frac{1408\alpha_0\kappa\ln 2}{9(x-2)^5}-\frac{2816\kappa\ln 2}{9(x-2)^5}-\frac{2816\kappa\ln 2}{9(x-2)^6}+\frac{1088\alpha_0\ln 2}{9(x-2)^4}-\frac{1088\ln 2}{9(x-2)^4}+\frac{2176\alpha_0\ln 2}{9(x-2)^5}-$$

$$\frac{4352\ln 2}{9(x-2)^5}-\frac{4352\ln 2}{9(x-2)^6}\Bigg)+\frac{25\pi^2x}{216(\kappa+1)}+\frac{242x}{81(\kappa+1)}+\frac{253\pi^2x\kappa}{216(\kappa+1)}-\frac{112\pi^2\kappa}{27(x-2)(\kappa+1)}+\frac{301\pi^2\kappa}{72(x-1)(\kappa+1)}+$$

$$\frac{140\pi^2\kappa}{27(x-2)^2(\kappa+1)}-\frac{14\pi^2\kappa}{27(x-1)^2(\kappa+1)}-\frac{280\pi^2\kappa}{27(x-2)^3(\kappa+1)}-\frac{7\pi^2\kappa}{216(x-1)^3(\kappa+1)}-\frac{8d_1\pi^2\kappa}{3(x-2)^4(\kappa+1)}-\frac{664\pi^2\kappa}{9(x-2)^4(\kappa+1)}-$$

$$\frac{379\pi^2\kappa}{216(x-1)^4(\kappa+1)}-\frac{32d_1\pi^2\kappa}{3(x-2)^5(\kappa+1)}-\frac{512\pi^2\kappa}{3(x-2)^5(\kappa+1)}-\frac{253\pi^2\kappa}{216(x-1)^5(\kappa+1)}-\frac{32d_1\pi^2\kappa}{3(x-2)^6(\kappa+1)}-\frac{416\pi^2\kappa}{9(x-2)^6(\kappa+1)}+$$

$$\frac{7\pi^2\kappa}{12(\kappa+1)}-\frac{16\pi^2}{27(x-2)(\kappa+1)}+\frac{43\pi^2}{72(x-1)(\kappa+1)}+\frac{20\pi^2}{27(x-2)^2(\kappa+1)}-\frac{2\pi^2}{27(x-1)^2(\kappa+1)}-\frac{40\pi^2}{27(x-2)^3(\kappa+1)}-$$

$$\frac{\pi^2}{216(x-1)^3(\kappa+1)}-\frac{8d_1\pi^2}{9(x-2)^4(\kappa+1)}-\frac{376\pi^2}{27(x-2)^4(\kappa+1)}-\frac{23\pi^2}{72(x-1)^4(\kappa+1)}-\frac{32d_1\pi^2}{9(x-2)^5(\kappa+1)}-\frac{1024\pi^2}{27(x-2)^5(\kappa+1)}-$$

$$\frac{17\pi^2}{72(x-1)^5(\kappa+1)}-\frac{32d_1\pi^2}{9(x-2)^6(\kappa+1)}-\frac{544\pi^2}{27(x-2)^6(\kappa+1)}+\frac{\pi^2}{12(\kappa+1)}-\frac{x\zeta_3}{\kappa+1}-\frac{7x\kappa\zeta_3}{3(\kappa+1)}+\frac{7\kappa\zeta_3}{3(x-1)^4(\kappa+1)}+$$

$$\frac{7\kappa\zeta_3}{3(x-1)^5(\kappa+1)}+\frac{\zeta_3}{3(x-1)^4(\kappa+1)}+\frac{\zeta_3}{3(x-1)^5(\kappa+1)}-\frac{1120\kappa\ln^3 2}{9(x-2)^4(\kappa+1)}-\frac{4480\kappa\ln^3 2}{9(x-2)^5(\kappa+1)}-\frac{4480\kappa\ln^3 2}{9(x-2)^6(\kappa+1)}-$$
$$\frac{160\ln^3 2}{9(x-2)^4(\kappa+1)}-\frac{640\ln^3 2}{9(x-2)^5(\kappa+1)}-\frac{640\ln^3 2}{9(x-2)^6(\kappa+1)}-\frac{32d_1\kappa\ln^2 2}{(x-2)^4(\kappa+1)}-\frac{416\kappa\ln^2 2}{3(x-2)^4(\kappa+1)}-\frac{128d_1\kappa\ln^2 2}{(x-2)^5(\kappa+1)}-$$
$$\frac{1664\kappa\ln^2 2}{3(x-2)^5(\kappa+1)}-\frac{128d_1\kappa\ln^2 2}{(x-2)^6(\kappa+1)}-\frac{1664\kappa\ln^2 2}{3(x-2)^6(\kappa+1)}-\frac{32d_1\ln^2 2}{3(x-2)^4(\kappa+1)}-\frac{544\ln^2 2}{9(x-2)^4(\kappa+1)}-\frac{128d_1\ln^2 2}{3(x-2)^5(\kappa+1)}-$$
$$\frac{2176\ln^2 2}{9(x-2)^5(\kappa+1)}-\frac{128d_1\ln^2 2}{3(x-2)^6(\kappa+1)}-\frac{2176\ln^2 2}{9(x-2)^6(\kappa+1)}-\frac{256d_1\kappa\ln 2}{9(x-2)^4(\kappa+1)}-\frac{80\pi^2\kappa\ln 2}{3(x-2)^4(\kappa+1)}-\frac{1856\kappa\ln 2}{27(x-2)^4(\kappa+1)}-$$
$$\frac{1024d_1\kappa\ln 2}{9(x-2)^5(\kappa+1)}-\frac{320\pi^2\kappa\ln 2}{3(x-2)^5(\kappa+1)}-\frac{7424\kappa\ln 2}{27(x-2)^5(\kappa+1)}-\frac{1024d_1\kappa\ln 2}{9(x-2)^6(\kappa+1)}-\frac{320\pi^2\kappa\ln 2}{3(x-2)^6(\kappa+1)}-\frac{7424\kappa\ln 2}{27(x-2)^6(\kappa+1)}-$$
$$\frac{256d_1\ln 2}{9(x-2)^4(\kappa+1)}-\frac{3392\ln 2}{27(x-2)^4(\kappa+1)}-\frac{1024d_1\ln 2}{9(x-2)^5(\kappa+1)}-\frac{13568\ln 2}{27(x-2)^5(\kappa+1)}-\frac{1024d_1\ln 2}{9(x-2)^6(\kappa+1)}-\frac{13568\ln 2}{27(x-2)^6(\kappa+1)}\Bigg\}.$$

### D.4 The $\mathcal{A}$ integral for $k=-1$ and $\kappa=0$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;0,2,0,g_A)&=x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;0,2)\\&=\frac{1}{\varepsilon^2}a_{-2}^{(0,-1)}+\frac{1}{\varepsilon}a_{-1}^{(0,-1)}+a_0^{(0,-1)}+\varepsilon a_1^{(0,-1)}+\varepsilon^2a_2^{(0,-1)}\mathcal{O}\left(\varepsilon^3\right),\end{aligned}\tag{D.4}$$

where

$$a_{-2}^{(0,-1)}=\tfrac{1}{2},$$

$$a_{-1}^{(0,-1)}=-H(0;x),$$

$$a_0^{(0,-1)}=\frac{\alpha_0^3}{12(x-1)^2}-\frac{\alpha_0^3}{12}+\frac{\alpha_0^2}{24(x-1)}-\frac{5\alpha_0^2}{24(x-1)^2}+\frac{7\alpha_0^2}{24(x-1)^3}+\frac{13\alpha_0^2}{24}-\frac{\alpha_0}{3(x-1)}+\frac{\alpha_0}{6(x-1)^2}-$$
$$\frac{\alpha_0}{3(x-1)^3}+\frac{13\alpha_0}{12(x-1)^4}-\frac{23\alpha_0}{12}+\Bigg(\frac{25}{12}+\frac{3}{4(x-1)}-\frac{1}{6(x-1)^2}-\frac{1}{6(x-1)^3}+\frac{3}{4(x-1)^4}+$$
$$\frac{25}{12(x-1)^5}\Bigg)H(0;\alpha_0)+\Bigg(-\frac{25}{12}-\frac{3}{4(x-1)}+\frac{1}{6(x-1)^2}+\frac{1}{6(x-1)^3}-\frac{3}{4(x-1)^4}-\frac{25}{12(x-1)^5}\Bigg)H(0;x)+$$
$$\Bigg(\frac{1}{(x-1)^5}-1\Bigg)H(0;\alpha_0)\,H(1;x)+\Bigg(-\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}+\frac{\alpha_0^3}{x-1}-\frac{\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}-\frac{3\alpha_0^2}{2(x-1)}+\frac{\alpha_0^2}{(x-1)^2}-$$
$$\frac{\alpha_0^2}{2(x-1)^3}+3\alpha_0^2+\frac{\alpha_0}{x-1}-\frac{\alpha_0}{(x-1)^2}+\frac{\alpha_0}{(x-1)^3}-\frac{\alpha_0}{(x-1)^4}-4\alpha_0+\frac{3}{4(x-1)}-\frac{1}{6(x-1)^2}-\frac{1}{6(x-1)^3}+$$
$$\frac{3}{4(x-1)^4}+\frac{25}{12(x-1)^5}+\frac{25}{12}\Bigg)H(c_1(\alpha_0);x)+2H(0,0;x)+\Bigg(\frac{1}{(x-1)^5}-1\Bigg)H(0,c_1(\alpha_0);x)+\Bigg(1-$$
$$\frac{1}{(x-1)^5}\Bigg)H(1,0;x)+\Bigg(\frac{1}{(x-1)^5}-1\Bigg)H(1,c_1(\alpha_0);x)-\frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{6(x-1)^5}-\frac{\pi^2}{12},$$

$$a_1^{(0,-1)}=\frac{7d_1\alpha_0^3}{72}-\frac{7d_1\alpha_0^3}{72(x-1)^2}+\frac{7\alpha_0^3}{72(x-1)^2}-\frac{7\alpha_0^3}{72}-\frac{109d_1\alpha_0^2}{144}-\frac{13d_1\alpha_0^2}{144(x-1)}-\frac{5\alpha_0^2}{144(x-1)}+\frac{29d_1\alpha_0^2}{144(x-1)^2}-$$
$$\frac{47\alpha_0^2}{144(x-1)^2}-\frac{67d_1\alpha_0^2}{144(x-1)^3}+\frac{85\alpha_0^2}{144(x-1)^3}+\frac{127\alpha_0^2}{144}+\frac{305d_1\alpha_0}{72}+\frac{19d_1\alpha_0}{18(x-1)}-\frac{2\alpha_0}{9(x-1)}-\frac{d_1\alpha_0}{9(x-1)^2}+\frac{13\alpha_0}{36(x-1)^2}+$$
$$\frac{d_1\alpha_0}{18(x-1)^3}-\frac{8\alpha_0}{9(x-1)^3}-\frac{217d_1\alpha_0}{72(x-1)^4}+\frac{149\alpha_0}{36(x-1)^4}-\frac{101\alpha_0}{18}+\Bigg(-\frac{\alpha_0^3}{6(x-1)^2}+\frac{\alpha_0^3}{6}-\frac{\alpha_0^2}{12(x-1)}+\frac{5\alpha_0^2}{12(x-1)^2}-$$
$$\frac{7\alpha_0^2}{12(x-1)^3}-\frac{13\alpha_0^2}{12}+\frac{2\alpha_0}{3(x-1)}-\frac{\alpha_0}{3(x-1)^2}+\frac{2\alpha_0}{3(x-1)^3}-\frac{13\alpha_0}{6(x-1)^4}+\frac{23\alpha_0}{6}-\frac{205d_1}{72}-\frac{15d_1}{8(x-1)}+\frac{1}{4(x-1)}+\frac{5d_1}{18(x-1)^2}-$$
$$\frac{7}{36(x-1)^2}+\frac{5d_1}{18(x-1)^3}-\frac{13}{36(x-1)^3}-\frac{15d_1}{8(x-1)^4}+\frac{3}{(x-1)^4}-\frac{205d_1}{72(x-1)^5}+\frac{65}{9(x-1)^5}+\frac{155}{36}\Bigg)H(0;\alpha_0)+$$
$$\Bigg(\frac{15d_1}{8(x-1)}-\frac{5d_1}{18(x-1)^2}-\frac{5d_1}{18(x-1)^3}+\frac{15d_1}{8(x-1)^4}+\frac{205d_1}{72(x-1)^5}+\frac{205d_1}{72}-\frac{1}{4(x-1)}+\frac{7}{36(x-1)^2}+\frac{13}{36(x-1)^3}-$$
$$\frac{3}{(x-1)^4}+\frac{\pi^2}{3(x-1)^5}-\frac{65}{9(x-1)^5}+\frac{\pi^2}{6}-\frac{155}{36}\Bigg)H(0;x)+\Bigg(\frac{d_1\alpha_0^3}{6}-\frac{d_1\alpha_0^3}{6(x-1)^2}-\frac{13d_1\alpha_0^2}{12}-\frac{d_1\alpha_0^2}{12(x-1)}+\frac{5d_1\alpha_0^2}{12(x-1)^2}-$$
$$\frac{7d_1\alpha_0^2}{12(x-1)^3}+\frac{23d_1\alpha_0}{6}+\frac{2d_1\alpha_0}{3(x-1)}-\frac{d_1\alpha_0}{3(x-1)^2}+\frac{2d_1\alpha_0}{3(x-1)^3}-\frac{13d_1\alpha_0}{6(x-1)^4}-\frac{35d_1}{12}-\frac{7d_1}{12(x-1)}+\frac{d_1}{12(x-1)^2}-\frac{d_1}{12(x-1)^3}+$$
$$\frac{13d_1}{6(x-1)^4}\Bigg)H(1;\alpha_0)+\Bigg(-\frac{d_1\alpha_0^4}{8}+\frac{d_1\alpha_0^4}{8(x-1)}-\frac{\alpha_0^4}{8(x-1)}+\frac{\alpha_0^4}{8}+\frac{13d_1\alpha_0^3}{18}-\frac{d_1\alpha_0^3}{2(x-1)}+\frac{5\alpha_0^3}{6(x-1)}+\frac{2d_1\alpha_0^3}{9(x-1)^2}-$$

$$\frac{17\alpha_0^3}{36(x-1)^2}-\frac{29\ \alpha_0^3}{36}-\frac{23d_1\alpha_0^2}{12}+\frac{3d_1\alpha_0^2}{4\ (x-1)}-\frac{19\alpha_0^2}{8(x-1)}-\frac{2d_1\alpha_0^2}{3\ (x-1)^2}+\frac{47\alpha_0^2}{24(x-1)^2}+\frac{d_1\alpha_0^2}{2\ (x-1)^3}-\frac{11\alpha_0^2}{8(x-1)^3}+\frac{59\alpha_0^2}{24}+$$

$$\frac{25d_1\ \alpha_0}{6}-\frac{d_1\alpha_0}{2(x-1)}+\frac{9\alpha_0}{2(x-1)}+\frac{2d_1\ \alpha_0}{3(x-1)^2}-\frac{23\alpha_0}{6(x-1)^2}-\frac{d_1\ \alpha_0}{(x-1)^3}+\frac{4\alpha_0}{(x-1)^3}+\frac{2d_1\ \alpha_0}{(x-1)^4}-\frac{21\alpha_0}{4(x-1)^4}-\frac{73\alpha_0}{12}-\frac{205\ d_1}{72}+$$

$$\Bigg(\frac{\alpha_0^4}{2(x-1)}-\frac{\alpha_0^4}{2}-\frac{2\ \alpha_0^3}{x-1}+\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}+\frac{3\ \alpha_0^2}{x-1}-\frac{2\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}-6\ \alpha_0^2-\frac{2\alpha_0}{x-1}+\frac{2\alpha_0}{(x-1)^2}-\frac{2\ \alpha_0}{(x-1)^3}+\frac{2\alpha_0}{(x-1)^4}+$$

$$8\alpha_0-\frac{3}{2\ (x-1)}+\frac{1}{3(x-1)^2}+\frac{1}{3(x-1)^3}-\frac{3}{2\ (x-1)^4}-\frac{25}{6(x-1)^5}-\frac{25}{6}\Bigg)\ H(0;\alpha_0)+\Bigg(-\frac{d_1\alpha_0^4}{2}+\frac{d_1\alpha_0^4}{2(x-1)}+\frac{8\ d_1\alpha_0^3}{3}-$$

$$\frac{2d_1\alpha_0^3}{x-1}+\frac{2d_1\alpha_0^3}{3(x-1)^2}-6\ d_1\alpha_0^2+\frac{3d_1\alpha_0^2}{x-1}-\frac{2d_1\ \alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}+8d_1\alpha_0-\frac{2d_1\ \alpha_0}{x-1}+\frac{2d_1\alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{2\ d_1\alpha_0}{(x-1)^4}-$$

$$\frac{25d_1}{6}-\frac{3d_1}{2(x-1)}+\frac{d_1}{3\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{3d_1}{2(x-1)^4}-\frac{25\ d_1}{6(x-1)^5}\Bigg)H(1;\alpha_0)-\frac{15d_1}{8(x-1)}+\frac{1}{4\ (x-1)}+\frac{5d_1}{18(x-1)^2}-$$

$$\frac{7}{36(x-1)^2}+\frac{5d_1}{18\ (x-1)^3}-\frac{13}{36(x-1)^3}-\frac{15d_1}{8\ (x-1)^4}+\frac{3}{(x-1)^4}-\frac{205d_1}{72(x-1)^5}+\frac{65}{9\ (x-1)^5}+\frac{155}{36}\Bigg)\ H(c_1(\alpha_0);x)+$$

$$\Bigg(-\frac{25}{6}-\frac{3}{2(x-1)}+\frac{1}{3\ (x-1)^2}+\frac{1}{3(x-1)^3}-\frac{3}{2(x-1)^4}-\frac{25}{6(x-1)^5}\ \Bigg)H(0,0;\alpha_0)+\Bigg(\frac{25}{6}+\frac{3}{2(x-1)}-\frac{1}{3\ (x-1)^2}-$$

$$\frac{1}{3(x-1)^3}+\frac{3}{2(x-1)^4}+\frac{25}{6(x-1)^5}\ \Bigg)H(0,0;x)+\Bigg(-\frac{3d_1}{2(x-1)}+\frac{d_1}{3\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{3d_1}{2(x-1)^4}-\frac{25\ d_1}{6(x-1)^5}-$$

$$\frac{25d_1}{6}\Bigg)H(0,1;\alpha_0)+H(1;x)\ \Bigg(-\frac{\pi^2d_1}{3(x-1)^5}+\Bigg(\frac{2\ d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2\ (x-1)^4}+\frac{25d_1}{6(x-1)^5}+\frac{5}{4(x-1)}-$$

$$\frac{5}{6\ (x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}+\frac{25}{12\ (x-1)^5}-\frac{25}{12}\Bigg)H(0;\alpha_0)+\Bigg(2-\frac{2}{(x-1)^5}\Bigg)\ H(0,0;\alpha_0)+\Bigg(2d_1-$$

$$\frac{2d_1}{(x-1)^5}\Bigg)H(0,1;\alpha_0)+\frac{\pi^2}{6(x-1)^5}+\frac{\pi^2}{6}\Bigg)+\Bigg(\frac{2d_1}{(x-1)^5}-2d_1\ \Bigg)H(0;\alpha_0)H(0,1;x)+\Bigg(-\frac{\alpha_0^4}{2\ (x-1)}+\frac{\alpha_0^4}{2}+$$

$$\frac{2\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}-\ \frac{8\alpha_0^3}{3}-\frac{3\alpha_0^2}{x-1}+\frac{2\ \alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2+\frac{2\ \alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\alpha_0}{(x-1)^3}-\frac{2\ \alpha_0}{(x-1)^4}-8\alpha_0+\Bigg(2-$$

$$\frac{2}{(x-1)^5}\Bigg)H(0;\alpha_0)+\Bigg(2\ d_1-\frac{2d_1}{(x-1)^5}\Bigg)H(1;\alpha_0)+\frac{3}{4(x-1)}-\frac{1}{6\ (x-1)^2}-\frac{1}{6(x-1)^3}+\frac{3}{4(x-1)^4}+\frac{25}{12\ (x-1)^5}+$$

$$\frac{25}{12}\Bigg)H(0,c_1(\alpha_0);x)+\Bigg(-\frac{2\ d_1}{x-1}+\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{d_1}{2\ (x-1)^4}-\frac{25d_1}{6(x-1)^5}-\frac{5}{4(x-1)}+\frac{5}{6\ (x-1)^2}-$$

$$\frac{5}{6(x-1)^3}+\frac{5}{4(x-1)^4}-\frac{25}{12\ (x-1)^5}+\frac{25}{12}\Bigg)H(1,0;x)+\Bigg(\frac{4d_1}{(x-1)^5}-2\ d_1-\frac{1}{(x-1)^5}-1\Bigg)H(0;\alpha_0)H(1,1;x)+$$

$$\Bigg(\frac{2\ d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2\ (x-1)^4}+\frac{25d_1}{6(x-1)^5}+\Bigg(2-\frac{2}{(x-1)^5}\Bigg)\ H(0;\alpha_0)+\Bigg(2d_1-\frac{2d_1}{(x-1)^5}\Bigg)H(1;\alpha_0)+$$

$$\frac{5}{4\ (x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4\ (x-1)^4}+\frac{25}{12(x-1)^5}-\frac{25}{12}\Bigg)\ H(1,c_1(\alpha_0);x)+\Bigg(\frac{3\alpha_0^4}{4(x-1)}-\frac{3\ \alpha_0^4}{4}-\frac{3\alpha_0^3}{x-1}+$$

$$\frac{\alpha_0^3}{(x-1)^2}+4\alpha_0^3+\frac{9\ \alpha_0^2}{2(x-1)}-\frac{3\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{2(x-1)^3}-9\ \alpha_0^2-\frac{3\alpha_0}{x-1}+\frac{3\alpha_0}{(x-1)^2}-\frac{3\ \alpha_0}{(x-1)^3}+\frac{3\alpha_0}{(x-1)^4}+12\alpha_0+\frac{2\ H(0;\alpha_0)}{(x-1)^5}+$$

$$\frac{2d_1H(1;\alpha_0)}{(x-1)^5}-\frac{9}{4\ (x-1)}+\frac{1}{2(x-1)^2}+\frac{1}{2(x-1)^3}-\frac{9}{4\ (x-1)^4}-\frac{25}{4(x-1)^5}-\frac{25}{4}\Bigg)\ H(c_1(\alpha_0),c_1(\alpha_0);x)-$$

$$4H(0,0,0;x)+\Bigg(2d_1-\frac{2\ d_1}{(x-1)^5}\Bigg)H(0,1,0;x)+\Bigg(\frac{2d_1}{(x-1)^5}-2d_1\Bigg)\ H(0,1,c_1(\alpha_0);x)+\Bigg(3-$$

$$\frac{1}{(x-1)^5}\Bigg)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{2}{(x-1)^5}-2\Bigg)\ H(1,0,0;x)+\Bigg(\frac{2d_1}{(x-1)^5}-\frac{1}{(x-1)^5}-$$

$$1\Bigg)\ H(1,0,c_1(\alpha_0);x)+\Bigg(-\frac{4d_1}{(x-1)^5}+2\ d_1+\frac{1}{(x-1)^5}+1\Bigg)H(1,1,0;x)+\Bigg(\frac{4d_1}{(x-1)^5}-2\ d_1-\frac{1}{(x-1)^5}-$$

$$1\Bigg)H(1,1,c_1(\alpha_0);x)+\Bigg(-\frac{2\ d_1}{(x-1)^5}-\frac{1}{(x-1)^5}+3\Bigg)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)-\frac{2\ H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+$$

$$\frac{3\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{8\ (x-1)}+\frac{\pi^2}{36(x-1)^2}+\frac{\pi^2}{36(x-1)^3}-\frac{\pi^2}{8(x-1)^4}-\frac{25\pi^2}{72(x-1)^5}-\frac{3\ \zeta_3}{(x-1)^5}-5\zeta_3-\frac{25\pi^2}{72},$$

$$a_2^{(0,-1)}=-\frac{37}{432}d_1^2\alpha_0^3+\frac{37d_1\alpha_0^3}{216}+\frac{37d_1^2\ \alpha_0^3}{432(x-1)^2}-\frac{37d_1\alpha_0^3}{216(x-1)^2}-\frac{\pi^2\ \alpha_0^3}{72(x-1)^2}+\frac{37\alpha_0^3}{432(x-1)^2}+\frac{\pi^2\ \alpha_0^3}{72}-\frac{37\alpha_0^3}{432}+$$

$$\frac{715d_1^2\alpha_0^2}{864}-\frac{52\ d_1\alpha_0^2}{27}+\frac{115d_1^2\alpha_0^2}{864(x-1)}+\frac{d_1\alpha_0^2}{216\ (x-1)}-\frac{\pi^2\alpha_0^2}{144(x-1)}-\frac{119\alpha_0^2}{864\ (x-1)}-\frac{107d_1^2\alpha_0^2}{864(x-1)^2}+\frac{14d_1\alpha_0^2}{27\ (x-1)^2}+\frac{5\pi^2\alpha_0^2}{144(x-1)^2}-$$

$$\frac{341\alpha_0^2}{864\ (x-1)^2}+\frac{493d_1^2\alpha_0^2}{864(x-1)^3}-\frac{305d_1\alpha_0^2}{216\ (x-1)^3}-\frac{7\pi^2\alpha_0^2}{144(x-1)^3}+\frac{727\alpha_0^2}{864\ (x-1)^3}-\frac{13\pi^2\alpha_0^2}{144}+\frac{949\alpha_0^2}{864}-\frac{3515\ d_1^2\alpha_0}{432}+$$

$$\frac{8965d_1\alpha_0}{432}-\frac{265d_1^2\alpha_0}{108\ (x-1)}+\frac{263d_1\alpha_0}{108(x-1)}+\frac{\pi^2\alpha_0}{18\ (x-1)}+\frac{65\alpha_0}{108(x-1)}-\frac{d_1^2\alpha_0}{108\ (x-1)^2}-\frac{113d_1\alpha_0}{216(x-1)^2}-\frac{\pi^2\alpha_0}{36\ (x-1)^2}+$$

$$\frac{115\alpha_0}{216(x-1)^2}+\frac{113d_1^2\alpha_0}{108\ (x-1)^3}+\frac{41d_1\alpha_0}{108(x-1)^3}+\frac{\pi^2\alpha_0}{18\ (x-1)^3}-\frac{217\alpha_0}{108(x-1)^3}+\frac{2911d_1^2\alpha_0}{432\ (x-1)^4}-\frac{7523d_1\alpha_0}{432(x-1)^4}-\frac{13\pi^2\alpha_0}{72\ (x-1)^4}+$$

$$\frac{2369\alpha_0}{216(x-1)^4}+\frac{23\pi^2\ \alpha_0}{72}-\frac{697\alpha_0}{54}+\Bigg(-\frac{7d_1\alpha_0^3}{36}+\frac{7d_1\ \alpha_0^3}{36(x-1)^2}-\frac{7\alpha_0^3}{36(x-1)^2}+\frac{7\ \alpha_0^3}{36}+\frac{109d_1\alpha_0^2}{72}+\frac{13d_1\alpha_0^2}{72\ (x-1)}+\frac{5\alpha_0^2}{72(x-1)}-$$

$$\frac{29d_1\alpha_0^2}{72\ (x-1)^2}+\frac{47\alpha_0^2}{72(x-1)^2}+\frac{67d_1\alpha_0^2}{72(x-1)^3}-\frac{85\alpha_0^2}{72(x-1)^3}-\frac{127\alpha_0^2}{72}-\frac{305d_1\ \alpha_0}{36}-\frac{19d_1\alpha_0}{9(x-1)}+\frac{4\alpha_0}{9(x-1)}+\frac{2d_1\ \alpha_0}{9(x-1)^2}-$$

$$\frac{13\alpha_0}{18(x-1)^2}-\frac{d_1\alpha_0}{9\ (x-1)^3}+\frac{16\alpha_0}{9(x-1)^3}+\frac{217d_1\alpha_0}{36\ (x-1)^4}-\frac{149\alpha_0}{18(x-1)^4}+\frac{101\alpha_0}{9}+\frac{2035\ d_1^2}{432}-\frac{5615d_1}{432}+\frac{63d_1^2}{16(x-1)}-\frac{209\ d_1}{48(x-1)}-$$

$$\frac{\pi^2}{8(x-1)}-\frac{2}{x-1}-\frac{19\ d_1^2}{54(x-1)^2}+\frac{347d_1}{216(x-1)^2}+\frac{\pi^2}{36\ (x-1)^2}-\frac{19}{216(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}+\frac{173\ d_1}{216(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-$$

$$\frac{205}{216\ (x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{197d_1}{16\ (x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{163}{24(x-1)^4}+\frac{2035\ d_1^2}{432(x-1)^5}-\frac{8705d_1}{432(x-1)^5}-\frac{25\pi^2}{72\ (x-1)^5}+$$

$$\frac{3965}{216(x-1)^5}-\frac{25\pi^2}{72}+\frac{235}{27}\Big)H(0;\alpha_0)+\Big(-\frac{7}{36}d_1^2\alpha_0^3+\frac{7d_1\alpha_0^3}{36}+\frac{7d_1^2\alpha_0^3}{36(x-1)^2}-\frac{7d_1\alpha_0^3}{36\ (x-1)^2}+\frac{109d_1^2\alpha_0^2}{72}-$$

$$\frac{127d_1\alpha_0^2}{72}+\frac{13\ d_1^2\alpha_0^2}{72(x-1)}+\frac{5d_1\alpha_0^2}{72(x-1)}-\frac{29d_1^2\ \alpha_0^2}{72(x-1)^2}+\frac{47d_1\alpha_0^2}{72(x-1)^2}+\frac{67d_1^2\ \alpha_0^2}{72(x-1)^3}-\frac{85d_1\alpha_0^2}{72(x-1)^3}-\frac{305d_1^2\ \alpha_0}{36}+\frac{101d_1\alpha_0}{9}-$$

$$\frac{19d_1^2\alpha_0}{9(x-1)}+\frac{4\ d_1\alpha_0}{9(x-1)}+\frac{2d_1^2\alpha_0}{9(x-1)^2}-\frac{13d_1\alpha_0}{18\ (x-1)^2}-\frac{d_1^2\alpha_0}{9(x-1)^3}+\frac{16d_1\alpha_0}{9\ (x-1)^3}+\frac{217d_1^2\alpha_0}{36(x-1)^4}-\frac{149d_1\alpha_0}{18\ (x-1)^4}+\frac{515d_1^2}{72}-\frac{695d_1}{72}+$$

$$\frac{139d_1^2}{72\ (x-1)}-\frac{37d_1}{72(x-1)}-\frac{d_1^2}{72(x-1)^2}+\frac{19\ d_1}{72(x-1)^2}-\frac{59d_1^2}{72(x-1)^3}-\frac{43d_1}{72\ (x-1)^3}-\frac{217d_1^2}{36(x-1)^4}+\frac{149d_1}{18(x-1)^4}\Big)H(1;\alpha_0)+$$

$$\Big(\frac{\alpha_0^3}{3(x-1)^2}-\frac{\alpha_0^3}{3}+\frac{\alpha_0^2}{6\ (x-1)}-\frac{5\alpha_0^2}{6(x-1)^2}+\frac{7\alpha_0^2}{6(x-1)^3}+\frac{13\ \alpha_0^2}{6}-\frac{4\alpha_0}{3(x-1)}+\frac{2\alpha_0}{3(x-1)^2}-\frac{4\ \alpha_0}{3(x-1)^3}+\frac{13\alpha_0}{3(x-1)^4}-\frac{23\alpha_0}{3}+$$

$$\frac{205\ d_1}{36}+\frac{15d_1}{4(x-1)}-\frac{1}{2(x-1)}-\frac{5d_1}{9\ (x-1)^2}+\frac{7}{18(x-1)^2}-\frac{5d_1}{9(x-1)^3}+\frac{13}{18\ (x-1)^3}+\frac{15d_1}{4(x-1)^4}-\frac{6}{(x-1)^4}+\frac{205d_1}{36\ (x-1)^5}-$$

$$\frac{130}{9(x-1)^5}-\frac{155}{18}\Big)H(0,0;\alpha_0)+\Big(-\frac{15d_1}{4(x-1)}+\frac{5d_1}{9\ (x-1)^2}+\frac{5d_1}{9(x-1)^3}-\frac{15d_1}{4(x-1)^4}-\frac{205\ d_1}{36(x-1)^5}-\frac{205d_1}{36}+\frac{1}{2(x-1)}-$$

$$\frac{7}{18\ (x-1)^2}-\frac{13}{18(x-1)^3}+\frac{6}{(x-1)^4}-\frac{2\pi^2}{3\ (x-1)^5}+\frac{130}{9(x-1)^5}-\frac{\pi^2}{3}+\frac{155}{18}\Big)H(0,0;x)+\Big(-\frac{d_1\alpha_0^3}{3}+\frac{d_1\alpha_0^3}{3\ (x-1)^2}+$$

$$\frac{13d_1\alpha_0^2}{6}+\frac{d_1\alpha_0^2}{6(x-1)}-\frac{5d_1\ \alpha_0^2}{6(x-1)^2}+\frac{7d_1\alpha_0^2}{6(x-1)^3}-\frac{23d_1\alpha_0}{3}-\frac{4d_1\alpha_0}{3(x-1)}+\frac{2d_1\alpha_0}{3(x-1)^2}-\frac{4d_1\ \alpha_0}{3(x-1)^3}+\frac{13d_1\alpha_0}{3(x-1)^4}+\frac{205\ d_1^2}{36}-$$

$$\frac{155d_1}{18}+\frac{15d_1^2}{4(x-1)}-\frac{d_1}{2\ (x-1)}-\frac{5d_1^2}{9(x-1)^2}+\frac{7d_1}{18(x-1)^2}-\frac{5\ d_1^2}{9(x-1)^3}+\frac{13d_1}{18(x-1)^3}+\frac{15d_1^2}{4\ (x-1)^4}-\frac{6d_1}{(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-$$

$$\frac{130\ d_1}{9(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(\frac{\pi^2d_1}{3\ (x-1)^5}+\frac{\pi^2d_1}{3}+\Big(\frac{5d_1}{2(x-1)}-\frac{5\ d_1}{3(x-1)^2}+\frac{5d_1}{3(x-1)^3}-\frac{5d_1}{2\ (x-1)^4}+\frac{25d_1}{6(x-1)^5}-\frac{25d_1}{6}+$$

$$\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2\ (x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)H(0;\alpha_0)+\Big(4\ d_1-\frac{4d_1}{(x-1)^5}\Big)H(0,0;\alpha_0)+$$

$$\Big(4d_1^2-\frac{4\ d_1^2}{(x-1)^5}\Big)H(0,1;\alpha_0)-\frac{2\pi^2}{3(x-1)^5}\Big)H(0,1;x)+\Big(-\frac{d_1\alpha_0^3}{3}+\frac{d_1\alpha_0^3}{3\ (x-1)^2}+\frac{13d_1\alpha_0^2}{6}+\frac{d_1\alpha_0^2}{6(x-1)}-\frac{5d_1\ \alpha_0^2}{6(x-1)^2}+$$

$$\frac{7d_1\alpha_0^2}{6(x-1)^3}-\frac{23d_1\alpha_0}{3}-\frac{4d_1\alpha_0}{3(x-1)}+\frac{2d_1\alpha_0}{3(x-1)^2}-\frac{4d_1\ \alpha_0}{3(x-1)^3}+\frac{13d_1\alpha_0}{3(x-1)^4}+\frac{35d_1}{6}+\frac{7\ d_1}{6(x-1)}-\frac{d_1}{6(x-1)^2}+\frac{d_1}{6(x-1)^3}-$$

$$\frac{13\ d_1}{3(x-1)^4}\Big)H(1,0;\alpha_0)+\Big(\frac{4\ d_1^2}{x-1}-\frac{d_1^2}{(x-1)^2}+\frac{4d_1^2}{9\ (x-1)^3}-\frac{d_1^2}{4(x-1)^4}+\frac{205d_1^2}{36\ (x-1)^5}-\frac{97d_1}{24(x-1)}+\frac{157d_1}{36(x-1)^2}-$$

$$\frac{137\ d_1}{36(x-1)^3}+\frac{19d_1}{8(x-1)^4}+\frac{2\pi^2d_1}{3\ (x-1)^5}-\frac{835d_1}{72(x-1)^5}-\frac{205d_1}{72}-\frac{97}{12\ (x-1)}+\frac{179}{36(x-1)^2}-\frac{179}{36(x-1)^3}+\frac{97}{12\ (x-1)^4}-$$

$$\frac{\pi^2}{6(x-1)^5}-\frac{155}{36(x-1)^5}-\frac{\pi^{\ 2}}{2}+\frac{155}{36}\Big)H(1,0;x)+\Big(-\frac{1}{3}d_1^2\ \alpha_0^3+\frac{d_1^2\alpha_0^3}{3(x-1)^2}+\frac{13d_1^2\ \alpha_0^2}{6}+\frac{d_1^2\alpha_0^2}{6(x-1)}-\frac{5d_1^2\alpha_0^2}{6\ (x-1)^2}+$$

$$\frac{7d_1^2\alpha_0^2}{6(x-1)^3}-\frac{23d_1^2\ \alpha_0}{3}-\frac{4d_1^2\alpha_0}{3(x-1)}+\frac{2d_1^2\alpha_0}{3\ (x-1)^2}-\frac{4d_1^2\alpha_0}{3(x-1)^3}+\frac{13d_1^2\alpha_0}{3\ (x-1)^4}+\frac{35d_1^2}{6}+\frac{7d_1^2}{6(x-1)}-\frac{d_1^2}{6\ (x-1)^2}+\frac{d_1^2}{6(x-1)^3}-$$

$$\frac{13d_1^2}{3(x-1)^4}\Big)H(1,1;\alpha_0)+H(0,c_1(\alpha_0);x)\Big(-\frac{d_1\alpha_0^4}{4}+\frac{d_1\ \alpha_0^4}{4(x-1)}-\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}+\frac{13d_1\ \alpha_0^3}{9}-\frac{d_1\alpha_0^3}{x-1}+\frac{5\alpha_0^3}{3(x-1)}+$$

$$\frac{4d_1\ \alpha_0^3}{9(x-1)^2}-\frac{7\alpha_0^3}{9(x-1)^2}-\frac{16\ \alpha_0^3}{9}-\frac{23d_1\alpha_0^2}{6}+\frac{3d_1\alpha_0^2}{2(x-1)}-\frac{14\ \alpha_0^2}{3(x-1)}-\frac{4d_1\alpha_0^2}{3(x-1)^2}+\frac{7\alpha_0^2}{2\ (x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{13\alpha_0^2}{6(x-1)^3}+6\ \alpha_0^2+$$

$$\frac{25d_1\alpha_0}{3}-\frac{d_1\alpha_0}{x-1}+\frac{25\alpha_0}{3\ (x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{22\alpha_0}{3(x-1)^2}-\frac{2\ d_1\alpha_0}{(x-1)^3}+\frac{22\alpha_0}{3(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{25\alpha_0}{3(x-1)^4}-16\alpha_0-\frac{205\ d_1}{72}+$$

$$\Big(\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{4\alpha_0^3}{x-1}+\frac{4\ \alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}+\frac{6\alpha_0^2}{x-1}-\frac{4\ \alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\frac{4\ \alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\ \alpha_0}{(x-1)^4}+$$

$$16\alpha_0-\frac{3}{2(x-1)}+\frac{1}{3(x-1)^2}+\frac{1}{3\ (x-1)^3}-\frac{3}{2(x-1)^4}-\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)H(0;\alpha_0)+\Big(-d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}+\frac{16d_1\ \alpha_0^3}{3}-$$

$$\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}-12\ d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2\ d_1\alpha_0^2}{(x-1)^3}+16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\ \alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\ \alpha_0}{(x-1)^4}-$$

$$\frac{25d_1}{6}-\frac{3d_1}{2(x-1)}+\frac{d_1}{3\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{3d_1}{2(x-1)^4}-\frac{25\ d_1}{6(x-1)^5}\Big)H(1;\alpha_0)+\Big(\frac{4}{(x-1)^5}-4\Big)H(0,0;\alpha_0)+$$

$$\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(0,1;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2\Big)H(1,1;\alpha_0)-\frac{15d_1}{8(x-1)}+$$

$$\frac{3}{x-1}+\frac{5d_1}{18\ (x-1)^2}-\frac{13}{36(x-1)^2}+\frac{5d_1}{18(x-1)^3}-\frac{7}{36\ (x-1)^3}-\frac{15d_1}{8(x-1)^4}+\frac{1}{4(x-1)^4}-\frac{205\ d_1}{72(x-1)^5}-\frac{\pi^2}{6(x-1)^5}+$$

$$\frac{155}{36\ (x-1)^5}+\frac{\pi^2}{6}+\frac{65}{9}\Big)+H(c_1(\alpha_0);x)\Big(\frac{d_1^2\alpha_0^4}{16}-\frac{d_1\alpha_0^4}{8}-\frac{d_1^2\alpha_0^4}{16\ (x-1)}+\frac{d_1\alpha_0^4}{8(x-1)}+\frac{\pi^2\alpha_0^4}{24(x-1)}-\frac{\alpha_0^4}{16(x-1)}-\frac{\pi^2\alpha_0^4}{24}+$$



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$$\frac{\alpha_0^4}{16}-\frac{43\ d_1^2\alpha_0^3}{108}+\frac{193d_1\alpha_0^3}{216}+\frac{d_1^2\alpha_0^3}{4\ (x-1)}-\frac{8d_1\alpha_0^3}{9(x-1)}-\frac{\pi^2\alpha_0^3}{6\ (x-1)}+\frac{23\alpha_0^3}{36(x-1)}-\frac{4d_1^2\alpha_0^3}{27\ (x-1)^2}+\frac{127d_1\alpha_0^3}{216(x-1)^2}+\frac{\pi^2\alpha_0^3}{18\ (x-1)^2}-$$

$$\frac{95\alpha_0^3}{216(x-1)^2}+\frac{2\pi^2\ \alpha_0^3}{9}-\frac{107\alpha_0^3}{216}+\frac{95d_1^2\alpha_0^2}{72}-\frac{163\ d_1\alpha_0^2}{48}-\frac{3d_1^2\alpha_0^2}{8(x-1)}+\frac{47d_1\alpha_0^2}{16\ (x-1)}+\frac{\pi^2\alpha_0^2}{4(x-1)}-\frac{47\alpha_0^2}{16(x-1)}+\frac{4\ d_1^2\alpha_0^2}{9(x-1)^2}-$$

$$\frac{125d_1\alpha_0^2}{48(x-1)^2}-\frac{\pi^2\ \alpha_0^2}{6(x-1)^2}+\frac{401\alpha_0^2}{144(x-1)^2}-\frac{d_1^2\alpha_0^2}{2\ (x-1)^3}+\frac{115d_1\alpha_0^2}{48(x-1)^3}+\frac{\pi^2\alpha_0^2}{12\ (x-1)^3}-\frac{35\alpha_0^2}{16(x-1)^3}-\frac{\pi^2\alpha_0^2}{2}+\frac{305\ \alpha_0^2}{144}-$$

$$\frac{205d_1^2\alpha_0}{36}+\frac{125d_1\ \alpha_0}{8}+\frac{d_1^2\alpha_0}{4(x-1)}-\frac{53d_1\alpha_0}{6\ (x-1)}-\frac{\pi^2\alpha_0}{6(x-1)}+\frac{47\alpha_0}{4(x-1)}-\frac{4\ d_1^2\alpha_0}{9(x-1)^2}+\frac{7d_1\alpha_0}{(x-1)^2}+\frac{\pi^2\alpha_0}{6\ (x-1)^2}-\frac{389\alpha_0}{36(x-1)^2}+$$

$$\frac{d_1^2\ \alpha_0}{(x-1)^3}-\frac{49d_1\alpha_0}{6(x-1)^3}-\frac{\pi^2\alpha_0}{6\ (x-1)^3}+\frac{34\alpha_0}{3(x-1)^3}-\frac{4d_1^2\ \alpha_0}{(x-1)^4}+\frac{409d_1\alpha_0}{24(x-1)^4}+\frac{\pi^2\alpha_0}{6\ (x-1)^4}-\frac{47\alpha_0}{3(x-1)^4}+\frac{2\pi^2\alpha_0}{3}-\frac{187\ \alpha_0}{18}+$$

$$\frac{2035d_1^2}{432}-\frac{5615d_1}{432}+\Big(\frac{d_1\ \alpha_0^4}{4}-\frac{d_1\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{4}-\frac{13d_1\alpha_0^3}{9}+\frac{d_1\ \alpha_0^3}{x-1}-\frac{5\alpha_0^3}{3(x-1)}-\frac{4d_1\alpha_0^3}{9\ (x-1)^2}+\frac{17\alpha_0^3}{18(x-1)^2}+$$

$$\frac{29\alpha_0^3}{18}+\frac{23d_1\ \alpha_0^2}{6}-\frac{3d_1\alpha_0^2}{2(x-1)}+\frac{19\alpha_0^2}{4\ (x-1)}+\frac{4d_1\alpha_0^2}{3(x-1)^2}-\frac{47\alpha_0^2}{12\ (x-1)^2}-\frac{d_1\alpha_0^2}{(x-1)^3}+\frac{11\alpha_0^2}{4\ (x-1)^3}-\frac{59\alpha_0^2}{12}-\frac{25d_1\alpha_0}{3}+\frac{d_1\ \alpha_0}{x-1}-$$

$$\frac{9\alpha_0}{x-1}-\frac{4d_1\alpha_0}{3(x-1)^2}+\frac{23\ \alpha_0}{3(x-1)^2}+\frac{2d_1\alpha_0}{(x-1)^3}-\frac{8\ \alpha_0}{(x-1)^3}-\frac{4d_1\alpha_0}{(x-1)^4}+\frac{21\alpha_0}{2\ (x-1)^4}+\frac{73\alpha_0}{6}+\frac{205d_1}{36}+\frac{15d_1}{4\ (x-1)}-\frac{1}{2(x-1)}-$$

$$\frac{5d_1}{9(x-1)^2}+\frac{7}{18\ (x-1)^2}-\frac{5d_1}{9(x-1)^3}+\frac{13}{18(x-1)^3}+\frac{15\ d_1}{4(x-1)^4}-\frac{6}{(x-1)^4}+\frac{205d_1}{36\ (x-1)^5}-\frac{130}{9(x-1)^5}-\frac{155}{18}\Big)\ H(0;\alpha_0)+$$

$$\Big(\frac{d_1^2\alpha_0^4}{4}-\frac{d_1\alpha_0^4}{4}-\frac{d_1^2\ \alpha_0^4}{4(x-1)}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{13d_1^2\ \alpha_0^3}{9}+\frac{29d_1\alpha_0^3}{18}+\frac{d_1^2\alpha_0^3}{x-1}-\frac{5d_1\ \alpha_0^3}{3(x-1)}-\frac{4d_1^2\alpha_0^3}{9(x-1)^2}+\frac{17d_1\ \alpha_0^3}{18(x-1)^2}+\frac{23d_1^2\alpha_0^2}{6}-$$

$$\frac{59d_1\ \alpha_0^2}{12}-\frac{3d_1^2\alpha_0^2}{2(x-1)}+\frac{19d_1\alpha_0^2}{4\ (x-1)}+\frac{4d_1^2\alpha_0^2}{3(x-1)^2}-\frac{47d_1\alpha_0^2}{12\ (x-1)^2}-\frac{d_1^2\alpha_0^2}{(x-1)^3}+\frac{11d_1\alpha_0^2}{4\ (x-1)^3}-\frac{25d_1^2\alpha_0}{3}+\frac{73d_1\alpha_0}{6}+\frac{d_1^2\ \alpha_0}{x-1}-$$

$$\frac{9d_1\alpha_0}{x-1}-\frac{4d_1^2\alpha_0}{3\ (x-1)^2}+\frac{23d_1\alpha_0}{3(x-1)^2}+\frac{2d_1^2\ \alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^3}-\frac{4d_1^2\ \alpha_0}{(x-1)^4}+\frac{21d_1\alpha_0}{2(x-1)^4}+\frac{205\ d_1^2}{36}-\frac{155d_1}{18}+\frac{15d_1^2}{4(x-1)}-\frac{d_1}{2\ (x-1)}-$$

$$\frac{5d_1^2}{9(x-1)^2}+\frac{7d_1}{18(x-1)^2}-\frac{5\ d_1^2}{9(x-1)^3}+\frac{13d_1}{18(x-1)^3}+\frac{15d_1^2}{4\ (x-1)^4}-\frac{6d_1}{(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{130\ d_1}{9(x-1)^5}\Big)H(1;\alpha_0)+\Big(-$$

$$\frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\ \alpha_0^3}{x-1}-\frac{4\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-\frac{6\ \alpha_0^2}{x-1}+\frac{4\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\ \alpha_0}{(x-1)^4}-$$

$$16\alpha_0+\frac{3}{x-1}-\frac{2}{3(x-1)^2}-\frac{2}{3\ (x-1)^3}+\frac{3}{(x-1)^4}+\frac{25}{3(x-1)^5}+\frac{25}{3}\Big)\ H(0,0;\alpha_0)+\Big(d_1\alpha_0^4-\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\ \alpha_0^3}{3}+$$

$$\frac{4d_1\alpha_0^3}{x-1}-\frac{4d_1\alpha_0^3}{3(x-1)^2}+12\ d_1\alpha_0^2-\frac{6d_1\alpha_0^2}{x-1}+\frac{4d_1\alpha_0^2}{(x-1)^2}-\frac{2\ d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0+\frac{4d_1\alpha_0}{x-1}-\frac{4d_1\ \alpha_0}{(x-1)^2}+\frac{4d_1\alpha_0}{(x-1)^3}-\frac{4d_1\ \alpha_0}{(x-1)^4}+$$

$$\frac{25d_1}{3}+\frac{3d_1}{x-1}-\frac{2d_1}{3\ (x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}+\frac{25\ d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(d_1\alpha_0^4-\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}+\frac{4d_1\alpha_0^3}{x-1}-$$

$$\frac{4d_1\alpha_0^3}{3\ (x-1)^2}+12d_1\alpha_0^2-\frac{6d_1\alpha_0^2}{x-1}+\frac{4d_1\ \alpha_0^2}{(x-1)^2}-\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0+\frac{4d_1\ \alpha_0}{x-1}-\frac{4d_1\alpha_0}{(x-1)^2}+\frac{4d_1\alpha_0}{(x-1)^3}-\frac{4\ d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{3}+$$

$$\frac{3d_1}{x-1}-\frac{2d_1}{3\ (x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}+\frac{25\ d_1}{3(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(d_1^2\alpha_0^4-\frac{d_1^2\ \alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}+\frac{4d_1^2\ \alpha_0^3}{x-1}-$$

$$\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2-\frac{6\ d_1^2\alpha_0^2}{x-1}+\frac{4d_1^2\alpha_0^2}{(x-1)^2}-\frac{2d_1^2\ \alpha_0^2}{(x-1)^3}-16d_1^2\alpha_0+\frac{4d_1^2\alpha_0}{x-1}-\frac{4d_1^2\ \alpha_0}{(x-1)^2}+\frac{4d_1^2\alpha_0}{(x-1)^3}-\frac{4d_1^2\ \alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+$$

$$\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3\ (x-1)^2}-\frac{2d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25\ d_1^2}{3(x-1)^5}\Big)H(1,1;\alpha_0)+\frac{63d_1^2}{16(x-1)}-\frac{209\ d_1}{48(x-1)}-\frac{\pi^2}{8(x-1)}-\frac{2}{x-1}-$$

$$\frac{19\ d_1^2}{54(x-1)^2}+\frac{347d_1}{216(x-1)^2}+\frac{\pi^2}{36\ (x-1)^2}-\frac{19}{216(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}+\frac{173\ d_1}{216(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-\frac{205}{216\ (x-1)^3}+$$

$$\frac{63d_1^2}{16(x-1)^4}-\frac{197d_1}{16\ (x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{163}{24(x-1)^4}+\frac{2035\ d_1^2}{432(x-1)^5}-\frac{8705d_1}{432(x-1)^5}-\frac{25\pi^2}{72\ (x-1)^5}+\frac{3965}{216(x-1)^5}-\frac{25\pi^2}{72}+$$

$$\frac{235}{27}\Big)+\Big(-\frac{2\pi^2d_1^2}{3(x-1)^5}+\frac{2\pi^2d_1}{3\ (x-1)^5}+\frac{\pi^2d_1}{3}+\Big(\frac{4d_1^2}{x-1}-\frac{2\ d_1^2}{(x-1)^2}+\frac{4d_1^2}{3\ (x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{9\ d_1}{2(x-1)}-$$

$$\frac{8d_1}{3(x-1)^2}+\frac{7d_1}{3(x-1)^3}-\frac{3\ d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}-\frac{25d_1}{6}-\frac{1}{4\ (x-1)}-\frac{1}{2(x-1)^2}+\frac{7}{6(x-1)^3}-\frac{11}{4\ (x-1)^4}-\frac{25}{12(x-1)^5}-$$

$$\frac{25}{4}\Big)\ H(0;\alpha_0)+\Big(-\frac{8d_1}{(x-1)^5}+4d_1+\frac{2}{(x-1)^5}+2\Big)\ H(0,0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{2\ d_1}{(x-1)^5}+$$

$$2d_1\Big)H(0,1;\alpha_0)-\frac{\pi^2}{6\ (x-1)^5}-\frac{\pi^2}{6}\Big)H(1,1;x)+\Big(-\frac{4\ d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9\ (x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\ (x-1)^5}+$$

$$\frac{97d_1}{24(x-1)}-\frac{157d_1}{36(x-1)^2}+\frac{137\ d_1}{36(x-1)^3}-\frac{19d_1}{8(x-1)^4}+\frac{835d_1}{72(x-1)^5}+\frac{205d_1}{72}+\Big(-\frac{4d_1}{x-1}+\frac{2\ d_1}{(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{d_1}{(x-1)^4}-$$

$$\frac{25\ d_1}{3(x-1)^5}-\frac{5}{2(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3\ (x-1)^3}+\frac{5}{2(x-1)^4}-\frac{25}{6(x-1)^5}+\frac{25}{6}\Big)\ H(0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-$$

$$\frac{4\ d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3\ (x-1)^5}-\frac{5d_1}{2(x-1)}+\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3\ (x-1)^3}+\frac{5d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25\ d_1}{6}\Big)H(1;\alpha_0)+$$

$$\Big(\frac{4}{(x-1)^5}-4\Big)\ H(0,0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)\ H(0,1;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)\ H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-$$

$$4d_1^2\Big)\ H(1,1;\alpha_0)+\frac{97}{12(x-1)}-\frac{179}{36(x-1)^2}+\frac{179}{36\ (x-1)^3}-\frac{97}{12(x-1)^4}-\frac{\pi^2}{6(x-1)^5}+\frac{155}{36\ (x-1)^5}+\frac{\pi^2}{6}-$$

$$\frac{155}{36}\Big) H(1,c_1(\alpha_0);x)+\Big(\frac{3d_1\alpha_0^4}{8}-\frac{3d_1\alpha_0^4}{8(x-1)}+\frac{3\alpha_0^4}{8(x-1)}-\frac{3\alpha_0^4}{8}-\frac{13d_1\alpha_0^3}{6}+\frac{3d_1\alpha_0^3}{2(x-1)}-\frac{5\alpha_0^3}{2(x-1)}-\frac{2d_1\alpha_0^3}{3(x-1)^2}+$$

$$\frac{5\alpha_0^3}{4(x-1)^2}+\frac{31\alpha_0^3}{12}+\frac{23d_1\alpha_0^2}{4}-\frac{9d_1\alpha_0^2}{4(x-1)}+\frac{169\alpha_0^2}{24(x-1)}+\frac{2d_1\alpha_0^2}{(x-1)^2}-\frac{131\alpha_0^2}{24(x-1)^2}-\frac{3d_1\alpha_0^2}{2(x-1)^3}+\frac{85\alpha_0^2}{24(x-1)^3}-\frac{203\alpha_0^2}{24}-$$

$$\frac{25d_1\alpha_0}{2}+\frac{3d_1\alpha_0}{2(x-1)}-\frac{77\alpha_0}{6(x-1)}-\frac{2d_1\alpha_0}{(x-1)^2}+\frac{67\alpha_0}{6(x-1)^2}+\frac{3d_1\alpha_0}{(x-1)^3}-\frac{34\alpha_0}{3(x-1)^3}-\frac{6d_1\alpha_0}{(x-1)^4}+\frac{163\alpha_0}{12(x-1)^4}+\frac{265\alpha_0}{12}+$$

$$\frac{205d_1}{24}+\Big(-\frac{3\alpha_0^4}{2(x-1)}+\frac{3\alpha_0^4}{2}+\frac{6\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{(x-1)^2}-8\alpha_0^3-\frac{9\alpha_0^2}{x-1}+\frac{6\alpha_0^2}{(x-1)^2}-\frac{3\alpha_0^2}{(x-1)^3}+18\alpha_0^2+\frac{6\alpha_0}{x-1}-\frac{6\alpha_0}{(x-1)^2}+$$

$$\frac{6\alpha_0}{(x-1)^3}-\frac{6\alpha_0}{(x-1)^4}-24\alpha_0+\frac{9}{2(x-1)}-\frac{1}{(x-1)^2}-\frac{1}{(x-1)^3}+\frac{9}{2(x-1)^4}+\frac{25}{2(x-1)^5}+\frac{25}{2}\Big)H(0;\alpha_0)+\Big(\frac{3d_1\alpha_0^4}{2}-$$

$$\frac{3d_1\alpha_0^4}{2(x-1)}-8d_1\alpha_0^3+\frac{6d_1\alpha_0^3}{x-1}-\frac{2d_1\alpha_0^3}{(x-1)^2}+18d_1\alpha_0^2-\frac{9d_1\alpha_0^2}{x-1}+\frac{6d_1\alpha_0^2}{(x-1)^2}-\frac{3d_1\alpha_0^2}{(x-1)^3}-24d_1\alpha_0+\frac{6d_1\alpha_0}{x-1}-\frac{6d_1\alpha_0}{(x-1)^2}+$$

$$\frac{6d_1\alpha_0}{(x-1)^3}-\frac{6d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{2}+\frac{9d_1}{2(x-1)}-\frac{d_1}{(x-1)^2}-\frac{d_1}{(x-1)^3}+\frac{9d_1}{2(x-1)^4}+\frac{25d_1}{2(x-1)^5}\Big)H(1;\alpha_0)-\frac{4H(0,0;\alpha_0)}{(x-1)^5}-$$

$$\frac{4d_1H(0,1;\alpha_0)}{(x-1)^5}-\frac{4d_1H(1,0;\alpha_0)}{(x-1)^5}-\frac{4d_1^2H(1,1;\alpha_0)}{(x-1)^5}+\frac{45d_1}{8(x-1)}-\frac{7}{2(x-1)}-\frac{5d_1}{6(x-1)^2}+\frac{3}{4(x-1)^2}-\frac{5d_1}{6(x-1)^3}+$$

$$\frac{11}{12(x-1)^3}+\frac{45d_1}{8(x-1)^4}-\frac{25}{4(x-1)^4}+\frac{205d_1}{24(x-1)^5}+\frac{\pi^2}{6(x-1)^5}-\frac{75}{4(x-1)^5}-\frac{95}{6}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(\frac{25}{3}+\frac{3}{x-1}-\frac{2}{3(x-1)^2}-\frac{2}{3(x-1)^3}+\frac{3}{(x-1)^4}+\frac{25}{3(x-1)^5}\Big)H(0,0,0;\alpha_0)+\Big(-\frac{25}{3}-\frac{3}{x-1}+\frac{2}{3(x-1)^2}+$$

$$\frac{2}{3(x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3(x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{3d_1}{x-1}-\frac{2d_1}{3(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}+$$

$$\frac{25d_1}{3}\Big)H(0,0,1;\alpha_0)+\Big(\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)H(0,0,1;x)+\Big(-\frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\alpha_0^3}{3(x-1)^2}-$$

$$\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\alpha_0}{(x-1)^4}-16\alpha_0+\frac{3}{2(x-1)}-\frac{1}{3(x-1)^2}-$$

$$\frac{1}{3(x-1)^3}+\frac{3}{2(x-1)^4}+\frac{25}{6(x-1)^5}+\frac{25}{6}\Big)H(0,0,c_1(\alpha_0);x)+\Big(\frac{3d_1}{x-1}-\frac{2d_1}{3(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}+$$

$$\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{3}\Big)H(0,1,0;\alpha_0)+\Big(-\frac{5d_1}{2(x-1)}+\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3(x-1)^3}+\frac{5d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25d_1}{6}-\frac{5}{2(x-1)}+$$

$$\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2(x-1)^4}-\frac{25}{6(x-1)^5}+\frac{25}{6}\Big)H(0,1,0;x)+\Big(\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-\frac{2d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+$$

$$\frac{25d_1^2}{3(x-1)^5}+\frac{25d_1^2}{3}\Big)H(0,1,1;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2-\frac{2d_1}{(x-1)^5}-2d_1+\frac{4}{(x-1)^5}\Big)H(0;\alpha_0)H(0,1,1;x)+$$

$$\Big(\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5d_1}{3(x-1)^3}-\frac{5d_1}{2(x-1)^4}+\frac{25d_1}{6(x-1)^5}-\frac{25d_1}{6}+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(4d_1^2-$$

$$\frac{4d_1^2}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)H(0,1,c_1(\alpha_0);x)+$$

$$\Big(\frac{3\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{2}-\frac{6\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{(x-1)^2}+8\alpha_0^3+\frac{9\alpha_0^2}{x-1}-\frac{6\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}-18\alpha_0^2-\frac{6\alpha_0}{x-1}+\frac{6\alpha_0}{(x-1)^2}-\frac{6\alpha_0}{(x-1)^3}+$$

$$\frac{6\alpha_0}{(x-1)^4}+24\alpha_0+\Big(\frac{2}{(x-1)^5}-6\Big)H(0;\alpha_0)+\Big(\frac{2d_1}{(x-1)^5}-6d_1\Big)H(1;\alpha_0)-\frac{3}{4(x-1)}+\frac{1}{6(x-1)^2}+\frac{1}{6(x-1)^3}-$$

$$\frac{3}{4(x-1)^4}-\frac{25}{12(x-1)^5}-\frac{25}{12}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4d_1}{x-1}-\frac{2d_1}{(x-1)^2}+\frac{4d_1}{3(x-1)^3}-\frac{d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}+$$

$$\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)H(1,0,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{2d_1}{(x-1)^5}-2d_1+$$

$$\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(1,0,1;x)+\Big(\frac{2d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2(x-1)^4}+\frac{25d_1}{6(x-1)^5}+\Big(-\frac{4d_1}{(x-1)^5}+$$

$$\frac{2}{(x-1)^5}+2\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}+2d_1\Big)H(1;\alpha_0)-\frac{1}{4(x-1)}-\frac{1}{2(x-1)^2}+\frac{7}{6(x-1)^3}-$$

$$\frac{11}{4(x-1)^4}-\frac{25}{12(x-1)^5}-\frac{25}{4}\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}-$$

$$\frac{9d_1}{2(x-1)}+\frac{8d_1}{3(x-1)^2}-\frac{7d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{6}+\frac{1}{4(x-1)}+\frac{1}{2(x-1)^2}-\frac{7}{6(x-1)^3}+\frac{11}{4(x-1)^4}+$$

$$\frac{25}{12(x-1)^5}+\frac{25}{4}\Big)H(1,1,0;x)+\Big(\frac{12d_1^2}{(x-1)^5}-4d_1^2-\frac{6d_1}{(x-1)^5}-4d_1+\frac{1}{(x-1)^5}+1\Big)H(0;\alpha_0)H(1,1,1;x)+$$

$$\Big(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{9d_1}{2(x-1)}-\frac{8d_1}{3(x-1)^2}+\frac{7d_1}{3(x-1)^3}-\frac{3d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}-$$

$$\frac{25d_1}{6}+\Big(-\frac{8d_1}{(x-1)^5}+4d_1+\frac{2}{(x-1)^5}+2\Big)H(0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{2d_1}{(x-1)^5}+2d_1\Big)H(1;\alpha_0)-$$

$$\frac{1}{4(x-1)}-\frac{1}{2(x-1)^2}+\frac{7}{6(x-1)^3}-\frac{11}{4(x-1)^4}-\frac{25}{12(x-1)^5}-\frac{25}{4}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{6d_1}{x-1}+\frac{3d_1}{(x-1)^2}-$$

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\frac{2d_1}{(x-1)^3}+\frac{3d_1}{2\ (x-1)^4}-\frac{25d_1}{2(x-1)^5}+\left(\frac{4\ d_1}{(x-1)^5}+\frac{2}{(x-1)^5}-6\right)H(0;\alpha_0)+\left(\frac{4\ d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}-6d_1\right)H(1;\alpha_0)-
\frac{9}{4\ (x-1)}+\frac{13}{6(x-1)^2}-\frac{17}{6(x-1)^3}+\frac{21}{4\ (x-1)^4}-\frac{25}{12(x-1)^5}+\frac{125}{12}\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\left(\frac{\alpha_0^4}{x-1}-\alpha_0^4-\right.
\frac{4\ \alpha_0^3}{x-1}+\frac{4\alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}+\frac{6\ \alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\ \frac{4\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\ \alpha_0}{(x-1)^4}+16\alpha_0+
\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\ H(1;\alpha_0)}{(x-1)^5}-\frac{3}{x-1}+\frac{2}{3(x-1)^2}+\frac{2}{3\ (x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{25}{3}\Big)\ H(c_1(\alpha_0),0,c_1(\alpha_0);x)+
\left(-\frac{7\alpha_0^4}{4(x-1)}+\frac{7\ \alpha_0^4}{4}+\frac{7\alpha_0^3}{x-1}-\frac{7\alpha_0^3}{3(x-1)^2}-\frac{28\ \alpha_0^3}{3}-\frac{21\alpha_0^2}{2(x-1)}+\frac{7\alpha_0^2}{(x-1)^2}-\frac{7\ \alpha_0^2}{2(x-1)^3}+21\alpha_0^2+\frac{7\alpha_0}{x-1}-\frac{7\ \alpha_0}{(x-1)^2}+\right.
\frac{7\alpha_0}{(x-1)^3}-\frac{7\alpha_0}{(x-1)^4}-28\ \alpha_0-\frac{6H(0;\alpha_0)}{(x-1)^5}-\frac{6d_1\ H(1;\alpha_0)}{(x-1)^5}+\frac{21}{4(x-1)}-\frac{7}{6(x-1)^2}-\frac{7}{6\ (x-1)^3}+\frac{21}{4(x-1)^4}+\frac{175}{12\ (x-1)^5}+
\frac{175}{12}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+8\ H(0,0,0,0;x)+\left(\frac{4}{(x-1)^5}-4\right)\ H(0,0,0,c_1(\alpha_0);x)+
\left(4-\frac{4}{(x-1)^5}\right)\ H(0,0,1,0;x)+\left(\frac{4}{(x-1)^5}-4\right)\ H(0,0,1,c_1(\alpha_0);x)-\frac{4\ H(0,0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+
\left(\frac{4d_1}{(x-1)^5}-4d_1\ \right)H(0,1,0,0;x)+\left(-\frac{2d_1}{(x-1)^5}-2\ d_1+\frac{4}{(x-1)^5}\right)H(0,1,0,c_1(\alpha_0);x)+\Big(-
\frac{4\ d_1^2}{(x-1)^5}+4d_1^2+\frac{2d_1}{(x-1)^5}+2d_1-\frac{4}{(x-1)^5}\ \Big)H(0,1,1,0;x)+\left(\frac{4d_1^2}{(x-1)^5}-4d_1^2-\frac{2\ d_1}{(x-1)^5}-2d_1+\right.
\frac{4}{(x-1)^5}\Big)H(0,1,1,c_1(\alpha_0);x)+\left(-\ \frac{2d_1}{(x-1)^5}+6d_1-\frac{4}{(x-1)^5}\right)\ H(0,1,c_1(\alpha_0),c_1(\alpha_0);x)+
4\ H(0,c_1(\alpha_0),0,c_1(\alpha_0);x)+\left(\frac{1}{(x-1)^5}-7\right)\ H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Big(4-
\frac{4}{(x-1)^5}\Big)\ H(1,0,0,0;x)+\left(\frac{2}{(x-1)^5}-2\right)H(1,0,0,c_1(\alpha_0);x)+\Big(-\ \frac{4d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}+2\ d_1-
\frac{2}{(x-1)^5}+2\Big)H(1,0,1,0;x)+\left(\frac{4\ d_1^2}{(x-1)^5}-\frac{2d_1}{(x-1)^5}-2d_1+\frac{2}{(x-1)^5}-2\right)\ H(1,0,1,c_1(\alpha_0);x)+\Big(-
\frac{2\ d_1}{(x-1)^5}+\frac{1}{(x-1)^5}+1\Big)\ H(1,0,c_1(\alpha_0),c_1(\alpha_0);x)+\left(\frac{8d_1}{(x-1)^5}-4\ d_1-\frac{2}{(x-1)^5}-2\right)H(1,1,0,0;x)+
\left(\frac{4\ d_1^2}{(x-1)^5}-\frac{4d_1}{(x-1)^5}-2d_1+\frac{1}{(x-1)^5}+1\right)\ H(1,1,0,c_1(\alpha_0);x)+\left(-\frac{12d_1^2}{(x-1)^5}+4d_1^2+\frac{6\ d_1}{(x-1)^5}+4d_1-\right.
\frac{1}{(x-1)^5}-1\Big)\ H(1,1,1,0;x)+\left(\frac{12d_1^2}{(x-1)^5}-4d_1^2-\frac{6\ d_1}{(x-1)^5}-4d_1+\frac{1}{(x-1)^5}+1\right)\ H(1,1,1,c_1(\alpha_0);x)+
\left(-\ \frac{4d_1^2}{(x-1)^5}-\frac{4\ d_1}{(x-1)^5}+6d_1+\frac{1}{(x-1)^5}+1\right)\ H(1,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(4-
\frac{4d_1}{(x-1)^5}\Big)H(1,c_1(\ \alpha_0),0,c_1(\alpha_0);x)+\left(\frac{6\ d_1}{(x-1)^5}+\frac{1}{(x-1)^5}-7\right)\ H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-
\frac{4\ H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{6\ H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{4\ H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-
\frac{7\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+H(0;x)\ \left(-\frac{63d_1^2}{16(x-1)}+\frac{19d_1^2}{54(x-1)^2}+\frac{19\ d_1^2}{54(x-1)^3}-\frac{63d_1^2}{16(x-1)^4}-\right.
\frac{2035d_1^2}{432\ (x-1)^5}-\frac{2035d_1^2}{432}+\frac{209d_1}{48(x-1)}-\frac{347\ d_1}{216(x-1)^2}-\frac{173d_1}{216(x-1)^3}+\frac{197d_1}{16\ (x-1)^4}+\frac{8705d_1}{432(x-1)^5}+\frac{5615d_1}{432}+\frac{3\ \pi^2}{8(x-1)}+
\frac{2}{x-1}-\frac{\pi^2}{12\ (x-1)^2}+\frac{19}{216(x-1)^2}-\frac{\pi^2}{12\ (x-1)^3}+\frac{205}{216(x-1)^3}+\frac{3\pi^2}{8\ (x-1)^4}-\frac{163}{24(x-1)^4}+\frac{25\pi^2}{24\ (x-1)^5}-\frac{3965}{216(x-1)^5}+
\frac{6\zeta_3}{(x-1)^5}+10\ \zeta_3+\frac{25\pi^2}{24}-\frac{235}{27}\Big)+H(1;x)\ \left(-\frac{\pi^2d_1}{3(x-1)}+\frac{\pi^2d_1}{6\ (x-1)^2}-\frac{\pi^2d_1}{9(x-1)^3}+\frac{\pi^2d_1}{12\ (x-1)^4}-\frac{25\pi^2d_1}{36(x-1)^5}-\right.
\frac{6\zeta_3\ d_1}{(x-1)^5}+\left(-\frac{4d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4\ d_1^2}{9(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\ (x-1)^5}+\frac{97d_1}{24(x-1)}-\frac{157d_1}{36(x-1)^2}+\frac{137\ d_1}{36(x-1)^3}-\right.
\frac{19d_1}{8(x-1)^4}+\frac{835d_1}{72(x-1)^5}+\frac{205d_1}{72}+\frac{97}{12(x-1)}-\frac{179}{36\ (x-1)^2}+\frac{179}{36(x-1)^3}-\frac{97}{12(x-1)^4}-\frac{\pi^2}{6\ (x-1)^5}+\frac{155}{36(x-1)^5}+\frac{\pi^2}{6}-
\frac{155}{36}\Big)\ H(0;\alpha_0)+\left(-\frac{4d_1}{x-1}+\frac{2d_1}{(x-1)^2}-\frac{4d_1}{3\ (x-1)^3}+\frac{d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}-\frac{5}{2\ (x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\right.
\frac{5}{2\ (x-1)^4}-\frac{25}{6(x-1)^5}+\frac{25}{6}\Big)\ H(0,0;\alpha_0)+\left(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4\ d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3\ (x-1)^5}-\frac{5d_1}{2(x-1)}+\right.
\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3\ (x-1)^3}+\frac{5d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25\ d_1}{6}\Big)H(0,1;\alpha_0)+\left(\frac{4}{(x-1)^5}-4\right)\ H(0,0,0;\alpha_0)+
\left(\frac{4d_1}{(x-1)^5}-4d_1\right)H(0,0,1;\alpha_0)+\left(\ \frac{4d_1}{(x-1)^5}-4d_1\right)H(0,1,0;\alpha_0)+\left(\frac{4\ d_1^2}{(x-1)^5}-4d_1^2\right)H(0,1,1;\alpha_0)+
\frac{\pi^2}{24\ (x-1)}+\frac{\pi^2}{12(x-1)^2}-\frac{7\pi^2}{36(x-1)^3}+\frac{11\ \pi^2}{24(x-1)^4}+\frac{25\pi^2}{72\ (x-1)^5}-\frac{\zeta_3}{(x-1)^5}+7\zeta_3+\frac{25\pi^2}{24}\Big)+\ \frac{5d_1\pi^2}{16(x-1)}-\frac{\pi^2}{2(x-1)}-
$$

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$$\frac{5d_1\pi^2}{108(x-1)^2}+\frac{13\pi^2}{216(x-1)^2}-\frac{5d_1\pi^2}{108(x-1)^3}+\frac{7\pi^2}{216(x-1)^3}+\frac{5d_1\pi^2}{16\ (x-1)^4}-\frac{\pi^2}{24(x-1)^4}-\frac{23\pi^4}{180\ (x-1)^5}+\frac{205d_1\pi^2}{432(x-1)^5}-\frac{155\pi^2}{216\ (x-1)^5}-\frac{21\zeta_3}{4(x-1)}+\frac{7\zeta_3}{6\ (x-1)^2}+\frac{7\zeta_3}{6(x-1)^3}-\frac{21\zeta_3}{4\ (x-1)^4}-\frac{175\zeta_3}{12(x-1)^5}-\frac{175\ \zeta_3}{12}-\frac{17\pi^4}{144}+\frac{205d_1\pi^2}{432}-\frac{65\pi^2}{54}.$$

### D.5 The $\mathcal{A}$ integral for $k=-1$ and $\kappa=1$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,2,0,g_A)=x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;1,2)$$
$$=\frac{1}{\varepsilon^2}a_{-2}^{(1,-1)}+\frac{1}{\varepsilon}a_{-1}^{(1,-1)}+a_0^{(1,-1)}+\varepsilon a_1^{(1,-1)}+\varepsilon^2 a_2^{(1,-1)}+\mathcal{O}\left(\varepsilon^3\right), \tag{D.5}$$

where

$$a_{-2}^{(1,-1)}=\tfrac{1}{6},$$

$$a_{-1}^{(1,-1)}=-\tfrac{2}{3}H(0;x),$$

$$a_0^{(1,-1)}=\frac{\alpha_0^3}{12(x-1)^2}-\frac{\alpha_0^3}{12}+\frac{\alpha_0^2}{24\ (x-1)}-\frac{5\alpha_0^2}{24(x-1)^2}+\frac{7\alpha_0^2}{24(x-1)^3}+\frac{13\ \alpha_0^2}{24}-\frac{\alpha_0}{3(x-1)}+\frac{\alpha_0}{6(x-1)^2}-\frac{\alpha_0}{3\ (x-1)^3}+\frac{13\alpha_0}{12(x-1)^4}-\frac{23\ \alpha_0}{12}+\left(\frac{25}{12}+\frac{3}{4(x-1)}-\frac{1}{6\ (x-1)^2}-\frac{1}{6(x-1)^3}+\frac{3}{4(x-1)^4}+\frac{25}{12\ (x-1)^5}\right)H(0;\alpha_0)+\left(-\frac{25}{12}-\frac{3}{4\ (x-1)}+\frac{1}{6(x-1)^2}+\frac{1}{6(x-1)^3}-\frac{3}{4\ (x-1)^4}-\frac{25}{12(x-1)^5}\right)H(0;x)+\left(\frac{1}{(x-1)^5}-1\right)H(0;\alpha_0)\ H(1;x)+\left(-\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}+\frac{\alpha_0^3}{x-1}-\frac{\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}-\frac{3\alpha_0^2}{2\ (x-1)}+\frac{\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{2(x-1)^3}+3\ \alpha_0^2+\frac{\alpha_0}{x-1}-\frac{\alpha_0}{(x-1)^2}+\frac{\alpha_0}{(x-1)^3}-\frac{\alpha_0}{(x-1)^4}-4\alpha_0+\frac{3}{4(x-1)}-\frac{1}{6(x-1)^2}-\frac{1}{6\ (x-1)^3}+\frac{3}{4(x-1)^4}+\frac{25}{12(x-1)^5}+\frac{25}{12}\right)H(c_1(\alpha_0);x)+\frac{8}{3}H(0,0;x)+\left(\frac{1}{(x-1)^5}-1\right)H(0,c_1(\alpha_0);x)+\left(1-\frac{1}{(x-1)^5}\right)H(1,0;x)+\left(\frac{1}{(x-1)^5}-1\right)H(1,c_1(\alpha_0);x)-\frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{6(x-1)^5}+\frac{\pi^2}{36},$$

$$a_1^{(1,-1)}=\frac{7d_1\alpha_0^3}{72}-\frac{7d_1\alpha_0^3}{72(x-1)^2}+\frac{7\ \alpha_0^3}{36(x-1)^2}-\frac{7\alpha_0^3}{36}-\frac{109d_1\ \alpha_0^2}{144}-\frac{13d_1\alpha_0^2}{144(x-1)}-\frac{\alpha_0^2}{36\ (x-1)}+\frac{29d_1\alpha_0^2}{144(x-1)^2}-\frac{11\alpha_0^2}{18\ (x-1)^2}-\frac{67d_1\alpha_0^2}{144(x-1)^3}+\frac{41\alpha_0^2}{36\ (x-1)^3}+\frac{31\alpha_0^2}{18}+\frac{305d_1\alpha_0}{72}+\frac{19d_1\ \alpha_0}{18(x-1)}-\frac{25\alpha_0}{36(x-1)}-\frac{d_1\alpha_0}{9\ (x-1)^2}+\frac{23\alpha_0}{36(x-1)^2}+\frac{d_1\alpha_0}{18\ (x-1)^3}-\frac{55\alpha_0}{36(x-1)^3}-\frac{217d_1\alpha_0}{72\ (x-1)^4}+\frac{569\alpha_0}{72(x-1)^4}-\frac{775\ \alpha_0}{72}+\left(-\frac{\alpha_0^3}{3(x-1)^2}+\frac{\alpha_0^3}{3}-\frac{\alpha_0^2}{6\ (x-1)}+\frac{5\alpha_0^2}{6(x-1)^2}-\frac{7\alpha_0^2}{6(x-1)^3}-\frac{13\ \alpha_0^2}{6}+\frac{4\alpha_0}{3(x-1)}-\frac{2\alpha_0}{3(x-1)^2}+\frac{4\ \alpha_0}{3(x-1)^3}-\frac{13\alpha_0}{3(x-1)^4}+\frac{23\alpha_0}{3}-\frac{205\ d_1}{72}-\frac{15d_1}{8(x-1)}+\frac{5}{8(x-1)}+\frac{5d_1}{18\ (x-1)^2}-\frac{7}{18(x-1)^2}+\frac{5d_1}{18(x-1)^3}-\frac{13}{18\ (x-1)^3}-\frac{15d_1}{8(x-1)^4}+\frac{49}{8(x-1)^4}-\frac{205\ d_1}{72(x-1)^5}+\frac{935}{72(x-1)^5}+\frac{515}{72}\right)H(0;\alpha_0)+\left(\frac{15d_1}{8(x-1)}-\frac{5d_1}{18(x-1)^2}-\frac{5d_1}{18\ (x-1)^3}+\frac{15d_1}{8(x-1)^4}+\frac{205d_1}{72\ (x-1)^5}+\frac{205d_1}{72}-\frac{5}{8(x-1)}+\frac{7}{18\ (x-1)^2}+\frac{13}{18(x-1)^3}-\frac{49}{8(x-1)^4}+\frac{2\pi^2}{3\ (x-1)^5}-\frac{935}{72(x-1)^5}-\frac{\pi^2}{9}-\frac{515}{72}\right)H(0;x)+\left(\frac{d_1\alpha_0^3}{6}-\frac{d_1\alpha_0^3}{6(x-1)^2}-\frac{13\ d_1\alpha_0^2}{12}-\frac{d_1\alpha_0^2}{12(x-1)}+\frac{5d_1\alpha_0^2}{12\ (x-1)^2}-\frac{7d_1\alpha_0^2}{12(x-1)^3}+\frac{23d_1\alpha_0}{6}+\frac{2\ d_1\alpha_0}{3(x-1)}-\frac{d_1\alpha_0}{3(x-1)^2}+\frac{2d_1\alpha_0}{3\ (x-1)^3}-\frac{13d_1\alpha_0}{6(x-1)^4}-\frac{35d_1}{12}-\frac{7\ d_1}{12(x-1)}+\frac{d_1}{12(x-1)^2}-\frac{d_1}{12(x-1)^3}+\frac{13\ d_1}{6(x-1)^4}\right)H(1;\alpha_0)+\left(-\frac{d_1\alpha_0^4}{8}+\frac{d_1\ \alpha_0^4}{8(x-1)}-\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}+\frac{13d_1\ \alpha_0^3}{18}-\frac{d_1\alpha_0^3}{2(x-1)}+\frac{3\alpha_0^3}{2(x-1)}+\frac{2\ d_1\alpha_0^3}{9(x-1)^2}-\frac{31\alpha_0^3}{36(x-1)^2}-\frac{55\ \alpha_0^3}{36}-\frac{23d_1\alpha_0^2}{12}+\frac{3d_1\alpha_0^2}{4\ (x-1)}-\frac{95\alpha_0^2}{24(x-1)}-\frac{2d_1\alpha_0^2}{3\ (x-1)^2}+\frac{27\alpha_0^2}{8(x-1)^2}+\frac{d_1\alpha_0^2}{2\ (x-1)^3}-\frac{59\alpha_0^2}{24(x-1)^3}+\frac{35\alpha_0^2}{8}+\frac{25d_1\ \alpha_0}{6}-\frac{d_1\alpha_0}{2(x-1)}+\frac{43\alpha_0}{6(x-1)}+\frac{2d_1\ \alpha_0}{3(x-1)^2}-\frac{37\alpha_0}{6(x-1)^2}-\frac{d_1\ \alpha_0}{(x-1)^3}+\frac{20\alpha_0}{3(x-1)^3}+\frac{2d_1\ \alpha_0}{(x-1)^4}-\frac{113\alpha_0}{12(x-1)^4}-\frac{41\alpha_0}{4}-\frac{205\ d_1}{72}+\left(\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{4\alpha_0^3}{x-1}+\frac{4\ \alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}+\frac{6\alpha_0^2}{x-1}-\frac{4\ \alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\frac{4\ \alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\ \alpha_0}{(x-1)^4}+16\alpha_0-\frac{3}{x-1}+\frac{2}{3(x-1)^2}+\frac{2}{3\ (x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{25}{3}\right)H(0;\alpha_0)+\left(-\frac{d_1\alpha_0^4}{2}+\right.$$

$$\frac{d_1\alpha_0^4}{2(x-1)}+\frac{8\ d_1\alpha_0^3}{3}-\frac{2d_1\alpha_0^3}{x-1}+\frac{2d_1\alpha_0^3}{3(x-1)^2}-6\ d_1\alpha_0^2+\frac{3d_1\alpha_0^2}{x-1}-\frac{2d_1\ \alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}+8d_1\alpha_0-\frac{2d_1\ \alpha_0}{x-1}+\frac{2d_1\alpha_0}{(x-1)^2}-$$
$$\frac{2d_1\alpha_0}{(x-1)^3}+\frac{2\ d_1\alpha_0}{(x-1)^4}-\frac{25d_1}{6}-\frac{3d_1}{2(x-1)}+\frac{d_1}{3\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{3d_1}{2(x-1)^4}-\frac{25\ d_1}{6(x-1)^5}\Big)H(1;\alpha_0)-\frac{15d_1}{8(x-1)}+$$
$$\frac{5}{8\ (x-1)}+\frac{5d_1}{18(x-1)^2}-\frac{7}{18(x-1)^2}+\frac{5d_1}{18\ (x-1)^3}-\frac{13}{18(x-1)^3}-\frac{15d_1}{8(x-1)^4}+\frac{49}{8\ (x-1)^4}-\frac{205d_1}{72(x-1)^5}+\frac{935}{72\ (x-1)^5}+$$
$$\frac{515}{72}\Big)\ H(c_1(\alpha_0);x)+\Big(-\frac{25}{3}-\frac{3}{x-1}+\frac{2}{3\ (x-1)^2}+\frac{2}{3(x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3\ (x-1)^5}\Big)H(0,0;\alpha_0)+\Big(\frac{25}{3}+$$
$$\frac{3}{x-1}-\frac{2}{3\ (x-1)^2}-\frac{2}{3(x-1)^3}+\frac{3}{(x-1)^4}+\frac{25}{3\ (x-1)^5}\Big)H(0,0;x)+\Big(-\frac{3d_1}{2(x-1)}+\frac{d_1}{3\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{3d_1}{2(x-1)^4}-$$
$$\frac{25\ d_1}{6(x-1)^5}-\frac{25d_1}{6}\Big)H(0,1;\alpha_0)+H(1;x)\ \Big(-\frac{\pi^2d_1}{3(x-1)^5}+\Big(\frac{2\ d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2\ (x-1)^4}+\frac{25d_1}{6(x-1)^5}+$$
$$\frac{5}{4(x-1)}-\frac{5}{6\ (x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}+\frac{25}{12\ (x-1)^5}-\frac{25}{12}\Big)H(0;\alpha_0)+\Big(4-\frac{4}{(x-1)^5}\Big)\ H(0,0;\alpha_0)+$$
$$\Big(2d_1-\frac{2d_1}{(x-1)^5}\Big)H(0,1;\alpha_0)+\frac{\pi^2}{2(x-1)^5}+\frac{\pi^2}{6}\Big)+\Big(\frac{2d_1}{(x-1)^5}-2\ d_1-\frac{2}{(x-1)^5}+2\Big)H(0;\alpha_0)H(0,1;x)+$$
$$\Big(-\frac{\alpha_0^4}{2\ (x-1)}+\frac{\alpha_0^4}{2}+\frac{2\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}-\frac{8\alpha_0^3}{3}-\frac{3\alpha_0^2}{x-1}+\frac{2\ \alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2+\frac{2\ \alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\alpha_0}{(x-1)^3}-$$
$$\frac{2\ \alpha_0}{(x-1)^4}-8\alpha_0+\Big(4-\frac{4}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(2\ d_1-\frac{2d_1}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{3}{4(x-1)}-\frac{1}{6\ (x-1)^2}-\frac{1}{6(x-1)^3}+$$
$$\frac{3}{4(x-1)^4}+\frac{25}{12\ (x-1)^5}+\frac{25}{12}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{2\ d_1}{x-1}+\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{d_1}{2\ (x-1)^4}-\frac{25d_1}{6(x-1)^5}-$$
$$\frac{5}{4(x-1)}+\frac{5}{6\ (x-1)^2}-\frac{5}{6(x-1)^3}+\frac{5}{4(x-1)^4}-\frac{25}{12\ (x-1)^5}+\frac{25}{12}\Big)H(1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2\ d_1-\frac{3}{(x-1)^5}-$$
$$1\Big)H(0;\alpha_0)H(1,1;x)+\Big(\frac{2\ d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2\ (x-1)^4}+\frac{25d_1}{6(x-1)^5}+\Big(4-\frac{4}{(x-1)^5}\Big)\ H(0;\alpha_0)+$$
$$\Big(2d_1-\frac{2d_1}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{5}{4\ (x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4\ (x-1)^4}+\frac{25}{12(x-1)^5}-\frac{25}{12}\Big)\ H(1,c_1(\alpha_0);x)+$$
$$\Big(\frac{5\alpha_0^4}{4(x-1)}-\frac{5\ \alpha_0^4}{4}-\frac{5\alpha_0^3}{x-1}+\frac{5\alpha_0^3}{3(x-1)^2}+\frac{20\ \alpha_0^3}{3}+\frac{15\alpha_0^2}{2(x-1)}-\frac{5\alpha_0^2}{(x-1)^2}+\frac{5\ \alpha_0^2}{2(x-1)^3}-15\alpha_0^2-\frac{5\alpha_0}{x-1}+\frac{5\ \alpha_0}{(x-1)^2}-$$
$$\frac{5\alpha_0}{(x-1)^3}+\frac{5\alpha_0}{(x-1)^4}+20\ \alpha_0+\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1\ H(1;\alpha_0)}{(x-1)^5}-\frac{15}{4(x-1)}+\frac{5}{6(x-1)^2}+\frac{5}{6\ (x-1)^3}-\frac{15}{4(x-1)^4}-$$
$$\frac{125}{12\ (x-1)^5}-\frac{125}{12}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)-\frac{32}{3}\ H(0,0,0;x)+\Big(2-\frac{2}{(x-1)^5}\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(-$$
$$\frac{2d_1}{(x-1)^5}+2\ d_1+\frac{2}{(x-1)^5}-2\Big)H(0,1,0;x)+\Big(\frac{2d_1}{(x-1)^5}-2\ d_1-\frac{2}{(x-1)^5}+2\Big)\ H(0,1,c_1(\alpha_0);x)+$$
$$\Big(5-\frac{1}{(x-1)^5}\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-4\Big)\ H(1,0,0;x)+\Big(\frac{2d_1}{(x-1)^5}-\frac{3}{(x-1)^5}-$$
$$1\Big)\ H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+2\ d_1+\frac{3}{(x-1)^5}+1\Big)H(1,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2\ d_1-\frac{3}{(x-1)^5}-$$
$$1\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{2\ d_1}{(x-1)^5}-\frac{1}{(x-1)^5}+5\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)-\frac{2\ H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+$$
$$\frac{5\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{8\ (x-1)}+\frac{\pi^2}{36(x-1)^2}+\frac{\pi^2}{36(x-1)^3}-\frac{\pi^2}{8(x-1)^4}-\frac{25\pi^2}{72(x-1)^5}-\frac{3\ \zeta_3}{(x-1)^5}-6\zeta_3-\frac{25\pi^2}{72},$$

$$a_2^{(1,-1)}=-\frac{37}{432}d_1^2\alpha_0^3+\frac{37d_1\alpha_0^3}{108}+\frac{37d_1^2\ \alpha_0^3}{432(x-1)^2}-\frac{37d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi^2\ \alpha_0^3}{72(x-1)^2}+\frac{37\alpha_0^3}{108(x-1)^2}+\frac{\pi^2\ \alpha_0^3}{72}-$$
$$\frac{37\alpha_0^3}{108}+\frac{715d_1^2\ \alpha_0^2}{864}-\frac{1625d_1\alpha_0^2}{432}+\frac{115d_1^2\alpha_0^2}{864\ (x-1)}-\frac{35d_1\alpha_0^2}{432(x-1)}-\frac{\pi^2\alpha_0^2}{144(x-1)}-\frac{10\alpha_0^2}{27(x-1)}-\frac{107d_1^2\alpha_0^2}{864\ (x-1)^2}+\frac{409d_1\alpha_0^2}{432(x-1)^2}+$$
$$\frac{5\pi^2\alpha_0^2}{144\ (x-1)^2}-\frac{151\alpha_0^2}{108(x-1)^2}+\frac{493d_1^2\alpha_0^2}{864\ (x-1)^3}-\frac{1181d_1\alpha_0^2}{432(x-1)^3}-\frac{7\pi^2\alpha_0^2}{144\ (x-1)^3}+\frac{86\alpha_0^2}{27(x-1)^3}-\frac{13\pi^2\ \alpha_0^2}{144}+\frac{455\alpha_0^2}{108}-$$
$$\frac{3515d_1^2\ \alpha_0}{432}+\frac{17285d_1\alpha_0}{432}-\frac{265d_1^2\alpha_0}{108\ (x-1)}+\frac{1205d_1\alpha_0}{216(x-1)}+\frac{\pi^2\alpha_0}{18\ (x-1)}+\frac{13\alpha_0}{54(x-1)}-\frac{d_1^2\alpha_0}{108\ (x-1)^2}-\frac{187d_1\alpha_0}{216(x-1)^2}-$$
$$\frac{\pi^2\alpha_0}{36\ (x-1)^2}+\frac{191\alpha_0}{108(x-1)^2}+\frac{113d_1^2\alpha_0}{108\ (x-1)^3}+\frac{11d_1\alpha_0}{216(x-1)^3}+\frac{\pi^2\alpha_0}{18\ (x-1)^3}-\frac{317\alpha_0}{54(x-1)^3}+\frac{2911d_1^2\alpha_0}{432\ (x-1)^4}-\frac{14479d_1\alpha_0}{432(x-1)^4}-$$
$$\frac{13\pi^2\alpha_0}{72\ (x-1)^4}+\frac{2207\alpha_0}{54(x-1)^4}+\frac{23\pi^2\ \alpha_0}{72}-\frac{5213\alpha_0}{108}+\Big(-\frac{7d_1\alpha_0^3}{18}+\frac{7\ d_1\alpha_0^3}{18(x-1)^2}-\frac{7\alpha_0^3}{9(x-1)^2}+\frac{7\ \alpha_0^3}{9}+\frac{109d_1\alpha_0^2}{36}+\frac{13d_1\alpha_0^2}{36\ (x-1)}+$$
$$\frac{\alpha_0^2}{9(x-1)}-\frac{29d_1\alpha_0^2}{36(x-1)^2}+\frac{22\ \alpha_0^2}{9(x-1)^2}+\frac{67d_1\alpha_0^2}{36(x-1)^3}-\frac{41\alpha_0^2}{9\ (x-1)^3}-\frac{62\alpha_0^2}{9}-\frac{305d_1\alpha_0}{18}-\frac{38d_1\ \alpha_0}{9(x-1)}+\frac{25\alpha_0}{9(x-1)}+\frac{4d_1\alpha_0}{9\ (x-1)^2}-$$
$$\frac{23\alpha_0}{9(x-1)^2}-\frac{2d_1\alpha_0}{9\ (x-1)^3}+\frac{55\alpha_0}{9(x-1)^3}+\frac{217d_1\alpha_0}{18\ (x-1)^4}-\frac{569\alpha_0}{18(x-1)^4}+\frac{775\alpha_0}{18}+\frac{2035\ d_1^2}{432}-\frac{9685d_1}{432}+\frac{63d_1^2}{16(x-1)}-\frac{407\ d_1}{48(x-1)}-$$
$$\frac{\pi^2}{8(x-1)}-\frac{37}{8(x-1)}-\frac{19\ d_1^2}{54(x-1)^2}+\frac{80d_1}{27(x-1)^2}+\frac{\pi^2}{36\ (x-1)^2}-\frac{101}{108(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}+\frac{73\ d_1}{54(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-$$

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$$\frac{365}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{1171d_1}{48(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{239}{8(x-1)^4}+\frac{2035d_1^2}{432(x-1)^5}-\frac{15865d_1}{432(x-1)^5}-\frac{25\pi^2}{72(x-1)^5}+$$
$$\frac{13505}{216(x-1)^5}-\frac{25\pi^2}{72}+\frac{5525}{216}\bigg)H(0;\alpha_0)+\bigg(-\frac{7}{36}d_1^2\alpha_0^3+\frac{7d_1\alpha_0^3}{18}+\frac{7d_1^2\alpha_0^3}{36(x-1)^2}-\frac{7d_1\alpha_0^3}{18(x-1)^2}+\frac{109d_1^2\alpha_0^2}{72}-\frac{31d_1\alpha_0^2}{9}+$$
$$\frac{13d_1^2\alpha_0^2}{72(x-1)}+\frac{d_1\alpha_0^2}{18(x-1)}-\frac{29d_1^2\alpha_0^2}{72(x-1)^2}+\frac{11d_1\alpha_0^2}{9(x-1)^2}+\frac{67d_1^2\alpha_0^2}{72(x-1)^3}-\frac{41d_1\alpha_0^2}{18(x-1)^3}-\frac{305d_1^2\alpha_0}{36}+\frac{775d_1\alpha_0}{36}-\frac{19d_1^2\alpha_0}{9(x-1)}+$$
$$\frac{25d_1\alpha_0}{18(x-1)}+\frac{2d_1^2\alpha_0}{9(x-1)^2}-\frac{23d_1\alpha_0}{18(x-1)^2}-\frac{d_1^2\alpha_0}{9(x-1)^3}+\frac{55d_1\alpha_0}{18(x-1)^3}+\frac{217d_1^2\alpha_0}{36(x-1)^4}-\frac{569d_1\alpha_0}{36(x-1)^4}+\frac{515d_1^2}{72}-\frac{665d_1}{36}+$$
$$\frac{139d_1^2}{72(x-1)}-\frac{13d_1}{9(x-1)}-\frac{d_1^2}{72(x-1)^2}+\frac{4d_1}{9(x-1)^2}-\frac{59d_1^2}{72(x-1)^3}-\frac{7d_1}{9(x-1)^3}-\frac{217d_1^2}{36(x-1)^4}+\frac{569d_1}{36(x-1)^4}\bigg)H(1;\alpha_0)+$$
$$\bigg(\frac{4\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{2\alpha_0^2}{3(x-1)}-\frac{10\alpha_0^2}{3(x-1)^2}+\frac{14\alpha_0^2}{3(x-1)^3}+\frac{26\alpha_0^2}{3}-\frac{16\alpha_0}{3(x-1)}+\frac{8\alpha_0}{3(x-1)^2}-\frac{16\alpha_0}{3(x-1)^3}+\frac{52\alpha_0}{3(x-1)^4}-$$
$$\frac{92\alpha_0}{3}+\frac{205d_1}{18}+\frac{15d_1}{2(x-1)}-\frac{5}{2(x-1)}-\frac{10d_1}{9(x-1)^2}+\frac{14}{9(x-1)^2}-\frac{10d_1}{9(x-1)^3}+\frac{26}{9(x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{49}{2(x-1)^4}+$$
$$\frac{205d_1}{18(x-1)^5}-\frac{935}{18(x-1)^5}-\frac{515}{18}\bigg)H(0,0;\alpha_0)+\bigg(-\frac{15d_1}{2(x-1)}+\frac{10d_1}{9(x-1)^2}+\frac{10d_1}{9(x-1)^3}-\frac{15d_1}{2(x-1)^4}-\frac{205d_1}{18(x-1)^5}-$$
$$\frac{205d_1}{18}+\frac{5}{2(x-1)}-\frac{14}{9(x-1)^2}-\frac{26}{9(x-1)^3}+\frac{49}{2(x-1)^4}-\frac{8\pi^2}{3(x-1)^5}+\frac{935}{18(x-1)^5}+\frac{4\pi^2}{9}+\frac{515}{18}\bigg)H(0,0;x)+\bigg(-$$
$$\frac{2d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3(x-1)}-\frac{5d_1\alpha_0^2}{3(x-1)^2}+\frac{7d_1\alpha_0^2}{3(x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+$$
$$\frac{26d_1\alpha_0}{3(x-1)^4}+\frac{205d_1^2}{36}-\frac{515d_1}{36}+\frac{15d_1^2}{4(x-1)}-\frac{5d_1}{4(x-1)}-\frac{5d_1^2}{9(x-1)^2}+\frac{7d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}+\frac{13d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-$$
$$\frac{49d_1}{4(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{935d_1}{36(x-1)^5}\bigg)H(0,1;\alpha_0)+\bigg(\frac{\pi^2d_1}{(x-1)^5}+\frac{\pi^2d_1}{3}+\bigg(\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5d_1}{3(x-1)^3}-$$
$$\frac{5d_1}{2(x-1)^4}+\frac{25d_1}{6(x-1)^5}-\frac{25d_1}{6}+\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\bigg)H(0;\alpha_0)+\bigg(-$$
$$\frac{8d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}-8\bigg)H(0,0;\alpha_0)+\bigg(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{4d_1}{(x-1)^5}-4d_1\bigg)H(0,1;\alpha_0)-\frac{7\pi^2}{3(x-1)^5}-$$
$$\frac{\pi^2}{3}\bigg)H(0,1;x)+\bigg(-\frac{2d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3(x-1)}-\frac{5d_1\alpha_0^2}{3(x-1)^2}+\frac{7d_1\alpha_0^2}{3(x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+$$
$$\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+\frac{26d_1\alpha_0}{3(x-1)^4}+\frac{35d_1}{3}+\frac{7d_1}{3(x-1)}-\frac{d_1}{3(x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{26d_1}{3(x-1)^4}\bigg)H(1,0;\alpha_0)+$$
$$\bigg(\frac{4d_1^2}{x-1}-\frac{d_1^2}{(x-1)^2}+\frac{4d_1^2}{9(x-1)^3}-\frac{d_1^2}{4(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{193d_1}{24(x-1)}+\frac{265d_1}{36(x-1)^2}-\frac{25d_1}{4(x-1)^3}+\frac{107d_1}{24(x-1)^4}+$$
$$\frac{4\pi^2d_1}{3(x-1)^5}-\frac{185d_1}{8(x-1)^5}-\frac{205d_1}{72}-\frac{133}{8(x-1)}+\frac{289}{36(x-1)^2}-\frac{289}{36(x-1)^3}+\frac{133}{8(x-1)^4}-\frac{11\pi^2}{6(x-1)^5}-\frac{305}{72(x-1)^5}-\frac{5\pi^2}{6}+$$
$$\frac{305}{72}\bigg)H(1,0;x)+\bigg(-\frac{1}{3}d_1^2\alpha_0^3+\frac{d_1^2\alpha_0^3}{3(x-1)^2}+\frac{13d_1^2\alpha_0^2}{6}+\frac{d_1^2\alpha_0^2}{6(x-1)}-\frac{5d_1^2\alpha_0^2}{6(x-1)^2}+\frac{7d_1^2\alpha_0^2}{6(x-1)^3}-\frac{23d_1^2\alpha_0}{3}-\frac{4d_1^2\alpha_0}{3(x-1)}+$$
$$\frac{2d_1^2\alpha_0}{3(x-1)^2}-\frac{4d_1^2\alpha_0}{3(x-1)^3}+\frac{13d_1^2\alpha_0}{3(x-1)^4}+\frac{35d_1^2}{6}+\frac{7d_1^2}{6(x-1)}-\frac{d_1^2}{6(x-1)^2}+\frac{d_1^2}{6(x-1)^3}-\frac{13d_1^2}{3(x-1)^4}\bigg)H(1,1;\alpha_0)+$$
$$H(0,c_1(\alpha_0);x)\bigg(-\frac{d_1\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{2}+\frac{13d_1\alpha_0^3}{9}-\frac{d_1\alpha_0^3}{x-1}+\frac{3\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{9(x-1)^2}-\frac{25\alpha_0^3}{18(x-1)^2}-$$
$$\frac{61\alpha_0^3}{18}-\frac{23d_1\alpha_0^2}{6}+\frac{3d_1\alpha_0^2}{2(x-1)}-\frac{31\alpha_0^2}{4(x-1)}-\frac{4d_1\alpha_0^2}{3(x-1)^2}+\frac{71\alpha_0^2}{12(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{15\alpha_0^2}{4(x-1)^3}+\frac{131\alpha_0^2}{12}+\frac{25d_1\alpha_0}{3}-\frac{d_1\alpha_0}{x-1}+$$
$$\frac{13\alpha_0}{x-1}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{35\alpha_0}{3(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{12\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{29\alpha_0}{2(x-1)^4}-\frac{169\alpha_0}{6}-\frac{205d_1}{72}+\bigg(\frac{2\alpha_0^4}{x-1}-2\alpha_0^4-$$
$$\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-1)^2}+\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}-24\alpha_0^2-\frac{8\alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\alpha_0}{(x-1)^4}+32\alpha_0-$$
$$\frac{3}{x-1}+\frac{2}{3(x-1)^2}+\frac{2}{3(x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{25}{3}\bigg)H(0;\alpha_0)+\bigg(-d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}+\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+$$
$$\frac{4d_1\alpha_0^3}{3(x-1)^2}-12d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}+16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{25d_1}{6}-$$
$$\frac{3d_1}{2(x-1)}+\frac{d_1}{3(x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{3d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}\bigg)H(1;\alpha_0)+\bigg(\frac{16}{(x-1)^5}-16\bigg)H(0,0;\alpha_0)+\bigg(\frac{8d_1}{(x-1)^5}-$$
$$8d_1\bigg)H(0,1;\alpha_0)+\bigg(\frac{8d_1}{(x-1)^5}-8d_1\bigg)H(1,0;\alpha_0)+\bigg(\frac{4d_1^2}{(x-1)^5}-4d_1^2\bigg)H(1,1;\alpha_0)-\frac{15d_1}{8(x-1)}+\frac{71}{8(x-1)}+$$
$$\frac{5d_1}{18(x-1)^2}-\frac{8}{9(x-1)^2}+\frac{5d_1}{18(x-1)^3}-\frac{2}{9(x-1)^3}-\frac{15d_1}{8(x-1)^4}-\frac{17}{8(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^2}{6(x-1)^5}+\frac{305}{72(x-1)^5}+\frac{\pi^2}{6}+$$
$$\frac{1145}{72}\bigg)+H(c_1(\alpha_0);x)\bigg(\frac{d_1^2\alpha_0^4}{16}-\frac{d_1\alpha_0^4}{4}-\frac{d_1^2\alpha_0^4}{16(x-1)}+\frac{d_1\alpha_0^4}{4(x-1)}+\frac{\pi^2\alpha_0^4}{24(x-1)}-\frac{\alpha_0^4}{4(x-1)}-\frac{\pi^2\alpha_0^4}{24}+\frac{\alpha_0^4}{4}-\frac{43d_1^2\alpha_0^3}{108}+$$
$$\frac{365d_1\alpha_0^3}{216}+\frac{d_1^2\alpha_0^3}{4(x-1)}-\frac{19d_1\alpha_0^3}{12(x-1)}-\frac{\pi^2\alpha_0^3}{6(x-1)}+\frac{13\alpha_0^3}{6(x-1)}-\frac{4d_1^2\alpha_0^3}{27(x-1)^2}+\frac{233d_1\alpha_0^3}{216(x-1)^2}+\frac{\pi^2\alpha_0^3}{18(x-1)^2}-\frac{169\alpha_0^3}{108(x-1)^2}+$$
$$\frac{2\pi^2\alpha_0^3}{9}-\frac{193\alpha_0^3}{108}+\frac{95d_1^2\alpha_0^2}{72}-\frac{869d_1\alpha_0^2}{144}-\frac{3d_1^2\alpha_0^2}{8(x-1)}+\frac{695d_1\alpha_0^2}{144(x-1)}+\frac{\pi^2\alpha_0^2}{4(x-1)}-\frac{319\alpha_0^2}{36(x-1)}+\frac{4d_1^2\alpha_0^2}{9(x-1)^2}-\frac{641d_1\alpha_0^2}{144(x-1)^2}-$$

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$$\frac{\pi^2\alpha_0^2}{6(x-1)^2}+\frac{26\alpha_0^2}{3(x-1)^2}-\frac{d_1^2\alpha_0^2}{2(x-1)^3}+\frac{623d_1\alpha_0^2}{144(x-1)^3}+\frac{\pi^2\alpha_0^2}{12(x-1)^3}-\frac{67\alpha_0^2}{9(x-1)^3}-\frac{\pi^2\alpha_0^2}{2}+\frac{27\alpha_0^2}{4}-\frac{205d_1^2\alpha_0}{36}+\frac{1945d_1\alpha_0}{72}+$$

$$\frac{d_1^2\alpha_0}{4(x-1)}-\frac{505d_1\alpha_0}{36(x-1)}-\frac{\pi^2\alpha_0}{6(x-1)}+\frac{299\alpha_0}{9(x-1)}-\frac{4d_1^2\alpha_0}{9(x-1)^2}+\frac{11d_1\alpha_0}{(x-1)^2}+\frac{\pi^2\alpha_0}{6(x-1)^2}-\frac{541\alpha_0}{18(x-1)^2}+\frac{d_1^2\alpha_0}{(x-1)^3}-\frac{239d_1\alpha_0}{18(x-1)^3}-$$

$$\frac{\pi^2\alpha_0}{6(x-1)^3}+\frac{296\alpha_0}{9(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{2237d_1\alpha_0}{72(x-1)^4}+\frac{\pi^2\alpha_0}{6(x-1)^4}-\frac{3835\alpha_0}{72(x-1)^4}+\frac{2\pi^2\alpha_0}{3}-\frac{739\alpha_0}{24}+\frac{2035d_1^2}{432}-\frac{9685d_1}{432}+$$

$$\Big(\frac{d_1\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{26d_1\alpha_0^3}{9}+\frac{2d_1\alpha_0^3}{x-1}-\frac{6\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{9(x-1)^2}+\frac{31\alpha_0^3}{9(x-1)^2}+\frac{55\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{3}-\frac{3d_1\alpha_0^2}{x-1}+$$

$$\frac{95\alpha_0^2}{6(x-1)}+\frac{8d_1\alpha_0^2}{3(x-1)^2}-\frac{27\alpha_0^2}{2(x-1)^2}-\frac{2d_1\alpha_0^2}{(x-1)^3}+\frac{59\alpha_0^2}{6(x-1)^3}-\frac{35\alpha_0^2}{2}-\frac{50d_1\alpha_0}{3}+\frac{2d_1\alpha_0}{x-1}-\frac{86\alpha_0}{3(x-1)}-\frac{8d_1\alpha_0}{3(x-1)^2}+\frac{74\alpha_0}{3(x-1)^2}+$$

$$\frac{4d_1\alpha_0}{(x-1)^3}-\frac{80\alpha_0}{3(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{113\alpha_0}{3(x-1)^4}+41\alpha_0+\frac{205d_1}{18}+\frac{15d_1}{2(x-1)}-\frac{5}{2(x-1)}-\frac{10d_1}{9(x-1)^2}+\frac{14}{9(x-1)^2}-$$

$$\frac{10d_1}{9(x-1)^3}+\frac{26}{9(x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{49}{2(x-1)^4}+\frac{205d_1}{18(x-1)^5}-\frac{935}{18(x-1)^5}-\frac{515}{18}\Big)H(0;\alpha_0)+\Big(\frac{d_1^2\alpha_0^4}{4}-\frac{d_1\alpha_0^4}{2}-$$

$$\frac{d_1^2\alpha_0^4}{4(x-1)}+\frac{d_1\alpha_0^4}{2(x-1)}-\frac{13d_1^2\alpha_0^3}{9}+\frac{55d_1\alpha_0^3}{18}+\frac{d_1^2\alpha_0^3}{x-1}-\frac{3d_1\alpha_0^3}{x-1}-\frac{4d_1^2\alpha_0^3}{9(x-1)^2}+\frac{31d_1\alpha_0^3}{18(x-1)^2}+\frac{23d_1^2\alpha_0^2}{6}-\frac{35d_1\alpha_0^2}{4}-\frac{3d_1^2\alpha_0^2}{2(x-1)}+$$

$$\frac{95d_1\alpha_0^2}{12(x-1)}+\frac{4d_1^2\alpha_0^2}{3(x-1)^2}-\frac{27d_1\alpha_0^2}{4(x-1)^2}-\frac{d_1^2\alpha_0^2}{(x-1)^3}+\frac{59d_1\alpha_0^2}{12(x-1)^3}-\frac{25d_1^2\alpha_0}{3}+\frac{41d_1\alpha_0}{2}+\frac{d_1^2\alpha_0}{x-1}-\frac{43d_1\alpha_0}{3(x-1)}-\frac{4d_1^2\alpha_0}{3(x-1)^2}+$$

$$\frac{37d_1\alpha_0}{3(x-1)^2}+\frac{2d_1^2\alpha_0}{(x-1)^3}-\frac{40d_1\alpha_0}{3(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{113d_1\alpha_0}{6(x-1)^4}+\frac{205d_1^2}{36}-\frac{515d_1}{36}+\frac{15d_1^2}{4(x-1)}-\frac{5d_1}{4(x-1)}-\frac{5d_1^2}{9(x-1)^2}+$$

$$\frac{7d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}+\frac{13d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-\frac{49d_1}{4(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{935d_1}{36(x-1)^5}\Big)H(1;\alpha_0)+\Big(-\frac{4\alpha_0^4}{x-1}+$$

$$4\alpha_0^4+\frac{16\alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3(x-1)^2}-\frac{64\alpha_0^3}{3}-\frac{24\alpha_0^2}{x-1}+\frac{16\alpha_0^2}{(x-1)^2}-\frac{8\alpha_0^2}{(x-1)^3}+48\alpha_0^2+\frac{16\alpha_0}{x-1}-\frac{16\alpha_0}{(x-1)^2}+\frac{16\alpha_0}{(x-1)^3}-\frac{16\alpha_0}{(x-1)^4}-$$

$$64\alpha_0+\frac{12}{x-1}-\frac{8}{3(x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3(x-1)^5}+\frac{100}{3}\Big)H(0,0;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+$$

$$\frac{8d_1\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-\frac{12d_1\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+$$

$$\frac{50d_1}{3}+\frac{6d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+$$

$$\frac{8d_1\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-\frac{12d_1\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+$$

$$\frac{50d_1}{3}+\frac{6d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(d_1^2\alpha_0^4-\frac{d_1^2\alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}+\frac{4d_1^2\alpha_0^3}{x-1}-$$

$$\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2-\frac{6d_1^2\alpha_0^2}{x-1}+\frac{4d_1^2\alpha_0^2}{(x-1)^2}-\frac{2d_1^2\alpha_0^2}{(x-1)^3}-16d_1^2\alpha_0+\frac{4d_1^2\alpha_0}{x-1}-\frac{4d_1^2\alpha_0}{(x-1)^2}+\frac{4d_1^2\alpha_0}{(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+$$

$$\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-\frac{2d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}\Big)H(1,1;\alpha_0)+\frac{63d_1^2}{16(x-1)}-\frac{407d_1}{48(x-1)}-\frac{\pi^2}{8(x-1)}-\frac{37}{8(x-1)}-$$

$$\frac{19d_1^2}{54(x-1)^2}+\frac{80d_1}{27(x-1)^2}+\frac{\pi^2}{36(x-1)^2}-\frac{101}{108(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}+\frac{73d_1}{54(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-\frac{365}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-$$

$$\frac{1171d_1}{48(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{239}{8(x-1)^4}+\frac{2035d_1^2}{432(x-1)^5}-\frac{15865d_1}{432(x-1)^5}-\frac{25\pi^2}{72(x-1)^5}+\frac{13505}{216(x-1)^5}-\frac{25\pi^2}{72}+\frac{5525}{216}\Big)+\Big(-$$

$$\frac{2\pi^2d_1^2}{3(x-1)^5}+\frac{2\pi^2d_1}{(x-1)^5}+\frac{\pi^2d_1}{3}+\Big(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{9d_1}{2(x-1)}-\frac{8d_1}{3(x-1)^2}+\frac{7d_1}{3(x-1)^3}-$$

$$\frac{3d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}-\frac{25d_1}{6}-\frac{13}{4(x-1)}+\frac{1}{6(x-1)^2}+\frac{11}{6(x-1)^3}-\frac{23}{4(x-1)^4}-\frac{125}{12(x-1)^5}-\frac{175}{12}\Big)H(0;\alpha_0)+\Big(-$$

$$\frac{16d_1}{(x-1)^5}+8d_1+\frac{12}{(x-1)^5}+4\Big)H(0,0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{6d_1}{(x-1)^5}+2d_1\Big)H(0,1;\alpha_0)-\frac{7\pi^2}{6(x-1)^5}-$$

$$\frac{5\pi^2}{6}\Big)H(1,1;x)+\Big(-\frac{4d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36(x-1)^5}+\frac{193d_1}{24(x-1)}-\frac{265d_1}{36(x-1)^2}+\frac{25d_1}{4(x-1)^3}-$$

$$\frac{107d_1}{24(x-1)^4}+\frac{185d_1}{8(x-1)^5}+\frac{205d_1}{72}+\Big(-\frac{8d_1}{x-1}+\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}-\frac{5}{x-1}+\frac{10}{3(x-1)^2}-$$

$$\frac{10}{3(x-1)^3}+\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}+\frac{25}{3}\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}-$$

$$\frac{5d_1}{2(x-1)}+\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3(x-1)^3}+\frac{5d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25d_1}{6}\Big)H(1;\alpha_0)+\Big(\frac{16}{(x-1)^5}-16\Big)H(0,0;\alpha_0)+$$

$$\Big(\frac{8d_1}{(x-1)^5}-8d_1\Big)H(0,1;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-8d_1\Big)H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2\Big)H(1,1;\alpha_0)+$$

$$\frac{133}{8(x-1)}-\frac{289}{36(x-1)^2}+\frac{289}{36(x-1)^3}-\frac{133}{8(x-1)^4}-\frac{\pi^2}{6(x-1)^5}+\frac{305}{72(x-1)^5}+\frac{\pi^2}{6}-\frac{305}{72}\Big)H(1,c_1(\alpha_0);x)+$$

$$\Big(\frac{5d_1\alpha_0^4}{8}-\frac{5d_1\alpha_0^4}{8(x-1)}+\frac{5\alpha_0^4}{4(x-1)}-\frac{5\alpha_0^4}{4}-\frac{65d_1\alpha_0^3}{18}+\frac{5d_1\alpha_0^3}{2(x-1)}-\frac{15\alpha_0^3}{2(x-1)}-\frac{10d_1\alpha_0^3}{9(x-1)^2}+\frac{137\alpha_0^3}{36(x-1)^2}+\frac{293\alpha_0^3}{36}+$$

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$$\frac{115 d_1\alpha_0^2}{12} - \frac{15 d_1 \alpha_0^2}{4(x-1)} + \frac{469\alpha_0^2}{24(x-1)} + \frac{10 d_1\alpha_0^2}{3(x-1)^2} - \frac{125\alpha_0^2}{8(x-1)^2} - \frac{5d_1\alpha_0^2}{2(x-1)^3} + \frac{253\alpha_0^2}{24(x-1)^3} - \frac{201\alpha_0^2}{8} - \frac{125 d_1\alpha_0}{6} + \frac{5d_1\alpha_0}{2(x-1)} -$$

$$\frac{203\alpha_0}{6(x-1)} - \frac{10d_1\alpha_0}{3(x-1)^2} + \frac{179\alpha_0}{6(x-1)^2} + \frac{5d_1\alpha_0}{(x-1)^3} - \frac{94\alpha_0}{3(x-1)^3} - \frac{10d_1\alpha_0}{(x-1)^4} + \frac{487\alpha_0}{12(x-1)^4} + \frac{251\alpha_0}{4} + \frac{1025 d_1}{72} + \Big(-\frac{5\alpha_0^4}{x-1} +$$

$$5\alpha_0^4 + \frac{20\alpha_0^3}{x-1} - \frac{20\alpha_0^3}{3(x-1)^2} - \frac{80\alpha_0^3}{3} - \frac{30\alpha_0^2}{x-1} + \frac{20\alpha_0^2}{(x-1)^2} - \frac{10\alpha_0^2}{(x-1)^3} + 60\alpha_0^2 + \frac{20\alpha_0}{x-1} - \frac{20\alpha_0}{(x-1)^2} + \frac{20\alpha_0}{(x-1)^3} - \frac{20\alpha_0}{(x-1)^4} -$$

$$80\alpha_0 + \frac{15}{x-1} - \frac{10}{3(x-1)^2} - \frac{10}{3(x-1)^3} + \frac{15}{(x-1)^4} + \frac{125}{3(x-1)^5} + \frac{125}{3}\Big) H(0;\alpha_0) + \Big(\frac{5d_1\alpha_0^4}{2} - \frac{5d_1\alpha_0^4}{2(x-1)} - \frac{40 d_1\alpha_0^3}{3} +$$

$$\frac{10d_1\alpha_0^3}{x-1} - \frac{10d_1\alpha_0^3}{3(x-1)^2} + 30d_1\alpha_0^2 - \frac{15d_1\alpha_0^2}{x-1} + \frac{10d_1\alpha_0^2}{(x-1)^2} - \frac{5d_1\alpha_0^2}{(x-1)^3} - 40d_1\alpha_0 + \frac{10d_1\alpha_0}{x-1} - \frac{10d_1\alpha_0}{(x-1)^2} + \frac{10d_1\alpha_0}{(x-1)^3} -$$

$$\frac{10d_1\alpha_0}{(x-1)^4} + \frac{125d_1}{6} + \frac{15d_1}{2(x-1)} - \frac{5d_1}{3(x-1)^2} - \frac{5d_1}{3(x-1)^3} + \frac{15d_1}{2(x-1)^4} + \frac{125d_1}{6(x-1)^5}\Big) H(1;\alpha_0) - \frac{16H(0,0;\alpha_0)}{(x-1)^5} -$$

$$\frac{8d_1 H(0,1;\alpha_0)}{(x-1)^5} - \frac{8d_1H(1,0;\alpha_0)}{(x-1)^5} - \frac{4d_1^2 H(1,1;\alpha_0)}{(x-1)^5} + \frac{75d_1}{8(x-1)} - \frac{91}{8(x-1)} - \frac{25d_1}{18(x-1)^2} + \frac{22}{9(x-1)^2} - \frac{25d_1}{18(x-1)^3} +$$

$$\frac{28}{9(x-1)^3} + \frac{75d_1}{8(x-1)^4} - \frac{179}{8(x-1)^4} + \frac{1025d_1}{72(x-1)^5} + \frac{\pi^2}{6(x-1)^5} - \frac{4045}{72(x-1)^5} - \frac{3205}{72}\Big) H(c_1(\alpha_0),c_1(\alpha_0);x) +$$

$$\Big(\frac{100}{3} + \frac{12}{x-1} - \frac{8}{3(x-1)^2} - \frac{8}{3(x-1)^3} + \frac{12}{(x-1)^4} + \frac{100}{3(x-1)^5}\Big) H(0,0,0;\alpha_0) + \Big(-\frac{100}{3} - \frac{12}{x-1} + \frac{8}{3(x-1)^2} +$$

$$\frac{8}{3(x-1)^3} - \frac{12}{(x-1)^4} - \frac{100}{3(x-1)^5}\Big) H(0,0,0;x) + \Big(\frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5} +$$

$$\frac{50d_1}{3}\Big) H(0,0,1;\alpha_0) + \Big(-\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{12}{(x-1)^5} - 12\Big) H(0;\alpha_0)\, H(0,0,1;x) + \Big(-\frac{\alpha_0^4}{x-1} + \alpha_0^4 + \frac{4\alpha_0^3}{x-1} -$$

$$\frac{4\alpha_0^3}{3(x-1)^2} - \frac{16\alpha_0^3}{3} - \frac{6\alpha_0^2}{x-1} + \frac{4\alpha_0^2}{(x-1)^2} - \frac{2\alpha_0^2}{(x-1)^3} + 12\alpha_0^2 + \frac{4\alpha_0}{x-1} - \frac{4\alpha_0}{(x-1)^2} + \frac{4\alpha_0}{(x-1)^3} - \frac{4\alpha_0}{(x-1)^4} - 16\alpha_0 + \Big(\frac{8}{(x-1)^5} -$$

$$8\Big) H(0;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1\Big) H(1;\alpha_0) + \frac{3}{2(x-1)} - \frac{1}{3(x-1)^2} - \frac{1}{3(x-1)^3} + \frac{3}{2(x-1)^4} + \frac{25}{6(x-1)^5} +$$

$$\frac{25}{6}\Big) H(0,0,c_1(\alpha_0);x) + \Big(\frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5} + \frac{50d_1}{3}\Big) H(0,1,0;\alpha_0) + \Big(-$$

$$\frac{5d_1}{2(x-1)} + \frac{5d_1}{3(x-1)^2} - \frac{5d_1}{3(x-1)^3} + \frac{5d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5} + \frac{25d_1}{6} - \frac{5}{2(x-1)} + \frac{5}{3(x-1)^2} - \frac{5}{3(x-1)^3} + \frac{5}{2(x-1)^4} -$$

$$\frac{25}{6(x-1)^5} + \frac{25}{6}\Big) H(0,1,0;x) + \Big(\frac{3d_1^2}{x-1} - \frac{2d_1^2}{3(x-1)^2} - \frac{2d_1^2}{3(x-1)^3} + \frac{3d_1^2}{(x-1)^4} + \frac{25d_1^2}{3(x-1)^5} + \frac{25d_1^2}{3}\Big) H(0,1,1;\alpha_0) +$$

$$\Big(\frac{4d_1^2}{(x-1)^5} - 4d_1^2 - \frac{10d_1}{(x-1)^5} + 2d_1 + \frac{14}{(x-1)^5} + 2\Big) H(0;\alpha_0)\, H(0,1,1;x) + \Big(\frac{5d_1}{2(x-1)} - \frac{5d_1}{3(x-1)^2} + \frac{5d_1}{3(x-1)^3} -$$

$$\frac{5d_1}{2(x-1)^4} + \frac{25d_1}{6(x-1)^5} - \frac{25d_1}{6} + \Big(-\frac{8d_1}{(x-1)^5} + 8d_1 + \frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} + 4d_1^2 + \frac{4d_1}{(x-1)^5} -$$

$$4d_1\Big) H(1;\alpha_0) + \frac{5}{2(x-1)} - \frac{5}{3(x-1)^2} + \frac{5}{3(x-1)^3} - \frac{5}{2(x-1)^4} + \frac{25}{6(x-1)^5} - \frac{25}{6}\Big) H(0,1,c_1(\alpha_0);x) +$$

$$\Big(\frac{5\alpha_0^4}{2(x-1)} - \frac{5\alpha_0^4}{2} - \frac{10\alpha_0^3}{x-1} + \frac{10\alpha_0^3}{3(x-1)^2} + \frac{40\alpha_0^3}{3} + \frac{15\alpha_0^2}{x-1} - \frac{10\alpha_0^2}{(x-1)^2} + \frac{5\alpha_0^2}{(x-1)^3} - 30\alpha_0^2 - \frac{10\alpha_0}{x-1} + \frac{10\alpha_0}{(x-1)^2} - \frac{10\alpha_0}{(x-1)^3} +$$

$$\frac{10\alpha_0}{(x-1)^4} + 40\alpha_0 + \Big(\frac{4}{(x-1)^5} - 20\Big) H(0;\alpha_0) + \Big(\frac{2d_1}{(x-1)^5} - 10d_1\Big) H(1;\alpha_0) + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} +$$

$$\frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5} + \frac{25}{12}\Big) H(0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{8d_1}{x-1} - \frac{4d_1}{(x-1)^2} + \frac{8d_1}{3(x-1)^3} - \frac{2d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5} +$$

$$\frac{5}{x-1} - \frac{10}{3(x-1)^2} + \frac{10}{3(x-1)^3} - \frac{5}{(x-1)^4} + \frac{25}{3(x-1)^5} - \frac{25}{3}\Big) H(1,0,0;x) + \Big(\frac{4d_1^2}{(x-1)^5} - \frac{10d_1}{(x-1)^5} - 2d_1 + \frac{10}{(x-1)^5} -$$

$$2\Big) H(0;\alpha_0)\, H(1,0,1;x) + \Big(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} + \frac{25d_1}{6(x-1)^5} + \Big(-\frac{8d_1}{(x-1)^5} + \frac{12}{(x-1)^5} +$$

$$4\Big) H(0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} + \frac{6d_1}{(x-1)^5} + 2d_1\Big) H(1;\alpha_0) - \frac{13}{4(x-1)} + \frac{1}{6(x-1)^2} + \frac{11}{6(x-1)^3} - \frac{23}{4(x-1)^4} -$$

$$\frac{125}{12(x-1)^5} - \frac{175}{12}\Big) H(1,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1^2}{x-1} + \frac{2d_1^2}{(x-1)^2} - \frac{4d_1^2}{3(x-1)^3} + \frac{d_1^2}{(x-1)^4} - \frac{25d_1^2}{3(x-1)^5} - \frac{9d_1}{2(x-1)} +$$

$$\frac{8d_1}{3(x-1)^2} - \frac{7d_1}{3(x-1)^3} + \frac{3d_1}{(x-1)^4} - \frac{25d_1}{3(x-1)^5} + \frac{25d_1}{6} + \frac{13}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{11}{6(x-1)^3} + \frac{23}{4(x-1)^4} + \frac{125}{12(x-1)^5} +$$

$$\frac{175}{12}\Big) H(1,1,0;x) + \Big(\frac{12d_1^2}{(x-1)^5} - 4d_1^2 - \frac{18d_1}{(x-1)^5} - 4d_1 + \frac{7}{(x-1)^5} + 5\Big) H(0;\alpha_0) H(1,1,1;x) + \Big(\frac{4d_1^2}{x-1} -$$

$$\frac{2d_1^2}{(x-1)^2} + \frac{4d_1^2}{3(x-1)^3} - \frac{d_1^2}{(x-1)^4} + \frac{25d_1^2}{3(x-1)^5} + \frac{9d_1}{2(x-1)} - \frac{8d_1}{3(x-1)^2} + \frac{7d_1}{3(x-1)^3} - \frac{3d_1}{(x-1)^4} + \frac{25d_1}{3(x-1)^5} - \frac{25d_1}{6} +$$

$$\Big(-\frac{16d_1}{(x-1)^5} + 8d_1 + \frac{12}{(x-1)^5} + 4\Big) H(0;\alpha_0) + \Big(-\frac{8d_1^2}{(x-1)^5} + 4d_1^2 + \frac{6d_1}{(x-1)^5} + 2d_1\Big) H(1;\alpha_0) - \frac{13}{4(x-1)} +$$

$$\frac{1}{6(x-1)^2} + \frac{11}{6(x-1)^3} - \frac{23}{4(x-1)^4} - \frac{125}{12(x-1)^5} - \frac{175}{12}\Big) H(1,1,c_1(\alpha_0);x) + \Big(-\frac{10d_1}{x-1} + \frac{5d_1}{(x-1)^2} - \frac{10d_1}{3(x-1)^3} +$$

$$
\frac{5\ d_1}{2(x-1)^4}-\frac{125 d_1}{6(x-1)^5}+\left(\frac{8d_1}{(x-1)^5}+\ \frac{4}{(x-1)^5}-20\right)H(0;\alpha_0)+\left(\frac{4\ d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}-10d_1\right)H(1;\alpha_0)-
$$

$$
\frac{7}{4\ (x-1)}+\frac{19}{6(x-1)^2}-\frac{31}{6(x-1)^3}+\frac{43}{4\ (x-1)^4}+\frac{25}{12(x-1)^5}+\frac{275}{12}\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3\alpha_0^4}{2(x-1)}-
$$

$$
\frac{3\ \alpha_0^4}{2}-\frac{6\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{(x-1)^2}+8\alpha_0^3+\frac{9\ \alpha_0^2}{x-1}-\frac{6\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}-18\alpha_0^2-\ \frac{6\alpha_0}{x-1}+\frac{6\alpha_0}{(x-1)^2}-\frac{6\alpha_0}{(x-1)^3}+
$$

$$
\frac{6\ \alpha_0}{(x-1)^4}+24\alpha_0+\frac{8H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\ H(1;\alpha_0)}{(x-1)^5}-\frac{9}{2\ (x-1)}+\frac{1}{(x-1)^2}+\frac{1}{(x-1)^3}-\frac{9}{2\ (x-1)^4}-\frac{25}{2(x-1)^5}-
$$

$$
\frac{25}{2}\Big)\ H(c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(-\frac{19\alpha_0^4}{4(x-1)}+\frac{19\ \alpha_0^4}{4}+\frac{19\alpha_0^3}{x-1}-\frac{19\alpha_0^3}{3(x-1)^2}-\frac{76\ \alpha_0^3}{3}-\frac{57\alpha_0^2}{2(x-1)}+\frac{19\alpha_0^2}{(x-1)^2}-
$$

$$
\frac{19\ \alpha_0^2}{2(x-1)^3}+57\alpha_0^2+\frac{19\alpha_0}{x-1}-\frac{19\alpha_0}{(x-1)^2}+\ \frac{19\alpha_0}{(x-1)^3}-\frac{19\alpha_0}{(x-1)^4}-76\alpha_0-\frac{20\ H(0;\alpha_0)}{(x-1)^5}-\frac{10d_1 H(1;\alpha_0)}{(x-1)^5}+\frac{57}{4\ (x-1)}-
$$

$$
\frac{19}{6(x-1)^2}-\frac{19}{6(x-1)^3}+\frac{57}{4\ (x-1)^4}+\frac{475}{12(x-1)^5}+\frac{475}{12}\Big)\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\frac{128}{3}\ H(0,0,0,0;x)+
$$

$$
\left(\frac{12}{(x-1)^5}-12\right)\ H(0,0,0,c_1(\alpha_0);x)+\left(\frac{4d_1}{(x-1)^5}-4\ d_1-\frac{12}{(x-1)^5}+12\right)H(0,0,1,0;x)+\Big(-\frac{4\ d_1}{(x-1)^5}+
$$

$$
4d_1+\frac{12}{(x-1)^5}-12\Big)\ H(0,0,1,c_1(\alpha_0);x)+\left(-10-\frac{6}{(x-1)^5}\right)\ H(0,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8d_1}{(x-1)^5}-
$$

$$
8\ d_1-\frac{8}{(x-1)^5}+8\Big)H(0,1,0,0;x)+\left(-\frac{6\ d_1}{(x-1)^5}-2d_1+\frac{14}{(x-1)^5}+2\right)\ H(0,1,0,c_1(\alpha_0);x)+\Big(-
$$

$$
\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{10\ d_1}{(x-1)^5}-2d_1-\frac{14}{(x-1)^5}-2\Big)\ H(0,1,1,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2-\frac{10\ d_1}{(x-1)^5}+2d_1+\frac{14}{(x-1)^5}+
$$

$$
2\Big)\ H(0,1,1,c_1(\alpha_0);x)+\left(-\frac{2d_1}{(x-1)^5}+10\ d_1-\frac{6}{(x-1)^5}-10\right)\ H(0,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(6+
$$

$$
\frac{2}{(x-1)^5}\Big)\ H(0,c_1(\alpha_0),0,c_1(\alpha_0);x)+\left(-19-\frac{1}{(x-1)^5}\right)\ H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Big(16-
$$

$$
\frac{16}{(x-1)^5}\Big)\ H(1,0,0,0;x)+\left(-\frac{4d_1}{(x-1)^5}+\frac{10}{(x-1)^5}-2\right)\ H(1,0,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{10\ d_1}{(x-1)^5}+
$$

$$
2d_1-\frac{10}{(x-1)^5}+2\Big)\ H(1,0,1,0;x)+\left(\frac{4d_1^2}{(x-1)^5}-\frac{10d_1}{(x-1)^5}-2\ d_1+\frac{10}{(x-1)^5}-2\right)H(1,0,1,c_1(\alpha_0);x)+
$$

$$
\left(-\frac{2\ d_1}{(x-1)^5}+\frac{5}{(x-1)^5}-1\right)\ H(1,0,c_1(\alpha_0),c_1(\alpha_0);x)+\left(\frac{16d_1}{(x-1)^5}-8\ d_1-\frac{12}{(x-1)^5}-4\right)H(1,1,0,0;x)+
$$

$$
\left(\frac{4\ d_1^2}{(x-1)^5}-\frac{12d_1}{(x-1)^5}-2d_1+\frac{7}{(x-1)^5}+5\right)\ H(1,1,0,c_1(\alpha_0);x)+\Big(-\frac{12d_1^2}{(x-1)^5}+4d_1^2+\frac{18\ d_1}{(x-1)^5}+4d_1-
$$

$$
\frac{7}{(x-1)^5}-5\Big)\ H(1,1,1,0;x)+\left(\frac{12d_1^2}{(x-1)^5}-4d_1^2-\frac{18\ d_1}{(x-1)^5}-4d_1+\frac{7}{(x-1)^5}+5\right)\ H(1,1,1,c_1(\alpha_0);x)+
$$

$$
\left(-\frac{4d_1^2}{(x-1)^5}-\frac{4\ d_1}{(x-1)^5}+10d_1+\frac{5}{(x-1)^5}-1\right)\ H(1,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4\ d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+
$$

$$
6\Big)\ H(1,c_1(\alpha_0),0,c_1(\alpha_0);x)+\left(\frac{10\ d_1}{(x-1)^5}-\frac{1}{(x-1)^5}-19\right)\ H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-
$$

$$
\frac{4\ H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{10\ H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{6\ H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-
$$

$$
\frac{19\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+H(0;x)\ \Big(-\frac{63d_1^2}{16(x-1)}+\frac{19d_1^2}{54(x-1)^2}+\frac{19\ d_1^2}{54(x-1)^3}-\frac{63d_1^2}{16(x-1)^4}-
$$

$$
\frac{2035d_1^2}{432\ (x-1)^5}-\frac{2035d_1^2}{432}+\frac{407d_1}{48(x-1)}-\frac{80\ d_1}{27(x-1)^2}-\frac{73d_1}{54(x-1)^3}+\frac{1171d_1}{48\ (x-1)^4}+\frac{15865d_1}{432(x-1)^5}+\frac{9685d_1}{432}+\frac{5\ \pi^2}{8(x-1)}+
$$

$$
\frac{37}{8(x-1)}-\frac{5\pi^2}{36\ (x-1)^2}+\frac{101}{108(x-1)^2}-\frac{5\pi^2}{36\ (x-1)^3}+\frac{365}{108(x-1)^3}+\frac{5\pi^2}{8\ (x-1)^4}-\frac{239}{8(x-1)^4}+\frac{125\pi^2}{72\ (x-1)^5}-\frac{13505}{216(x-1)^5}+
$$

$$
\frac{12\zeta_3}{(x-1)^5}+24\ \zeta_3+\frac{125\pi^2}{72}-\frac{5525}{216}\Big)+H(1;x)\ \Big(-\frac{\pi^2 d_1}{3(x-1)}+\frac{\pi^2 d_1}{6\ (x-1)^2}-\frac{\pi^2 d_1}{9(x-1)^3}+\frac{\pi^2 d_1}{12\ (x-1)^4}-\frac{25\pi^2 d_1}{36(x-1)^5}-
$$

$$
\frac{6\zeta_3\ d_1}{(x-1)^5}+\Big(-\frac{4d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4\ d_1^2}{9(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\ (x-1)^5}+\frac{193d_1}{24(x-1)}-\frac{265d_1}{36(x-1)^2}+\frac{25\ d_1}{4(x-1)^3}-
$$

$$
\frac{107d_1}{24(x-1)^4}+\frac{185d_1}{8(x-1)^5}+\ \frac{205d_1}{72}+\frac{133}{8(x-1)}-\frac{289}{36\ (x-1)^2}+\frac{289}{36(x-1)^3}-\frac{133}{8(x-1)^4}-\frac{\pi^2}{6\ (x-1)^5}+\frac{305}{72(x-1)^5}+\frac{\pi^2}{6}-
$$

$$
\frac{305}{72}\Big)\ H(0;\alpha_0)+\Big(-\frac{8d_1}{x-1}+\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3\ (x-1)^3}+\frac{2d_1}{(x-1)^4}-\frac{50d_1}{3\ (x-1)^5}-\frac{5}{x-1}+\frac{10}{3(x-1)^2}-\frac{10}{3\ (x-1)^3}+
$$

$$
\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}+\frac{25}{3}\Big)\ H(0,0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4\ d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3\ (x-1)^5}-\frac{5d_1}{2(x-1)}+
$$

$$
\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3\ (x-1)^3}+\frac{5d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25\ d_1}{6}\Big)H(0,1;\alpha_0)+\left(\frac{16}{(x-1)^5}-16\right)H(0,0,0;\alpha_0)+
$$

$$
\left(\frac{8d_1}{(x-1)^5}-8d_1\right)H(0,0,1;\alpha_0)+\left(\frac{8\ d_1}{(x-1)^5}-8d_1\right)H(0,1,0;\alpha_0)+\left(\frac{4d_1^2}{(x-1)^5}-4\ d_1^2\right)H(0,1,1;\alpha_0)+
$$

$$\frac{13\pi^2}{24(x-1)}-\frac{\pi^2}{36\,(x-1)^2}-\frac{11\pi^2}{36(x-1)^3}+\frac{23\pi^2}{24\,(x-1)^4}+\frac{125\pi^2}{72(x-1)^5}-\frac{\zeta_3}{(x-1)^5}+13\,\zeta_3+\frac{175\pi^2}{72}\Bigg)+\frac{5d_1\pi^2}{16\,(x-1)}-\frac{71\pi^2}{48(x-1)}-\frac{5d_1\pi^2}{108\,(x-1)^2}+\frac{4\pi^2}{27(x-1)^2}-\frac{5d_1\pi^2}{108\,(x-1)^3}+\frac{\pi^2}{27(x-1)^3}+\frac{5d_1\pi^2}{16\,(x-1)^4}+\frac{17\pi^2}{48(x-1)^4}-\frac{61\pi^4}{180\,(x-1)^5}+\frac{205d_1\pi^2}{432(x-1)^5}-\frac{305\pi^2}{432\,(x-1)^5}-\frac{39\zeta_3}{4(x-1)}+\frac{13\zeta_3}{6\,(x-1)^2}+\frac{13\zeta_3}{6(x-1)^3}-\frac{39\zeta_3}{4\,(x-1)^4}-\frac{325\zeta_3}{12(x-1)^5}-\frac{325\,\zeta_3}{12}-\frac{49\pi^4}{432}+\frac{205d_1\pi^2}{432}-\frac{1145\pi^2}{432}.$$

## E. The $\mathcal{B}$-type collinear integrals

### E.1 The $\mathcal{B}$ integral for $k=0$ and $\delta=-1$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,0,-1,g_B)&=x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;-1,0)\\&=\frac{1}{\varepsilon}b_{-1}^{(-1,0)}+b_0^{(-1,0)}+\varepsilon b_1^{(-1,0)}+\varepsilon^2 b_2^{(-1,0)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned}\tag{E.1}$$

where

$$b_{-1}^{(-1,0)}=-\tfrac{1}{2},$$

$$b_0^{(-1,0)}=\frac{\alpha_0^4}{4\,(x-1)}+\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3\,(x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{3\alpha_0^2}{2\,(x-1)}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{2(x-1)^3}+3\,\alpha_0^2-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}-4\alpha_0+\left(1+\frac{1}{(x-1)^5}\right)H(0;\alpha_0)+\left(1-\frac{1}{(x-1)^5}\right)H(0;x)+\frac{H(c_1(\alpha_0);x)}{(x-1)^5}-1,$$

$$b_1^{(-1,0)}=-\frac{d_1\alpha_0^4}{8}-\frac{d_1\alpha_0^4}{8(x-1)}+\frac{3\alpha_0^4}{4\,(x-1)}+\frac{3\alpha_0^4}{4}+\frac{13d_1\alpha_0^3}{18}+\frac{d_1\alpha_0^3}{2\,(x-1)}-\frac{3\alpha_0^3}{x-1}-\frac{2d_1\alpha_0^3}{9(x-1)^2}+\frac{23\,\alpha_0^3}{18(x-1)^2}-\frac{77\alpha_0^3}{18}-\frac{23d_1\,\alpha_0^2}{12}-\frac{3d_1\alpha_0^2}{4(x-1)}+\frac{53\alpha_0^2}{12\,(x-1)}+\frac{2d_1\alpha_0^2}{3(x-1)^2}-\frac{47\alpha_0^2}{12\,(x-1)^2}-\frac{d_1\alpha_0^2}{2(x-1)^3}+\frac{31\alpha_0^2}{12\,(x-1)^3}+\frac{131\alpha_0^2}{12}+\frac{25d_1\alpha_0}{6}+\frac{d_1\alpha_0}{2\,(x-1)}-\frac{7\alpha_0}{3(x-1)}-\frac{2d_1\alpha_0}{3(x-1)^2}+\frac{4\,\alpha_0}{(x-1)^2}+\frac{d_1\alpha_0}{(x-1)^3}-\frac{17\alpha_0}{3\,(x-1)^3}-\frac{2d_1\alpha_0}{(x-1)^4}+\frac{49\alpha_0}{6(x-1)^4}-\frac{121\,\alpha_0}{6}+\Bigg(-\frac{\alpha_0^4}{x-1}-\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\,\alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\,\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2+\frac{4\,\alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\,\alpha_0}{(x-1)^4}+16\alpha_0-\frac{5}{2(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3\,(x-1)^3}+\frac{5}{2(x-1)^4}+\frac{37}{6(x-1)^5}-\frac{13}{6}\Bigg)H(0;\alpha_0)+\Bigg(\frac{37}{6}+\frac{5}{2(x-1)}-\frac{5}{3\,(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}-\frac{37}{6(x-1)^5}\Bigg)H(0;x)+\Bigg(-\frac{d_1\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2\,(x-1)}+\frac{8d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{x-1}-\frac{2d_1\,\alpha_0^3}{3(x-1)^2}-6d_1\alpha_0^2-\frac{3d_1\alpha_0^2}{x-1}+\frac{2d_1\,\alpha_0^2}{(x-1)^2}-\frac{d_1\alpha_0^2}{(x-1)^3}+8d_1\alpha_0+\frac{2d_1\,\alpha_0}{x-1}-\frac{2d_1\alpha_0}{(x-1)^2}+\frac{2d_1\alpha_0}{(x-1)^3}-\frac{2\,d_1\alpha_0}{(x-1)^4}-\frac{25d_1}{6}-\frac{d_1}{2(x-1)}+\frac{2d_1}{3\,(x-1)^2}-\frac{d_1}{(x-1)^3}+\frac{2d_1}{(x-1)^4}\Bigg)H(1;\alpha_0)+\left(\frac{2d_1}{(x-1)^5}-\frac{2}{(x-1)^5}+2\right)H(0;\alpha_0)\,H(1;x)+\Bigg(-\frac{\alpha_0^4}{2(x-1)}-\frac{\alpha_0^4}{2}+\frac{2\,\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}-\frac{3\,\alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}-6\,\alpha_0^2+\frac{2\alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\,\alpha_0}{(x-1)^3}-\frac{2\alpha_0}{(x-1)^4}+8\alpha_0-\frac{4H(0;\alpha_0)}{(x-1)^5}-\frac{2d_1H(1;\alpha_0)}{(x-1)^5}-\frac{5}{2(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2(x-1)^4}+\frac{37}{6\,(x-1)^5}-\frac{25}{6}\Bigg)H(c_1(\alpha_0);x)+\left(-4-\frac{4}{(x-1)^5}\right)H(0,0;\alpha_0)+\left(\frac{4}{(x-1)^5}-4\right)H(0,0;x)+\left(-\frac{2\,d_1}{(x-1)^5}-2d_1\right)H(0,1;\alpha_0)+\left(2-\frac{2}{(x-1)^5}\right)H(0,c_1(\alpha_0);x)+\left(-\frac{2d_1}{(x-1)^5}+\frac{2}{(x-1)^5}-2\right)H(1,0;x)+\left(\frac{2d_1}{(x-1)^5}-\frac{2}{(x-1)^5}+2\right)H(1,c_1(\,\alpha_0);x)-\frac{2H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{\pi^2}{3\,(x-1)^5}-\frac{\pi^2}{3}-2,$$

$$b_2^{(-1,0)}=\frac{d_1^2\alpha_0^4}{16}-\frac{d_1\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{16\,(x-1)}-\frac{d_1\alpha_0^4}{2(x-1)}-\frac{\pi^2\alpha_0^4}{24\,(x-1)}+\frac{7\alpha_0^4}{4(x-1)}-\frac{\pi^2\alpha_0^4}{24}+\frac{7\,\alpha_0^4}{4}-\frac{43d_1^2\alpha_0^3}{108}+\frac{349d_1\,\alpha_0^3}{108}-\frac{d_1^2\alpha_0^3}{4(x-1)}+\frac{2d_1\,\alpha_0^3}{x-1}+\frac{\pi^2\alpha_0^3}{6(x-1)}-\frac{7\alpha_0^3}{x-1}+\frac{4\,d_1^2\alpha_0^3}{27(x-1)^2}-\frac{133d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi^{\,2}\alpha_0^3}{18(x-1)^2}+\frac{191\alpha_0^3}{54(x-1)^2}+\frac{2\pi^2\,\alpha_0^3}{9}-\frac{569\alpha_0^3}{54}+\frac{95d_1^2\alpha_0^2}{72}-\frac{85d_1\,\alpha_0^2}{8}+\frac{3d_1^2\alpha_0^2}{8(x-1)}-\frac{203d_1\alpha_0^2}{72\,(x-1)}-\frac{\pi^2\alpha_0^2}{4(x-1)}+\frac{353\alpha_0^2}{36\,(x-1)}-\frac{4d_1^2\alpha_0^2}{9(x-1)^2}+\frac{31d_1\alpha_0^2}{8\,(x-1)^2}+\frac{\pi^2\alpha_0^2}{6(x-1)^2}-\frac{407\alpha_0^2}{36(x-1)^2}+\frac{d_1^2\alpha_0^2}{2(x-1)^3}-\frac{283d_1\alpha_0^2}{72(x-1)^3}-\frac{\pi^2\alpha_0^2}{12(x-1)^3}+\frac{331\alpha_0^2}{36(x-1)^3}-\frac{\pi^2\,\alpha_0^2}{2}+\frac{1091\alpha_0^2}{36}-\frac{205d_1^2\alpha_0}{36}+\frac{475\,d_1\alpha_0}{12}+$$

$$\frac{2\alpha_0}{3(x-2)} - \frac{d_1^2\alpha_0}{4(x-1)} - \frac{d_1\alpha_0}{9(x-1)} + \frac{\pi^2\alpha_0}{6(x-1)} - \frac{13\alpha_0}{36(x-1)} + \frac{4d_1^2\alpha_0}{9(x-1)^2} - \frac{73d_1\alpha_0}{18(x-1)^2} - \frac{\pi^2\alpha_0}{6(x-1)^2} + \frac{35\alpha_0}{3(x-1)^2} - \frac{d_1^2\alpha_0}{(x-1)^3} +$$

$$\frac{173d_1\alpha_0}{18(x-1)^3} + \frac{\pi^2\alpha_0}{6(x-1)^3} - \frac{875\alpha_0}{36(x-1)^3} + \frac{4d_1^2\alpha_0}{(x-1)^4} - \frac{937d_1\alpha_0}{36(x-1)^4} - \frac{\pi^2\alpha_0}{6(x-1)^4} + \frac{413\alpha_0}{9(x-1)^4} + \frac{2\pi^2\alpha_0}{3} - \frac{737\alpha_0}{9} + \Big(\frac{d_1\alpha_0^4}{2} +$$

$$\frac{d_1\alpha_0^4}{2(x-1)} - \frac{3\alpha_0^4}{x-1} - 3\alpha_0^4 - \frac{26d_1\alpha_0^3}{9} - \frac{2d_1\alpha_0^3}{x-1} + \frac{12\alpha_0^3}{x-1} + \frac{8d_1\alpha_0^3}{9(x-1)^2} - \frac{46\alpha_0^3}{9(x-1)^2} + \frac{154\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{3} + \frac{3d_1\alpha_0^2}{x-1} -$$

$$\frac{53\alpha_0^2}{3(x-1)} - \frac{8d_1\alpha_0^2}{3(x-1)^2} + \frac{47\alpha_0^2}{3(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} - \frac{31\alpha_0^2}{3(x-1)^3} - \frac{131\alpha_0^2}{3} - \frac{50d_1\alpha_0}{3} - \frac{2d_1\alpha_0}{x-1} + \frac{28\alpha_0}{3(x-1)} + \frac{8d_1\alpha_0}{3(x-1)^2} -$$

$$\frac{16\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{68\alpha_0}{3(x-1)^3} + \frac{8d_1\alpha_0}{(x-1)^4} - \frac{98\alpha_0}{3(x-1)^4} + \frac{242\alpha_0}{3} + \frac{205d_1}{36} - \frac{4}{x-2} + \frac{17d_1}{4(x-1)} - \frac{53}{4(x-1)} + \frac{8}{3(x-2)^2} -$$

$$\frac{13d_1}{9(x-1)^2} + \frac{317}{36(x-1)^2} + \frac{13d_1}{9(x-1)^3} - \frac{371}{36(x-1)^3} - \frac{17d_1}{4(x-1)^4} + \frac{193}{12(x-1)^4} - \frac{205d_1}{36(x-1)^5} - \frac{\pi^2}{6(x-1)^5} + \frac{266}{9(x-1)^5} -$$

$$\frac{\pi^2}{6} - \frac{194}{9}\Big)H(0;\alpha_0) + \Big(-\frac{17d_1}{4(x-1)} + \frac{13d_1}{9(x-1)^2} - \frac{13d_1}{9(x-1)^3} + \frac{17d_1}{4(x-1)^4} + \frac{205d_1}{36(x-1)^5} - \frac{205d_1}{36} + \frac{4}{x-2} + \frac{53}{4(x-1)} -$$

$$\frac{8}{3(x-2)^2} - \frac{317}{36(x-1)^2} + \frac{371}{36(x-1)^3} - \frac{193}{12(x-1)^4} - \frac{7\pi^2}{6(x-1)^5} - \frac{266}{9(x-1)^5} + \frac{3\pi^2}{2} + \frac{266}{9}\Big)H(0;x) + \Big(\frac{d_1^2\alpha_0^4}{4} -$$

$$\frac{3d_1\alpha_0^4}{2} + \frac{d_1^2\alpha_0^4}{4(x-1)} - \frac{3d_1\alpha_0^4}{2(x-1)} - \frac{13d_1^2\alpha_0^3}{9} + \frac{77d_1\alpha_0^3}{9} - \frac{d_1^2\alpha_0^3}{x-1} + \frac{6d_1\alpha_0^3}{x-1} + \frac{4d_1^2\alpha_0^3}{9(x-1)^2} - \frac{23d_1\alpha_0^3}{9(x-1)^2} + \frac{23d_1^2\alpha_0^2}{6} - \frac{131d_1\alpha_0^2}{6} +$$

$$\frac{3d_1^2\alpha_0^2}{2(x-1)} - \frac{53d_1\alpha_0^2}{6(x-1)} - \frac{4d_1^2\alpha_0^2}{3(x-1)^2} + \frac{47d_1\alpha_0^2}{6(x-1)^2} + \frac{d_1^2\alpha_0^2}{(x-1)^3} - \frac{31d_1\alpha_0^2}{6(x-1)^3} - \frac{25d_1^2\alpha_0}{3} + \frac{121d_1\alpha_0}{3} - \frac{d_1^2\alpha_0}{x-1} + \frac{14d_1\alpha_0}{3(x-1)} +$$

$$\frac{4d_1^2\alpha_0}{3(x-1)^2} - \frac{8d_1\alpha_0}{(x-1)^2} - \frac{2d_1^2\alpha_0}{(x-1)^3} + \frac{34d_1\alpha_0}{3(x-1)^3} + \frac{4d_1^2\alpha_0}{(x-1)^4} - \frac{49d_1\alpha_0}{3(x-1)^4} + \frac{205d_1^2}{36} - \frac{230d_1}{9} + \frac{d_1^2}{4(x-1)} - \frac{d_1}{3(x-1)} - \frac{4d_1^2}{9(x-1)^2} +$$

$$\frac{49d_1}{18(x-1)^2} + \frac{d_1^2}{(x-1)^3} - \frac{37d_1}{6(x-1)^3} - \frac{4d_1^2}{(x-1)^4} + \frac{49d_1}{3(x-1)^4}\Big)H(1;\alpha_0) + \Big(\frac{\pi^2}{2(x-1)^5} - \frac{\pi^2}{2}\Big)H(2;x) + \Big(\frac{4\alpha_0^4}{x-1} +$$

$$4\alpha_0^4 - \frac{16\alpha_0^3}{x-1} + \frac{16\alpha_0^3}{3(x-1)^2} - \frac{64\alpha_0^3}{3} + \frac{24\alpha_0^2}{x-1} - \frac{16\alpha_0^2}{(x-1)^2} + \frac{8\alpha_0^2}{(x-1)^3} + 48\alpha_0^2 - \frac{16\alpha_0}{x-1} + \frac{16\alpha_0}{(x-1)^2} - \frac{16\alpha_0}{(x-1)^3} + \frac{16\alpha_0}{(x-1)^4} -$$

$$64\alpha_0 + \frac{10}{x-1} - \frac{20}{3(x-1)^2} + \frac{20}{3(x-1)^3} - \frac{10}{(x-1)^4} - \frac{74}{3(x-1)^5} + \frac{26}{3}\Big)H(0,0;\alpha_0) + \Big(-\frac{74}{3} - \frac{10}{x-1} + \frac{20}{3(x-1)^2} -$$

$$\frac{20}{3(x-1)^3} + \frac{10}{(x-1)^4} + \frac{74}{3(x-1)^5}\Big)H(0,0;x) + \Big(2d_1\alpha_0^4 + \frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} - \frac{8d_1\alpha_0^3}{x-1} + \frac{8d_1\alpha_0^3}{3(x-1)^2} + 24d_1\alpha_0^2 +$$

$$\frac{12d_1\alpha_0^2}{x-1} - \frac{8d_1\alpha_0^2}{(x-1)^2} + \frac{4d_1\alpha_0^2}{(x-1)^3} - 32d_1\alpha_0 - \frac{8d_1\alpha_0}{x-1} + \frac{8d_1\alpha_0}{(x-1)^2} - \frac{8d_1\alpha_0}{(x-1)^3} + \frac{8d_1\alpha_0}{(x-1)^4} + \frac{13d_1}{3} + \frac{5d_1}{x-1} - \frac{10d_1}{3(x-1)^2} +$$

$$\frac{10d_1}{3(x-1)^3} - \frac{5d_1}{(x-1)^4} - \frac{37d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0) + H(1;x)\Big(\frac{2\pi^2d_1}{3(x-1)^5} + \Big(-\frac{4d_1}{x-1} + \frac{2d_1}{(x-1)^2} - \frac{4d_1}{3(x-1)^3} +$$

$$\frac{d_1}{(x-1)^4} + \frac{37d_1}{3(x-1)^5} + \frac{4}{x-2} + \frac{5}{2(x-1)} - \frac{8}{3(x-2)^2} - \frac{3}{(x-1)^2} + \frac{8}{3(x-2)^3} + \frac{5}{3(x-1)^3} - \frac{13}{2(x-1)^4} - \frac{37}{3(x-1)^5} +$$

$$\frac{37}{3}\Big)H(0;\alpha_0) + \Big(-\frac{8d_1}{(x-1)^5} + \frac{8}{(x-1)^5} - 8\Big)H(0,0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} + \frac{4d_1}{(x-1)^5} - 4d_1\Big)H(0,1;\alpha_0) -$$

$$\frac{2\pi^2}{3(x-1)^5} + \frac{\pi^2}{3}\Big) + \Big(-\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{8}{(x-1)^5} - 8\Big)H(0;\alpha_0)\,H(0,1;x) + \Big(\Big(\frac{8}{(x-1)^5} - 8\Big)H(0;\alpha_0) +$$

$$\Big(\frac{4d_1}{(x-1)^5} - 4d_1\Big)H(1;\alpha_0) + \frac{4}{x-2} + \frac{5}{2(x-1)} - \frac{8}{3(x-2)^2} - \frac{3}{(x-1)^2} + \frac{8}{3(x-2)^3} + \frac{5}{3(x-1)^3} - \frac{13}{2(x-1)^4} -$$

$$\frac{37}{3(x-1)^5} + \frac{37}{3}\Big)H(0,c_1(\alpha_0);x) + \Big(2d_1\alpha_0^4 + \frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} - \frac{8d_1\alpha_0^3}{x-1} + \frac{8d_1\alpha_0^3}{3(x-1)^2} + 24d_1\alpha_0^2 + \frac{12d_1\alpha_0^2}{x-1} -$$

$$\frac{8d_1\alpha_0^2}{(x-1)^2} + \frac{4d_1\alpha_0^2}{(x-1)^3} - 32d_1\alpha_0 - \frac{8d_1\alpha_0}{x-1} + \frac{8d_1\alpha_0}{(x-1)^2} - \frac{8d_1\alpha_0}{(x-1)^3} + \frac{8d_1\alpha_0}{(x-1)^4} + \frac{50d_1}{3} + \frac{2d_1}{x-1} - \frac{8d_1}{3(x-1)^2} + \frac{4d_1}{(x-1)^3} -$$

$$\frac{8d_1}{(x-1)^4}\Big)H(1,0;\alpha_0) + \Big(\frac{4d_1}{x-1} - \frac{2d_1}{(x-1)^2} + \frac{4d_1}{3(x-1)^3} - \frac{d_1}{(x-1)^4} - \frac{37d_1}{3(x-1)^5} - \frac{4}{x-2} - \frac{5}{2(x-1)} + \frac{8}{3(x-2)^2} +$$

$$\frac{3}{(x-1)^2} - \frac{8}{3(x-2)^3} - \frac{5}{3(x-1)^3} + \frac{13}{2(x-1)^4} + \frac{37}{3(x-1)^5} - \frac{37}{3}\Big)H(1,0;x) + \Big(d_1^2\alpha_0^4 + \frac{d_1^2\alpha_0^4}{x-1} - \frac{16d_1^2\alpha_0^3}{3} - \frac{4d_1^2\alpha_0^3}{x-1} +$$

$$\frac{4d_1^2\alpha_0^3}{3(x-1)^2} + 12d_1^2\alpha_0^2 + \frac{6d_1^2\alpha_0^2}{x-1} - \frac{4d_1^2\alpha_0^2}{(x-1)^2} + \frac{2d_1^2\alpha_0^2}{(x-1)^3} - 16d_1^2\alpha_0 - \frac{4d_1^2\alpha_0}{x-1} + \frac{4d_1^2\alpha_0}{(x-1)^2} - \frac{4d_1^2\alpha_0}{(x-1)^3} + \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{25d_1^2}{3} +$$

$$\frac{d_1^2}{x-1} - \frac{4d_1^2}{3(x-1)^2} + \frac{2d_1^2}{(x-1)^3} - \frac{4d_1^2}{(x-1)^4}\Big)H(1,1;\alpha_0) + H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{4} + \frac{d_1\alpha_0^4}{4(x-1)} - \frac{3\alpha_0^4}{2(x-1)} - \frac{3\alpha_0^4}{2} -$$

$$\frac{13d_1\alpha_0^3}{9} - \frac{d_1\alpha_0^3}{x-1} + \frac{6\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{23\alpha_0^3}{9(x-1)^2} + \frac{77\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{6} - \frac{\alpha_0^2}{3(x-2)} + \frac{3d_1\alpha_0^2}{2(x-1)} - \frac{103\alpha_0^2}{12(x-1)} - \frac{4d_1\alpha_0^2}{3(x-1)^2} +$$

$$\frac{95\alpha_0^2}{12(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{31\alpha_0^2}{6(x-1)^3} - \frac{131\alpha_0^2}{6} - \frac{25d_1\alpha_0}{3} + \frac{2\alpha_0}{x-2} - \frac{d_1\alpha_0}{x-1} + \frac{10\alpha_0}{3(x-1)} - \frac{4\alpha_0}{3(x-2)^2} + \frac{4d_1\alpha_0}{3(x-1)^2} -$$

$$\frac{15\alpha_0}{2(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{71\alpha_0}{6(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{49\alpha_0}{3(x-1)^4} + \frac{121\alpha_0}{3} + \frac{205d_1}{36} + \Big(\frac{2\alpha_0^4}{x-1} + 2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)^2} -$$

$$\frac{32\alpha_0^3}{3} + \frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{4\alpha_0^2}{(x-1)^3} + 24\alpha_0^2 - \frac{8\alpha_0}{x-1} + \frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} - 32\alpha_0 + \frac{10}{x-1} - \frac{20}{3(x-1)^2} +$$

$$\frac{20}{3(x-1)^3} - \frac{10}{(x-1)^4} - \frac{74}{3(x-1)^5} + \frac{50}{3}\Big)H(0;\alpha_0) + \Big(d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} - \frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} + 12d_1\alpha_0^2 +$$

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$$\frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} - 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} + \frac{25d_1}{3} + \frac{5d_1}{x-1} - \frac{10d_1}{3(x-1)^2} +$$
$$\frac{10d_1}{3(x-1)^3} - \frac{5d_1}{(x-1)^4} - \frac{37d_1}{3(x-1)^5}\Big) H(1;\alpha_0) + \frac{16H(0,0;\alpha_0)}{(x-1)^5} + \frac{8d_1H(0,1;\alpha_0)}{(x-1)^5} + \frac{8d_1H(1,0;\alpha_0)}{(x-1)^5} + \frac{4d_1^2H(1,1;\alpha_0)}{(x-1)^5} -$$
$$\frac{4}{x-2} + \frac{17d_1}{4(x-1)} - \frac{53}{4(x-1)} + \frac{8}{3(x-2)^2} - \frac{13d_1}{9(x-1)^2} + \frac{317}{36(x-1)^2} + \frac{13d_1}{9(x-1)^3} - \frac{371}{36(x-1)^3} - \frac{17d_1}{4(x-1)^4} + \frac{193}{12(x-1)^4} -$$
$$\frac{205d_1}{36(x-1)^5} - \frac{\pi^2}{6(x-1)^5} + \frac{266}{9(x-1)^5} - \frac{230}{9}\Big) + \Big(\frac{4d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} + 4d_1 + \frac{4}{(x-1)^5} - 2\Big) H(0;\alpha_0)H(1,1;x) +$$
$$\Big(-\frac{4d_1}{x-1} + \frac{2d_1}{(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{d_1}{(x-1)^4} + \frac{37d_1}{3(x-1)^5} + \Big(-\frac{8d_1}{(x-1)^5} + \frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} +$$
$$\frac{4d_1}{(x-1)^5} - 4d_1\Big) H(1;\alpha_0) + \frac{4}{x-2} + \frac{5}{2(x-1)} - \frac{8}{3(x-2)^2} - \frac{3}{(x-1)^2} + \frac{8}{3(x-2)^3} + \frac{5}{3(x-1)^3} - \frac{13}{2(x-1)^4} -$$
$$\frac{37}{3(x-1)^5} + \frac{37}{3}\Big) H(1,c_1(\alpha_0);x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0;\alpha_0)H(2,1;x) + \Big(\frac{\alpha_0^4}{x-1} + \frac{3\alpha_0^4}{2} - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} -$$
$$8\alpha_0^3 + \frac{6\alpha_0^2}{x-1} - \frac{4\alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} + 18\alpha_0^2 - \frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\alpha_0}{(x-1)^4} - 24\alpha_0 + \frac{8H(0;\alpha_0)}{(x-1)^5} +$$
$$\frac{4d_1H(1;\alpha_0)}{(x-1)^5} + \frac{7}{x-1} - \frac{13}{3(x-1)^2} + \frac{4}{(x-1)^3} - \frac{11}{2(x-1)^4} - \frac{37}{3(x-1)^5} + \frac{25}{2}\Big) H(c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{\alpha_0^4}{2(x-1)} -$$
$$\frac{\alpha_0^4}{2} - \frac{2\alpha_0^3}{x-1} + \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} + \frac{3\alpha_0^2}{x-1} - \frac{2\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} - 6\alpha_0^2 - \frac{2\alpha_0}{x-1} + \frac{2\alpha_0}{(x-1)^2} - \frac{2\alpha_0}{(x-1)^3} + \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 -$$
$$\frac{4}{x-2} + \frac{1}{2(x-1)} + \frac{8}{3(x-2)^2} + \frac{2}{3(x-1)^2} - \frac{8}{3(x-2)^3} + \frac{1}{(x-1)^3} + \frac{2}{(x-1)^4} - \frac{25}{6}\Big) H(c_2(\alpha_0),c_1(\alpha_0);x) + \Big(16 +$$
$$\frac{16}{(x-1)^5}\Big) H(0,0,0;\alpha_0) + \Big(16 - \frac{16}{(x-1)^5}\Big) H(0,0,0;x) + \Big(\frac{8d_1}{(x-1)^5} + 8d_1\Big) H(0,0,1;\alpha_0) + \Big(\frac{8}{(x-1)^5} -$$
$$8\Big) H(0,0,c_1(\alpha_0);x) + \Big(\frac{8d_1}{(x-1)^5} + 8d_1\Big) H(0,1,0;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 - \frac{8}{(x-1)^5} + 8\Big) H(0,1,0;x) +$$
$$\Big(\frac{4d_1^2}{(x-1)^5} + 4d_1^2\Big) H(0,1,1;\alpha_0) + \Big(-\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{8}{(x-1)^5} - 8\Big) H(0,1,c_1(\alpha_0);x) + \Big(\frac{4}{(x-1)^5} -$$
$$6\Big) H(0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{8d_1}{(x-1)^5} - \frac{8}{(x-1)^5} +$$
$$8\Big) H(1,0,0;x) + \Big(-\frac{4d_1}{(x-1)^5} + \frac{4}{(x-1)^5} - 2\Big) H(1,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1^2}{(x-1)^5} + \frac{8d_1}{(x-1)^5} - 4d_1 -$$
$$\frac{4}{(x-1)^5} + 2\Big) H(1,1,0;x) + \Big(\frac{4d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} + 4d_1 + \frac{4}{(x-1)^5} - 2\Big) H(1,1,c_1(\alpha_0);x) + \Big(-$$
$$\frac{4d_1}{(x-1)^5} + \frac{4}{(x-1)^5} - 6\Big) H(1,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(2,0,c_1(\alpha_0);x) + \Big(\frac{2}{(x-1)^5} -$$
$$2\Big) H(2,1,0;x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(2,1,c_1(\alpha_0);x) + \Big(\frac{2}{(x-1)^5} - 2\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) +$$
$$\frac{4H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} + \frac{2H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{\pi^2}{x-2} - \frac{3\pi^2}{8(x-1)} + \frac{2\pi^2}{3(x-2)^2} + \frac{5\pi^2}{9(x-1)^2} -$$
$$\frac{2\pi^2}{3(x-2)^3} - \frac{7\pi^2}{36(x-1)^3} + \frac{5\pi^2}{4(x-1)^4} + \frac{37\pi^2}{18(x-1)^5} - \frac{21\zeta_3}{4(x-1)^5} + \frac{17\zeta_3}{4} + \frac{\pi^2\ln 2}{2(x-1)^5} - \frac{1}{2}\pi^2\ln 2 - \frac{173\pi^2}{72} - 4.$$

### E.2 The $\mathcal{B}$ integral for $k = 1$ and $\delta = -1$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,1,-1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;-1,1)\\ &= \frac{1}{\varepsilon}b_{-1}^{(-1,1)} + b_0^{(-1,1)} + \varepsilon b_1^{(-1,1)} + \varepsilon^2 b_2^{(-1,1)} + \mathcal{O}\left(\varepsilon^3\right),\end{aligned} \tag{E.2}$$

where

$$b_{-1}^{(-1,1)} = -\frac{1}{4},$$

$$b_0^{(-1,1)} =$$
$$\frac{\alpha_0^4}{8(x-1)} + \frac{\alpha_0^4}{8} - \frac{\alpha_0^3}{2(x-1)} + \frac{\alpha_0^3}{6(x-1)^2} - \frac{2\alpha_0^3}{3} + \frac{3\alpha_0^2}{4(x-1)} - \frac{\alpha_0^2}{2(x-1)^2} + \frac{\alpha_0^2}{4(x-1)^3} + \frac{3\alpha_0^2}{2} - \frac{\alpha_0}{2(x-1)} + \frac{\alpha_0}{2(x-1)^2} -$$
$$\frac{\alpha_0}{2(x-1)^3} + \frac{\alpha_0}{2(x-1)^4} - 2\alpha_0 + \Big(\frac{1}{2} + \frac{1}{2(x-1)^5}\Big) H(0;\alpha_0) + \Big(\frac{1}{2} - \frac{1}{2(x-1)^5}\Big) H(0;x) + \frac{H(c_1(\alpha_0);x)}{2(x-1)^5} - \frac{1}{4},$$

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$$b_1^{(-1,1)} = -\frac{d_1\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{16(x-1)} + \frac{\alpha_0^4}{4\ (x-1)} + \frac{\alpha_0^4}{4} + \frac{13d_1\alpha_0^3}{36} + \frac{\alpha_0^3}{6(x-2)} + \frac{d_1\alpha_0^3}{4(x-1)} - \frac{13\alpha_0^3}{12(x-1)} - \frac{d_1\ \alpha_0^3}{9(x-1)^2} +$$
$$\frac{17\alpha_0^3}{36(x-1)^2} - \frac{53\ \alpha_0^3}{36} - \frac{23d_1\alpha_0^2}{24} - \frac{5\alpha_0^2}{6(x-2)} - \frac{3\ d_1\alpha_0^2}{8(x-1)} + \frac{23\alpha_0^2}{12(x-1)} + \frac{2\alpha_0^2}{3\ (x-2)^2} + \frac{d_1\alpha_0^2}{3(x-1)^2} - \frac{19\alpha_0^2}{12\ (x-1)^2} - \frac{d_1\alpha_0^2}{4(x-1)^3} +$$
$$\frac{25\alpha_0^2}{24\ (x-1)^3} + \frac{95\alpha_0^2}{24} + \frac{25d_1\alpha_0}{12} + \frac{7\alpha_0}{3\ (x-2)} + \frac{d_1\alpha_0}{4(x-1)} - \frac{9\alpha_0}{4(x-1)} - \frac{10\alpha_0}{3\ (x-2)^2} - \frac{d_1\alpha_0}{3(x-1)^2} + \frac{13\alpha_0}{6(x-1)^2} + \frac{4\ \alpha_0}{(x-2)^3} +$$
$$\frac{d_1\alpha_0}{2(x-1)^3} - \frac{31\alpha_0}{12\ (x-1)^3} - \frac{d_1\alpha_0}{(x-1)^4} + \frac{43\alpha_0}{12(x-1)^4} - \frac{97\ \alpha_0}{12} + \Bigg( - \frac{\alpha_0^4}{2(x-1)} - \frac{\alpha_0^4}{2} + \frac{2\ \alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} - \frac{3\ \alpha_0^2}{x-1} +$$
$$\frac{2\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} - 6\ \alpha_0^2 + \frac{2\alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\ \alpha_0}{(x-1)^3} - \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{4}{x-2} + \frac{5}{2\ (x-1)} + \frac{16}{3(x-2)^2} -$$
$$\frac{1}{12\ (x-1)^2} - \frac{8}{(x-2)^3} - \frac{5}{12\ (x-1)^3} + \frac{16}{(x-2)^4} + \frac{1}{(x-1)^4} + \frac{31}{12\ (x-1)^5} - \frac{19}{12}\Bigg) H(0;\alpha_0) + \Bigg( - \frac{5}{2\ (x-1)} +$$
$$\frac{1}{12(x-1)^2} + \frac{5}{12\ (x-1)^3} - \frac{1}{(x-1)^4} - \frac{31}{12\ (x-1)^5} + \frac{31}{12} + \frac{4}{x-2} - \frac{16}{3\ (x-2)^2} + \frac{8}{(x-2)^3} - \frac{16}{(x-2)^4}\Bigg) H(0;x) + \Bigg( -$$
$$\frac{d_1\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{4(x-1)} + \frac{4\ d_1\alpha_0^3}{3} + \frac{d_1\alpha_0^3}{x-1} - \frac{d_1\alpha_0^3}{3(x-1)^2} - 3d_1\ \alpha_0^2 - \frac{3d_1\alpha_0^2}{2(x-1)} + \frac{d_1\alpha_0^2}{(x-1)^2} - \frac{d_1\ \alpha_0^2}{2(x-1)^3} + 4d_1\alpha_0 + \frac{d_1\alpha_0}{x-1} -$$
$$\frac{d_1\ \alpha_0}{(x-1)^2} + \frac{d_1\alpha_0}{(x-1)^3} - \frac{d_1\ \alpha_0}{(x-1)^4} - \frac{25d_1}{12} - \frac{d_1}{4(x-1)} + \frac{d_1}{3\ (x-1)^2} - \frac{d_1}{2(x-1)^3} + \frac{d_1}{(x-1)^4}\Bigg) H(1;\alpha_0) + \Bigg(\frac{d_1}{(x-1)^5} +$$
$$\frac{16}{(x-2)^5} - \frac{1}{(x-1)^5}\ + 1\Bigg) H(0;\alpha_0)H(1;x) + \Bigg( - \frac{\alpha_0^4}{4(x-2)} - \frac{\alpha_0^4}{4\ (x-1)} - \frac{\alpha_0^4}{4} + \frac{\alpha_0^3}{x-2} + \frac{\alpha_0^3}{x-1} - \frac{2\ \alpha_0^3}{3(x-2)^2} -$$
$$\frac{\alpha_0^3}{3(x-1)^2} + \frac{4\alpha_0^3}{3} - \frac{3\ \alpha_0^2}{2(x-2)} - \frac{3\alpha_0^2}{2(x-1)} + \frac{2\ \alpha_0^2}{(x-2)^2} + \frac{\alpha_0^2}{(x-1)^2} - \frac{2\ \alpha_0^2}{(x-2)^3} - \frac{\alpha_0^2}{2(x-1)^3} - 3\ \alpha_0^2 + \frac{\alpha_0}{x-2} + \frac{\alpha_0}{x-1} - \frac{2\ \alpha_0}{(x-2)^2} -$$
$$\frac{\alpha_0}{(x-1)^2} + \frac{4\ \alpha_0}{(x-2)^3} + \frac{\alpha_0}{(x-1)^3} - \frac{8\ \alpha_0}{(x-2)^4} - \frac{\alpha_0}{(x-1)^4} + 4\alpha_0 - \frac{2\ H(0;\alpha_0)}{(x-1)^5} - \frac{d_1\ H(1;\alpha_0)}{(x-1)^5} - \frac{4}{x-2} + \frac{5}{2(x-1)} +$$
$$\frac{16}{3\ (x-2)^2} - \frac{1}{12(x-1)^2} - \frac{8}{(x-2)^3} - \frac{5}{12(x-1)^3} + \frac{16}{(x-2)^4} + \frac{1}{(x-1)^4} + \frac{31}{12\ (x-1)^5} - \frac{25}{12}\Bigg) H(c_1(\alpha_0);x) + \Bigg( -$$
$$2 - \frac{2}{(x-1)^5}\Bigg) H(0,0;\alpha_0) + \Bigg(\frac{2}{(x-1)^5} - 2\Bigg) H(0,0;x) + \Bigg( - \frac{d_1}{(x-1)^5} - d_1\Bigg) H(0,1;\alpha_0) + \Bigg( - \frac{1}{(x-1)^5} +$$
$$1 + \frac{16}{(x-2)^5}\Bigg) H(0,c_1(\ \alpha_0);x) + \Bigg( - \frac{d_1}{(x-1)^5} - \frac{16}{(x-2)^5} + \frac{1}{(x-1)^5}\ - 1\Bigg) H(1,0;x) + \Bigg(\frac{d_1}{(x-1)^5} + \frac{16}{(x-2)^5} -$$
$$\frac{1}{(x-1)^5} + 1\Bigg) H(1,c_1(\alpha_0);x) - \frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{16\ H(c_2(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5} - \frac{4\pi^2}{(x-2)^5} + \frac{\pi^2}{6(x-1)^5} - \frac{\pi^2}{6} - \frac{1}{4},$$

$$b_2^{(-1,1)} =$$
$$\frac{d_1^2\alpha_0^4}{32} - \frac{3d_1\alpha_0^4}{16} + \frac{d_1^2\alpha_0^4}{32\ (x-1)} - \frac{3d_1\alpha_0^4}{16(x-1)} - \frac{\pi^2\alpha_0^4}{48\ (x-1)} + \frac{3\alpha_0^4}{8(x-1)} - \frac{\pi^2\alpha_0^4}{48} + \frac{3\ \alpha_0^4}{8} - \frac{43d_1^2\alpha_0^3}{216} + \frac{271d_1\ \alpha_0^3}{216} - \frac{7d_1\alpha_0^3}{36(x-2)} +$$
$$\frac{5\alpha_0^3}{9\ (x-2)} - \frac{d_1^2\alpha_0^3}{8(x-1)} + \frac{61d_1\alpha_0^3}{72\ (x-1)} + \frac{\pi^2\alpha_0^3}{12(x-1)} - \frac{16\alpha_0^3}{9(x-1)} + \frac{2\ d_1^2\alpha_0^3}{27(x-1)^2} - \frac{109d_1\alpha_0^3}{216(x-1)^2} - \frac{\pi^2\alpha_0^3}{36(x-1)^2} + \frac{26\alpha_0^3}{27(x-1)^2} + \frac{\pi^2\ \alpha_0^3}{9} -$$
$$\frac{133\alpha_0^3}{54} + \frac{95d_1^2\alpha_0^2}{144} - \frac{209\ d_1\alpha_0^2}{48} + \frac{41d_1\alpha_0^2}{36(x-2)} - \frac{28\alpha_0^2}{9\ (x-2)} + \frac{3d_1^2\alpha_0^2}{16(x-1)} - \frac{61d_1\alpha_0^2}{36\ (x-1)} - \frac{\pi^2\alpha_0^2}{8(x-1)} + \frac{253\alpha_0^2}{72\ (x-1)} - \frac{10d_1\alpha_0^2}{9(x-2)^2} +$$
$$\frac{26\alpha_0^2}{9\ (x-2)^2} - \frac{2d_1^2\alpha_0^2}{9(x-1)^2} + \frac{43d_1\alpha_0^2}{24\ (x-1)^2} + \frac{\pi^2\alpha_0^2}{12(x-1)^2} - \frac{281\alpha_0^2}{72\ (x-1)^2} + \frac{d_1^2\alpha_0^2}{4(x-1)^3} - \frac{247d_1\alpha_0^2}{144\ (x-1)^3} - \frac{\pi^2\alpha_0^2}{24(x-1)^3} + \frac{55\alpha_0^2}{18(x-1)^3} -$$
$$\frac{\pi^2\alpha_0^2}{4} + \frac{295\alpha_0^2}{36} - \frac{205d_1^2\alpha_0}{72} + \frac{425d_1\alpha_0}{24} - \frac{97d_1\alpha_0}{18(x-2)} + \frac{221\alpha_0}{18\ (x-2)} - \frac{d_1^2\alpha_0}{8(x-1)} + \frac{91d_1\alpha_0}{24\ (x-1)} + \frac{\pi^2\alpha_0}{12(x-1)} - \frac{17\alpha_0}{3(x-1)} +$$
$$\frac{74\ d_1\alpha_0}{9(x-2)^2} - \frac{178\alpha_0}{9(x-2)^2} + \frac{2d_1^2\alpha_0}{9\ (x-1)^2} - \frac{29d_1\alpha_0}{9(x-1)^2} - \frac{\pi^2\alpha_0}{12\ (x-1)^2} + \frac{145\alpha_0}{18(x-1)^2} - \frac{12d_1\ \alpha_0}{(x-2)^3} + \frac{28\alpha_0}{(x-2)^3} - \frac{d_1^2\alpha_0}{2\ (x-1)^3} +$$
$$\frac{355d_1\alpha_0}{72(x-1)^3} + \frac{\pi^2\alpha_0}{12\ (x-1)^3} - \frac{409\alpha_0}{36(x-1)^3} + \frac{2d_1^2\ \alpha_0}{(x-1)^4} - \frac{865d_1\alpha_0}{72(x-1)^4} - \frac{\pi^2\alpha_0}{12\ (x-1)^4} + \frac{661\alpha_0}{36(x-1)^4} + \frac{\pi^2\alpha_0}{3} - \frac{1039\ \alpha_0}{36} + \Bigg(\frac{d_1\alpha_0^4}{4} +$$
$$\frac{d_1\alpha_0^4}{4\ (x-1)} - \frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{13d_1\alpha_0^3}{9} - \frac{2\ \alpha_0^3}{3(x-2)} - \frac{d_1\alpha_0^3}{x-1} + \frac{13\alpha_0^3}{3\ (x-1)} + \frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{17\alpha_0^3}{9\ (x-1)^2} + \frac{53\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{6} + \frac{10\alpha_0^2}{3\ (x-2)} +$$
$$\frac{3d_1\alpha_0^2}{2(x-1)} - \frac{23\alpha_0^2}{3(x-1)} - \frac{8\ \alpha_0^2}{3(x-2)^2} - \frac{4d_1\alpha_0^2}{3(x-1)^2} + \frac{19\alpha_0^2}{3\ (x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{25\alpha_0^2}{6\ (x-1)^3} - \frac{95\alpha_0^2}{6} - \frac{25d_1\alpha_0}{3} - \frac{28\alpha_0}{3\ (x-2)} - \frac{d_1\alpha_0}{x-1} +$$
$$\frac{9\alpha_0}{x-1} + \frac{40\alpha_0}{3\ (x-2)^2} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{26\alpha_0}{3\ (x-1)^2} - \frac{16\alpha_0}{(x-2)^3} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{31\ \alpha_0}{3(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{43\alpha_0}{3\ (x-1)^4} + \frac{97\alpha_0}{3} + \frac{205d_1}{72} +$$
$$\frac{34d_1}{3\ (x-2)} - \frac{8}{x-2} - \frac{109d_1}{12(x-1)} - \frac{1}{3\ (x-1)} - \frac{116d_1}{9(x-2)^2} + \frac{112}{9(x-2)^2} + \frac{37\ d_1}{72(x-1)^2} + \frac{2}{9(x-1)^2} + \frac{16\ d_1}{(x-2)^3} - \frac{24}{(x-2)^3} +$$
$$\frac{29d_1}{72\ (x-1)^3} - \frac{31}{18(x-1)^3} - \frac{32\ d_1}{(x-2)^4} + \frac{80}{(x-2)^4} - \frac{2\ d_1}{(x-1)^4} + \frac{4}{(x-1)^4} - \frac{205d_1}{72(x-1)^5} - \frac{\pi\ ^2}{12(x-1)^5} + \frac{403}{36(x-1)^5} - \frac{\pi\ ^2}{12} -$$
$$\frac{367}{36}\Bigg) H(0;\alpha_0) + \Bigg( - \frac{34d_1}{3\ (x-2)} + \frac{109d_1}{12(x-1)} + \frac{116d_1}{9(x-2)^2} - \frac{37\ d_1}{72(x-1)^2} - \frac{16d_1}{(x-2)^3} - \frac{29d_1}{72\ (x-1)^3} + \frac{32d_1}{(x-2)^4} + \frac{2d_1}{(x-1)^4} +$$
$$\frac{205\ d_1}{72(x-1)^5} - \frac{205d_1}{72} + \frac{8}{x-2} + \frac{1}{3\ (x-1)} - \frac{112}{9(x-2)^2} - \frac{2}{9\ (x-1)^2} + \frac{24}{(x-2)^3} + \frac{31}{18(x-1)^3} - \frac{80}{(x-2)^4} - \frac{4}{(x-1)^4} +$$
$$\frac{16\pi^2}{(x-2)^5} - \frac{7\pi^2}{12\ (x-1)^5} - \frac{403}{36(x-1)^5} + \frac{3\pi\ ^2}{4} + \frac{403}{36}\Bigg) H(0;x) + \Bigg(\frac{d_1^2\ \alpha_0^4}{8} - \frac{d_1\alpha_0^4}{2} + \frac{d_1^2\alpha_0^4}{8(x-1)} - \frac{d_1\ \alpha_0^4}{2(x-1)} - \frac{13d_1^2\alpha_0^3}{18} +$$

$$\frac{53d_1\alpha_0^3}{18}-\frac{d_1\alpha_0^3}{3(x-2)}-\frac{d_1^2\alpha_0^3}{2(x-1)}+\frac{13d_1\alpha_0^3}{6(x-1)}+\frac{2d_1^2\alpha_0^3}{9(x-1)^2}-\frac{17d_1\alpha_0^3}{18(x-1)^2}+\frac{23d_1^2\alpha_0^2}{12}-\frac{95d_1\alpha_0^2}{12}+\frac{5d_1\alpha_0^2}{3(x-2)}+\frac{3d_1^2\alpha_0^2}{4(x-1)}-$$

$$\frac{23d_1\alpha_0^2}{6(x-1)}-\frac{4d_1\alpha_0^2}{3(x-2)^2}-\frac{2d_1^2\alpha_0^2}{3(x-1)^2}+\frac{19d_1\alpha_0^2}{6(x-1)^2}+\frac{d_1^2\alpha_0^2}{2(x-1)^3}-\frac{25d_1\alpha_0^2}{12(x-1)^3}-\frac{25d_1^2\alpha_0}{6}+\frac{97d_1\alpha_0}{6}-\frac{14d_1\alpha_0}{3(x-2)}-\frac{d_1^2\alpha_0}{2(x-1)}+$$

$$\frac{9d_1\alpha_0}{2(x-1)}+\frac{20d_1\alpha_0}{3(x-2)^2}+\frac{2d_1^2\alpha_0}{3(x-1)^2}-\frac{13d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{(x-2)^3}-\frac{d_1^2\alpha_0}{(x-1)^3}+\frac{31d_1\alpha_0}{6(x-1)^3}+\frac{2d_1^2\alpha_0}{(x-1)^4}-\frac{43d_1\alpha_0}{6(x-1)^4}+\frac{205d_1^2}{72}-$$

$$\frac{385d_1}{36}+\frac{10d_1}{3(x-2)}+\frac{d_1^2}{8(x-1)}-\frac{7d_1}{3(x-1)}-\frac{16d_1}{3(x-2)^2}-\frac{2d_1^2}{9(x-1)^2}+\frac{19d_1}{9(x-1)^2}+\frac{8d_1}{(x-2)^3}+\frac{d_1^2}{2(x-1)^3}-\frac{37d_1}{12(x-1)^3}-$$

$$\frac{2d_1^2}{(x-1)^4}+\frac{43d_1}{6(x-1)^4}\Big)H(1;\alpha_0)+\Big(\frac{8\pi^2d_1}{(x-2)^5}-\frac{16\pi^2}{(x-2)^5}+\frac{\pi^2}{4(x-1)^5}-\frac{\pi^2}{4}\Big)H(2;x)+\Big(\frac{2\alpha_0^4}{x-1}+2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+$$

$$\frac{8\alpha_0^3}{3(x-1)^2}-\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}+24\alpha_0^2-\frac{8\alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\alpha_0}{(x-1)^4}-32\alpha_0+\frac{16}{x-2}-$$

$$\frac{10}{x-1}-\frac{64}{3(x-2)^2}+\frac{1}{3(x-1)^2}+\frac{32}{(x-2)^3}+\frac{5}{3(x-1)^3}-\frac{64}{(x-2)^4}-\frac{4}{(x-1)^4}-\frac{31}{3(x-1)^5}+\frac{19}{3}\Big)H(0,0;\alpha_0)+$$

$$\Big(\frac{10}{x-1}-\frac{1}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{4}{(x-1)^4}+\frac{31}{3(x-1)^5}-\frac{31}{3}-\frac{16}{x-2}+\frac{64}{3(x-2)^2}-\frac{32}{(x-2)^3}+\frac{64}{(x-2)^4}\Big)H(0,0;x)+$$

$$\Big(d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+$$

$$\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{19d_1}{6}+\frac{8d_1}{x-2}-\frac{5d_1}{x-1}-\frac{32d_1}{3(x-2)^2}+\frac{d_1}{6(x-1)^2}+\frac{16d_1}{(x-2)^3}+\frac{5d_1}{6(x-1)^3}-\frac{32d_1}{(x-2)^4}-$$

$$\frac{2d_1}{(x-1)^4}-\frac{31d_1}{6(x-1)^5}\Big)H(0,1;\alpha_0)+H(1;x)\Big(\frac{\pi^2d_1}{3(x-1)^5}+\Big(-\frac{15d_1}{2(x-2)}+\frac{11d_1}{2(x-1)}+\frac{28d_1}{3(x-2)^2}-\frac{5d_1}{6(x-1)^2}-$$

$$\frac{12d_1}{(x-2)^3}+\frac{d_1}{6(x-1)^3}+\frac{16d_1}{(x-2)^4}+\frac{31d_1}{6(x-1)^5}-\frac{3}{2(x-2)}+\frac{5}{x-1}+\frac{8}{3(x-2)^2}-\frac{29}{12(x-1)^2}-\frac{8}{3(x-2)^3}+\frac{5}{4(x-1)^3}-$$

$$\frac{7}{2(x-1)^4}+\frac{16}{(x-2)^5}-\frac{31}{6(x-1)^5}+\frac{31}{6}\Big)H(0;\alpha_0)+\Big(-\frac{4d_1}{(x-1)^5}-\frac{64}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Big)H(0,0;\alpha_0)+$$

$$\Big(-\frac{2d_1^2}{(x-1)^5}-\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-2d_1\Big)H(0,1;\alpha_0)-\frac{8\pi^2}{3(x-2)^5}-\frac{\pi^2}{3(x-1)^5}+\frac{\pi^2}{6}\Big)+\Big(\frac{32d_1}{(x-2)^5}-\frac{2d_1}{(x-1)^5}+$$

$$2d_1-\frac{32}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)\ H(0,1;x)+\Big(-\frac{\alpha_0^4}{2(x-2)}+\frac{2\alpha_0^3}{x-2}-\frac{4\alpha_0^3}{3(x-2)^2}-\frac{3\alpha_0^2}{x-2}+\frac{4\alpha_0^2}{(x-2)^2}-$$

$$\frac{4\alpha_0^2}{(x-2)^3}+\frac{2\alpha_0}{x-2}-\frac{4\alpha_0}{(x-2)^2}+\frac{8\alpha_0}{(x-2)^3}-\frac{16\alpha_0}{(x-2)^4}+\Big(\frac{4}{(x-1)^5}-4-\frac{64}{(x-2)^5}\Big)H(0;\alpha_0)+\Big(-\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-$$

$$2d_1\Big)H(1;\alpha_0)-\frac{2}{x-2}+\frac{5}{x-1}+\frac{4}{(x-2)^2}-\frac{29}{12(x-1)^2}-\frac{20}{3(x-2)^3}+\frac{5}{4(x-1)^3}+\frac{16}{(x-2)^4}-\frac{7}{2(x-1)^4}+\frac{16}{(x-2)^5}-$$

$$\frac{31}{6(x-1)^5}+\frac{31}{6}\Big)H(0,c_1(\alpha_0);x)+\Big(d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-$$

$$\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{3}+\frac{d_1}{x-1}-\frac{4d_1}{3(x-1)^2}+\frac{2d_1}{(x-1)^3}-$$

$$\frac{4d_1}{(x-1)^4}\Big)H(1,0;\alpha_0)+\Big(\frac{15d_1}{2(x-2)}-\frac{11d_1}{2(x-1)}-\frac{28d_1}{3(x-2)^2}+\frac{5d_1}{6(x-1)^2}+\frac{12d_1}{(x-2)^3}-\frac{d_1}{6(x-1)^3}-\frac{16d_1}{(x-2)^4}-$$

$$\frac{31d_1}{6(x-1)^5}+\frac{3}{2(x-2)}-\frac{5}{x-1}-\frac{8}{3(x-2)^2}+\frac{29}{12(x-1)^2}+\frac{8}{3(x-2)^3}-\frac{5}{4(x-1)^3}+\frac{7}{2(x-1)^4}-\frac{16}{(x-2)^5}+\frac{31}{6(x-1)^5}-$$

$$\frac{31}{6}\Big)H(1,0;x)+\Big(\frac{d_1^2\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{2(x-1)}-\frac{8d_1^2\alpha_0^3}{3}-\frac{2d_1^2\alpha_0^3}{x-1}+\frac{2d_1^2\alpha_0^3}{3(x-1)^2}+6d_1^2\alpha_0^2+\frac{3d_1^2\alpha_0^2}{x-1}-\frac{2d_1^2\alpha_0^2}{(x-1)^2}+\frac{d_1^2\alpha_0^2}{(x-1)^3}-$$

$$8d_1^2\alpha_0-\frac{2d_1^2\alpha_0}{x-1}+\frac{2d_1^2\alpha_0}{(x-1)^2}-\frac{2d_1^2\alpha_0}{(x-1)^3}+\frac{2d_1^2\alpha_0}{(x-1)^4}+\frac{25d_1^2}{6}+\frac{d_1^2}{2(x-1)}-\frac{2d_1^2}{3(x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{2d_1^2}{(x-1)^4}\Big)H(1,1;\alpha_0)+$$

$$H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{8}+\frac{d_1\alpha_0^4}{8(x-2)}-\frac{\alpha_0^4}{2(x-2)}+\frac{d_1\alpha_0^4}{8(x-1)}-\frac{\alpha_0^4}{2(x-1)}-\frac{\alpha_0^4}{2}-\frac{13d_1\alpha_0^3}{18}-\frac{d_1\alpha_0^3}{2(x-2)}+\frac{5\alpha_0^3}{3(x-2)}-\frac{d_1\alpha_0^3}{2(x-1)}+$$

$$\frac{29\alpha_0^3}{12(x-1)}+\frac{4d_1\alpha_0^3}{9(x-2)^2}-\frac{14\alpha_0^3}{9(x-2)^2}+\frac{2d_1\alpha_0^3}{9(x-1)^2}-\frac{17\alpha_0^3}{18(x-1)^2}+\frac{53\alpha_0^3}{18}+\frac{23d_1\alpha_0^2}{12}+\frac{3d_1\alpha_0^2}{4(x-2)}-\frac{5\alpha_0^2}{4(x-2)}+\frac{3d_1\alpha_0^2}{4(x-1)}-$$

$$\frac{61\alpha_0^2}{12(x-1)}-\frac{4d_1\alpha_0^2}{3(x-2)^2}+\frac{10\alpha_0^2}{3(x-2)^2}-\frac{2d_1\alpha_0^2}{3(x-1)^2}+\frac{43\alpha_0^2}{12(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-2)^3}-\frac{6\alpha_0^2}{(x-2)^3}+\frac{d_1\alpha_0^2}{2(x-1)^3}-\frac{25\alpha_0^2}{12(x-1)^3}-\frac{95\alpha_0^2}{12}-$$

$$\frac{25d_1\alpha_0}{6}-\frac{d_1\alpha_0}{2(x-2)}-\frac{25\alpha_0}{6(x-2)}-\frac{d_1\alpha_0}{2(x-1)}+\frac{103\alpha_0}{12(x-1)}+\frac{4d_1\alpha_0}{3(x-2)^2}+\frac{10\alpha_0}{3(x-2)^2}+\frac{2d_1\alpha_0}{3(x-1)^2}-\frac{73\alpha_0}{12(x-1)^2}-\frac{4d_1\alpha_0}{(x-2)^3}+$$

$$\frac{4\alpha_0}{(x-2)^3}-\frac{d_1\alpha_0}{(x-1)^3}+\frac{37\alpha_0}{6(x-1)^3}+\frac{16d_1\alpha_0}{(x-2)^4}-\frac{40\alpha_0}{(x-2)^4}+\frac{2d_1\alpha_0}{(x-1)^4}-\frac{43\alpha_0}{6(x-1)^4}+\frac{97\alpha_0}{6}+\frac{205d_1}{72}+\Big(\frac{\alpha_0^4}{x-2}+\frac{\alpha_0^4}{x-1}+\alpha_0^4-$$

$$\frac{4\alpha_0^3}{x-2}-\frac{4\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-2)^2}+\frac{4\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}+\frac{6\alpha_0^2}{x-2}+\frac{6\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-2)^2}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{8\alpha_0^2}{(x-2)^3}+\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2-$$

$$\frac{4\alpha_0}{x-2}-\frac{4\alpha_0}{x-1}+\frac{8\alpha_0}{(x-2)^2}+\frac{4\alpha_0}{(x-1)^2}-\frac{16\alpha_0}{(x-2)^3}-\frac{4\alpha_0}{(x-1)^3}+\frac{32\alpha_0}{(x-2)^4}+\frac{4\alpha_0}{(x-1)^4}-16\alpha_0+\frac{16}{x-2}-\frac{10}{x-1}-\frac{64}{3(x-2)^2}+$$

$$\frac{1}{3(x-1)^2}+\frac{32}{(x-2)^3}+\frac{5}{3(x-1)^3}-\frac{64}{(x-2)^4}-\frac{4}{(x-1)^4}-\frac{31}{3(x-1)^5}+\frac{25}{3}\Big)H(0;\alpha_0)+\Big(\frac{d_1\alpha_0^4}{2}+\frac{d_1\alpha_0^4}{2(x-2)}+$$

$$\frac{d_1\alpha_0^4}{2(x-1)}-\frac{8d_1\alpha_0^3}{3}-\frac{2d_1\alpha_0^3}{x-2}-\frac{2d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-2)^2}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+6d_1\alpha_0^2+\frac{3d_1\alpha_0^2}{x-2}+\frac{3d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-2)^2}-\frac{2d_1\alpha_0^2}{(x-1)^2}+$$

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$$\frac{4d_1\alpha_0^2}{(x-2)^3}+\frac{d_1\alpha_0^2}{(x-1)^3}-8d_1\alpha_0-\frac{2d_1\alpha_0}{x-2}-\frac{2d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-2)^2}+\frac{2d_1\alpha_0}{(x-1)^2}-\frac{8d_1\alpha_0}{(x-2)^3}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{16d_1\alpha_0}{(x-2)^4}+\frac{2d_1\alpha_0}{(x-1)^4}+$$

$$\frac{25d_1}{6}+\frac{8d_1}{x-2}-\frac{5d_1}{x-1}-\frac{32d_1}{3(x-2)^2}+\frac{d_1}{6(x-1)^2}+\frac{16d_1}{(x-2)^3}+\frac{5d_1}{6(x-1)^3}-\frac{32d_1}{(x-2)^4}-\frac{2d_1}{(x-1)^4}-\frac{31d_1}{6(x-1)^5}\Big)H(1;\alpha_0)+$$

$$\frac{8H(0,0;\alpha_0)}{(x-1)^5}+\frac{4d_1H(0,1;\alpha_0)}{(x-1)^5}+\frac{4d_1H(1,0;\alpha_0)}{(x-1)^5}+\frac{2d_1^2H(1,1;\alpha_0)}{(x-1)^5}+\frac{34d_1}{3(x-2)}-\frac{8}{x-2}-\frac{109d_1}{12(x-1)}-\frac{1}{3(x-1)}-$$

$$\frac{116d_1}{9(x-2)^2}+\frac{112}{9(x-2)^2}+\frac{37d_1}{72(x-1)^2}+\frac{2}{9(x-1)^2}+\frac{16d_1}{(x-2)^3}-\frac{24}{(x-2)^3}+\frac{29d_1}{72(x-1)^3}-\frac{31}{18(x-1)^3}-\frac{32d_1}{(x-2)^4}+\frac{80}{(x-2)^4}-$$

$$\frac{2d_1}{(x-1)^4}+\frac{4}{(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^2}{12(x-1)^5}+\frac{403}{36(x-1)^5}-\frac{385}{36}\Big)+\Big(\frac{2d_1^2}{(x-1)^5}+\frac{32d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2d_1+$$

$$\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)H(0;\alpha_0)\,H(1,1;x)+\Big(-\frac{15d_1}{2(x-2)}+\frac{11d_1}{2(x-1)}+\frac{28d_1}{3(x-2)^2}-\frac{5d_1}{6(x-1)^2}-\frac{12d_1}{(x-2)^3}+$$

$$\frac{d_1}{6(x-1)^3}+\frac{16d_1}{(x-2)^4}+\frac{31d_1}{6(x-1)^5}+\Big(-\frac{4d_1}{(x-1)^5}-\frac{64}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)+\Big(-\frac{2d_1^2}{(x-1)^5}-\frac{32d_1}{(x-2)^5}+$$

$$\frac{2d_1}{(x-1)^5}-2d_1\Big)H(1;\alpha_0)-\frac{3}{2(x-2)}+\frac{5}{x-1}+\frac{8}{3(x-2)^2}-\frac{29}{12(x-1)^2}-\frac{8}{3(x-2)^3}+\frac{5}{4(x-1)^3}-\frac{7}{2(x-1)^4}+$$

$$\frac{16}{(x-2)^5}-\frac{31}{6(x-1)^5}+\frac{31}{6}\Big)H(1,c_1(\alpha_0);x)+\Big(-\frac{32d_1}{(x-2)^5}+\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+1\Big)H(0;\alpha_0)\,H(2,1;x)+$$

$$\Big(\frac{5\alpha_0^4}{4(x-2)}+\frac{\alpha_0^4}{2(x-1)}+\frac{3\alpha_0^4}{4}-\frac{5\alpha_0^3}{x-2}-\frac{2\alpha_0^3}{x-1}+\frac{10\alpha_0^3}{3(x-2)^2}+\frac{2\alpha_0^3}{3(x-1)^2}-4\alpha_0^3+\frac{15\alpha_0^2}{2(x-2)}+\frac{3\alpha_0^2}{x-1}-\frac{10\alpha_0^2}{(x-2)^2}-\frac{2\alpha_0^2}{(x-1)^2}+$$

$$\frac{10\alpha_0^2}{(x-2)^3}+\frac{\alpha_0^2}{(x-1)^3}+9\alpha_0^2-\frac{5\alpha_0}{x-2}-\frac{2\alpha_0}{x-1}+\frac{10\alpha_0}{(x-2)^2}+\frac{2\alpha_0}{(x-1)^2}-\frac{20\alpha_0}{(x-2)^3}-\frac{2\alpha_0}{(x-1)^3}+\frac{40\alpha_0}{(x-2)^4}+\frac{2\alpha_0}{(x-1)^4}-12\alpha_0+$$

$$\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1H(1;\alpha_0)}{(x-1)^5}+\frac{20}{x-2}-\frac{61}{4(x-1)}-\frac{80}{3(x-2)^2}+\frac{29}{12(x-1)^2}+\frac{40}{(x-2)^3}-\frac{1}{12(x-1)^3}-\frac{80}{(x-2)^4}-\frac{3}{2(x-1)^4}-$$

$$\frac{31}{6(x-1)^5}+\frac{25}{4}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{4(x-1)}-\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3(x-1)^2}+\frac{4\alpha_0^3}{3}+\frac{3\alpha_0^2}{2(x-1)}-\frac{\alpha_0^2}{(x-1)^2}+$$

$$\frac{\alpha_0^2}{2(x-1)^3}-3\alpha_0^2-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}+4\alpha_0+\frac{64H(0;\alpha_0)}{(x-2)^5}+\frac{32d_1H(1;\alpha_0)}{(x-2)^5}-\frac{2}{x-2}+\frac{1}{4(x-1)}+$$

$$\frac{4}{3(x-2)^2}+\frac{1}{3(x-1)^2}-\frac{4}{3(x-2)^3}+\frac{1}{2(x-1)^3}+\frac{1}{(x-1)^4}-\frac{16}{(x-2)^5}-\frac{25}{12}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(8+$$

$$\frac{8}{(x-1)^5}\Big)H(0,0,0;\alpha_0)+\Big(8-\frac{8}{(x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{4d_1}{(x-1)^5}+4d_1\Big)H(0,0,1;\alpha_0)+\Big(\frac{4}{(x-1)^5}-4-$$

$$\frac{32}{(x-2)^5}\Big)H(0,0,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}+4d_1\Big)H(0,1,0;\alpha_0)+\Big(-\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-2d_1+\frac{32}{(x-2)^5}-$$

$$\frac{4}{(x-1)^5}+4\Big)H(0,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}+2d_1^2\Big)H(0,1,1;\alpha_0)+\Big(\frac{32d_1}{(x-2)^5}-\frac{2d_1}{(x-1)^5}+2d_1-\frac{32}{(x-2)^5}+$$

$$\frac{4}{(x-1)^5}-4\Big)H(0,1,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-3-\frac{80}{(x-2)^5}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{1}{(x-1)^5}+$$

$$1+\frac{64}{(x-2)^5}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}+\frac{64}{(x-2)^5}-\frac{4}{(x-1)^5}+4\Big)H(1,0,0;x)+\Big(-\frac{2d_1}{(x-1)^5}+$$

$$\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{2d_1^2}{(x-1)^5}-\frac{32d_1}{(x-2)^5}+\frac{4d_1}{(x-1)^5}-2d_1-\frac{16}{(x-2)^5}-\frac{2}{(x-1)^5}+$$

$$1\Big)H(1,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}+\frac{32d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2d_1+\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)H(1,1,c_1(\alpha_0);x)+$$

$$\Big(-\frac{2d_1}{(x-1)^5}-\frac{80}{(x-2)^5}+\frac{2}{(x-1)^5}-3\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{32d_1}{(x-2)^5}+\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+$$

$$1\Big)H(2,0,c_1(\alpha_0);x)+\Big(\frac{32d_1}{(x-2)^5}-\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-1\Big)H(2,1,0;x)+\Big(-\frac{32d_1}{(x-2)^5}+\frac{64}{(x-2)^5}-$$

$$\frac{1}{(x-1)^5}+1\Big)H(2,1,c_1(\alpha_0);x)+\Big(\frac{32d_1}{(x-2)^5}-\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-1\Big)H(2,c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\frac{2H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{32H(c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-2)^5}+$$

$$\frac{80H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5}+\frac{\pi^2}{6(x-2)}-\frac{13\pi^2}{16(x-1)}-\frac{5\pi^2}{9(x-2)^2}+\frac{31\pi^2}{72(x-1)^2}+\frac{\pi^2}{(x-2)^3}-\frac{\pi^2}{6(x-1)^3}-\frac{8\pi^2}{3(x-2)^4}+$$

$$\frac{2\pi^2}{3(x-1)^4}-\frac{4\pi^2}{(x-2)^5}+\frac{31\pi^2}{36(x-1)^5}+\frac{28\zeta_3}{(x-2)^5}-\frac{21\zeta_3}{8(x-1)^5}+\frac{17\zeta_3}{8}-\frac{24\pi^2\ln 2}{(x-2)^5}+\frac{\pi^2\ln 2}{4(x-1)^5}-\frac{1}{4}\pi^2\ln 2-\frac{149\pi^2}{144}-\frac{1}{4}$$

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### E.3 The $\mathcal{B}$ integral for $k=2$ and $\delta=-1$ and $d_1=-3$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,2,-1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;-1,2)\\ &= \frac{1}{\varepsilon}b_{-1}^{(-1,2)}+b_0^{(-1,2)}+\varepsilon b_1^{(-1,2)}+\varepsilon^2 b_2^{(-1,2)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned} \qquad \text{(E.3)}$$

where

$$b_{-1}^{(-1,2)}=-\tfrac{1}{6},$$

$$\begin{aligned}b_0^{(-1,2)} =& -\frac{\alpha_0^{10}}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0^9}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0^8}{12(\alpha_0+1)^4(x-1)}+\\
&\frac{4\ \alpha_0^8}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}-\frac{4\alpha_0^7}{3(\alpha_0+1)^4(x\ \alpha_0-2\alpha_0-x)}-\frac{\alpha_0^6}{3(\alpha_0+1)^4(x-1)}-\frac{2\ \alpha_0^6}{(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\\
&\frac{\alpha_0^6}{9(\alpha_0+1)^3\ (x-1)^2}+\frac{\alpha_0^5}{3(x-2)}+\frac{2\alpha_0^5}{(\alpha_0+1)^4(x\alpha_0-2\ \alpha_0-x)}-\frac{5\alpha_0^4}{4(x-2)}+\frac{5\alpha_0^4}{12(\alpha_0+1)^4\ (x-1)}+\frac{4\alpha_0^4}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\\
&\frac{5\alpha_0^4}{6\ (x-2)^2}-\frac{\alpha_0^4}{3(\alpha_0+1)^3(x-1)^2}+\frac{\alpha_0^4}{6(\alpha_0+1)^2\ (x-1)^3}+\frac{\alpha_0^4}{12}+\frac{5\alpha_0^3}{3(x-2)}-\frac{\alpha_0^3}{3\ (\alpha_0+1)^4(x-1)}-\frac{4\alpha_0^3}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}-\\
&\frac{20\ \alpha_0^3}{9(x-2)^2}+\frac{\alpha_0^3}{9(\alpha_0+1)^3(x-1)^2}+\frac{20\alpha_0^3}{9\ (x-2)^3}-\frac{4\alpha_0^3}{9}-\frac{5\alpha_0^2}{6(x-2)}-\frac{5\alpha_0^2}{6(\ \alpha_0+1)^4(x-1)}-\frac{\alpha_0^2}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\\
&\frac{5\ \alpha_0^2}{3(x-2)^2}+\frac{2\alpha_0^2}{3(\alpha_0+1)^3(x-1)^2}-\frac{10\ \alpha_0^2}{3(x-2)^3}-\frac{\alpha_0^2}{2(\alpha_0+1)^2(x-1)^3}+\frac{20\alpha_0^2}{3\ (x-2)^4}+\frac{\alpha_0^2}{3(\alpha_0+1)(x-1)^4}+\alpha_0^2-\\
&\frac{\alpha_0}{3(\alpha_0+1)^4\ (x-1)}+\frac{\alpha_0}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0}{3(\alpha_0+1)^3\ (x-1)^2}-\frac{\alpha_0}{3(\alpha_0+1)^2(x-1)^3}+\frac{\alpha_0}{3(\alpha_0+1)\ (x-1)^4}+\\
&\frac{80\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3}+\left(\frac{1}{3\ (x-1)^5}+\frac{1}{3}+\frac{80}{3(x-2)^5}+\frac{160}{3(x-2)^6}\right)H(0;\alpha_0)+\left(-\frac{1}{3(x-1)^5}+\frac{1}{3}-\frac{80}{3\ (x-2)^5}-\right.\\
&\left.\frac{160}{3(x-2)^6}\right)H(0;x)+\frac{H(c_1(\alpha_0);x)}{3\ (x-1)^5}+\left(\frac{80}{3(x-2)^5}+\frac{160}{3(x-2)^6}\right)H(c_2(\alpha_0);x)+\frac{80\ln 2}{3(x-2)^5}+\frac{160\ln 2}{3\ (x-2)^6}-\frac{1}{9},\end{aligned}$$

$$\begin{aligned}b_1^{(-1,2)} =& \frac{1}{\alpha_0 x-x-2\alpha_0}\left\{\frac{19x\alpha_0^5}{72}+\frac{31\alpha_0^5}{36(x-2)}-\frac{19\alpha_0^5}{72\ (x-1)}+\frac{\alpha_0^5}{6}-\frac{131x\alpha_0^4}{72}-\frac{5\alpha_0^4}{2\ (x-2)}+\frac{95\alpha_0^4}{72(x-1)}+\right.\\
&\frac{65\alpha_0^4}{18\ (x-2)^2}-\frac{\alpha_0^4}{2(x-1)^2}-\frac{\alpha_0^4}{3}+\frac{52x\ \alpha_0^3}{9}+\frac{25\alpha_0^3}{18(x-2)}-\frac{95\alpha_0^3}{36\ (x-1)}-\frac{40\alpha_0^3}{9(x-2)^2}+\frac{53\alpha_0^3}{24\ (x-1)^2}+\frac{20\alpha_0^3}{(x-2)^3}-\frac{41\alpha_0^3}{36\ (x-1)^3}-\\
&\frac{121\alpha_0^3}{72}-\frac{40x\alpha_0^2}{3}+\frac{23\alpha_0^2}{9\ (x-2)}+\frac{13\alpha_0^2}{6(x-1)}-\frac{9\alpha_0^2}{(x-2)^2}-\frac{271\ \alpha_0^2}{72(x-1)^2}+\frac{400\alpha_0^2}{9(x-2)^3}+\frac{17\alpha_0^2}{3\ (x-1)^3}+\frac{1880\alpha_0^2}{9(x-2)^4}-\frac{77\alpha_0^2}{18\ (x-1)^4}+\\
&\frac{857\alpha_0^2}{72}-\frac{1}{9}\pi^2 x\alpha_0+\frac{244x\ \alpha_0}{27}-\frac{10\alpha_0}{9(x-2)}-\frac{13\alpha_0}{12(x-1)}+\frac{6\ \alpha_0}{(x-2)^2}+\frac{31\alpha_0}{36(x-1)^2}-\frac{392\alpha_0}{9\ (x-2)^3}-\frac{7\alpha_0}{4(x-1)^3}+\frac{4\pi^2\alpha_0}{9\ (x-2)^4}-\\
&\frac{3760\alpha_0}{9(x-2)^4}+\frac{\pi^2\alpha_0}{9\ (x-1)^4}-\frac{77\alpha_0}{18(x-1)^4}+\frac{80\pi^2\alpha_0}{9\ (x-2)^5}-\frac{5120\alpha_0}{9(x-2)^5}-\frac{\pi^2\alpha_0}{9\ (x-1)^5}+\frac{160\ln^2 2\,\alpha_0}{3(x-2)^4}+\frac{320\ln^2 2\ \ \alpha_0}{3(x-2)^5}+\frac{160\ln 2\,\alpha_0}{9(x-2)^4}+\\
&\frac{320\ln 2\ \ \alpha_0}{9(x-2)^5}+\frac{2\pi^2\alpha_0}{9}+\frac{265\alpha_0}{108}+\frac{\pi\ ^2x}{9}+\frac{2x}{27}+\left(-\frac{x\alpha_0^5}{3}-\frac{2\alpha_0^5}{3\ (x-2)}+\frac{\alpha_0^5}{3(x-1)}+\frac{19x\alpha_0^4}{9}+\frac{20\alpha_0^4}{9\ (x-2)}-\frac{13\alpha_0^4}{9(x-1)}-\right.\\
&\frac{20\alpha_0^4}{9(x-2)^2}+\frac{4\ \alpha_0^4}{9(x-1)^2}-\frac{2\alpha_0^4}{9}-\frac{52x\alpha_0^3}{9}-\frac{20\ \alpha_0^3}{9(x-2)}+\frac{22\alpha_0^3}{9(x-1)}+\frac{40\alpha_0^3}{9\ (x-2)^2}-\frac{14\alpha_0^3}{9(x-1)^2}-\frac{80\alpha_0^3}{9\ (x-2)^3}+\frac{2\alpha_0^3}{3(x-1)^3}+\frac{4\alpha_0^3}{3}+\\
&\frac{28x\ \alpha_0^2}{3}-\frac{2\alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{2\ \alpha_0^2}{(x-1)^3}-\frac{160\alpha_0^2}{3(x-2)^4}+\frac{4\alpha_0^2}{3\ (x-1)^4}-4\alpha_0^2-\frac{13x\alpha_0}{2}-\frac{32\alpha_0}{9(x-2)}+\frac{37\ \alpha_0}{6(x-1)}+\frac{8\alpha_0}{9(x-2)^2}-\\
&\frac{13\alpha_0}{9\ (x-1)^2}+\frac{16\alpha_0}{(x-2)^3}+\frac{23\alpha_0}{18(x-1)^3}+\frac{2080\ \alpha_0}{9(x-2)^4}+\frac{79\alpha_0}{36(x-1)^4}+\frac{2240\alpha_0}{9(x-2)^5}-\frac{29\alpha_0}{18(x-1)^5}-\frac{19\alpha_0}{12}+\frac{7x}{6}-\frac{40}{9\ (x-2)}+\\
&\frac{13}{3(x-1)}+\frac{56}{9(x-2)^2}-\frac{7}{18\ (x-1)^2}-\frac{160}{9(x-2)^3}-\frac{2}{9(x-1)^3}-\frac{1408}{9\ (x-2)^4}-\frac{85}{36(x-1)^4}-\frac{2560}{9(x-2)^5}-\frac{29}{18\ (x-1)^5}-\\
&\left.\frac{640}{9(x-2)^6}+\frac{5}{4}\right)H(0;\alpha_0)+\left(\frac{x\ \alpha_0^5}{2}+\frac{\alpha_0^5}{x-2}-\frac{\alpha_0^5}{2(x-1)}-\frac{19x\ \alpha_0^4}{6}-\frac{10\alpha_0^4}{3(x-2)}+\frac{13\alpha_0^4}{6(x-1)}+\frac{10\ \alpha_0^4}{3(x-2)^2}-\frac{2\alpha_0^4}{3(x-1)^2}+\right.\\
&\frac{\alpha_0^4}{3}+\frac{26\ x\alpha_0^3}{3}+\frac{10\alpha_0^3}{3(x-2)}-\frac{11\alpha_0^3}{3\ (x-1)}-\frac{20\alpha_0^3}{3(x-2)^2}+\frac{7\alpha_0^3}{3(x-1)^2}+\frac{40\ \alpha_0^3}{3(x-2)^3}-\frac{\alpha_0^3}{(x-1)^3}-2\alpha_0^3-14x\alpha_0^2+\frac{3\ \alpha_0^2}{x-1}-\\
&\frac{3\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}+\frac{80\ \alpha_0^2}{(x-2)^4}-\frac{2\alpha_0^2}{(x-1)^4}+6\alpha_0^2+\frac{73x\ \alpha_0}{6}-\frac{5\alpha_0}{3(x-2)}-\frac{7\alpha_0}{6(x-1)}+\frac{20\alpha_0}{3\ (x-2)^2}+\frac{5\alpha_0}{3(x-1)^2}-\frac{40\alpha_0}{(x-2)^3}-\\
&\frac{3\ \alpha_0}{(x-1)^3}-\frac{320\alpha_0}{(x-2)^4}-\frac{320\ \alpha_0}{(x-2)^5}-\frac{10\alpha_0}{3}-\frac{25x}{6}+\frac{2}{3\ (x-2)}+\frac{1}{6(x-1)}-\frac{10}{3(x-2)^2}-\frac{1}{3\ (x-1)^2}+\frac{80}{3\ (x-2)^3}+\frac{1}{(x-1)^3}+\\
&\left.\frac{240}{(x-2)^4}+\frac{2}{(x-1)^4}+\frac{320}{(x-2)^5}-1\right)H(1;\alpha_0)+\left(\frac{2x\alpha_0}{3}+\frac{208\ \alpha_0}{3(x-2)^4}-\frac{8\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3\ (x-2)^5}+\frac{8\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\right.\\
&\left.\frac{2\ x}{3}-\frac{208}{3(x-2)^4}+\frac{8}{3(x-1)^4}-\frac{736}{3\ (x-2)^5}+\frac{8}{3(x-1)^5}-\frac{640}{3(x-2)^6}\right)H(0;\alpha_0)\ H(1;x)+\left(-\frac{x\alpha_0^5}{6}-\frac{\alpha_0^5}{3(x-2)}+\right.\end{aligned}$$

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$$\frac{\alpha_0^5}{6\,(x-1)} - \frac{\alpha_0^5}{4} + \frac{19x\alpha_0^4}{18} + \frac{17\alpha_0^4}{18\,(x-2)} - \frac{13\alpha_0^4}{18(x-1)} - \frac{10\alpha_0^4}{9(x-2)^2} + \frac{2\,\alpha_0^4}{9(x-1)^2} + \frac{41\alpha_0^4}{36} - \frac{26x\alpha_0^3}{9} - \frac{4\,\alpha_0^3}{9(x-2)} + \frac{11\alpha_0^3}{9(x-1)} +$$
$$\frac{14\alpha_0^3}{9\,(x-2)^2} - \frac{7\alpha_0^3}{9(x-1)^2} - \frac{40\alpha_0^3}{9\,(x-2)^3} + \frac{\alpha_0^3}{3(x-1)^3} - \frac{11\alpha_0^3}{6} + \frac{14x\,\alpha_0^2}{3} - \frac{\alpha_0^2}{x-2} - \frac{\alpha_0^2}{x-1} + \frac{2\,\alpha_0^2}{(x-2)^2} + \frac{\alpha_0^2}{(x-1)^2} - \frac{4\,\alpha_0^2}{(x-2)^3} -$$
$$\frac{\alpha_0^2}{(x-1)^3} - \frac{80\alpha_0^2}{3\,(x-2)^4} + \frac{2\alpha_0^2}{3(x-1)^4} + \frac{\alpha_0^2}{2} - \frac{73x\,\alpha_0}{18} - \frac{32\alpha_0}{9(x-2)} + \frac{37\alpha_0}{6(x-1)} + \frac{8\alpha_0}{9\,(x-2)^2} - \frac{13\alpha_0}{9(x-1)^2} + \frac{16\alpha_0}{(x-2)^3} +$$
$$\frac{23\,\alpha_0}{18(x-1)^3} + \frac{176\alpha_0}{(x-2)^4} + \frac{55\alpha_0}{36\,(x-1)^4} + \frac{320\alpha_0}{3(x-2)^5} - \frac{29\alpha_0}{18(x-1)^5} - \frac{29\,\alpha_0}{36} + \frac{25x}{18} + \Bigg( - \frac{4\alpha_0}{3(x-1)^4} + \frac{4\alpha_0}{3\,(x-1)^5} + \frac{4}{3(x-1)^4} +$$
$$\frac{4}{3(x-1)^5}\Bigg)\, H(0;\alpha_0) + \Bigg(\frac{2\alpha_0}{(x-1)^4} - \frac{2\,\alpha_0}{(x-1)^5} - \frac{2}{(x-1)^4} - \frac{2}{(x-1)^5}\Bigg)\, H(1;\alpha_0) - \frac{40}{9(x-2)} + \frac{13}{3(x-1)} + \frac{56}{9\,(x-2)^2} -$$
$$\frac{7}{18(x-1)^2} - \frac{160}{9(x-2)^3} - \frac{2}{9\,(x-1)^3} - \frac{416}{3(x-2)^4} - \frac{85}{36(x-1)^4} - \frac{640}{3\,(x-2)^5} - \frac{29}{18(x-1)^5} + \frac{5}{4}\Bigg)\, H(c_1(\alpha_0);x) +$$
$$\Bigg(\frac{160\alpha_0}{9(x-2)^4} + \frac{320\alpha_0}{9\,(x-2)^5} + \Bigg( - \frac{320\alpha_0}{3(x-2)^4} - \frac{640\alpha_0}{3\,(x-2)^5} + \frac{320}{3(x-2)^4} + \frac{1280}{3(x-2)^5} + \frac{1280}{3\,(x-2)^6}\Bigg) H(0;\alpha_0) + \Bigg(\frac{160\alpha_0}{(x-2)^4} +$$
$$\frac{320\,\alpha_0}{(x-2)^5} - \frac{160}{(x-2)^4} - \frac{640}{(x-2)^5} - \frac{640}{(x-2)\,^6}\Bigg) H(1;\alpha_0) - \frac{160}{9(x-2)^4} - \frac{640}{9\,(x-2)^5} - \frac{640}{9(x-2)^6}\Bigg) H(c_2(\alpha_0);x) +$$
$$\Bigg( - \frac{4x\,\alpha_0}{3} - \frac{320\alpha_0}{3(x-2)^4} - \frac{4\alpha_0}{3(x-1)^4} - \frac{640\,\alpha_0}{3(x-2)^5} + \frac{4\alpha_0}{3(x-1)^5} + \frac{8\alpha_0}{3} + \frac{4\,x}{3} + \frac{320}{3(x-2)^4} + \frac{4}{3(x-1)^4} + \frac{1280}{3\,(x-2)^5} +$$
$$\frac{4}{3(x-1)^5} + \frac{1280}{3(x-2)^6}\Bigg)\, H(0,0;\alpha_0) + \Bigg( - \frac{4x\alpha_0}{3} + \frac{320\alpha_0}{3(x-2)^4} + \frac{4\,\alpha_0}{3(x-1)^4} + \frac{640\alpha_0}{3(x-2)^5} - \frac{4\alpha_0}{3\,(x-1)^5} + \frac{8\alpha_0}{3} +$$
$$\frac{4x}{3} - \frac{320}{3\,(x-2)^4} - \frac{4}{3(x-1)^4} - \frac{1280}{3(x-2)^5} - \frac{4}{3\,(x-1)^5} - \frac{1280}{3(x-2)^6}\Bigg) H(0,0;x) + \Bigg(2x\alpha_0 + \frac{160\,\alpha_0}{(x-2)^4} + \frac{2\alpha_0}{(x-1)^4} +$$
$$\frac{320\alpha_0}{(x-2)^5} - \frac{2\,\alpha_0}{(x-1)^5} - 4\alpha_0 - 2\,x - \frac{160}{(x-2)^4} - \frac{2}{(x-1)^4} - \frac{640}{(x-2)^5} - \frac{2}{(\,x-1)^5} - \frac{640}{(x-2)^6}\Bigg) H(0,1;\alpha_0) + \Bigg(\frac{2x\,\alpha_0}{3} +$$
$$\frac{208\alpha_0}{3(x-2)^4} - \frac{2\alpha_0}{3(x-1)^4} + \frac{320\,\alpha_0}{3(x-2)^5} + \frac{2\alpha_0}{3(x-1)^5} - \frac{4\alpha_0}{3} - \frac{2\,x}{3} - \frac{208}{3(x-2)^4} + \frac{2}{3(x-1)^4} - \frac{736}{3\,(x-2)^5} + \frac{2}{3(x-1)^5} -$$
$$\frac{640}{3(x-2)^6}\Bigg)\, H(0,c_1(\alpha_0);x) + \Bigg( - \frac{320\alpha_0}{3(x-2)^4} - \frac{640\alpha_0}{3\,(x-2)^5} + \frac{320}{3(x-2)^4} + \frac{1280}{3(x-2)^5} + \frac{1280}{3\,(x-2)^6}\Bigg) H(0,c_2(\alpha_0);x) +$$
$$\Bigg( - \frac{2x\alpha_0}{3} - \frac{208\,\alpha_0}{3(x-2)^4} + \frac{8\alpha_0}{3(x-1)^4} - \frac{320\alpha_0}{3\,(x-2)^5} - \frac{8\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} + \frac{2\,x}{3} + \frac{208}{3(x-2)^4} - \frac{8}{3(x-1)^4} + \frac{736}{3\,(x-2)^5} -$$
$$\frac{8}{3(x-1)^5} + \frac{640}{3(x-2)^6}\Bigg)\, H(1,0;x) + \Bigg(\frac{2x\alpha_0}{3} + \frac{208\alpha_0}{3(x-2)^4} - \frac{8\,\alpha_0}{3(x-1)^4} + \frac{320\alpha_0}{3(x-2)^5} + \frac{8\alpha_0}{3\,(x-1)^5} - \frac{4\alpha_0}{3} - \frac{2x}{3} -$$
$$\frac{208}{3\,(x-2)^4} + \frac{8}{3(x-1)^4} - \frac{736}{3(x-2)^5} + \frac{8}{3\,(x-1)^5} - \frac{640}{3(x-2)^6}\Bigg) H(1,c_1(\alpha_0);x) + \Bigg( - \frac{800\,\alpha_0}{3(x-2)^4} - \frac{1600\alpha_0}{3(x-2)^5} +$$
$$\frac{800}{3\,(x-2)^4} + \frac{3200}{3(x-2)^5} + \frac{3200}{3(x-2)^6}\Bigg) H(2,0;x) + \Bigg(\frac{800\alpha_0}{3(x-2)^4} + \frac{1600\alpha_0}{3\,(x-2)^5} - \frac{800}{3(x-2)^4} - \frac{3200}{3(x-2)^5} -$$
$$\frac{3200}{3\,(x-2)^6}\Bigg) H(2,c_2(\alpha_0);x) + \Bigg( - \frac{2\alpha_0}{3(x-1)^4} + \frac{2\,\alpha_0}{3(x-1)^5} + \frac{2}{3(x-1)^4} + \frac{2}{3(x-1)^5}\Bigg)\, H(c_1(\alpha_0),c_1(\alpha_0);x) +$$
$$\Bigg( - \frac{208\alpha_0}{3(x-2)^4} - \frac{320\,\alpha_0}{3(x-2)^5} + \frac{208}{3(x-2)^4} + \frac{736}{3\,(x-2)^5} + \frac{640}{3(x-2)^6}\Bigg) H(c_2(\alpha_0),c_1(\alpha_0);x) + H(0;x)\,\Bigg(\frac{29x\alpha_0}{18} +$$
$$\frac{32\alpha_0}{9(x-2)} - \frac{37\alpha_0}{6\,(x-1)} - \frac{8\alpha_0}{9(x-2)^2} + \frac{13\alpha_0}{9(x-1)^2} - \frac{16\,\alpha_0}{(x-2)^3} - \frac{23\alpha_0}{18(x-1)^3} - \frac{1120\alpha_0}{9\,(x-2)^4} - \frac{31\alpha_0}{36(x-1)^4} - \frac{320\alpha_0}{9(x-2)^5} +$$
$$\frac{29\,\alpha_0}{18(x-1)^5} - \frac{320\ln 2\,\alpha_0}{3(x-2)^4} - \frac{640\ln 2\,\alpha_0}{3(x-2)^5} - \frac{71\alpha_0}{36} - \frac{29x}{18} + \frac{40}{9\,(x-2)} - \frac{13}{3(x-1)} - \frac{56}{9(x-2)^2} + \frac{7}{18\,(x-1)^2} +$$
$$\frac{160}{9(x-2)^3} + \frac{2}{9(x-1)^3} + \frac{1408}{9\,(x-2)^4} + \frac{85}{36(x-1)^4} + \frac{2560}{9(x-2)^5} + \frac{29}{18\,(x-1)^5} + \frac{640}{9(x-2)^6} + \frac{320\ln 2}{3\,(x-2)^4} + \frac{1280\ln 2}{3(x-2)^5} +$$
$$\frac{1280\ln 2}{3\,(x-2)^6} - \frac{5}{4}\Bigg) + H(2;x)\Bigg(\frac{800\ln 2\,\alpha_0}{3\,(x-2)^4} + \frac{1600\ln 2\,\alpha_0}{3(x-2)^5} + \Bigg(\frac{800\alpha_0}{3\,(x-2)^4} + \frac{1600\alpha_0}{3(x-2)^5} - \frac{800}{3\,(x-2)^4} - \frac{3200}{3(x-2)^5} -$$
$$\frac{3200}{3(x-2)^6}\Bigg) H(0;\alpha_0) - \frac{800\ln 2}{3(x-2)^4} - \frac{3200\ln 2}{3\,(x-2)^5} - \frac{3200\ln 2}{3(x-2)^6}\Bigg) - \frac{4\pi^2}{9\,(x-2)^4} - \frac{\pi^2}{9(x-1)^4} - \frac{88\pi^2}{9\,(x-2)^5} -$$
$$\frac{\pi^2}{9(x-1)^5} - \frac{160\pi^2}{9\,(x-2)^6} - \frac{160\ln^2 2}{3(x-2)^4} - \frac{640\ln^2 2}{3\,(x-2)^5} - \frac{640\ln^2 2}{3(x-2)^6} - \frac{160\ln 2}{9\,(x-2)^4} - \frac{640\ln 2}{9(x-2)^5} - \frac{640\ln 2}{9(x-2)^6}\Big\},$$

$$b_2^{(-1,2)} = \frac{1}{\alpha_0 x - x - 2\alpha_0}\Big\{ - \frac{1}{72}\pi^2 x\alpha_0^5 + \frac{301x\alpha_0^5}{432} - \frac{\pi^2\,\alpha_0^5}{36(x-2)} + \frac{673\alpha_0^5}{216(x-2)} + \frac{\pi^2\alpha_0^5}{72\,(x-1)} - \frac{301\alpha_0^5}{432(x-1)} +$$
$$\frac{31\alpha_0^5}{36} + \frac{19}{216}\,\pi^2 x\alpha_0^4 - \frac{6967x\alpha_0^4}{1296} + \frac{5\pi^2\alpha_0^4}{54\,(x-2)} - \frac{2345\alpha_0^4}{324(x-2)} - \frac{13\pi^2\alpha_0^4}{216\,(x-1)} + \frac{5251\alpha_0^4}{1296(x-1)} - \frac{5\pi^2\alpha_0^4}{54\,(x-2)^2} + \frac{5405\alpha_0^4}{324(x-2)^2} +$$
$$\frac{\pi^2\alpha_0^4}{54\,(x-1)^2} - \frac{613\alpha_0^4}{324(x-1)^2} - \frac{\pi^2\,\alpha_0^4}{108} - \frac{299\alpha_0^4}{162} - \frac{13}{54}\pi^2 x\,\alpha_0^3 + \frac{3413x\alpha_0^3}{162} - \frac{5\pi^2\alpha_0^3}{54\,(x-2)} - \frac{895\alpha_0^3}{324(x-2)} + \frac{11\pi^2\alpha_0^3}{108(x-1)} -$$
$$\frac{5807\alpha_0^3}{648(x-1)} + \frac{5\pi^2\alpha_0^3}{27\,(x-2)^2} - \frac{115\alpha_0^3}{81(x-2)^2} - \frac{7\pi^2\alpha_0^3}{108\,(x-1)^2} + \frac{14261\alpha_0^3}{1296(x-1)^2} - \frac{10\pi^2\alpha_0^3}{27\,(x-2)^3} + \frac{10580\alpha_0^3}{81(x-2)^3} + \frac{\pi^2\alpha_0^3}{36\,(x-1)^3} -$$
$$\frac{1411\alpha_0^3}{216(x-1)^3} + \frac{\pi^2\,\alpha_0^3}{18} - \frac{4837\alpha_0^3}{432} + \frac{7}{18}\pi^2 x\,\alpha_0^2 - \frac{4571x\alpha_0^2}{54} + \frac{545\alpha_0^2}{18(x-2)} - \frac{\pi^2\,\alpha_0^2}{12(x-1)} - \frac{121\alpha_0^2}{36(x-1)} - \frac{2075\alpha_0^2}{18\,(x-2)^2} +$$
$$\frac{\pi^2\alpha_0^2}{12(x-1)^2} - \frac{3577\alpha_0^2}{144\,(x-1)^2} + \frac{7600\alpha_0^2}{9(x-2)^3} - \frac{\pi^2\alpha_0^2}{12\,(x-1)^3} + \frac{524\alpha_0^2}{9(x-1)^3} - \frac{20\pi^2\alpha_0^2}{9\,(x-2)^4} + \frac{66760\alpha_0^2}{27(x-2)^4} + \frac{\pi^2\alpha_0^2}{18\,(x-1)^4} - \frac{5047\alpha_0^2}{108(x-1)^4} -$$

$$\frac{\pi^2\ \alpha_0^2}{6}+\frac{17483\alpha_0^2}{144}-\frac{7}{8}\pi^2 x\alpha_0+\frac{5525\ x\alpha_0}{81}-\frac{26\pi^2\alpha_0}{9(x-2)}-\frac{17\alpha_0}{9\ (x-2)}+\frac{745\pi^2\alpha_0}{216(x-1)}-\frac{467\alpha_0}{24\ (x-1)}+\frac{10\pi^2\alpha_0}{3(x-2)^2}+$$
$$\frac{565\alpha_0}{9\ (x-2)^2}-\frac{8\pi^2\alpha_0}{9(x-1)^2}+\frac{91\alpha_0}{8\ (x-1)^2}-\frac{8\pi^2\alpha_0}{3(x-2)^3}-\frac{7240\alpha_0}{9\ (x-2)^3}+\frac{79\pi^2\alpha_0}{108(x-1)^3}-\frac{689\alpha_0}{24\ (x-1)^3}+\frac{920\pi^2\alpha_0}{27(x-2)^4}-\frac{133520\alpha_0}{27\ (x-2)^4}+$$
$$\frac{5\pi^2\alpha_0}{54(x-1)^4}-\frac{5047\alpha_0}{108\ (x-1)^4}+\frac{400\pi^2\alpha_0}{27(x-2)^5}-\frac{154240\alpha_0}{27\ (x-2)^5}-\frac{29\pi^2\alpha_0}{54(x-1)^5}+\frac{17}{12}x\zeta_3\ \alpha_0+\frac{224\zeta_3\alpha_0}{3(x-2)^4}-\frac{7\zeta_3\alpha_0}{4\ (x-1)^4}+$$
$$\frac{280\zeta_3\alpha_0}{3(x-2)^5}+\frac{7\zeta_3\alpha_0}{4\ (x-1)^5}-\frac{17}{6}\zeta_3\alpha_0+\frac{640\ln^3 2\,\alpha_0}{9\ (x-2)^4}+\frac{1280\ln^3 2\,\alpha_0}{9(x-2)^5}+\frac{320\ln^2 2\ \ \alpha_0}{9(x-2)^4}+\frac{640\ln^2 2\,\alpha_0}{9(x-2)^5}-\frac{1}{6}\pi^{\ 2}x\ln 2\,\alpha_0-$$
$$\frac{32\pi^2\ln 2\,\alpha_0}{3(x-2)^4}+\frac{320\ \ \ln 2\,\alpha_0}{27(x-2)^4}+\frac{\pi^2\ln 2\,\alpha_0}{6\ (x-1)^4}+\frac{80\pi^2\ln 2\,\alpha_0}{3(x-2)^5}+\frac{640\ln 2\ \ \alpha_0}{27(x-2)^5}-\frac{\pi^2\ln 2\,\alpha_0}{6(x-1)^5}+\frac{1}{3}\ \pi^2\ln 2\,\alpha_0+\frac{53\pi^2\alpha_0}{72}+$$
$$\frac{1669\ \alpha_0}{648}+\frac{47\pi^2 x}{72}+\frac{4x}{81}+\Bigg(-\frac{19x\ \alpha_0^5}{18}-\frac{31\alpha_0^5}{9(x-2)}+\frac{19\alpha_0^5}{18(x-1)}-\frac{2\ \alpha_0^5}{3}+\frac{131x\alpha_0^4}{18}+\frac{10\alpha_0^4}{x-2}-\frac{95\ \alpha_0^4}{18(x-1)}-\frac{130\alpha_0^4}{9(x-2)^2}+$$
$$\frac{2\alpha_0^4}{(x-1)^2}+\frac{4\alpha_0^4}{3}-\frac{208x\alpha_0^3}{9}-\frac{50\alpha_0^3}{9\ (x-2)}+\frac{95\alpha_0^3}{9(x-1)}+\frac{160\alpha_0^3}{9(x-2)^2}-\frac{53\ \alpha_0^3}{6(x-1)^2}-\frac{80\alpha_0^3}{(x-2)^3}+\frac{41\alpha_0^3}{9\ (x-1)^3}+\frac{121\alpha_0^3}{18}+\frac{160x\alpha_0^2}{3}-$$
$$\frac{92\alpha_0^2}{9\ (x-2)}-\frac{26\alpha_0^2}{3(x-1)}+\frac{36\alpha_0^2}{(x-2)^2}+\frac{271\ \alpha_0^2}{18(x-1)^2}-\frac{1600\alpha_0^2}{9(x-2)^3}-\frac{68\alpha_0^2}{3\ (x-1)^3}-\frac{7520\alpha_0^2}{9(x-2)^4}+\frac{154\alpha_0^2}{9\ (x-1)^4}-\frac{857\alpha_0^2}{18}-\frac{1}{18}\pi^2 x\alpha_0-$$
$$\frac{5255x\ \alpha_0}{108}-\frac{812\alpha_0}{9(x-2)}+\frac{239\alpha_0}{2(x-1)}+\frac{448\ \alpha_0}{9(x-2)^2}-\frac{18\alpha_0}{(x-1)^2}+\frac{3248\alpha_0}{9\ (x-2)^3}+\frac{164\alpha_0}{9(x-1)^3}-\frac{40\pi^2\alpha_0}{9\ (x-2)^4}+\frac{76160\alpha_0}{27(x-2)^4}-\frac{\pi^2\alpha_0}{18\ (x-1)^4}+$$
$$\frac{4877\alpha_0}{216(x-1)^4}-\frac{80\pi^2\alpha_0}{9\ (x-2)^5}+\frac{62080\alpha_0}{27(x-2)^5}+\frac{\pi^2\alpha_0}{18\ (x-1)^5}-\frac{1351\alpha_0}{108(x-1)^5}+\frac{\pi^2\alpha_0}{9}+\frac{809\ \alpha_0}{216}+\frac{\pi^2 x}{18}+\frac{1319\ x}{108}-\frac{92}{x-2}+$$
$$\frac{1133}{12(x-1)}+\frac{1040}{9\ (x-2)^2}-\frac{223}{36(x-1)^2}-\frac{3008}{9(x-2)^3}-\frac{103}{36\ (x-1)^3}+\frac{40\pi^2}{9(x-2)^4}-\frac{41120}{27\ (x-2)^4}+\frac{\pi^2}{18(x-1)^4}-\frac{4223}{216(x-1)^4}+$$
$$\frac{160\ \pi^2}{9(x-2)^5}-\frac{62720}{27(x-2)^5}+\frac{\pi^2}{18\ (x-1)^5}-\frac{1351}{108(x-1)^5}+\frac{160\pi^2}{9\ (x-2)^6}-\frac{1280}{27(x-2)^6}+\frac{275}{24}\Bigg)\ H(0;\alpha_0)+\Bigg(\frac{19x\alpha_0^5}{12}+$$
$$\frac{31\alpha_0^5}{6(x-2)}-\frac{19\ \alpha_0^5}{12(x-1)}+\alpha_0^5-\frac{131x\alpha_0^4}{12}-\frac{15\ \alpha_0^4}{x-2}+\frac{95\alpha_0^4}{12(x-1)}+\frac{65\alpha_0^4}{3\ (x-2)^2}-\frac{3\alpha_0^4}{(x-1)^2}-2\alpha_0^4+\frac{104x\ \alpha_0^3}{3}+\frac{25\alpha_0^3}{3(x-2)}-$$
$$\frac{95\alpha_0^3}{6(x-1)}-\frac{80\ \alpha_0^3}{3(x-2)^2}+\frac{53\alpha_0^3}{4(x-1)^2}+\frac{120\ \alpha_0^3}{(x-2)^3}-\frac{41\alpha_0^3}{6(x-1)^3}-\frac{121\alpha_0^3}{12}-80x\ \alpha_0^2+\frac{46\alpha_0^2}{3(x-2)}+\frac{13\alpha_0^2}{x-1}-\frac{54\ \alpha_0^2}{(x-2)^2}-\frac{271\alpha_0^2}{12(x-1)^2}+$$
$$\frac{800\alpha_0^2}{3\ (x-2)^3}+\frac{34\alpha_0^2}{(x-1)^3}+\frac{3760\alpha_0^2}{3\ (x-2)^4}-\frac{77\alpha_0^2}{3(x-1)^4}+\frac{857\alpha_0^2}{12}+\frac{367x\ \alpha_0}{4}-\frac{109\alpha_0}{6(x-2)}-\frac{103\alpha_0}{12(x-1)}+\frac{296\ \alpha_0}{3(x-2)^2}+\frac{205\alpha_0}{12(x-1)^2}-$$
$$\frac{888\ \alpha_0}{(x-2)^3}-\frac{89\alpha_0}{2(x-1)^3}-\frac{12640\alpha_0}{3\ (x-2)^4}-\frac{10240\alpha_0}{3(x-2)^5}-\frac{233\alpha_0}{4}-\frac{445\ x}{12}+\frac{13}{3(x-2)}+\frac{61}{12(x-1)}-\frac{119}{3\ (x-2)^2}-\frac{19}{4(x-1)^2}+$$
$$\frac{1504}{3(x-2)^3}+\frac{52}{3\ (x-1)^3}+\frac{2960}{(x-2)^4}+\frac{77}{3(x-1)^4}+\frac{10240}{3\ (x-2)^5}-\frac{25}{12}\Bigg)H(1;\alpha_0)+\Bigg(\frac{4x\alpha_0^5}{3}+\frac{8\ \alpha_0^5}{3(x-2)}-\frac{4\alpha_0^5}{3(x-1)}-$$
$$\frac{76x\alpha_0^4}{9}-\frac{80\ \alpha_0^4}{9(x-2)}+\frac{52\alpha_0^4}{9(x-1)}+\frac{80\alpha_0^4}{9\ (x-2)^2}-\frac{16\alpha_0^4}{9(x-1)^2}+\frac{8\alpha_0^4}{9}+\frac{208x\ \alpha_0^3}{9}+\frac{80\alpha_0^3}{9(x-2)}-\frac{88\alpha_0^3}{9(x-1)}-\frac{160\ \alpha_0^3}{9(x-2)^2}+\frac{56\alpha_0^3}{9(x-1)^2}+$$
$$\frac{320\alpha_0^3}{9\ (x-2)^3}-\frac{8\alpha_0^3}{3(x-1)^3}-\frac{16\alpha_0^3}{3}-\frac{112x\ \alpha_0^2}{3}+\frac{8\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+\frac{8\ \alpha_0^2}{(x-1)^3}+\frac{640\alpha_0^2}{3(x-2)^4}-\frac{16\alpha_0^2}{3\ (x-1)^4}+16\alpha_0^2+26x\alpha_0+$$
$$\frac{128\alpha_0}{9(x-2)}-\frac{74\alpha_0}{3\ (x-1)}-\frac{32\alpha_0}{9(x-2)^2}+\frac{52\alpha_0}{9(x-1)^2}-\frac{64\ \alpha_0}{(x-2)^3}-\frac{46\alpha_0}{9(x-1)^3}-\frac{8320\alpha_0}{9\ (x-2)^4}-\frac{79\alpha_0}{9(x-1)^4}-\frac{8960\alpha_0}{9(x-2)^5}+\frac{58\ \alpha_0}{9(x-1)^5}+$$
$$\frac{19\alpha_0}{3}-\frac{14x}{3}+\frac{160}{9\ (x-2)}-\frac{52}{3(x-1)}-\frac{224}{9(x-2)^2}+\frac{14}{9(x-1)^2}+\frac{640}{9(x-2)^3}+\frac{8}{9(x-1)^3}+\frac{5632}{9\ (x-2)^4}+\frac{85}{9(x-1)^4}+\frac{10240}{9(x-2)^5}+$$
$$\frac{58}{9\ (x-1)^5}+\frac{2560}{9(x-2)^6}-5\Bigg)H(0,0;\alpha_0)+\Bigg(-2x\ \alpha_0^5-\frac{4\alpha_0^5}{x-2}+\frac{2\alpha_0^5}{x-1}+\frac{38x\ \alpha_0^4}{3}+\frac{40\alpha_0^4}{3(x-2)}-\frac{26\alpha_0^4}{3(x-1)}-\frac{40\ \alpha_0^4}{3(x-2)^2}+$$
$$\frac{8\alpha_0^4}{3(x-1)^2}-\frac{4\ \alpha_0^4}{3}-\frac{104x\alpha_0^3}{3}-\frac{40\alpha_0^3}{3(x-2)}+\frac{44\ \alpha_0^3}{3(x-1)}+\frac{80\alpha_0^3}{3(x-2)^2}-\frac{28\alpha_0^3}{3\ (x-1)^2}-\frac{160\alpha_0^3}{3(x-2)^3}+\frac{4\alpha_0^3}{(x-1)^3}+8\ \alpha_0^3+56x\alpha_0^2-$$
$$\frac{12\alpha_0^2}{x-1}+\frac{12\ \alpha_0^2}{(x-1)^2}-\frac{12\alpha_0^2}{(x-1)^3}-\frac{320\ \alpha_0^2}{(x-2)^4}+\frac{8\alpha_0^2}{(x-1)^4}-24\alpha_0^2-39x\alpha_0-\frac{64\ \alpha_0}{3(x-2)}+\frac{37\alpha_0}{x-1}+\frac{16\alpha_0}{3(x-2)^2}-\frac{26\ \alpha_0}{3(x-1)^2}+$$
$$\frac{96\alpha_0}{(x-2)^3}+\frac{23\alpha_0}{3\ (x-1)^3}+\frac{4160\alpha_0}{3(x-2)^4}+\frac{79\alpha_0}{6\ (x-1)^4}+\frac{4480\alpha_0}{3(x-2)^5}-\frac{29\alpha_0}{3(x-1)^5}-\frac{19\ \alpha_0}{2}+7x-\frac{80}{3(x-2)}+\frac{26}{x-1}+\frac{112}{3\ (x-2)^2}-$$
$$\frac{7}{3(x-1)^2}-\frac{320}{3(x-2)^3}-\frac{4}{3\ (x-1)^3}-\frac{2816}{3(x-2)^4}-\frac{85}{6(x-1)^4}-\frac{5120}{3\ (x-2)^5}-\frac{29}{3(x-1)^5}-\frac{1280}{3\ (x-2)^6}+\frac{15}{2}\Bigg)H(0,1;\alpha_0)+$$
$$H(1;x)\Bigg(\frac{1}{9}\pi^2\ x\alpha_0+\frac{32\pi^2\alpha_0}{3(x-2)^4}-\frac{8\pi^2\alpha_0}{9(x-1)^4}+\ \frac{80\pi^2\alpha_0}{3(x-2)^5}+\frac{8\pi^2\alpha_0}{9\ (x-1)^5}-\frac{2\pi^2\alpha_0}{9}-\frac{\pi^2 x}{9}+\Bigg(\frac{29x\ \alpha_0}{9}+\frac{406\alpha_0}{9(x-2)}-$$
$$\frac{166\alpha_0}{3(x-1)}-\frac{424\ \alpha_0}{9(x-2)^2}+\frac{193\alpha_0}{18(x-1)^2}+\frac{32\ \alpha_0}{(x-2)^3}-\frac{53\alpha_0}{9(x-1)^3}-\frac{4000\alpha_0}{9\ (x-2)^4}-\frac{175\alpha_0}{18(x-1)^4}+\frac{640\alpha_0}{9\ (x-2)^5}+\frac{116\alpha_0}{9(x-1)^5}+\frac{2\alpha_0}{9}-$$
$$\frac{29\ x}{9}+\frac{326}{9(x-2)}-\frac{118}{3(x-1)}-\frac{388}{9\ (x-2)^2}+\frac{95}{18(x-1)^2}+\frac{560}{9(x-2)^3}+\frac{4}{9\ (x-1)^3}+\frac{3424}{9(x-2)^4}+\frac{289}{18(x-1)^4}+\frac{7360}{9\ (x-2)^5}+$$
$$\frac{116}{9(x-1)^5}-\frac{1280}{9\ (x-2)^6}-\frac{20}{3}\Bigg)H(0;\alpha_0)+\Bigg(-\frac{8x\alpha_0}{3}-\frac{832\ \alpha_0}{3(x-2)^4}+\frac{32\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3\ (x-2)^5}-\frac{32\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+$$
$$\frac{8\ x}{3}+\frac{832}{3(x-2)^4}-\frac{32}{3(x-1)^4}+\frac{2944}{3\ (x-2)^5}-\frac{32}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Bigg)H(0,0;\alpha_0)+\ \Bigg(4x\alpha_0+\frac{416\alpha_0}{(x-2)^4}-\frac{16\alpha_0}{(x-1)^4}+$$
$$\frac{640\ \alpha_0}{(x-2)^5}+\frac{16\alpha_0}{(x-1)^5}-8\alpha_0-4\ x-\frac{416}{(x-2)^4}+\frac{16}{(x-1)^4}-\frac{1472}{(x-2)^5}+\frac{16}{(x-1)^5}-\frac{1280}{(x-2)^6}\Bigg)H(0,1;\alpha_0)-\frac{32\pi^2}{3\ (x-2)^4}+$$
$$\frac{8\pi^2}{9(x-1)^4}-\frac{48\pi^2}{(x-2)^5}+\frac{8\ \pi^2}{9(x-1)^5}-\frac{160\pi^2}{3(x-2)^6}\Bigg)+\Bigg(-\frac{20x\ \alpha_0}{3}-\frac{1984\alpha_0}{3(x-2)^4}+\frac{20\alpha_0}{3\ (x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{20\alpha_0}{3(x-1)^5}+$$

$$\frac{40\alpha_0}{3}+\frac{20x}{3}+\frac{1984}{3(x-2)^4}-\frac{20}{3(x-1)^4}+\frac{7168}{3(x-2)^5}-\frac{20}{3(x-1)^5}+\frac{6400}{3(x-2)^6}\Big)H(0;\alpha_0)H(0,1;x)+\Big(-\frac{\alpha_0^5}{2}-$$

$$\frac{\alpha_0^4}{3(x-2)}+\frac{5\alpha_0^4}{2}+\frac{4\alpha_0^3}{3(x-2)}-\frac{4\alpha_0^3}{3(x-2)^2}-5\alpha_0^3-\frac{2\alpha_0^2}{x-2}+\frac{4\alpha_0^2}{(x-2)^2}-\frac{8\alpha_0^2}{(x-2)^3}+5\alpha_0^2+\frac{29x\alpha_0}{9}+\frac{160\alpha_0}{9(x-2)}-\frac{62\alpha_0}{3(x-1)}-$$

$$\frac{184\alpha_0}{9(x-2)^2}+\frac{97\alpha_0}{18(x-1)^2}+\frac{16\alpha_0}{(x-2)^3}-\frac{38\alpha_0}{9(x-1)^3}-\frac{832\alpha_0}{9(x-2)^4}-\frac{5\alpha_0}{9(x-1)^4}+\frac{640\alpha_0}{9(x-2)^5}+\frac{29\alpha_0}{9(x-1)^5}-\frac{113\alpha_0}{18}-\frac{29x}{9}+$$

$$\Big(-\frac{8x\alpha_0}{3}-\frac{832\alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-\frac{8\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{832}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{2944}{3(x-2)^5}-$$

$$\frac{8}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(4x\alpha_0+\frac{416\alpha_0}{(x-2)^4}-\frac{4\alpha_0}{(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}+\frac{4\alpha_0}{(x-1)^5}-8\alpha_0-4x-\frac{416}{(x-2)^4}+$$

$$\frac{4}{(x-1)^4}-\frac{1472}{(x-2)^5}+\frac{4}{(x-1)^5}-\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{104}{9(x-2)}-\frac{13}{x-1}-\frac{136}{9(x-2)^2}+\frac{41}{18(x-1)^2}+\frac{224}{9(x-2)^3}+$$

$$\frac{10}{9(x-1)^3}+\frac{832}{9(x-2)^4}+\frac{53}{9(x-1)^4}+\frac{1600}{9(x-2)^5}+\frac{29}{9(x-1)^5}-\frac{1280}{9(x-2)^6}-\frac{13}{6}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{640\alpha_0}{9(x-2)^4}-$$

$$\frac{1280\alpha_0}{9(x-2)^5}+\Big(\frac{1280\alpha_0}{3(x-2)^4}+\frac{2560\alpha_0}{3(x-2)^5}-\frac{1280}{3(x-2)^4}-\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\alpha_0}{(x-2)^5}+$$

$$\frac{640}{(x-2)^4}+\frac{2560}{(x-2)^5}+\frac{2560}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{640}{9(x-2)^4}+\frac{2560}{9(x-2)^5}+\frac{2560}{9(x-2)^6}\Big)H(0,c_2(\alpha_0);x)+\Big(-2x\alpha_0^5-$$

$$\frac{4\alpha_0^5}{x-2}+\frac{2\alpha_0^5}{x-1}+\frac{38x\alpha_0^4}{3}+\frac{40\alpha_0^4}{3(x-2)}-\frac{26\alpha_0^4}{3(x-1)}-\frac{40\alpha_0^4}{3(x-2)^2}+\frac{8\alpha_0^4}{3(x-1)^2}-\frac{4\alpha_0^4}{3}-\frac{104x\alpha_0^3}{3}-\frac{40\alpha_0^3}{3(x-2)}+\frac{44\alpha_0^3}{3(x-1)}+$$

$$\frac{80\alpha_0^3}{3(x-2)^2}-\frac{28\alpha_0^3}{3(x-1)^2}-\frac{160\alpha_0^3}{3(x-2)^3}+\frac{4\alpha_0^3}{(x-1)^3}+8\alpha_0^3+56x\alpha_0^2-\frac{12\alpha_0^2}{x-1}+\frac{12\alpha_0^2}{(x-1)^2}-\frac{12\alpha_0^2}{(x-1)^3}-\frac{320\alpha_0^2}{(x-2)^4}+\frac{8\alpha_0^2}{(x-1)^4}-$$

$$24\alpha_0^2-\frac{146x\alpha_0}{3}+\frac{20\alpha_0}{3(x-2)}+\frac{14\alpha_0}{3(x-1)}-\frac{80\alpha_0}{3(x-2)^2}-\frac{20\alpha_0}{3(x-1)^2}+\frac{160\alpha_0}{(x-2)^3}+\frac{12\alpha_0}{(x-1)^3}+\frac{1280\alpha_0}{(x-2)^4}+\frac{1280\alpha_0}{(x-2)^5}+$$

$$\frac{40\alpha_0}{3}+\frac{50x}{3}-\frac{8}{3(x-2)}-\frac{2}{3(x-1)}+\frac{40}{3(x-2)^2}+\frac{4}{3(x-1)^2}-\frac{320}{3(x-2)^3}-\frac{4}{(x-1)^3}-\frac{960}{(x-2)^4}-\frac{8}{(x-1)^4}-\frac{1280}{(x-2)^5}+$$

$$4\Big)H(1,0;\alpha_0)+\Big(-\frac{29x\alpha_0}{9}-\frac{406\alpha_0}{9(x-2)}+\frac{166\alpha_0}{3(x-1)}+\frac{424\alpha_0}{9(x-2)^2}-\frac{193\alpha_0}{18(x-1)^2}-\frac{32\alpha_0}{(x-2)^3}+\frac{53\alpha_0}{9(x-1)^3}+\frac{4000\alpha_0}{9(x-2)^4}+$$

$$\frac{175\alpha_0}{18(x-1)^4}-\frac{640\alpha_0}{9(x-2)^5}-\frac{116\alpha_0}{9(x-1)^5}-\frac{2\alpha_0}{9}+\frac{29x}{9}-\frac{326}{9(x-2)}+\frac{118}{3(x-1)}+\frac{388}{9(x-2)^2}-\frac{95}{18(x-1)^2}-\frac{560}{9(x-2)^3}-$$

$$\frac{4}{9(x-1)^3}-\frac{3424}{9(x-2)^4}-\frac{289}{18(x-1)^4}-\frac{7360}{9(x-2)^5}-\frac{116}{9(x-1)^5}+\frac{1280}{9(x-2)^6}+\frac{20}{3}\Big)H(1,0;x)+\Big(3x\alpha_0^5+\frac{6\alpha_0^5}{x-2}-$$

$$\frac{3\alpha_0^5}{x-1}-19x\alpha_0^4-\frac{20\alpha_0^4}{x-2}+\frac{13\alpha_0^4}{x-1}+\frac{20\alpha_0^4}{(x-2)^2}-\frac{4\alpha_0^4}{(x-1)^2}+2\alpha_0^4+52x\alpha_0^3+\frac{20\alpha_0^3}{x-2}-\frac{22\alpha_0^3}{x-1}-\frac{40\alpha_0^3}{(x-2)^2}+\frac{14\alpha_0^3}{(x-1)^2}+$$

$$\frac{80\alpha_0^3}{(x-2)^3}-\frac{6\alpha_0^3}{(x-1)^3}-12\alpha_0^3-84x\alpha_0^2+\frac{18\alpha_0^2}{x-1}-\frac{18\alpha_0^2}{(x-1)^2}+\frac{18\alpha_0^2}{(x-1)^3}+\frac{480\alpha_0^2}{(x-2)^4}-\frac{12\alpha_0^2}{(x-1)^4}+36\alpha_0^2+73x\alpha_0-$$

$$\frac{10\alpha_0}{x-2}-\frac{7\alpha_0}{x-1}+\frac{40\alpha_0}{(x-2)^2}+\frac{10\alpha_0}{(x-1)^2}-\frac{240\alpha_0}{(x-2)^3}-\frac{18\alpha_0}{(x-1)^3}-\frac{1920\alpha_0}{(x-2)^4}-\frac{1920\alpha_0}{(x-2)^5}-20\alpha_0-25x+\frac{4}{x-2}+\frac{1}{x-1}-$$

$$\frac{20}{(x-2)^2}-\frac{2}{(x-1)^2}+\frac{160}{(x-2)^3}+\frac{6}{(x-1)^3}+\frac{1440}{(x-2)^4}+\frac{12}{(x-1)^4}+\frac{1920}{(x-2)^5}-6\Big)H(1,1;\alpha_0)+H(c_2(\alpha_0);x)\Big(-$$

$$\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{320\alpha_0}{27(x-2)^4}-\frac{80\pi^2\alpha_0}{9(x-2)^5}+\frac{640\alpha_0}{27(x-2)^5}+\Big(-\frac{640\alpha_0}{9(x-2)^4}-\frac{1280\alpha_0}{9(x-2)^5}+\frac{640}{9(x-2)^4}+\frac{2560}{9(x-2)^5}+$$

$$\frac{2560}{9(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{320\alpha_0}{3(x-2)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{320}{3(x-2)^4}-\frac{1280}{3(x-2)^5}-\frac{1280}{3(x-2)^6}\Big)H(1;\alpha_0)+\Big(\frac{1280\alpha_0}{3(x-2)^4}+$$

$$\frac{2560\alpha_0}{3(x-2)^5}-\frac{1280}{3(x-2)^4}-\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0;\alpha_0)+\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{640}{(x-2)^4}+\frac{2560}{(x-2)^5}+$$

$$\frac{2560}{(x-2)^6}\Big)H(0,1;\alpha_0)+\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{640}{(x-2)^4}+\frac{2560}{(x-2)^5}+\frac{2560}{(x-2)^6}\Big)H(1,0;\alpha_0)+\Big(\frac{960\alpha_0}{(x-2)^4}+$$

$$\frac{1920\alpha_0}{(x-2)^5}-\frac{960}{(x-2)^4}-\frac{3840}{(x-2)^5}-\frac{3840}{(x-2)^6}\Big)H(1,1;\alpha_0)+\frac{40\pi^2}{9(x-2)^4}-\frac{320}{27(x-2)^4}+\frac{160\pi^2}{9(x-2)^5}-\frac{1280}{27(x-2)^5}+$$

$$\frac{160\pi^2}{9(x-2)^6}-\frac{1280}{27(x-2)^6}\Big)+H(c_1(\alpha_0);x)\Big(-\frac{19x\alpha_0^5}{36}-\frac{31\alpha_0^5}{18(x-2)}+\frac{19\alpha_0^5}{36(x-1)}-\frac{9\alpha_0^5}{8}+\frac{131x\alpha_0^4}{36}+\frac{137\alpha_0^4}{36(x-2)}-$$

$$\frac{103\alpha_0^4}{36(x-1)}-\frac{65\alpha_0^4}{9(x-2)^2}+\frac{\alpha_0^4}{(x-1)^2}+\frac{349\alpha_0^4}{72}-\frac{104x\alpha_0^3}{9}+\frac{2\alpha_0^3}{x-2}+\frac{235\alpha_0^3}{36(x-1)}+\frac{20\alpha_0^3}{9(x-2)^2}-\frac{43\alpha_0^3}{9(x-1)^2}-\frac{40\alpha_0^3}{(x-2)^3}+$$

$$\frac{41\alpha_0^3}{18(x-1)^3}-\frac{209\alpha_0^3}{36}+\frac{80x\alpha_0^2}{3}-\frac{103\alpha_0^2}{9(x-2)}-\frac{307\alpha_0^2}{36(x-1)}+\frac{38\alpha_0^2}{(x-2)^2}+\frac{86\alpha_0^2}{9(x-1)^2}-\frac{1420\alpha_0^2}{9(x-2)^3}-\frac{73\alpha_0^2}{6(x-1)^3}-\frac{3760\alpha_0^2}{9(x-2)^4}+$$

$$\frac{77\alpha_0^2}{9(x-1)^4}-\frac{455\alpha_0^2}{36}-\frac{367x\alpha_0}{12}-\frac{802\alpha_0}{9(x-2)}+\frac{231\alpha_0}{2(x-1)}+\frac{52\alpha_0}{(x-2)^2}-\frac{140\alpha_0}{9(x-1)^2}+\frac{2864\alpha_0}{9(x-2)^3}+\frac{125\alpha_0}{9(x-1)^3}+\frac{2160\alpha_0}{(x-2)^4}-$$

$$\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{3029\alpha_0}{216(x-1)^4}+\frac{10240\alpha_0}{9(x-2)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}-\frac{1351\alpha_0}{108(x-1)^5}+\frac{235\alpha_0}{72}+\frac{445x}{36}+\Big(\frac{2x\alpha_0^5}{3}+\frac{4\alpha_0^5}{3(x-2)}-$$

$$\frac{2\alpha_0^5}{3(x-1)}+\alpha_0^5-\frac{38x\alpha_0^4}{9}-\frac{34\alpha_0^4}{9(x-2)}+\frac{26\alpha_0^4}{9(x-1)}+\frac{40\alpha_0^4}{9(x-2)^2}-\frac{8\alpha_0^4}{9(x-1)^2}-\frac{41\alpha_0^4}{9}+\frac{104x\alpha_0^3}{9}+\frac{16\alpha_0^3}{9(x-2)}-\frac{44\alpha_0^3}{9(x-1)}-$$

$$\frac{56\alpha_0^3}{9(x-2)^2}+\frac{28\alpha_0^3}{9(x-1)^2}+\frac{160\alpha_0^3}{9(x-2)^3}-\frac{4\alpha_0^3}{3(x-1)^3}+\frac{22\alpha_0^3}{3}-\frac{56x\alpha_0^2}{3}+\frac{4\alpha_0^2}{x-2}+\frac{4\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-2)^2}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{16\alpha_0^2}{(x-2)^3}+$$

$$\frac{4\alpha_0^2}{(x-1)^3}+\frac{320\alpha_0^2}{3(x-2)^4}-\frac{8\alpha_0^2}{3(x-1)^4}-2\alpha_0^2+\frac{146x\alpha_0}{9}+\frac{128\alpha_0}{9(x-2)}-\frac{74\alpha_0}{3(x-1)}-\frac{32\alpha_0}{9(x-2)^2}+\frac{52\alpha_0}{9(x-1)^2}-\frac{64\alpha_0}{(x-2)^3}-$$
$$\frac{46\alpha_0}{9(x-1)^3}-\frac{704\alpha_0}{(x-2)^4}-\frac{55\alpha_0}{9(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}+\frac{58\alpha_0}{9(x-1)^5}+\frac{29\alpha_0}{9}-\frac{50x}{9}+\frac{160}{9(x-2)}-\frac{52}{3(x-1)}-\frac{224}{9(x-2)^2}+$$
$$\frac{14}{9(x-1)^2}+\frac{640}{9(x-2)^3}+\frac{8}{9(x-1)^3}+\frac{1664}{3(x-2)^4}+\frac{85}{9(x-1)^4}+\frac{2560}{3(x-2)^5}+\frac{58}{9(x-1)^5}-5\Big)H(0;\alpha_0)+\Big(-x\alpha_0^5-$$
$$\frac{2\alpha_0^5}{x-2}+\frac{\alpha_0^5}{x-1}-\frac{3\alpha_0^5}{2}+\frac{19x\alpha_0^4}{3}+\frac{17\alpha_0^4}{3(x-2)}-\frac{13\alpha_0^4}{3(x-1)}-\frac{20\alpha_0^4}{3(x-2)^2}+\frac{4\alpha_0^4}{3(x-1)^2}+\frac{41\alpha_0^4}{6}-\frac{52x\alpha_0^3}{3}-\frac{8\alpha_0^3}{3(x-2)}+$$
$$\frac{22\alpha_0^3}{3(x-1)}+\frac{28\alpha_0^3}{3(x-2)^2}-\frac{14\alpha_0^3}{3(x-1)^2}-\frac{80\alpha_0^3}{3(x-2)^3}+\frac{2\alpha_0^3}{(x-1)^3}-11\alpha_0^3+28x\alpha_0^2-\frac{6\alpha_0^2}{x-2}-\frac{6\alpha_0^2}{x-1}+\frac{12\alpha_0^2}{(x-2)^2}+\frac{6\alpha_0^2}{(x-1)^2}-$$
$$\frac{24\alpha_0^2}{(x-2)^3}-\frac{6\alpha_0^2}{(x-1)^3}-\frac{160\alpha_0^2}{(x-2)^4}+\frac{4\alpha_0^2}{(x-1)^4}+3\alpha_0^2-\frac{73x\alpha_0}{3}-\frac{64\alpha_0}{3(x-2)}+\frac{37\alpha_0}{x-1}+\frac{16\alpha_0}{3(x-2)^2}-\frac{26\alpha_0}{3(x-1)^2}+\frac{96\alpha_0}{(x-2)^3}+$$
$$\frac{23\alpha_0}{3(x-1)^3}+\frac{1056\alpha_0}{(x-2)^4}+\frac{55\alpha_0}{6(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}-\frac{29\alpha_0}{3(x-1)^5}-\frac{29\alpha_0}{6}+\frac{25x}{3}-\frac{80}{3(x-2)}+\frac{26}{x-1}+\frac{112}{3(x-2)^2}-\frac{7}{3(x-1)^2}-$$
$$\frac{320}{3(x-2)^3}-\frac{4}{3(x-1)^3}-\frac{832}{(x-2)^4}-\frac{85}{6(x-1)^4}-\frac{1280}{(x-2)^5}-\frac{29}{3(x-1)^5}+\frac{15}{2}\Big)H(1;\alpha_0)+\Big(\frac{16\alpha_0}{3(x-1)^4}-\frac{16\alpha_0}{3(x-1)^5}-$$
$$\frac{16}{3(x-1)^4}-\frac{16}{3(x-1)^5}\Big)H(0,0;\alpha_0)+\Big(-\frac{8\alpha_0}{(x-1)^4}+\frac{8\alpha_0}{(x-1)^5}+\frac{8}{(x-1)^4}+\frac{8}{(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(-\frac{8\alpha_0}{(x-1)^4}+$$
$$\frac{8\alpha_0}{(x-1)^5}+\frac{8}{(x-1)^4}+\frac{8}{(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(\frac{12\alpha_0}{(x-1)^4}-\frac{12\alpha_0}{(x-1)^5}-\frac{12}{(x-1)^4}-\frac{12}{(x-1)^5}\Big)H(1,1;\alpha_0)-\frac{92}{x-2}+$$
$$\frac{1133}{12(x-1)}+\frac{1040}{9(x-2)^2}-\frac{223}{36(x-1)^2}-\frac{3008}{9(x-2)^3}-\frac{103}{36(x-1)^3}-\frac{13600}{9(x-2)^4}+\frac{\pi^2}{18(x-1)^4}-\frac{4223}{216(x-1)^4}-\frac{20480}{9(x-2)^5}+$$
$$\frac{\pi^2}{18(x-1)^5}-\frac{1351}{108(x-1)^5}+\frac{275}{24}\Big)+\Big(-\frac{14x\alpha_0}{3}-\frac{480\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{(x-2)^5}-\frac{64\alpha_0}{3(x-1)^5}+\frac{28\alpha_0}{3}+\frac{14x}{3}+$$
$$\frac{480}{(x-2)^4}-\frac{64}{3(x-1)^4}+\frac{1760}{(x-2)^5}-\frac{64}{3(x-1)^5}+\frac{1600}{(x-2)^6}\Big)H(0;\alpha_0)H(1,1;x)+\Big(\frac{29x\alpha_0}{9}+\frac{406\alpha_0}{9(x-2)}-\frac{166\alpha_0}{3(x-1)}-$$
$$\frac{424\alpha_0}{9(x-2)^2}+\frac{193\alpha_0}{18(x-1)^2}+\frac{32\alpha_0}{(x-2)^3}-\frac{53\alpha_0}{9(x-1)^3}-\frac{4000\alpha_0}{9(x-2)^4}-\frac{175\alpha_0}{18(x-1)^4}+\frac{640\alpha_0}{9(x-2)^5}+\frac{116\alpha_0}{9(x-1)^5}+\frac{2\alpha_0}{9}-\frac{29x}{9}+$$
$$\Big(-\frac{8x\alpha_0}{3}-\frac{832\alpha_0}{3(x-2)^4}+\frac{32\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-\frac{32\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{832}{3(x-2)^4}-\frac{32}{3(x-1)^4}+\frac{2944}{3(x-2)^5}-$$
$$\frac{32}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(4x\alpha_0+\frac{416\alpha_0}{(x-2)^4}-\frac{16\alpha_0}{(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}+\frac{16\alpha_0}{(x-1)^5}-8\alpha_0-4x-\frac{416}{(x-2)^4}+$$
$$\frac{16}{(x-1)^4}-\frac{1472}{(x-2)^5}+\frac{16}{(x-1)^5}-\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{326}{9(x-2)}-\frac{118}{3(x-1)}-\frac{388}{9(x-2)^2}+\frac{95}{18(x-1)^2}+\frac{560}{9(x-2)^3}+$$
$$\frac{4}{9(x-1)^3}+\frac{3424}{9(x-2)^4}+\frac{289}{18(x-1)^4}+\frac{7360}{9(x-2)^5}+\frac{116}{9(x-1)^5}-\frac{1280}{9(x-2)^6}-\frac{20}{3}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{2x\alpha_0}{3}+$$
$$\frac{2080\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{2080}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{7360}{3(x-2)^5}+\frac{2}{3(x-1)^5}-$$
$$\frac{6400}{3(x-2)^6}\Big)H(0;\alpha_0)\,H(2,1;x)+\Big(\frac{1600\alpha_0}{9(x-2)^4}+\frac{3200\alpha_0}{9(x-2)^5}+\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3(x-2)^5}+$$
$$\frac{12800}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{1600\alpha_0}{(x-2)^4}+\frac{3200\alpha_0}{(x-2)^5}-\frac{1600}{(x-2)^4}-\frac{6400}{(x-2)^5}-\frac{6400}{(x-2)^6}\Big)H(1;\alpha_0)-\frac{1600}{9(x-2)^4}-$$
$$\frac{6400}{9(x-2)^5}-\frac{6400}{9(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+\Big(\frac{x\alpha_0^5}{2}+\frac{5\alpha_0^5}{6(x-2)}-\frac{\alpha_0^5}{3(x-1)}+\alpha_0^5-\frac{19x\alpha_0^4}{6}-\frac{35\alpha_0^4}{18(x-2)}+\frac{13\alpha_0^4}{9(x-1)}+$$
$$\frac{25\alpha_0^4}{9(x-2)^2}-\frac{4\alpha_0^4}{9(x-1)^2}-\frac{14\alpha_0^4}{3}+\frac{26x\alpha_0^3}{3}-\frac{5\alpha_0^3}{9(x-2)}-\frac{22\alpha_0^3}{9(x-1)}-\frac{20\alpha_0^3}{9(x-2)^2}+\frac{14\alpha_0^3}{9(x-1)^2}+\frac{100\alpha_0^3}{9(x-2)^3}-\frac{2\alpha_0^3}{3(x-1)^3}+$$
$$8\alpha_0^3-14x\alpha_0^2+\frac{5\alpha_0^2}{x-2}+\frac{2\alpha_0^2}{x-1}-\frac{10\alpha_0^2}{(x-2)^2}-\frac{2\alpha_0^2}{(x-1)^2}+\frac{20\alpha_0^2}{(x-2)^3}+\frac{2\alpha_0^2}{(x-1)^3}+\frac{200\alpha_0^2}{3(x-2)^4}-\frac{4\alpha_0^2}{3(x-1)^4}-4\alpha_0^2+\frac{73x\alpha_0}{6}-$$
$$\frac{40\alpha_0}{9(x-2)}-\frac{73\alpha_0}{18(x-1)}+\frac{160\alpha_0}{9(x-2)^2}+\frac{5\alpha_0}{18(x-1)^2}-\frac{80\alpha_0}{(x-2)^3}-\frac{11\alpha_0}{9(x-1)^3}-\frac{480\alpha_0}{(x-2)^4}-\frac{32\alpha_0}{9(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}+\frac{29\alpha_0}{9(x-1)^5}+$$
$$\frac{11\alpha_0}{3}-\frac{25x}{6}+\Big(\frac{8\alpha_0}{3(x-1)^4}-\frac{8\alpha_0}{3(x-1)^5}-\frac{8}{3(x-1)^4}-\frac{8}{3(x-1)^5}\Big)H(0;\alpha_0)+\Big(-\frac{4\alpha_0}{(x-1)^4}+\frac{4\alpha_0}{(x-1)^5}+\frac{4}{(x-1)^4}+$$
$$\frac{4}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{40}{9(x-2)}-\frac{71}{18(x-1)}-\frac{80}{9(x-2)^2}-\frac{1}{6(x-1)^2}+\frac{400}{9(x-2)^3}+\frac{7}{9(x-1)^3}+\frac{1280}{3(x-2)^4}+\frac{38}{9(x-1)^4}+$$
$$\frac{1600}{3(x-2)^5}+\frac{29}{9(x-1)^5}-4\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{x\alpha_0^5}{6}-\frac{\alpha_0^5}{6(x-1)}+\frac{\alpha_0^5}{2}+\frac{19x\alpha_0^4}{18}+\frac{13\alpha_0^4}{18(x-1)}-\frac{2\alpha_0^4}{9(x-1)^2}-$$
$$\frac{47\alpha_0^4}{18}-\frac{26x\alpha_0^3}{9}-\frac{11\alpha_0^3}{9(x-1)}+\frac{7\alpha_0^3}{9(x-1)^2}-\frac{\alpha_0^3}{3(x-1)^3}+\frac{17\alpha_0^3}{3}+\frac{14x\alpha_0^2}{3}+\frac{\alpha_0^2}{x-1}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}-\frac{2\alpha_0^2}{3(x-1)^4}-7\alpha_0^2-$$
$$\frac{73x\alpha_0}{18}+\frac{8\alpha_0}{9(x-2)}+\frac{\alpha_0}{18(x-1)}-\frac{8\alpha_0}{9(x-2)^2}+\frac{\alpha_0}{9(x-1)^2}+\frac{\alpha_0}{3(x-1)^3}-\frac{320\alpha_0}{9(x-2)^4}-\frac{4\alpha_0}{3(x-1)^4}-\frac{640\alpha_0}{9(x-2)^5}+\frac{41\alpha_0}{18}+$$
$$\frac{25x}{18}+\Big(\frac{832\alpha_0}{3(x-2)^4}+\frac{1280\alpha_0}{3(x-2)^5}-\frac{832}{3(x-2)^4}-\frac{2944}{3(x-2)^5}-\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{416\alpha_0}{(x-2)^4}-\frac{640\alpha_0}{(x-2)^5}+\frac{416}{(x-2)^4}+$$
$$\frac{1472}{(x-2)^5}+\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{16}{9(x-2)}-\frac{7}{18(x-1)}-\frac{8}{9(x-2)^2}-\frac{5}{9(x-1)^2}+\frac{16}{9(x-2)^3}-\frac{1}{(x-1)^3}+\frac{320}{9(x-2)^4}-$$

$$\frac{2}{3(x-1)^4}+\frac{1280}{9(x-2)^5}+\frac{1280}{9(x-2)^6}+\frac{7}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{16x\alpha_0}{3}+\frac{1280\alpha_0}{3(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}+\frac{2560\alpha_0}{3(x-2)^5}-$$

$$\frac{16\alpha_0}{3(x-1)^5}-\frac{32\alpha_0}{3}-\frac{16x}{3}-\frac{1280}{3(x-2)^4}-\frac{16}{3(x-1)^4}-\frac{5120}{3(x-2)^5}-\frac{16}{3(x-1)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0,0;\alpha_0)+\Big(\frac{16x\alpha_0}{3}-$$

$$\frac{1280\alpha_0}{3(x-2)^4}-\frac{16\alpha_0}{3(x-1)^4}-\frac{2560\alpha_0}{3(x-2)^5}+\frac{16\alpha_0}{3(x-1)^5}-\frac{32\alpha_0}{3}-\frac{16x}{3}+\frac{1280}{3(x-2)^4}+\frac{16}{3(x-1)^4}+\frac{5120}{3(x-2)^5}+\frac{16}{3(x-1)^5}+$$

$$\frac{5120}{3(x-2)^6}\Big)H(0,0,0;x)+\Big(-8x\alpha_0-\frac{640\alpha_0}{(x-2)^4}-\frac{8\alpha_0}{(x-1)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{8\alpha_0}{(x-1)^5}+16\alpha_0+8x+\frac{640}{(x-2)^4}+$$

$$\frac{8}{(x-1)^4}+\frac{2560}{(x-2)^5}+\frac{8}{(x-1)^5}+\frac{2560}{(x-2)^6}\Big)H(0,0,1;\alpha_0)+\Big(-\frac{8x\alpha_0}{3}-\frac{736\alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-$$

$$\frac{8\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{736}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{2752}{3(x-2)^5}-\frac{8}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)H(0,0,c_1(\alpha_0);x)+$$

$$\Big(\frac{1280\alpha_0}{3(x-2)^4}+\frac{2560\alpha_0}{3(x-2)^5}-\frac{1280}{3(x-2)^4}-\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0,c_2(\alpha_0);x)+\Big(-8x\alpha_0-\frac{640\alpha_0}{(x-2)^4}-$$

$$\frac{8\alpha_0}{(x-1)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{8\alpha_0}{(x-1)^5}+16\alpha_0+8x+\frac{640}{(x-2)^4}+\frac{8}{(x-1)^4}+\frac{2560}{(x-2)^5}+\frac{8}{(x-1)^5}+$$

$$\frac{2560}{(x-2)^6}\Big)H(0,1,0;\alpha_0)+\Big(\frac{20x\alpha_0}{3}+\frac{1984\alpha_0}{3(x-2)^4}-\frac{20\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+\frac{20\alpha_0}{3(x-1)^5}-\frac{40\alpha_0}{3}-\frac{20x}{3}-\frac{1984}{3(x-2)^4}+$$

$$\frac{20}{3(x-1)^4}-\frac{7168}{3(x-2)^5}+\frac{20}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(0,1,0;x)+\Big(12x\alpha_0+\frac{960\alpha_0}{(x-2)^4}+\frac{12\alpha_0}{(x-1)^4}+\frac{1920\alpha_0}{(x-2)^5}-$$

$$\frac{12\alpha_0}{(x-1)^5}-24\alpha_0-12x-\frac{960}{(x-2)^4}-\frac{12}{(x-1)^4}-\frac{3840}{(x-2)^5}-\frac{12}{(x-1)^5}-\frac{3840}{(x-2)^6}\Big)H(0,1,1;\alpha_0)+$$

$$\Big(-\frac{20x\alpha_0}{3}-\frac{1984\alpha_0}{3(x-2)^4}+\frac{20\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{20\alpha_0}{3(x-1)^5}+\frac{40\alpha_0}{3}+\frac{20x}{3}+\frac{1984}{3(x-2)^4}-\frac{20}{3(x-1)^4}+$$

$$\frac{7168}{3(x-2)^5}-\frac{20}{3(x-1)^5}+\frac{6400}{3(x-2)^6}\Big)H(0,1,c_1(\alpha_0);x)+\Big(\frac{3200\alpha_0}{3(x-2)^4}+\frac{6400\alpha_0}{3(x-2)^5}-\frac{3200}{3(x-2)^4}-\frac{12800}{3(x-2)^5}-$$

$$\frac{12800}{3(x-2)^6}\Big)H(0,2,0;x)+\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big)H(0,2,c_2(\alpha_0);x)+$$

$$\Big(-2x\alpha_0-\frac{640\alpha_0}{3(x-2)^4}+\frac{4\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3(x-1)^5}+4\alpha_0+2x+\frac{640}{3(x-2)^4}-\frac{4}{3(x-1)^4}+\frac{2080}{3(x-2)^5}-$$

$$\frac{4}{3(x-1)^5}+\frac{1600}{3(x-2)^6}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2x\alpha_0}{3}+\frac{832\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{1280\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-$$

$$\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{832}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{2944}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{2560}{3(x-2)^6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(\frac{8x\alpha_0}{3}+\frac{832\alpha_0}{3(x-2)^4}-\frac{32\alpha_0}{3(x-1)^4}+\frac{1280\alpha_0}{3(x-2)^5}+\frac{32\alpha_0}{3(x-1)^5}-\frac{16\alpha_0}{3}-\frac{8x}{3}-\frac{832}{3(x-2)^4}+\frac{32}{3(x-1)^4}-\frac{2944}{3(x-2)^5}+$$

$$\frac{32}{3(x-1)^5}-\frac{2560}{3(x-2)^6}\Big)H(1,0,0;x)+\Big(-\frac{2x\alpha_0}{3}-\frac{64\alpha_0}{(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{(x-2)^5}-\frac{16\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+$$

$$\frac{64}{(x-2)^4}-\frac{16}{3(x-1)^4}+\frac{288}{(x-2)^5}-\frac{16}{3(x-1)^5}+\frac{320}{(x-2)^6}\Big)H(1,0,c_1(\alpha_0);x)+\Big(\frac{14x\alpha_0}{3}+\frac{480\alpha_0}{(x-2)^4}-\frac{64\alpha_0}{3(x-1)^4}+$$

$$\frac{800\alpha_0}{(x-2)^5}+\frac{64\alpha_0}{3(x-1)^5}-\frac{28\alpha_0}{3}-\frac{14x}{3}-\frac{480}{(x-2)^4}+\frac{64}{3(x-1)^4}-\frac{1760}{(x-2)^5}+\frac{64}{3(x-1)^5}-\frac{1600}{(x-2)^6}\Big)H(1,1,0;x)+$$

$$\Big(-\frac{14x\alpha_0}{3}-\frac{480\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{(x-2)^5}-\frac{64\alpha_0}{3(x-1)^5}+\frac{28\alpha_0}{3}+\frac{14x}{3}+\frac{480}{(x-2)^4}-\frac{64}{3(x-1)^4}+\frac{1760}{(x-2)^5}-$$

$$\frac{64}{3(x-1)^5}+\frac{1600}{(x-2)^6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-2x\alpha_0-\frac{640\alpha_0}{3(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}-\frac{16\alpha_0}{3(x-1)^5}+4\alpha_0+$$

$$2x+\frac{640}{3(x-2)^4}-\frac{16}{3(x-1)^4}+\frac{2080}{3(x-2)^5}-\frac{16}{3(x-1)^5}+\frac{1600}{3(x-2)^6}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3200\alpha_0}{3(x-2)^4}+$$

$$\frac{6400\alpha_0}{3(x-2)^5}-\frac{3200}{3(x-2)^4}-\frac{12800}{3(x-2)^5}-\frac{12800}{3(x-2)^6}\Big)H(2,0,0;x)+\Big(\frac{2x\alpha_0}{3}+\frac{2080\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+$$

$$\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{2080}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{7360}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(2,0,c_1(\alpha_0);x)+$$

$$\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big)H(2,0,c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-$$

$$\frac{2080\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+\frac{2080}{3(x-2)^4}-\frac{2}{3(x-1)^4}+\frac{7360}{3(x-2)^5}-\frac{2}{3(x-1)^5}+$$

$$\frac{6400}{3(x-2)^6}\Big)H(2,1,0;x)+\Big(\frac{2x\alpha_0}{3}+\frac{2080\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{2080}{3(x-2)^4}+$$

$$\frac{2}{3(x-1)^4}-\frac{7360}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(2,1,c_1(\alpha_0);x)+\Big(-\frac{8000\alpha_0}{3(x-2)^4}-\frac{16000\alpha_0}{3(x-2)^5}+$$

$$\frac{8000}{3(x-2)^4}+\frac{32000}{3(x-2)^5}+\frac{32000}{3(x-2)^6}\Big)H(2,2,0;x)+\Big(\frac{8000\alpha_0}{3(x-2)^4}+\frac{16000\alpha_0}{3(x-2)^5}-\frac{8000}{3(x-2)^4}-\frac{32000}{3(x-2)^5}-$$

$$
\begin{aligned}
&\frac{32000}{3(x-2)^6}\Big) H(2,2,c_2(\alpha_0);x) + \Big(-\frac{2x\alpha_0}{3} - \frac{2080\alpha_0}{3(x-2)^4} + \frac{2\alpha_0}{3(x-1)^4} - \frac{3200\alpha_0}{3(x-2)^5} - \frac{2\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} + \frac{2x}{3} + \\
&\frac{2080}{3(x-2)^4} - \frac{2}{3(x-1)^4} + \frac{7360}{3(x-2)^5} - \frac{2}{3(x-1)^5} + \frac{6400}{3(x-2)^6}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{4\alpha_0}{3(x-1)^4} - \\
&\frac{4\alpha_0}{3(x-1)^5} - \frac{4}{3(x-1)^4} - \frac{4}{3(x-1)^5}\Big) H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{2\alpha_0}{3(x-1)^4} - \frac{2\alpha_0}{3(x-1)^5} - \frac{2}{3(x-1)^4} - \\
&\frac{2}{3(x-1)^5}\Big) H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x) + \Big(-\frac{32\alpha_0}{(x-2)^4} + \frac{32}{(x-2)^4} + \frac{64}{(x-2)^5}\Big) H(c_2(\alpha_0),0,c_1(\alpha_0);x) + \\
&\Big(\frac{640\alpha_0}{3(x-2)^4} + \frac{800\alpha_0}{3(x-2)^5} - \frac{640}{3(x-2)^4} - \frac{2080}{3(x-2)^5} - \frac{1600}{3(x-2)^6}\Big) H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + H(2,0;x)\Big(- \\
&\frac{1600\alpha_0}{9(x-2)^4} - \frac{3200\alpha_0}{9(x-2)^5} - \frac{3200\ln 2\,\alpha_0}{3(x-2)^4} - \frac{6400\ln 2\,\alpha_0}{3(x-2)^5} + \frac{1600}{9(x-2)^4} + \frac{6400}{9(x-2)^5} + \frac{6400}{9(x-2)^6} + \frac{3200\ln 2}{3(x-2)^4} + \frac{12800\ln 2}{3(x-2)^5} + \\
&\frac{12800\ln 2}{3(x-2)^6}\Big) + H(0,2;x)\Big(-\frac{3200\ln 2\,\alpha_0}{3(x-2)^4} - \frac{6400\ln 2\,\alpha_0}{3(x-2)^5} + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} + \frac{12800}{3(x-2)^5} + \\
&\frac{12800}{3(x-2)^6}\Big) H(0;\alpha_0) + \frac{3200\ln 2}{3(x-2)^4} + \frac{12800\ln 2}{3(x-2)^5} + \frac{12800\ln 2}{3(x-2)^6}\Big) + H(0,0;x)\Big(-\frac{58x\alpha_0}{9} - \frac{128\alpha_0}{9(x-2)} + \frac{74\alpha_0}{3(x-1)} + \\
&\frac{32\alpha_0}{9(x-2)^2} - \frac{52\alpha_0}{9(x-1)^2} + \frac{64\alpha_0}{(x-2)^3} + \frac{46\alpha_0}{9(x-1)^3} + \frac{4480\alpha_0}{9(x-2)^4} + \frac{31\alpha_0}{9(x-1)^4} + \frac{1280\alpha_0}{9(x-2)^5} - \frac{58\alpha_0}{9(x-1)^5} + \frac{1280\ln 2\,\alpha_0}{3(x-2)^4} + \\
&\frac{2560\ln 2\,\alpha_0}{3(x-2)^5} + \frac{71\alpha_0}{9} + \frac{58x}{9} - \frac{160}{9(x-2)} + \frac{52}{3(x-1)} + \frac{224}{9(x-2)^2} - \frac{14}{9(x-1)^2} - \frac{640}{9(x-2)^3} - \frac{8}{9(x-1)^3} - \frac{5632}{9(x-2)^4} - \\
&\frac{85}{9(x-1)^4} - \frac{10240}{9(x-2)^5} - \frac{58}{9(x-1)^5} - \frac{2560}{9(x-2)^6} - \frac{1280\ln 2}{3(x-2)^4} - \frac{5120\ln 2}{3(x-2)^5} - \frac{5120\ln 2}{3(x-2)^6} + 5\Big) + H(2,2;x)\Big(\frac{8000\ln 2\,\alpha_0}{3(x-2)^4} + \\
&\frac{16000\ln 2\,\alpha_0}{3(x-2)^5} + \Big(\frac{8000\alpha_0}{3(x-2)^4} + \frac{16000\alpha_0}{3(x-2)^5} - \frac{8000}{3(x-2)^4} - \frac{32000}{3(x-2)^5} - \frac{32000}{3(x-2)^6}\Big) H(0;\alpha_0) - \frac{8000\ln 2}{3(x-2)^4} - \\
&\frac{32000\ln 2}{3(x-2)^5} - \frac{32000\ln 2}{3(x-2)^6}\Big) + H(0;x)\Big(\frac{1}{2}\pi^2 x\alpha_0 + \frac{1351x\alpha_0}{108} + \frac{284\alpha_0}{3(x-2)} - \frac{691\alpha_0}{6(x-1)} - \frac{664\alpha_0}{9(x-2)^2} + \frac{131\alpha_0}{9(x-1)^2} - \\
&\frac{560\alpha_0}{3(x-2)^3} - \frac{101\alpha_0}{9(x-1)^3} + \frac{8\pi^2\alpha_0}{3(x-2)^4} - \frac{31040\alpha_0}{27(x-2)^4} - \frac{7\pi^2\alpha_0}{18(x-1)^4} - \frac{1181\alpha_0}{216(x-1)^4} - \frac{80\pi^2\alpha_0}{3(x-2)^5} - \frac{640\alpha_0}{27(x-2)^5} + \frac{7\pi^2\alpha_0}{18(x-1)^5} + \\
&\frac{1351\alpha_0}{108(x-1)^5} - \frac{640\ln^2 2\,\alpha_0}{3(x-2)^4} - \frac{1280\ln^2 2\,\alpha_0}{3(x-2)^5} - \frac{640\ln 2\,\alpha_0}{9(x-2)^4} - \frac{1280\ln 2\,\alpha_0}{9(x-2)^5} - \pi^2\alpha_0 - \frac{2929\alpha_0}{216} - \frac{\pi^2 x}{2} - \frac{1351x}{108} + \\
&\frac{92}{x-2} - \frac{1133}{12(x-1)} - \frac{1040}{9(x-2)^2} + \frac{223}{36(x-1)^2} + \frac{3008}{9(x-2)^3} + \frac{103}{36(x-1)^3} - \frac{8\pi^2}{3(x-2)^4} + \frac{41120}{27(x-2)^4} + \frac{7\pi^2}{18(x-1)^4} + \\
&\frac{4223}{216(x-1)^4} + \frac{64\pi^2}{3(x-2)^5} + \frac{62720}{27(x-2)^5} + \frac{7\pi^2}{18(x-1)^5} + \frac{1351}{108(x-1)^5} + \frac{160\pi^2}{3(x-2)^6} + \frac{1280}{27(x-2)^6} + \frac{640\ln^2 2}{3(x-2)^4} + \\
&\frac{2560\ln^2 2}{3(x-2)^5} + \frac{2560\ln^2 2}{3(x-2)^6} + \frac{640\ln 2}{9(x-2)^4} + \frac{2560\ln 2}{9(x-2)^5} + \frac{2560\ln 2}{9(x-2)^6} - \frac{275}{24}\Big) + H(2;x)\Big(-\frac{1}{6}\pi^2 x\alpha_0 + \frac{40\pi^2\alpha_0}{9(x-2)^4} + \\
&\frac{\pi^2\alpha_0}{6(x-1)^4} + \frac{800\pi^2\alpha_0}{9(x-2)^5} - \frac{\pi^2\alpha_0}{6(x-1)^5} + \frac{1600\ln^2 2\,\alpha_0}{3(x-2)^4} + \frac{3200\ln^2 2\,\alpha_0}{3(x-2)^5} + \frac{1600\ln 2\,\alpha_0}{9(x-2)^4} + \frac{3200\ln 2\,\alpha_0}{9(x-2)^5} + \frac{\pi^2\alpha_0}{3} + \frac{\pi^2 x}{6} + \\
&\Big(\frac{1600\alpha_0}{9(x-2)^4} + \frac{3200\alpha_0}{9(x-2)^5} - \frac{1600}{9(x-2)^4} - \frac{6400}{9(x-2)^5} - \frac{6400}{9(x-2)^6}\Big) H(0;\alpha_0) + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} + \\
&\frac{12800}{3(x-2)^5} + \frac{12800}{3(x-2)^6}\Big) H(0,0;\alpha_0) + \Big(\frac{1600\alpha_0}{(x-2)^4} + \frac{3200\alpha_0}{(x-2)^5} - \frac{1600}{(x-2)^4} - \frac{6400}{(x-2)^5} - \frac{6400}{(x-2)^6}\Big) H(0,1;\alpha_0) - \\
&\frac{40\pi^2}{9(x-2)^4} - \frac{\pi^2}{6(x-1)^4} - \frac{880\pi^2}{9(x-2)^5} - \frac{\pi^2}{6(x-1)^5} - \frac{1600\pi^2}{9(x-2)^6} - \frac{1600\ln^2 2}{3(x-2)^4} - \frac{6400\ln^2 2}{3(x-2)^5} - \frac{6400\ln^2 2}{3(x-2)^6} - \frac{1600\ln 2}{9(x-2)^4} - \\
&\frac{6400\ln 2}{9(x-2)^5} - \frac{6400\ln 2}{9(x-2)^6}\Big) - \frac{16\pi^2}{9(x-2)} + \frac{461\pi^2}{216(x-1)} + \frac{22\pi^2}{9(x-2)^2} - \frac{23\pi^2}{54(x-1)^2} - \frac{4\pi^2}{(x-2)^3} - \frac{29\pi^2}{108(x-1)^3} - \frac{656\pi^2}{27(x-2)^4} - \\
&\frac{28\pi^2}{27(x-1)^4} - \frac{1760\pi^2}{27(x-2)^5} - \frac{29\pi^2}{54(x-1)^5} - \frac{320\pi^2}{27(x-2)^6} - \frac{17}{12}x\zeta_3 - \frac{224\zeta_3}{3(x-2)^4} + \frac{7\zeta_3}{4(x-1)^4} - \frac{728\zeta_3}{3(x-2)^5} + \frac{7\zeta_3}{4(x-1)^5} - \\
&\frac{560\zeta_3}{3(x-2)^6} - \frac{640\ln^3 2}{9(x-2)^4} - \frac{2560\ln^3 2}{9(x-2)^5} - \frac{2560\ln^3 2}{9(x-2)^6} - \frac{320\ln^2 2}{9(x-2)^4} - \frac{1280\ln^2 2}{9(x-2)^5} - \frac{1280\ln^2 2}{9(x-2)^6} + \frac{1}{6}\pi^2 x\ln 2 + \\
&\frac{32\pi^2\ln 2}{3(x-2)^4} - \frac{320\ln 2}{27(x-2)^4} - \frac{\pi^2\ln 2}{6(x-1)^4} - \frac{16\pi^2\ln 2}{3(x-2)^5} - \frac{1280\ln 2}{27(x-2)^5} - \frac{\pi^2\ln 2}{6(x-1)^5} - \frac{160\pi^2\ln 2}{3(x-2)^6} - \frac{1280\ln 2}{27(x-2)^6} + \frac{11\pi^2}{24}\Big\}.
\end{aligned}
$$

### E.4 The $\mathcal{B}$ integral for $k = -1$ and $\delta = -1$

The $\varepsilon$ expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,-1,-1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;-1,-1) \\
&= \frac{1}{\varepsilon^2}b_{-2}^{(-1,-1)} + \frac{1}{\varepsilon}b_{-1}^{(-1,-1)} + b_0^{(-1,-1)} + \varepsilon b_1^{(-1,-1)} + \varepsilon^2 b_2^{(-1,-1)} + \mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{E.4}
$$

where



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$$b_{-2}^{(-1,-1)} = \frac{1}{8},$$

$$b_{-1}^{(-1,-1)} = -\frac{1}{2}H(0;x),$$

$$b_0^{(-1,-1)} = \frac{\alpha_0^3}{12(x-1)^2} - \frac{\alpha_0^3}{12} + \frac{\alpha_0^2}{24\ (x-1)} - \frac{5\alpha_0^2}{24(x-1)^2} + \frac{7\alpha_0^2}{24(x-1)^3} + \frac{13\ \alpha_0^2}{24} - \frac{\alpha_0}{3(x-1)} + \frac{\alpha_0}{6(x-1)^2} -$$
$$\frac{\alpha_0}{3\ (x-1)^3} + \frac{13\alpha_0}{12(x-1)^4} - \frac{23\ \alpha_0}{12} + \Big(\frac{25}{12} + \frac{3}{4(x-1)} - \frac{1}{6\ (x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} +$$
$$\frac{25}{12\ (x-1)^5}\Big)H(0;\alpha_0) + \Big( - \frac{25}{12} - \frac{3}{4\ (x-1)} + \frac{1}{6(x-1)^2} + \frac{1}{6(x-1)^3} - \frac{3}{4\ (x-1)^4} - \frac{25}{12(x-1)^5}\Big)\ H(0;x) +$$
$$\Big(\frac{1}{(x-1)^5} - 1\Big)H(0;\alpha_0)\ H(1;x) + \Big( - \frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} + \frac{\alpha_0^3}{x-1} - \frac{\alpha_0^3}{3(x-1)^2} - \frac{4\alpha_0^3}{3} - \frac{3\alpha_0^2}{2\ (x-1)} + \frac{\alpha_0^2}{(x-1)^2} -$$
$$\frac{\alpha_0^2}{2(x-1)^3} + 3\ \alpha_0^2 + \frac{\alpha_0}{x-1} - \frac{\alpha_0}{(x-1)^2} + \frac{\alpha_0}{(x-1)^3} - \frac{\alpha_0}{(x-1)^4} - 4\alpha_0 + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6\ (x-1)^3} +$$
$$\frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5} + \frac{25}{12}\Big)\ H(c_1(\alpha_0);x) + 2H(0,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)\ H(0,c_1(\alpha_0);x) + \Big(1 -$$
$$\frac{1}{(x-1)^5}\Big)\ H(1,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)\ H(1,c_1(\alpha_0);x) - \frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{\pi\ ^2}{6(x-1)^5} + \frac{\pi^2}{8},$$

$$b_1^{(-1,-1)} =$$
$$\frac{7d_1\alpha_0^3}{72} - \frac{7d_1\alpha_0^3}{72(x-1)^2} + \frac{7\ \alpha_0^3}{36(x-1)^2} - \frac{7\alpha_0^3}{36} - \frac{109d_1\ \alpha_0^2}{144} - \frac{13d_1\alpha_0^2}{144(x-1)} + \frac{7\alpha_0^2}{72\ (x-1)} + \frac{29d_1\alpha_0^2}{144(x-1)^2} - \frac{35\alpha_0^2}{72\ (x-1)^2} -$$
$$\frac{67d_1\alpha_0^2}{144(x-1)^3} + \frac{85\alpha_0^2}{72\ (x-1)^3} + \frac{127\alpha_0^2}{72} + \frac{305d_1\alpha_0}{72} - \frac{2\alpha_0}{3\ (x-2)} + \frac{19d_1\alpha_0}{18(x-1)} - \frac{10\alpha_0}{9(x-1)} - \frac{d_1\ \alpha_0}{9(x-1)^2} + \frac{13\alpha_0}{18(x-1)^2} + \frac{d_1\alpha_0}{18(x-1)^3} -$$
$$\frac{7\alpha_0}{9(x-1)^3} - \frac{217d_1\alpha_0}{72(x-1)^4} + \frac{149\ \alpha_0}{18(x-1)^4} - \frac{101\alpha_0}{9} + \Big( - \frac{\alpha_0^3}{3\ (x-1)^2} + \frac{\alpha_0^3}{3} - \frac{\alpha_0^2}{6(x-1)} + \frac{5\alpha_0^2}{6\ (x-1)^2} - \frac{7\alpha_0^2}{6(x-1)^3} - \frac{13\alpha_0^2}{6} +$$
$$\frac{4\alpha_0}{3\ (x-1)} - \frac{2\alpha_0}{3(x-1)^2} + \frac{4\alpha_0}{3(x-1)^3} - \frac{13\ \alpha_0}{3(x-1)^4} + \frac{23\alpha_0}{3} - \frac{205\ d_1}{72} + \frac{4}{x-2} - \frac{15d_1}{8(x-1)} - \frac{1}{2\ (x-1)} - \frac{8}{3(x-2)^2} + \frac{5d_1}{18(x-1)^2} -$$
$$\frac{13}{18\ (x-1)^2} + \frac{5d_1}{18(x-1)^3} + \frac{5}{18(x-1)^3} - \frac{15\ d_1}{8(x-1)^4} + \frac{9}{(x-1)^4} - \frac{205d_1}{72\ (x-1)^5} + \frac{130}{9(x-1)^5} + \frac{155}{18}\Big)\ H(0;\alpha_0) +$$
$$\Big(\frac{15d_1}{8(x-1)} - \frac{5d_1}{18(x-1)^2} - \frac{5\ d_1}{18(x-1)^3} + \frac{15d_1}{8(x-1)^4} + \frac{205d_1}{72(x-1)^5} + \frac{205d_1}{72} - \frac{4}{x-2} + \frac{1}{2(x-1)} + \frac{8}{3\ (x-2)^2} + \frac{13}{18(x-1)^2} -$$
$$\frac{5}{18\ (x-1)^3} - \frac{9}{(x-1)^4} + \frac{2\pi^2}{3(x-1)^5} - \frac{130}{9\ (x-1)^5} - \frac{\pi^2}{2} - \frac{155}{18}\Big)H(0;x) + \Big(\frac{d_1\ \alpha_0^3}{6} - \frac{d_1\alpha_0^3}{6(x-1)^2} - \frac{13d_1\ \alpha_0^2}{12} -$$
$$\frac{d_1\alpha_0^2}{12(x-1)} + \frac{5d_1\alpha_0^2}{12(x-1)^2} - \frac{7d_1\alpha_0^2}{12(x-1)^3} + \frac{23d_1\alpha_0}{6} + \frac{2d_1\ \alpha_0}{3(x-1)} - \frac{d_1\alpha_0}{3(x-1)^2} + \frac{2d_1\alpha_0}{3\ (x-1)^3} - \frac{13d_1\alpha_0}{6(x-1)^4} - \frac{35d_1}{12} - \frac{7\ d_1}{12(x-1)} +$$
$$\frac{d_1}{12(x-1)^2} - \frac{d_1}{12(x-1)^3} + \frac{13\ d_1}{6(x-1)^4}\Big)H(1;\alpha_0) + \Big(\frac{\pi^2}{2} - \frac{\pi^2}{2\ (x-1)^5}\Big)H(2;x) + \Big( - \frac{d_1\alpha_0^4}{8} + \frac{d_1\alpha_0^4}{8\ (x-1)} - \frac{\alpha_0^4}{4(x-1)} +$$
$$\frac{\alpha_0^4}{4} + \frac{13d_1\alpha_0^3}{18} - \frac{d_1\alpha_0^3}{2(x-1)} + \frac{4\alpha_0^3}{3(x-1)} + \frac{2d_1\ \alpha_0^3}{9(x-1)^2} - \frac{17\alpha_0^3}{18(x-1)^2} - \frac{29\ \alpha_0^3}{18} - \frac{23d_1\alpha_0^2}{12} + \frac{\alpha_0^2}{3(x-2)} + \frac{3d_1\ \alpha_0^2}{4(x-1)} - \frac{41\alpha_0^2}{12(x-1)} -$$
$$\frac{2d_1\alpha_0^2}{3\ (x-1)^2} + \frac{13\alpha_0^2}{4(x-1)^2} + \frac{d_1\alpha_0^2}{2\ (x-1)^3} - \frac{11\alpha_0^2}{4(x-1)^3} + \frac{59\alpha_0^2}{12} + \frac{25d_1\ \alpha_0}{6} - \frac{2\alpha_0}{x-2} - \frac{d_1\alpha_0}{2(x-1)} + \frac{20\alpha_0}{3\ (x-1)} + \frac{4\alpha_0}{3(x-2)^2} +$$
$$\frac{2d_1\alpha_0}{3(x-1)^2} - \frac{17\ \alpha_0}{3(x-1)^2} - \frac{d_1\alpha_0}{(x-1)^3} + \frac{6\alpha_0}{(x-1)^3} + \frac{2\ d_1\alpha_0}{(x-1)^4} - \frac{21\alpha_0}{2(x-1)^4} - \frac{73\alpha_0}{6} - \frac{205\ d_1}{72} + \Big(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} + \frac{4\ \alpha_0^3}{3(x-1)^2} +$$
$$\frac{16\alpha_0^3}{3} + \frac{6\alpha_0^2}{x-1} - \frac{4\ \alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 - \frac{4\ \alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\ \alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{3}{x-1} + \frac{2}{3(x-1)^2} +$$
$$\frac{2}{3\ (x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{3}\Big)\ H(0;\alpha_0) + \Big( - \frac{d_1\alpha_0^4}{2} + \frac{d_1\alpha_0^4}{2(x-1)} + \frac{8\ d_1\alpha_0^3}{3} - \frac{2d_1\alpha_0^3}{x-1} + \frac{2d_1\alpha_0^3}{3(x-1)^2} - 6\ d_1\alpha_0^2 +$$
$$\frac{3d_1\alpha_0^2}{x-1} - \frac{2d_1\ \alpha_0^2}{(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} + 8d_1\alpha_0 - \frac{2d_1\ \alpha_0}{x-1} + \frac{2d_1\alpha_0}{(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{2\ d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{3d_1}{2(x-1)} + \frac{d_1}{3\ (x-1)^2} +$$
$$\frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25\ d_1}{6(x-1)^5}\Big)H(1;\alpha_0) + \frac{4}{x-2} - \frac{15d_1}{8\ (x-1)} - \frac{1}{2(x-1)} - \frac{8}{3(x-2)^2} + \frac{5d_1}{18\ (x-1)^2} - \frac{13}{18(x-1)^2} +$$
$$\frac{5d_1}{18(x-1)^3} + \frac{5}{18\ (x-1)^3} - \frac{15d_1}{8(x-1)^4} + \frac{9}{(x-1)^4} - \frac{205d_1}{72\ (x-1)^5} + \frac{130}{9(x-1)^5} + \frac{155}{18}\Big)\ H(c_1(\alpha_0);x) + \Big( - \frac{25}{3} - \frac{3}{x-1} +$$
$$\frac{2}{3\ (x-1)^2} + \frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3\ (x-1)^5}\Big)H(0,0;\alpha_0) + \Big(\frac{25}{3} + \frac{3}{x-1} - \frac{2}{3\ (x-1)^2} - \frac{2}{3(x-1)^3} + \frac{3}{(x-1)^4} +$$
$$\frac{25}{3\ (x-1)^5}\Big)H(0,0;x) + \Big( - \frac{3d_1}{2(x-1)} + \frac{d_1}{3\ (x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25\ d_1}{6(x-1)^5} - \frac{25d_1}{6}\Big)H(0,1;\alpha_0) +$$
$$H(1;x)\ \Big( - \frac{\pi^2 d_1}{3(x-1)^5} + \Big(\frac{2\ d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2\ (x-1)^4} + \frac{25d_1}{6(x-1)^5} - \frac{4}{x-2} + \frac{5}{2\ (x-1)} + \frac{8}{3(x-2)^2} -$$
$$\frac{1}{3(x-1)^2} - \frac{8}{3\ (x-2)^3} + \frac{5}{3(x-1)^3} + \frac{3}{2(x-1)^4} + \frac{25}{6\ (x-1)^5} - \frac{25}{6}\Big)H(0;\alpha_0) + \Big(4 - \frac{4}{(x-1)^5}\Big)\ H(0,0;\alpha_0) +$$

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$$\Big(2d_1-\frac{2d_1}{(x-1)^5}\Big)H(0,1;\alpha_0)+\frac{\pi^2}{3(x-1)^5}+\frac{\pi^2}{3}\Big)+\Big(\frac{2d_1}{(x-1)^5}-2d_1-\frac{2}{(x-1)^5}+2\Big)H(0;\alpha_0)H(0,1;x)+$$
$$\Big(-\frac{\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{2}+\frac{2\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}-\frac{8\alpha_0^3}{3}-\frac{3\alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2+\frac{2\alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\alpha_0}{(x-1)^3}-$$
$$\frac{2\alpha_0}{(x-1)^4}-8\alpha_0+\Big(4-\frac{4}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(2d_1-\frac{2d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{4}{x-2}+\frac{2}{x-1}+\frac{8}{3(x-2)^2}+$$
$$\frac{1}{3(x-1)^2}-\frac{8}{3(x-2)^3}+\frac{2}{3(x-1)^3}+\frac{7}{2(x-1)^4}+\frac{25}{6(x-1)^5}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{2d_1}{x-1}+\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+$$
$$\frac{d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{4}{x-2}-\frac{5}{2(x-1)}-\frac{8}{3(x-2)^2}+\frac{1}{3(x-1)^2}+\frac{8}{3(x-2)^3}-\frac{5}{3(x-1)^3}-\frac{3}{2(x-1)^4}-\frac{25}{6(x-1)^5}+$$
$$\frac{25}{6}\Big)H(1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2d_1-\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(1,1;x)+\Big(\frac{2d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-$$
$$\frac{d_1}{2(x-1)^4}+\frac{25d_1}{6(x-1)^5}+\Big(4-\frac{4}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(2d_1-\frac{2d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{4}{x-2}+\frac{5}{2(x-1)}+$$
$$\frac{8}{3(x-2)^2}-\frac{1}{3(x-1)^2}-\frac{8}{3(x-2)^3}+\frac{5}{3(x-1)^3}+\frac{3}{2(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-$$
$$2\Big)H(0;\alpha_0)H(2,1;x)+\Big(\frac{3\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{2}-\frac{6\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{(x-1)^2}+8\alpha_0^3+\frac{9\alpha_0^2}{x-1}-\frac{6\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}-18\alpha_0^2-\frac{6\alpha_0}{x-1}+$$
$$\frac{6\alpha_0}{(x-1)^2}-\frac{6\alpha_0}{(x-1)^3}+\frac{6\alpha_0}{(x-1)^4}+24\alpha_0+\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1\,H(1;\alpha_0)}{(x-1)^5}-\frac{9}{2(x-1)}+\frac{1}{(x-1)^2}+\frac{1}{(x-1)^3}-\frac{9}{2(x-1)^4}-$$
$$\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{2}+\frac{2\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}-\frac{8\alpha_0^3}{3}-\frac{3\alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-$$
$$\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2+\frac{2\alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\alpha_0}{(x-1)^3}-\frac{2\alpha_0}{(x-1)^4}-8\alpha_0+\frac{4}{x-2}-\frac{1}{2(x-1)}-\frac{8}{3(x-2)^2}-\frac{2}{3(x-1)^2}+\frac{8}{3(x-2)^3}-$$
$$\frac{1}{(x-1)^3}-\frac{2}{(x-1)^4}+\frac{25}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)-8H(0,0,0;x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(0,0,c_1(\alpha_0);x)+$$
$$\Big(-\frac{2d_1}{(x-1)^5}+2d_1+\frac{2}{(x-1)^5}-2\Big)H(0,1,0;x)+\Big(\frac{2d_1}{(x-1)^5}-2d_1-\frac{2}{(x-1)^5}+2\Big)H(0,1,c_1(\alpha_0);x)+$$
$$\Big(6-\frac{2}{(x-1)^5}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-2\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-$$
$$4\Big)H(1,0,0;x)+\Big(\frac{2d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-2\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+2d_1+\frac{2}{(x-1)^5}+$$
$$2\Big)H(1,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2d_1-\frac{2}{(x-1)^5}-2\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{2d_1}{(x-1)^5}-\frac{2}{(x-1)^5}+$$
$$6\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-2\Big)H(2,0,c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(2,1,0;x)+$$
$$\Big(\frac{2}{(x-1)^5}-2\Big)H(2,1,c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(2,c_2(\alpha_0),c_1(\alpha_0);x)-\frac{2H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+$$
$$\frac{6H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{2H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{\pi^2}{x-2}-\frac{3\pi^2}{8(x-1)}-\frac{2\pi^2}{3(x-2)^2}-\frac{\pi^2}{9(x-1)^2}+$$
$$\frac{2\pi^2}{3(x-2)^3}-\frac{7\pi^2}{36(x-1)^3}-\frac{3\pi^2}{4(x-1)^4}-\frac{25\pi^2}{36(x-1)^5}-\frac{3\zeta_3}{4(x-1)^5}-4\zeta_3-\frac{\pi^2\ln 2}{2(x-1)^5}+\frac{1}{2}\pi^2\ln 2+\frac{25\pi^2}{72},$$

$$b_2^{(-1,-1)}=-\frac{37}{432}d_1^2\alpha_0^3+\frac{37d_1\alpha_0^3}{108}+\frac{37d_1^2\alpha_0^3}{432(x-1)^2}-\frac{37d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi^2\alpha_0^3}{72(x-1)^2}+\frac{37\alpha_0^3}{108(x-1)^2}+\frac{\pi^2\alpha_0^3}{72}-\frac{37\alpha_0^3}{108}+$$
$$\frac{715d_1^2\alpha_0^2}{864}-\frac{104d_1\alpha_0^2}{27}+\frac{115d_1^2\alpha_0^2}{864(x-1)}-\frac{19d_1\alpha_0^2}{54(x-1)}-\frac{\pi^2\alpha_0^2}{144(x-1)}+\frac{37\alpha_0^2}{216(x-1)}-\frac{107d_1^2\alpha_0^2}{864(x-1)^2}+\frac{73d_1\alpha_0^2}{108(x-1)^2}+\frac{5\pi^2\alpha_0^2}{144(x-1)^2}-$$
$$\frac{185\alpha_0^2}{216(x-1)^2}+\frac{493d_1^2\alpha_0^2}{864(x-1)^3}-\frac{305d_1\alpha_0^2}{108(x-1)^3}-\frac{7\pi^2\alpha_0^2}{144(x-1)^3}+\frac{727\alpha_0^2}{216(x-1)^3}-\frac{13\pi^2\alpha_0^2}{144}+\frac{949\alpha_0^2}{216}-\frac{3515d_1^2\alpha_0}{432}+\frac{8965d_1\alpha_0}{216}+$$
$$\frac{25d_1\alpha_0}{9(x-2)}-\frac{50\alpha_0}{9(x-2)}-\frac{265d_1^2\alpha_0}{108(x-1)}+\frac{341d_1\alpha_0}{54(x-1)}+\frac{\pi^2\alpha_0}{18(x-1)}-\frac{107\alpha_0}{54(x-1)}-\frac{d_1^2\alpha_0}{108(x-1)^2}-\frac{185d_1\alpha_0}{108(x-1)^2}-\frac{\pi^2\alpha_0}{36(x-1)^2}+$$
$$\frac{187\alpha_0}{54(x-1)^2}+\frac{113d_1^2\alpha_0}{108(x-1)^3}-\frac{74d_1\alpha_0}{27(x-1)^3}+\frac{\pi^2\alpha_0}{18(x-1)^3}+\frac{25\alpha_0}{54(x-1)^3}+\frac{2911d_1^2\alpha_0}{432(x-1)^4}-\frac{7523d_1\alpha_0}{216(x-1)^4}-\frac{13\pi^2\alpha_0}{72(x-1)^4}+$$
$$\frac{2369\alpha_0}{54(x-1)^4}+\frac{23\pi^2\alpha_0}{72}-\frac{1394\alpha_0}{27}+\Big(-\frac{7d_1\alpha_0^3}{18}+\frac{7d_1\alpha_0^3}{18(x-1)^2}-\frac{7\alpha_0^3}{9(x-1)^2}+\frac{7\alpha_0^3}{9}+\frac{109d_1\alpha_0^2}{36}+\frac{13d_1\alpha_0^2}{36(x-1)}-\frac{7\alpha_0^2}{18(x-1)}-$$
$$\frac{29d_1\alpha_0^2}{36(x-1)^2}+\frac{35\alpha_0^2}{18(x-1)^2}+\frac{67d_1\alpha_0^2}{36(x-1)^3}-\frac{85\alpha_0^2}{18(x-1)^3}-\frac{127\alpha_0^2}{18}-\frac{305d_1\alpha_0}{18}+\frac{8\alpha_0}{3(x-2)}-\frac{38d_1\alpha_0}{9(x-1)}+\frac{40\alpha_0}{9(x-1)}+\frac{4d_1\alpha_0}{9(x-1)^2}-$$
$$\frac{26\alpha_0}{9(x-1)^2}-\frac{2d_1\alpha_0}{9(x-1)^3}+\frac{28\alpha_0}{9(x-1)^3}+\frac{217d_1\alpha_0}{18(x-1)^4}-\frac{298\alpha_0}{9(x-1)^4}+\frac{404\alpha_0}{9}+\frac{2035d_1^2}{432}-\frac{5615d_1}{216}-\frac{38d_1}{3(x-2)}+\frac{68}{3(x-2)}+$$
$$\frac{63d_1^2}{16(x-1)}-\frac{85d_1}{24(x-1)}-\frac{\pi^2}{8(x-1)}-\frac{37}{4(x-1)}+\frac{76d_1}{9(x-2)^2}-\frac{152}{9(x-2)^2}-\frac{19d_1^2}{54(x-1)^2}+\frac{317d_1}{108(x-1)^2}+\frac{\pi^2}{36(x-1)^2}+$$
$$\frac{49}{108(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}-\frac{313d_1}{108(x-1)^3}+\frac{\pi^2}{36(x-1)^3}+\frac{949}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{257d_1}{8(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{213}{4(x-1)^4}+$$

$$\frac{2035d_1^2}{432(x-1)^5} - \frac{8705d_1}{216(x-1)^5} - \frac{25\pi^2}{72(x-1)^5} + \frac{3965}{54(x-1)^5} - \frac{25\pi^2}{72} + \frac{940}{27}\Big) H(0;\alpha_0) + \Big( -\frac{7}{36}d_1^2\alpha_0^3 + \frac{7d_1\alpha_0^3}{18} +$$

$$\frac{7d_1^2\alpha_0^3}{36(x-1)^2} - \frac{7d_1\alpha_0^3}{18(x-1)^2} + \frac{109d_1^2\alpha_0^2}{72} - \frac{127d_1\alpha_0^2}{36} + \frac{13d_1^2\alpha_0^2}{72(x-1)} - \frac{7d_1\alpha_0^2}{36(x-1)} - \frac{29d_1^2\alpha_0^2}{72(x-1)^2} + \frac{35d_1\alpha_0^2}{36(x-1)^2} + \frac{67d_1^2\alpha_0^2}{72(x-1)^3} -$$

$$\frac{85d_1\alpha_0^2}{36(x-1)^3} - \frac{305d_1^2\alpha_0}{36} + \frac{202d_1\alpha_0}{9} + \frac{4d_1\alpha_0}{3(x-2)} - \frac{19d_1^2\alpha_0}{9(x-1)} + \frac{20d_1\alpha_0}{9(x-1)} + \frac{2d_1^2\alpha_0}{9(x-1)^2} - \frac{13d_1\alpha_0}{9(x-1)^2} - \frac{d_1^2\alpha_0}{9(x-1)^3} + \frac{14d_1\alpha_0}{9(x-1)^3} +$$

$$\frac{217d_1^2\alpha_0}{36(x-1)^4} - \frac{149d_1\alpha_0}{9(x-1)^4} + \frac{515d_1^2}{72} - \frac{695d_1}{36} - \frac{4d_1}{3(x-2)} + \frac{139d_1^2}{72(x-1)} - \frac{73d_1}{36(x-1)} - \frac{d_1^2}{72(x-1)^2} + \frac{31d_1}{36(x-1)^2} - \frac{59d_1^2}{72(x-1)^3} +$$

$$\frac{29d_1}{36(x-1)^3} - \frac{217d_1^2}{36(x-1)^4} + \frac{149d_1}{9(x-1)^4}\Big) H(1;\alpha_0) + \Big(\frac{4\alpha_0^3}{3(x-1)^2} - \frac{4\alpha_0^3}{3} + \frac{2\alpha_0^2}{3(x-1)} - \frac{10\alpha_0^2}{3(x-1)^2} + \frac{14\alpha_0^2}{3(x-1)^3} + \frac{26\alpha_0^2}{3} -$$

$$\frac{16\alpha_0}{3(x-1)} + \frac{8\alpha_0}{3(x-1)^2} - \frac{16\alpha_0}{3(x-1)^3} + \frac{52\alpha_0}{3(x-1)^4} - \frac{92\alpha_0}{3} + \frac{205d_1}{18} - \frac{16}{x-2} + \frac{15d_1}{2(x-1)} + \frac{2}{x-1} + \frac{32}{3(x-2)^2} - \frac{10d_1}{9(x-1)^2} +$$

$$\frac{26}{9(x-1)^2} - \frac{10d_1}{9(x-1)^3} - \frac{10}{9(x-1)^3} + \frac{15d_1}{2(x-1)^4} - \frac{36}{(x-1)^4} + \frac{205d_1}{18(x-1)^5} - \frac{520}{9(x-1)^5} - \frac{310}{9}\Big) H(0,0;\alpha_0) + \Big( -$$

$$\frac{15d_1}{2(x-1)} + \frac{10d_1}{9(x-1)^2} + \frac{10d_1}{9(x-1)^3} - \frac{15d_1}{2(x-1)^4} - \frac{205d_1}{18(x-1)^5} - \frac{205d_1}{18} + \frac{16}{x-2} - \frac{2}{x-1} - \frac{32}{3(x-2)^2} - \frac{26}{9(x-1)^2} +$$

$$\frac{10}{9(x-1)^3} + \frac{36}{(x-1)^4} - \frac{8\pi^2}{3(x-1)^5} + \frac{520}{9(x-1)^5} + 2\pi^2 + \frac{310}{9}\Big) H(0,0;x) + \Big( -\frac{2d_1\alpha_0^3}{3} + \frac{2d_1\alpha_0^3}{3(x-1)^2} + \frac{13d_1\alpha_0^2}{3} +$$

$$\frac{d_1\alpha_0^2}{3(x-1)} - \frac{5d_1\alpha_0^2}{3(x-1)^2} + \frac{7d_1\alpha_0^2}{3(x-1)^3} - \frac{46d_1\alpha_0}{3} - \frac{8d_1\alpha_0}{3(x-1)} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{8d_1\alpha_0}{3(x-1)^3} + \frac{26d_1\alpha_0}{3(x-1)^4} + \frac{205d_1^2}{36} - \frac{155d_1}{9} - \frac{8d_1}{x-2} +$$

$$\frac{15d_1^2}{4(x-1)} + \frac{d_1}{x-1} + \frac{16d_1}{3(x-2)^2} - \frac{5d_1^2}{9(x-1)^2} + \frac{13d_1}{9(x-1)^2} - \frac{5d_1^2}{9(x-1)^3} - \frac{5d_1}{9(x-1)^3} + \frac{15d_1^2}{4(x-1)^4} - \frac{18d_1}{(x-1)^4} + \frac{205d_1^2}{36(x-1)^5} -$$

$$\frac{260d_1}{9(x-1)^5}\Big) H(0,1;\alpha_0) + \Big(\frac{2\pi^2 d_1}{3(x-1)^5} + \frac{2\pi^2 d_1}{3} + \Big(-\frac{8d_1}{x-2} + \frac{5d_1}{x-1} + \frac{16d_1}{3(x-2)^2} - \frac{2d_1}{3(x-1)^2} - \frac{16d_1}{3(x-2)^3} + \frac{10d_1}{3(x-1)^3} +$$

$$\frac{3d_1}{(x-1)^4} + \frac{25d_1}{3(x-1)^5} - \frac{25d_1}{3} + \frac{8}{x-2} - \frac{16}{3(x-2)^2} - \frac{8}{3(x-1)^2} + \frac{16}{3(x-2)^3} - \frac{8}{(x-1)^4}\Big) H(0;\alpha_0) + \Big(-\frac{8d_1}{(x-1)^5} + 8d_1 +$$

$$\frac{8}{(x-1)^5} - 8\Big) H(0,0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} + 4d_1^2 + \frac{4d_1}{(x-1)^5} - 4d_1\Big) H(0,1;\alpha_0) - \frac{2\pi^2}{(x-1)^5} - \frac{2\pi^2}{3}\Big) H(0,1;x) +$$

$$\Big(-\frac{\pi^2 d_1}{(x-1)^5} + \pi^2 d_1 + \frac{\pi^2}{(x-1)^5} - \pi^2\Big) H(0,2;x) + \Big(-\frac{2d_1\alpha_0^3}{3} + \frac{2d_1\alpha_0^3}{3(x-1)^2} + \frac{13d_1\alpha_0^2}{3} + \frac{d_1\alpha_0^2}{3(x-1)} - \frac{5d_1\alpha_0^2}{3(x-1)^2} +$$

$$\frac{7d_1\alpha_0^2}{3(x-1)^3} - \frac{46d_1\alpha_0}{3} - \frac{8d_1\alpha_0}{3(x-1)} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{8d_1\alpha_0}{3(x-1)^3} + \frac{26d_1\alpha_0}{3(x-1)^4} + \frac{35d_1}{3} + \frac{7d_1}{3(x-1)} - \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} -$$

$$\frac{26d_1}{3(x-1)^4}\Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{x-1} - \frac{d_1^2}{(x-1)^2} + \frac{4d_1^2}{9(x-1)^3} - \frac{d_1^2}{4(x-1)^4} + \frac{205d_1^2}{36(x-1)^5} - \frac{46d_1}{3(x-2)} - \frac{3d_1}{4(x-1)} + \frac{52d_1}{9(x-2)^2} +$$

$$\frac{185d_1}{18(x-1)^2} - \frac{28d_1}{9(x-2)^3} - \frac{29d_1}{18(x-1)^3} + \frac{27d_1}{4(x-1)^4} + \frac{4\pi^2 d_1}{3(x-1)^5} - \frac{835d_1}{36(x-1)^5} - \frac{205d_1}{36} + \frac{80}{3(x-2)} - \frac{70}{3(x-1)} - \frac{56}{9(x-2)^2} -$$

$$\frac{13}{18(x-1)^2} + \frac{56}{9(x-2)^3} - \frac{355}{18(x-1)^3} - \frac{10}{3(x-1)^4} - \frac{7\pi^2}{6(x-1)^5} - \frac{155}{9(x-1)^5} - \frac{3\pi^2}{2} + \frac{155}{9}\Big) H(1,0;x) + \Big( -$$

$$\frac{1}{3}d_1^2\alpha_0^3 + \frac{d_1^2\alpha_0^3}{3(x-1)^2} + \frac{13d_1^2\alpha_0^2}{6} + \frac{d_1^2\alpha_0^2}{6(x-1)} - \frac{5d_1^2\alpha_0^2}{6(x-1)^2} + \frac{7d_1^2\alpha_0^2}{6(x-1)^3} - \frac{23d_1^2\alpha_0}{3} - \frac{4d_1^2\alpha_0}{3(x-1)} + \frac{2d_1^2\alpha_0}{3(x-1)^2} - \frac{4d_1^2\alpha_0}{3(x-1)^3} +$$

$$\frac{13d_1^2\alpha_0}{3(x-1)^4} + \frac{35d_1^2}{6} + \frac{7d_1^2}{6(x-1)} - \frac{d_1^2}{6(x-1)^2} + \frac{d_1^2}{6(x-1)^3} - \frac{13d_1^2}{3(x-1)^4}\Big) H(1,1;\alpha_0) + H(0,c_1(\alpha_0);x)\Big(-\frac{d_1\alpha_0^4}{4} +$$

$$\frac{d_1\alpha_0^4}{4(x-1)} - \frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} + \frac{13d_1\alpha_0^3}{9} - \frac{d_1\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)} + \frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{14\alpha_0^3}{9(x-1)^2} - \frac{32\alpha_0^3}{9} - \frac{23d_1\alpha_0^2}{6} + \frac{2\alpha_0^2}{3(x-2)} +$$

$$\frac{3d_1\alpha_0^2}{2(x-1)} - \frac{20\alpha_0^2}{3(x-1)} - \frac{4d_1\alpha_0^2}{3(x-1)^2} + \frac{17\alpha_0^2}{3(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{13\alpha_0^2}{3(x-1)^3} + 12\alpha_0^2 + \frac{25d_1\alpha_0}{3} - \frac{4\alpha_0}{x-2} - \frac{d_1\alpha_0}{x-1} + \frac{12\alpha_0}{x-1} +$$

$$\frac{8\alpha_0}{3(x-2)^2} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{32\alpha_0}{3(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{32\alpha_0}{3(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{50\alpha_0}{3(x-1)^4} - 32\alpha_0 + \Big(\frac{2\alpha_0^4}{x-1} - 2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} +$$

$$\frac{8\alpha_0^3}{3(x-1)^2} + \frac{32\alpha_0^3}{3} + \frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{4\alpha_0^2}{(x-1)^3} - 24\alpha_0^2 - \frac{8\alpha_0}{x-1} + \frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} + 32\alpha_0 + \frac{16}{x-2} -$$

$$\frac{8}{x-1} - \frac{32}{3(x-2)^2} - \frac{4}{3(x-1)^2} + \frac{32}{3(x-2)^3} - \frac{8}{3(x-1)^3} - \frac{14}{(x-1)^4} - \frac{50}{3(x-1)^5}\Big) H(0;\alpha_0) + \Big(-d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} +$$

$$\frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} - 12d_1\alpha_0^2 + \frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} + 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} +$$

$$\frac{4d_1\alpha_0}{(x-1)^4} + \frac{8d_1}{x-2} - \frac{4d_1}{x-1} - \frac{16d_1}{3(x-2)^2} - \frac{2d_1}{3(x-1)^2} + \frac{16d_1}{3(x-2)^3} - \frac{4d_1}{3(x-1)^3} - \frac{7d_1}{(x-1)^4} - \frac{25d_1}{3(x-1)^5}\Big) H(1;\alpha_0) +$$

$$\Big(\frac{16}{(x-1)^5} - 16\Big) H(0,0;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} - 8d_1\Big) H(0,1;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} - 8d_1\Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} -$$

$$4d_1^2\Big) H(1,1;\alpha_0) + \frac{32d_1}{3(x-2)} - \frac{70}{3(x-2)} - \frac{20d_1}{3(x-1)} + \frac{95}{6(x-1)} - \frac{28d_1}{9(x-2)^2} + \frac{32}{9(x-2)^2} - \frac{23d_1}{9(x-1)^2} + \frac{131}{18(x-1)^2} +$$

$$\frac{28d_1}{9(x-2)^3} - \frac{56}{9(x-2)^3} - \frac{40d_1}{9(x-1)^3} + \frac{241}{18(x-1)^3} - \frac{31d_1}{4(x-1)^4} + \frac{20}{(x-1)^4} - \frac{205d_1}{36(x-1)^5} - \frac{\pi^2}{6(x-1)^5} + \frac{155}{9(x-1)^5} + \frac{\pi^2}{6} +$$

$$\frac{35}{6}\Big) + H(c_1(\alpha_0);x)\Big(\frac{d_1^2\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{4} - \frac{d_1^2\alpha_0^4}{16(x-1)} + \frac{d_1\alpha_0^4}{4(x-1)} + \frac{\pi^2\alpha_0^4}{24(x-1)} - \frac{\alpha_0^4}{4(x-1)} - \frac{\pi^2\alpha_0^4}{24} + \frac{\alpha_0^4}{4} - \frac{43d_1^2\alpha_0^3}{108} +$$

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$$\frac{193d_1\alpha_0^3}{108}+\frac{d_1^2\alpha_0^3}{4\,(x-1)}-\frac{25d_1\alpha_0^3}{18(x-1)}-\frac{\pi^2\alpha_0^3}{6\,(x-1)}+\frac{16\alpha_0^3}{9(x-1)}-\frac{4d_1^2\alpha_0^3}{27\,(x-1)^2}+\frac{127d_1\alpha_0^3}{108(x-1)^2}+\frac{\pi^2\alpha_0^3}{18\,(x-1)^2}-\frac{95\alpha_0^3}{54(x-1)^2}+$$

$$\frac{2\pi^2\,\alpha_0^3}{9}-\frac{107\alpha_0^3}{54}+\frac{95d_1^2\alpha_0^2}{72}-\frac{163\,d_1\alpha_0^2}{24}-\frac{13d_1\alpha_0^2}{18(x-2)}+\frac{13\alpha_0^2}{9\,(x-2)}-\frac{3d_1^2\alpha_0^2}{8(x-1)}+\frac{311d_1\alpha_0^2}{72\,(x-1)}+\frac{\pi^2\alpha_0^2}{4(x-1)}-\frac{281\alpha_0^2}{36\,(x-1)}+$$

$$\frac{4d_1^2\alpha_0^2}{9(x-1)^2}-\frac{295d_1\alpha_0^2}{72\,(x-1)^2}-\frac{\pi^2\alpha_0^2}{6(x-1)^2}+\frac{89\alpha_0^2}{12\,(x-1)^2}-\frac{d_1^2\alpha_0^2}{2(x-1)^3}+\frac{115d_1\alpha_0^2}{24\,(x-1)^3}+\frac{\pi^2\alpha_0^2}{12(x-1)^3}-\frac{35\alpha_0^2}{4\,(x-1)^3}-\frac{\pi^2\alpha_0^2}{2}+$$

$$\frac{305\alpha_0^2}{36}-\frac{205d_1^2\,\alpha_0}{36}+\frac{125d_1\alpha_0}{4}+\frac{17d_1\alpha_0}{3(x-2)}-\frac{10\,\alpha_0}{x-2}+\frac{d_1^2\alpha_0}{4(x-1)}-\frac{251d_1\alpha_0}{18\,(x-1)}-\frac{\pi^2\alpha_0}{6(x-1)}+\frac{1115\alpha_0}{36(x-1)}-\frac{38\,d_1\alpha_0}{9(x-2)^2}+$$

$$\frac{76\alpha_0}{9(x-2)^2}-\frac{4d_1^2\alpha_0}{9\,(x-1)^2}+\frac{32d_1\alpha_0}{3(x-1)^2}+\frac{\pi^2\alpha_0}{6\,(x-1)^2}-\frac{511\alpha_0}{18(x-1)^2}+\frac{d_1^2\,\alpha_0}{(x-1)^3}-\frac{31d_1\alpha_0}{3(x-1)^3}-\frac{\pi^2\alpha_0}{6\,(x-1)^3}+\frac{95\alpha_0}{4(x-1)^3}-$$

$$\frac{4d_1^2\,\alpha_0}{(x-1)^4}+\frac{409d_1\alpha_0}{12(x-1)^4}+\frac{\pi^2\alpha_0}{6\,(x-1)^4}-\frac{188\alpha_0}{3(x-1)^4}+\frac{2\pi^2\alpha_0}{3}-\frac{374\,\alpha_0}{9}+\frac{2035d_1^2}{432}-\frac{5615d_1}{216}+\Big(\frac{d_1\,\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{x-1}-$$

$$\alpha_0^4-\frac{26\,d_1\alpha_0^3}{9}+\frac{2d_1\alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3\,(x-1)}-\frac{8d_1\alpha_0^3}{9(x-1)^2}+\frac{34\alpha_0^3}{9\,(x-1)^2}+\frac{58\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{3}-\frac{4\alpha_0^2}{3\,(x-2)}-\frac{3d_1\alpha_0^2}{x-1}+\frac{41\alpha_0^2}{3(x-1)}+$$

$$\frac{8d_1\,\alpha_0^2}{3(x-1)^2}-\frac{13\alpha_0^2}{(x-1)^2}-\frac{2d_1\,\alpha_0^2}{(x-1)^3}+\frac{11\alpha_0^2}{(x-1)^3}-\frac{59\alpha_0^2}{3}-\frac{50\,d_1\alpha_0}{3}+\frac{8\alpha_0}{x-2}+\frac{2d_1\alpha_0}{x-1}-\frac{80\alpha_0}{3\,(x-1)}-\frac{16\alpha_0}{3(x-2)^2}-\frac{8d_1\alpha_0}{3(x-1)^2}+$$

$$\frac{68\,\alpha_0}{3(x-1)^2}+\frac{4d_1\alpha_0}{(x-1)^3}-\frac{24\,\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{42\,\alpha_0}{(x-1)^4}+\frac{146\alpha_0}{3}+\frac{205\,d_1}{18}-\frac{16}{x-2}+\frac{15d_1}{2\,(x-1)}+\frac{2}{x-1}+\frac{32}{3(x-2)^2}-$$

$$\frac{10d_1}{9\,(x-1)^2}+\frac{26}{9(x-1)^2}-\frac{10d_1}{9(x-1)^3}-\frac{10}{9\,(x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{36}{(x-1)^4}+\frac{205\,d_1}{18(x-1)^5}-\frac{520}{9(x-1)^5}-\frac{310}{9}\Big)\,H(0;\alpha_0)+$$

$$\Big(\frac{d_1^2\alpha_0^4}{4}-\frac{d_1\alpha_0^4}{2}-\frac{d_1^2\,\alpha_0^4}{4(x-1)}+\frac{d_1\alpha_0^4}{2(x-1)}-\frac{13d_1^2\,\alpha_0^3}{9}+\frac{29d_1\alpha_0^3}{9}+\frac{d_1^2\alpha_0^3}{x-1}-\frac{8d_1\,\alpha_0^3}{3(x-1)}-\frac{4d_1^2\alpha_0^3}{9(x-1)^2}+\frac{17d_1\alpha_0^3}{9\,(x-1)^2}+\frac{23d_1^2\alpha_0^2}{6}-$$

$$\frac{59d_1\alpha_0^2}{6}-\frac{2d_1\,\alpha_0^2}{3(x-2)}-\frac{3d_1^2\alpha_0^2}{2(x-1)}+\frac{41d_1\alpha_0^2}{6\,(x-1)}+\frac{4d_1^2\alpha_0^2}{3(x-1)^2}-\frac{13d_1\alpha_0^2}{2\,(x-1)^2}-\frac{d_1^2\alpha_0^2}{(x-1)^3}+\frac{11d_1\alpha_0^2}{2\,(x-1)^3}-\frac{25d_1^2\alpha_0}{3}+\frac{73d_1\alpha_0}{3}+$$

$$\frac{4d_1\,\alpha_0}{x-2}+\frac{d_1^2\alpha_0}{x-1}-\frac{40d_1\alpha_0}{3(x-1)}-\frac{8\,d_1\alpha_0}{3(x-2)^2}-\frac{4d_1^2\alpha_0}{3(x-1)^2}+\frac{34d_1\alpha_0}{3\,(x-1)^2}+\frac{2d_1^2\alpha_0}{(x-1)^3}-\frac{12d_1\,\alpha_0}{(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{21d_1\alpha_0}{(x-1)^4}+\frac{205d_1^2}{36}-$$

$$\frac{155d_1}{9}-\frac{8d_1}{x-2}+\frac{15\,d_1^2}{4(x-1)}+\frac{d_1}{x-1}+\frac{16d_1}{3(x-2)^2}-\frac{5\,d_1^2}{9(x-1)^2}+\frac{13d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}-\frac{5d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-\frac{18\,d_1}{(x-1)^4}+$$

$$\frac{205d_1^2}{36(x-1)^5}-\frac{260d_1}{9\,(x-1)^5}\Big)H(1;\alpha_0)+\Big(-\frac{4\alpha_0^4}{x-1}+4\alpha_0^4+\frac{16\,\alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3(x-1)^2}-\frac{64\alpha_0^3}{3}-\frac{24\,\alpha_0^2}{x-1}+\frac{16\alpha_0^2}{(x-1)^2}-\frac{8\alpha_0^2}{(x-1)^3}+$$

$$48\,\alpha_0^2+\frac{16\alpha_0}{x-1}-\frac{16\alpha_0}{(x-1)^2}+\frac{16\,\alpha_0}{(x-1)^3}-\frac{16\alpha_0}{(x-1)^4}-64\alpha_0+\frac{12}{x-1}-\frac{8}{3\,(x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3\,(x-1)^5}+$$

$$\frac{100}{3}\Big)H(0,0;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{2d_1\,\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+\frac{8d_1\alpha_0^3}{x-1}-\frac{8\,d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-\frac{12d_1\alpha_0^2}{x-1}+\frac{8\,d_1\alpha_0^2}{(x-1)^2}-$$

$$\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8\,d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\,\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6\,d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6\,d_1}{(x-1)^4}+$$

$$\frac{50d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(2d_1\,\alpha_0^4-\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+\frac{8d_1\,\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-\frac{12d_1\,\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-$$

$$\frac{4d_1\,\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-\frac{8d_1\,\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-\frac{8d_1\,\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6d_1}{x-1}-\frac{4d_1}{3\,(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+$$

$$\frac{50\,d_1}{3(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(d_1^2\alpha_0^4-\frac{d_1^2\,\alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}+\frac{4d_1^2\,\alpha_0^3}{x-1}-\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2-\frac{6\,d_1^2\alpha_0^2}{x-1}+\frac{4d_1^2\alpha_0^2}{(x-1)^2}-$$

$$\frac{2d_1^2\,\alpha_0^2}{(x-1)^3}-16d_1^2\alpha_0+\frac{4d_1^2\alpha_0}{x-1}-\frac{4d_1^2\,\alpha_0}{(x-1)^2}+\frac{4d_1^2\alpha_0}{(x-1)^3}-\frac{4d_1^2\,\alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3\,(x-1)^2}-\frac{2d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+$$

$$\frac{25\,d_1^2}{3(x-1)^5}\Big)H(1,1;\alpha_0)-\frac{38d_1}{3(x-2)}+\frac{68}{3\,(x-2)}+\frac{63d_1^2}{16(x-1)}-\frac{85d_1}{24(x-1)}-\frac{\pi^{\,2}}{8(x-1)}-\frac{37}{4(x-1)}+\frac{76d_1}{9(x-2)^2}-\frac{152}{9\,(x-2)^2}-$$

$$\frac{19d_1^2}{54(x-1)^2}+\frac{317d_1}{108\,(x-1)^2}+\frac{\pi^2}{36(x-1)^2}+\frac{49}{108(x-1)^2}-\frac{19\,d_1^2}{54(x-1)^3}-\frac{313d_1}{108(x-1)^3}+\frac{\pi^2}{36\,(x-1)^3}+\frac{949}{108(x-1)^3}+$$

$$\frac{63d_1^2}{16\,(x-1)^4}-\frac{257d_1}{8(x-1)^4}-\frac{\pi^2}{8\,(x-1)^4}+\frac{213}{4(x-1)^4}+\frac{2035d_1^2}{432\,(x-1)^5}-\frac{8705d_1}{216(x-1)^5}-\frac{25\pi^2}{72\,(x-1)^5}+\frac{3965}{54(x-1)^5}-$$

$$\frac{25\pi^{\,2}}{72}+\frac{940}{27}\Big)+\Big(-\frac{2\pi^2d_1^2}{3\,(x-1)^5}+\frac{4\pi^2d_1}{3(x-1)^5}+\frac{2\pi^2\,d_1}{3}+\Big(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4\,d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3\,(x-1)^5}-$$

$$\frac{8d_1}{x-2}+\frac{9d_1}{x-1}+\frac{16d_1}{3\,(x-2)^2}-\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{14\,d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}+\frac{50d_1}{3\,(x-1)^5}-\frac{25d_1}{3}-\frac{4}{x-2}-\frac{3}{2(x-1)}+$$

$$\frac{8}{3\,(x-2)^2}-\frac{8}{3(x-2)^3}+\frac{11}{3\,(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{125}{6}\Big)\,H(0;\alpha_0)+\Big(-\frac{16d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}+$$

$$8\Big)\,H(0,0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{4\,d_1}{(x-1)^5}+4d_1\Big)H(0,1;\alpha_0)-\frac{2\pi^2}{3\,(x-1)^5}-\frac{2\pi^2}{3}\Big)H(1,1;x)+\Big(-$$

$$\frac{\pi^2\,d_1}{(x-1)^5}+\frac{\pi^2}{2(x-1)^5}+\frac{3\pi^2}{2}\Big)\,H(1,2;x)+\Big(-\frac{4d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4\,d_1^2}{9(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\,(x-1)^5}+\frac{46d_1}{3(x-2)}+$$

$$\frac{3d_1}{4(x-1)}-\frac{52d_1}{9\,(x-2)^2}-\frac{185d_1}{18(x-1)^2}+\frac{28d_1}{9(x-2)^3}+\frac{29\,d_1}{18(x-1)^3}-\frac{27d_1}{4(x-1)^4}+\frac{835d_1}{36(x-1)^5}+\frac{205d_1}{36}+\Big(-\frac{8d_1}{x-1}+\frac{4\,d_1}{(x-1)^2}-$$

$$\frac{8d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}-\frac{50\,d_1}{3(x-1)^5}+\frac{16}{x-2}-\frac{10}{x-1}-\frac{32}{3\,(x-2)^2}+\frac{4}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{20}{3\,(x-1)^3}-\frac{6}{(x-1)^4}-$$

$$\frac{50}{3(x-1)^5}+\frac{50}{3}\Big)\ H(0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4\ d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3\ (x-1)^5}+\frac{8d_1}{x-2}-\frac{5d_1}{x-1}-\frac{16d_1}{3\ (x-2)^2}+$$

$$\frac{2d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{10\ d_1}{3(x-1)^3}-\frac{3d_1}{(x-1)^4}-\frac{25d_1}{3\ (x-1)^5}+\frac{25d_1}{3}\Big)\ H(1;\alpha_0)+\Big(\frac{16}{(x-1)^5}-16\Big)H(0,0;\alpha_0)+$$

$$\Big(\frac{8\ d_1}{(x-1)^5}-8d_1\Big)H(0,1;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-8\ d_1\Big)H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2\Big)\ H(1,1;\alpha_0)-$$

$$\frac{80}{3(x-2)}+\frac{70}{3(x-1)}+\frac{56}{9\ (x-2)^2}+\frac{13}{18(x-1)^2}-\frac{56}{9(x-2)^3}+\frac{355}{18\ (x-1)^3}+\frac{10}{3(x-1)^4}-\frac{\pi^2}{6(x-1)^5}+\frac{155}{9\ (x-1)^5}+\frac{\pi^2}{6}-$$

$$\frac{155}{9}\Big)\ H(1,c_1(\alpha_0);x)+\Big(\frac{2\pi^2}{(x-1)^5}-2\pi^2\Big)H(2,0;x)+\ \Big(\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3\ (x-1)^2}+\frac{16d_1}{3(x-2)^3}-$$

$$\frac{8\ d_1}{(x-1)^4}-\frac{16}{x-2}+\frac{15}{2(x-1)}+\frac{32}{3(x-2)^2}+\frac{1}{3(x-1)^2}-\frac{32}{3\ (x-2)^3}+\frac{5}{(x-1)^3}+\frac{17}{2(x-1)^4}+\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)H(0;\alpha_0)+$$

$$\Big(8-\frac{8}{(x-1)^5}\Big)\ H(0,0;\alpha_0)+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(0,1;\alpha_0)-\frac{\pi\ ^2}{3(x-1)^5}+\frac{\pi^2}{3}\Big)H(2,1;x)+\Big(\frac{\pi^2\ d_1}{(x-1)^5}-$$

$$\pi^2d_1-\frac{2\pi^2}{(x-1)^5}+2\pi^2\Big)\ H(2,2;x)+\Big(\frac{3d_1\alpha_0^4}{4}-\frac{3d_1\alpha_0^4}{4\ (x-1)}+\frac{3\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{2}-\frac{13d_1\ \alpha_0^3}{3}+\frac{3d_1\alpha_0^3}{x-1}-\frac{49\alpha_0^3}{6(x-1)}-$$

$$\frac{4\ d_1\alpha_0^3}{3(x-1)^2}+\frac{5\alpha_0^3}{(x-1)^2}+\frac{61\ \alpha_0^3}{6}+\frac{23d_1\alpha_0^2}{2}-\frac{5\alpha_0^2}{3(x-2)}-\frac{9d_1\ \alpha_0^2}{2(x-1)}+\frac{83\alpha_0^2}{4(x-1)}+\frac{4d_1\alpha_0^2}{(x-1)^2}-\frac{109\alpha_0^2}{6(x-1)^2}-\frac{3d_1\alpha_0^2}{(x-1)^3}+\frac{85\ \alpha_0^2}{6(x-1)^3}-$$

$$\frac{131\alpha_0^2}{4}-25d_1\alpha_0+\frac{10\ \alpha_0}{x-2}+\frac{3d_1\alpha_0}{x-1}-\frac{229\alpha_0}{6(x-1)}-\frac{20\ \alpha_0}{3(x-2)^2}-\frac{4d_1\alpha_0}{(x-1)^2}+\frac{100\alpha_0}{3\ (x-1)^2}+\frac{6d_1\alpha_0}{(x-1)^3}-\frac{103\alpha_0}{3(x-1)^3}-\frac{12\ d_1\alpha_0}{(x-1)^4}+$$

$$\frac{163\alpha_0}{3(x-1)^4}+\frac{169\ \alpha_0}{2}+\frac{205d_1}{12}+\Big(-\frac{6\alpha_0^4}{x-1}+6\alpha_0^4+\frac{24\ \alpha_0^3}{x-1}-\frac{8\alpha_0^3}{(x-1)^2}-32\alpha_0^3-\frac{36\ \alpha_0^2}{x-1}+\frac{24\alpha_0^2}{(x-1)^2}-\frac{12\alpha_0^2}{(x-1)^3}+72\ \alpha_0^2+$$

$$\frac{24\alpha_0}{x-1}-\frac{24\alpha_0}{(x-1)^2}+\frac{24\ \alpha_0}{(x-1)^3}-\frac{24\alpha_0}{(x-1)^4}-96\ \alpha_0+\frac{18}{x-1}-\frac{4}{(x-1)^2}-\frac{4}{(x-1)^3}+\frac{18}{(x-1)\ ^4}+\frac{50}{(x-1)^5}+50\Big)H(0;\alpha_0)+$$

$$\Big(3d_1\alpha_0^4-\frac{3d_1\ \alpha_0^4}{x-1}-16d_1\alpha_0^3+\frac{12d_1\alpha_0^3}{x-1}-\frac{4d_1\ \alpha_0^3}{(x-1)^2}+36d_1\alpha_0^2-\frac{18d_1\alpha_0^2}{x-1}+\frac{12d_1\ \alpha_0^2}{(x-1)^2}-\frac{6d_1\alpha_0^2}{(x-1)^3}-48d_1\alpha_0+$$

$$\frac{12d_1\ \alpha_0}{x-1}-\frac{12d_1\alpha_0}{(x-1)^2}+\frac{12d_1\ \alpha_0}{(x-1)^3}-\frac{12d_1\alpha_0}{(x-1)^4}+25d_1+\frac{9\ d_1}{x-1}-\frac{2d_1}{(x-1)^2}-\frac{2d_1}{(x-1)^3}+\frac{9\ d_1}{(x-1)^4}+\frac{25d_1}{(x-1)^5}\Big)H(1;\alpha_0)-$$

$$\frac{16\ H(0,0;\alpha_0)}{(x-1)^5}-\frac{8d_1H(0,1;\alpha_0)}{(x-1)^5}-\frac{8d_1\ H(1,0;\alpha_0)}{(x-1)^5}-\frac{4d_1^2\ H(1,1;\alpha_0)}{(x-1)^5}-\frac{20}{x-2}+\frac{45d_1}{4\ (x-1)}-\frac{31}{4(x-1)}+\frac{40}{3(x-2)^2}-$$

$$\frac{5d_1}{3\ (x-1)^2}+\frac{55}{12(x-1)^2}-\frac{5d_1}{3(x-1)^3}-\frac{5}{4\ (x-1)^3}+\frac{45d_1}{4(x-1)^4}-\frac{83}{2(x-1)^4}+\frac{205\ d_1}{12(x-1)^5}+\frac{\pi^2}{6\ (x-1)^5}-\frac{75}{(x-1)^5}-$$

$$\frac{725}{12}\Big)\ H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{d_1\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{2}+\frac{13d_1\ \alpha_0^3}{9}-\frac{d_1\alpha_0^3}{x-1}+\frac{3\alpha_0^3}{x-1}+\frac{4d_1\ \alpha_0^3}{9(x-1)^2}-$$

$$\frac{25\alpha_0^3}{18(x-1)^2}-\frac{61\ \alpha_0^3}{18}-\frac{23d_1\alpha_0^2}{6}+\frac{3d_1\alpha_0^2}{2\ (x-1)}-\frac{31\alpha_0^2}{4(x-1)}-\frac{4d_1\alpha_0^2}{3\ (x-1)^2}+\frac{71\alpha_0^2}{12(x-1)^2}+\frac{d_1\ \alpha_0^2}{(x-1)^3}-\frac{15\alpha_0^2}{4(x-1)^3}+\frac{131\ \alpha_0^2}{12}+$$

$$\frac{25d_1\alpha_0}{3}-\frac{d_1\alpha_0}{x-1}+\frac{13\ \alpha_0}{x-1}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{35\alpha_0}{3\ (x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{12\alpha_0}{(x-1)^3}+\frac{4d_1\ \alpha_0}{(x-1)^4}-\frac{29\alpha_0}{2(x-1)^4}-\frac{169\alpha_0}{6}-\frac{205\ d_1}{36}+$$

$$\Big(\frac{2\alpha_0^4}{x-1}-2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\ \alpha_0^3}{3(x-1)^2}+\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\ \alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}-24\alpha_0^2-\frac{8\ \alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+$$

$$\frac{8\ \alpha_0}{(x-1)^4}+32\alpha_0-\frac{16}{x-2}+\frac{2}{x-1}+\frac{32}{3\ (x-2)^2}+\frac{8}{3(x-1)^2}-\frac{32}{3\ (x-2)^3}+\frac{4}{(x-1)^3}+\frac{8}{(x-1)^4}-\frac{50}{3}\Big)\ H(0;\alpha_0)+$$

$$\Big(-d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}+\frac{16d_1\ \alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}-12\ d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2\ d_1\alpha_0^2}{(x-1)^3}+16d_1\alpha_0-$$

$$\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\ \alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\ \alpha_0}{(x-1)^4}-\frac{25d_1}{3}-\frac{8\ d_1}{x-2}+\frac{d_1}{x-1}+\frac{16d_1}{3(x-2)^2}+\frac{4d_1}{3\ (x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{2d_1}{(x-1)^3}+$$

$$\frac{4\ d_1}{(x-1)^4}\Big)H(1;\alpha_0)-\frac{32d_1}{3(x-2)}+\frac{82}{3\ (x-2)}+\frac{35d_1}{12(x-1)}-\frac{73}{12(x-1)}+\frac{28d_1}{9\ (x-2)^2}-\frac{56}{9(x-2)^2}+\frac{28d_1}{9(x-1)^2}-\frac{323}{36\ (x-1)^2}-$$

$$\frac{28d_1}{9(x-2)^3}+\frac{56}{9(x-2)^3}+\frac{5\ d_1}{(x-1)^3}-\frac{53}{4(x-1)^3}+\frac{4d_1}{(x-1)^4}-\frac{29}{2\ (x-1)^4}+\frac{725}{36}\Big)\ H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{100}{3}+\frac{12}{x-1}-$$

$$\frac{8}{3\ (x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3(x-1)^5}\ \Big)H(0,0,0;\alpha_0)+\Big(-\frac{100}{3}-\frac{12}{x-1}+\frac{8}{3\ (x-1)^2}+\frac{8}{3(x-1)^3}-\frac{12}{(x-1)^4}-$$

$$\frac{100}{3(x-1)^5}\ \Big)H(0,0,0;x)+\Big(\frac{6d_1}{x-1}-\frac{4d_1}{3\ (x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50\ d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,0,1;\alpha_0)+$$

$$\Big(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{12}{(x-1)^5}-12\Big)H(0;\alpha_0)\ H(0,0,1;x)+\Big(-\frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\ \alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-$$

$$\frac{6\alpha_0^2}{x-1}+\frac{4\ \alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\ \alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\ \alpha_0}{(x-1)^4}-16\alpha_0+\Big(\frac{8}{(x-1)^5}-8\Big)\ H(0;\alpha_0)+$$

$$\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)\ H(1;\alpha_0)+\frac{8}{x-2}-\frac{1}{x-1}-\frac{16}{3(x-2)^2}-\frac{4}{3\ (x-1)^2}+\frac{16}{3\ (x-2)^3}-\frac{2}{(x-1)^3}-\frac{4}{(x-1)^4}+$$

$$\frac{25}{3}\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(\frac{6d_1}{x-1}-\frac{4d_1}{3\ (x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50\ d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,1,0;\alpha_0)+$$

$$\Big(\frac{8d_1}{x-2}-\frac{5d_1}{x-1}-\frac{16d_1}{3(x-2)^2}+\frac{2d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{10d_1}{3(x-1)^3}-\frac{3d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{3}-\frac{8}{x-2}+\frac{16}{3(x-2)^2}+$$
$$\frac{8}{3(x-1)^2}-\frac{16}{3(x-2)^3}+\frac{8}{(x-1)^4}\Big)H(0,1,0;x)+\Big(\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-\frac{2d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+$$
$$\frac{25d_1^2}{3}\Big)H(0,1,1;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2-\frac{8d_1}{(x-1)^5}+\frac{12}{(x-1)^5}+4\Big)H(0;\alpha_0)H(0,1,1;x)+\Big(-\frac{8d_1}{x-2}+$$
$$\frac{5d_1}{x-1}+\frac{16d_1}{3(x-2)^2}-\frac{2d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{10d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}-\frac{25d_1}{3}+\Big(-\frac{8d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}-$$
$$8\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+\frac{8}{x-2}-\frac{16}{3(x-2)^2}-\frac{8}{3(x-1)^2}+\frac{16}{3(x-2)^3}-$$
$$\frac{8}{(x-1)^4}\Big)H(0,1,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-4d_1-\frac{4}{(x-1)^5}+4\Big)H(0;\alpha_0)H(0,2,1;x)+\Big(\frac{3\alpha_0^4}{x-1}-3\alpha_0^4-$$
$$\frac{12\alpha_0^3}{x-1}+\frac{4\alpha_0^3}{(x-1)^2}+16\alpha_0^3+\frac{18\alpha_0^2}{x-1}-\frac{12\alpha_0^2}{(x-1)^2}+\frac{6\alpha_0^2}{(x-1)^3}-36\alpha_0^2-\frac{12\alpha_0}{x-1}+\frac{12\alpha_0}{(x-1)^2}-\frac{12\alpha_0}{(x-1)^3}+\frac{12\alpha_0}{(x-1)^4}+48\alpha_0+$$
$$\Big(\frac{8}{(x-1)^5}-24\Big)H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-12d_1\Big)H(1;\alpha_0)+\frac{20}{x-2}-\frac{11}{2(x-1)}-\frac{40}{3(x-2)^2}-\frac{8}{3(x-1)^2}+\frac{40}{3(x-2)^3}-$$
$$\frac{13}{3(x-1)^3}-\frac{13}{(x-1)^4}-\frac{25}{3(x-1)^5}+\frac{25}{2}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-$$
$$\frac{6\alpha_0^2}{x-1}+\frac{4\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\alpha_0}{(x-1)^4}-16\alpha_0+\Big(8-\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)+$$
$$\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{16}{x-2}+\frac{13}{2(x-1)}+\frac{32}{3(x-2)^2}+\frac{5}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{3}{(x-1)^3}+\frac{25}{2(x-1)^4}+$$
$$\frac{25}{2(x-1)^5}-\frac{25}{6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8d_1}{x-1}-\frac{4d_1}{(x-1)^2}+\frac{8d_1}{3(x-1)^3}-\frac{2d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}-\frac{16}{x-2}+$$
$$\frac{10}{x-1}+\frac{32}{3(x-2)^2}-\frac{4}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{20}{3(x-1)^3}+\frac{6}{(x-1)^4}+\frac{50}{3(x-1)^5}-\frac{50}{3}\Big)H(1,0,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-$$
$$\frac{8d_1}{(x-1)^5}-4d_1+\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)H(1,0,1;x)+\Big(\frac{4d_1}{x-1}-\frac{2d_1}{(x-1)^2}+\frac{4d_1}{3(x-1)^3}-\frac{d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}+\Big(-$$
$$\frac{8d_1}{(x-1)^5}+\frac{8}{(x-1)^5}+8\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}+4d_1\Big)H(1;\alpha_0)-\frac{4}{x-2}-\frac{3}{2(x-1)}+\frac{8}{3(x-2)^2}-$$
$$\frac{8}{3(x-2)^3}+\frac{11}{3(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{125}{6}\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4d_1^2}{3(x-1)^3}+$$
$$\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}+\frac{8d_1}{x-2}-\frac{9d_1}{x-1}-\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{14d_1}{3(x-1)^3}-\frac{2d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}+\frac{25d_1}{3}+$$
$$\frac{4}{x-2}+\frac{3}{2(x-1)}-\frac{8}{3(x-2)^2}+\frac{8}{3(x-2)^3}-\frac{11}{3(x-1)^3}+\frac{5}{(x-1)^4}+\frac{25}{3(x-1)^5}+\frac{125}{6}\Big)H(1,1,0;x)+\Big(\frac{12d_1^2}{(x-1)^5}-$$
$$4d_1^2-\frac{12d_1}{(x-1)^5}-8d_1+\frac{4}{(x-1)^5}+4\Big)H(0;\alpha_0)H(1,1,1;x)+\Big(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+$$
$$\frac{25d_1^2}{3(x-1)^5}-\frac{8d_1}{x-2}+\frac{9d_1}{x-1}+\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{14d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}-\frac{25d_1}{3}+\Big(-$$
$$\frac{16d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}+8\Big)H(0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{4d_1}{(x-1)^5}+4d_1\Big)H(1;\alpha_0)-\frac{4}{x-2}-$$
$$\frac{3}{2(x-1)}+\frac{8}{3(x-2)^2}-\frac{8}{3(x-2)^3}+\frac{11}{3(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{125}{6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-$$
$$\frac{2}{(x-1)^5}-6\Big)H(0;\alpha_0)H(1,2,1;x)+\Big(-\frac{12d_1}{x-1}+\frac{6d_1}{(x-1)^2}-\frac{4d_1}{(x-1)^3}+\frac{3d_1}{(x-1)^4}-\frac{25d_1}{(x-1)^5}+\Big(\frac{8d_1}{(x-1)^5}+$$
$$\frac{8}{(x-1)^5}-24\Big)H(0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}-12d_1\Big)H(1;\alpha_0)+\frac{20}{x-2}-\frac{17}{2(x-1)}-\frac{40}{3(x-2)^2}+\frac{4}{3(x-1)^2}+$$
$$\frac{40}{3(x-2)^3}-\frac{31}{3(x-1)^3}-\frac{1}{(x-1)^4}-\frac{25}{3(x-1)^5}+\frac{75}{2}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-4d_1-\frac{4}{(x-1)^5}+$$
$$4\Big)H(0;\alpha_0)H(2,0,1;x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}+\Big(8-\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)+$$
$$\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{16}{x-2}+\frac{15}{2(x-1)}+\frac{32}{3(x-2)^2}+\frac{1}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{5}{(x-1)^3}+\frac{17}{2(x-1)^4}+$$
$$\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)H(2,0,c_1(\alpha_0);x)+\Big(-\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}+\frac{16}{x-2}-$$
$$\frac{15}{2(x-1)}-\frac{32}{3(x-2)^2}-\frac{1}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{5}{(x-1)^3}-\frac{17}{2(x-1)^4}-\frac{25}{2(x-1)^5}+\frac{25}{2}\Big)H(2,1,0;x)+$$
$$\Big(\frac{4d_1}{(x-1)^5}-4d_1+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(2,1,1;x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-$$
$$\frac{8d_1}{(x-1)^4}+\Big(8-\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{16}{x-2}+\frac{15}{2(x-1)}+\frac{32}{3(x-2)^2}+\frac{1}{3(x-1)^2}-$$

$$\frac{32}{3 (x-2)^3} + \frac{5}{(x-1)^3} + \frac{17}{2(x-1)^4} + \frac{25}{2(x-1)^5} - \frac{25}{2}\Big) H(2,1,c_1(\alpha_0);x) + \Big(-\frac{4d_1}{(x-1)^5} + 4 d_1 + \frac{8}{(x-1)^5} -$$

$$8\Big) H(0;\alpha_0) H(2,2,1;x) + \Big(-\frac{8 d_1}{x-2} + \frac{16 d_1}{3(x-2)^2} + \frac{8d_1}{3(x-1)^2} - \frac{16 d_1}{3(x-2)^3} + \frac{8d_1}{(x-1)^4} + \Big(\frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0) +$$

$$\Big(\frac{4d_1}{(x-1)^5} - 4d_1\Big) H(1;\alpha_0) + \frac{16}{x-2} - \frac{15}{2(x-1)} - \frac{32}{3(x-2)^2} - \frac{1}{3(x-1)^2} + \frac{32}{3(x-2)^3} - \frac{5}{(x-1)^3} - \frac{17}{2(x-1)^4} -$$

$$\frac{25}{2(x-1)^5} + \frac{25}{2}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{2\alpha_0^4}{x-1} - 2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)^2} + \frac{32\alpha_0^3}{3} + \frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} +$$

$$\frac{4\alpha_0^2}{(x-1)^3} - 24\alpha_0^2 - \frac{8\alpha_0}{x-1} + \frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} + 32\alpha_0 + \frac{8H(0;\alpha_0)}{(x-1)^5} + \frac{4d_1 H(1;\alpha_0)}{(x-1)^5} - \frac{6}{x-1} + \frac{4}{3(x-1)^2} +$$

$$\frac{4}{3(x-1)^3} - \frac{6}{(x-1)^4} - \frac{50}{3(x-1)^5} - \frac{50}{3}\Big) H(c_1(\alpha_0),0,c_1(\alpha_0);x) + \Big(-\frac{7\alpha_0^4}{x-1} + 7\alpha_0^4 + \frac{28\alpha_0^3}{x-1} - \frac{28\alpha_0^3}{3(x-1)^2} -$$

$$\frac{112\alpha_0^3}{3} - \frac{42\alpha_0^2}{x-1} + \frac{28\alpha_0^2}{(x-1)^2} - \frac{14\alpha_0^2}{(x-1)^3} + 84\alpha_0^2 + \frac{28\alpha_0}{x-1} - \frac{28\alpha_0}{(x-1)^2} + \frac{28\alpha_0}{(x-1)^3} - \frac{28\alpha_0}{(x-1)^4} - 112\alpha_0 - \frac{24H(0;\alpha_0)}{(x-1)^5} -$$

$$\frac{12d_1 H(1;\alpha_0)}{(x-1)^5} + \frac{21}{x-1} - \frac{14}{3(x-1)^2} - \frac{14}{3(x-1)^3} + \frac{21}{(x-1)^4} + \frac{175}{3(x-1)^5} + \frac{175}{3}\Big) H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) +$$

$$\Big(\frac{3\alpha_0^4}{2(x-1)} - \frac{3\alpha_0^4}{2} - \frac{6\alpha_0^3}{x-1} + \frac{2\alpha_0^3}{(x-1)^2} + 8\alpha_0^3 + \frac{9\alpha_0^2}{x-1} - \frac{6\alpha_0^2}{(x-1)^2} + \frac{3\alpha_0^2}{(x-1)^3} - 18\alpha_0^2 - \frac{6\alpha_0}{x-1} + \frac{6\alpha_0}{(x-1)^2} - \frac{6\alpha_0}{(x-1)^3} +$$

$$\frac{6\alpha_0}{(x-1)^4} + 24\alpha_0 + \frac{8H(0;\alpha_0)}{(x-1)^5} + \frac{4d_1 H(1;\alpha_0)}{(x-1)^5} - \frac{9}{2(x-1)} + \frac{1}{(x-1)^2} + \frac{1}{(x-1)^3} - \frac{9}{2(x-1)^4} - \frac{25}{2(x-1)^5} -$$

$$\frac{25}{2}\Big) H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x) + \Big(-\frac{\alpha_0^4}{x-1} + \alpha_0^4 + \frac{4\alpha_0^3}{x-1} - \frac{4\alpha_0^3}{3(x-1)^2} - \frac{16\alpha_0^3}{3} - \frac{6\alpha_0^2}{x-1} + \frac{4\alpha_0^2}{(x-1)^2} - \frac{2\alpha_0^2}{(x-1)^3} +$$

$$12\alpha_0^2 + \frac{4\alpha_0}{x-1} - \frac{4\alpha_0}{(x-1)^2} + \frac{4\alpha_0}{(x-1)^3} - \frac{4\alpha_0}{(x-1)^4} - 16\alpha_0 + \frac{8}{x-2} - \frac{1}{x-1} - \frac{16}{3(x-2)^2} - \frac{4}{3(x-1)^2} + \frac{16}{3(x-2)^3} -$$

$$\frac{2}{(x-1)^3} - \frac{4}{(x-1)^4} + \frac{25}{3}\Big) H(c_2(\alpha_0),0,c_1(\alpha_0);x) + \Big(\frac{5\alpha_0^4}{2(x-1)} - \frac{5\alpha_0^4}{2} - \frac{10\alpha_0^3}{x-1} + \frac{10\alpha_0^3}{3(x-1)^2} + \frac{40\alpha_0^3}{3} + \frac{15\alpha_0^2}{x-1} -$$

$$\frac{10\alpha_0^2}{(x-1)^2} + \frac{5\alpha_0^2}{(x-1)^3} - 30\alpha_0^2 - \frac{10\alpha_0}{x-1} + \frac{10\alpha_0}{(x-1)^2} - \frac{10\alpha_0}{(x-1)^3} + \frac{10\alpha_0}{(x-1)^4} + 40\alpha_0 - \frac{20}{x-2} + \frac{5}{2(x-1)} + \frac{40}{3(x-2)^2} +$$

$$\frac{10}{3(x-1)^2} - \frac{40}{3(x-2)^3} + \frac{5}{(x-1)^3} + \frac{10}{(x-1)^4} - \frac{125}{6}\Big) H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + 32 H(0,0,0,0;x) +$$

$$\Big(\frac{12}{(x-1)^5} - 12\Big) H(0,0,0,c_1(\alpha_0);x) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 - \frac{12}{(x-1)^5} + 12\Big) H(0,0,1,0;x) + \Big(-\frac{4d_1}{(x-1)^5} +$$

$$4d_1 + \frac{12}{(x-1)^5} - 12\Big) H(0,0,1,c_1(\alpha_0);x) + \Big(-12 - \frac{4}{(x-1)^5}\Big) H(0,0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(4 -$$

$$\frac{4}{(x-1)^5}\Big) H(0,0,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{8d_1}{(x-1)^5} - 8d_1 - \frac{8}{(x-1)^5} + 8\Big) H(0,1,0,0;x) + \Big(-\frac{4d_1}{(x-1)^5} -$$

$$4d_1 + \frac{12}{(x-1)^5} + 4\Big) H(0,1,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1^2}{(x-1)^5} + 4d_1^2 + \frac{8d_1}{(x-1)^5} - \frac{12}{(x-1)^5} - 4\Big) H(0,1,1,0;x) +$$

$$\Big(\frac{4d_1^2}{(x-1)^5} - 4d_1^2 - \frac{8d_1}{(x-1)^5} + \frac{12}{(x-1)^5} + 4\Big) H(0,1,1,c_1(\alpha_0);x) + \Big(-\frac{4d_1}{(x-1)^5} + 12 d_1 - \frac{4}{(x-1)^5} -$$

$$12\Big) H(0,1,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 - \frac{4}{(x-1)^5} + 4\Big) H(0,2,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1}{(x-1)^5} +$$

$$4d_1 + \frac{4}{(x-1)^5} - 4\Big) H(0,2,1,0;x) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 - \frac{4}{(x-1)^5} + 4\Big) H(0,2,1,c_1(\alpha_0);x) + \Big(-$$

$$\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{4}{(x-1)^5} - 4\Big) H(0,2,c_2(\alpha_0),c_1(\alpha_0);x) + 8 H(0,c_1(\alpha_0),0,c_1(\alpha_0);x) + \Big(\frac{4}{(x-1)^5} -$$

$$28\Big) H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + \Big(6 + \frac{2}{(x-1)^5}\Big) H(0,c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{4}{(x-1)^5} -$$

$$4\Big) H(0,c_2(\alpha_0),0,c_1(\alpha_0);x) + \Big(10 - \frac{10}{(x-1)^5}\Big) H(0,c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + \Big(16 -$$

$$\frac{16}{(x-1)^5}\Big) H(1,0,0,0;x) + \Big(\frac{8}{(x-1)^5} - \frac{4d_1}{(x-1)^5}\Big) H(1,0,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1^2}{(x-1)^5} + \frac{8d_1}{(x-1)^5} + 4d_1 -$$

$$\frac{8}{(x-1)^5}\Big) H(1,0,1,0;x) + \Big(\frac{4d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} - 4d_1 + \frac{8}{(x-1)^5}\Big) H(1,0,1,c_1(\alpha_0);x) + \Big(-\frac{4d_1}{(x-1)^5} +$$

$$\frac{4}{(x-1)^5} + 4\Big) H(1,0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{4d_1}{(x-1)^5} - \frac{2}{(x-1)^5} - 6\Big) H(1,0,c_2(\alpha_0),c_1(\alpha_0);x) +$$

$$\Big(\frac{16d_1}{(x-1)^5} - 8d_1 - \frac{8}{(x-1)^5} - 8\Big) H(1,1,0,0;x) + \Big(\frac{4d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} - 4d_1 + \frac{4}{(x-1)^5} +$$

$$4\Big) H(1,1,0,c_1(\alpha_0);x) + \Big(-\frac{12d_1^2}{(x-1)^5} + 4d_1^2 + \frac{12d_1}{(x-1)^5} + 8d_1 - \frac{4}{(x-1)^5} - 4\Big) H(1,1,1,0;x) +$$

$$\Big(\frac{12d_1^2}{(x-1)^5} - 4d_1^2 - \frac{12d_1}{(x-1)^5} - 8d_1 + \frac{4}{(x-1)^5} + 4\Big) H(1,1,1,c_1(\alpha_0);x) + \Big(-\frac{4d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} + 12d_1 +$$

$$\frac{4}{(x-1)^5}+4\Big) H(1,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4 d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Big) H(1,2,0,c_1(\alpha_0);x)+\Big(-\frac{4 d_1}{(x-1)^5}+$$

$$\frac{2}{(x-1)^5}+6\Big)H(1,2,1,0;x)+\Big(\frac{4 d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Big) H(1,2,1,c_1(\alpha_0);x)+\Big(-\frac{4 d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+$$

$$6\Big) H(1,2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(8-\frac{4d_1}{(x-1)^5}\Big)H(1,c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(\frac{12 d_1}{(x-1)^5}+\frac{4}{(x-1)^5}-$$

$$28\Big) H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4 d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+6\Big) H(1,c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(4-\frac{4}{(x-1)^5}\Big) H(2,0,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+4 d_1+\frac{4}{(x-1)^5}-4\Big)H(2,0,1,0;x)+$$

$$\Big(\frac{4 d_1}{(x-1)^5}-4d_1-\frac{4}{(x-1)^5}+4\Big) H(2,0,1,c_1(\alpha_0);x)+\Big(10-\frac{10}{(x-1)^5}\Big) H(2,0,c_1(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(\frac{8}{(x-1)^5}-8\Big) H(2,0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8}{(x-1)^5}-8\Big) H(2,1,0,0;x)+\Big(\frac{2}{(x-1)^5}-$$

$$2\Big)H(2,1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+4d_1-\frac{2}{(x-1)^5}+2\Big) H(2,1,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-4 d_1+$$

$$\frac{2}{(x-1)^5}-2\Big) H(2,1,1,c_1(\alpha_0);x)+\Big(10-\frac{10}{(x-1)^5}\Big) H(2,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+4 d_1+$$

$$\frac{8}{(x-1)^5}-8\Big)H(2,2,0,c_1(\alpha_0);x)+\Big(\frac{4 d_1}{(x-1)^5}-4d_1-\frac{8}{(x-1)^5}+8\Big) H(2,2,1,0;x)+\Big(-\frac{4d_1}{(x-1)^5}+$$

$$4 d_1+\frac{8}{(x-1)^5}-8\Big)H(2,2,1,c_1(\alpha_0);x)+\Big(\frac{4 d_1}{(x-1)^5}-4d_1-\frac{8}{(x-1)^5}+8\Big) H(2,2,c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(4-\frac{4}{(x-1)^5}\Big) H(2,c_2(\alpha_0),0,c_1(\alpha_0);x)+\Big(\frac{10}{(x-1)^5}-10\Big) H(2,c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-$$

$$\frac{4 H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{12 H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{4H(c_1(\alpha_0),0,c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+$$

$$\frac{8 H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-\frac{28 H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{6 H(c_1(\alpha_0),c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-$$

$$\frac{4 H(c_1(\alpha_0),c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{10 H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+H(0;x)\Big(-\frac{63d_1^2}{16(x-1)}+\frac{19d_1^2}{54(x-1)^2}+$$

$$\frac{19 d_1^2}{54(x-1)^3}-\frac{63d_1^2}{16(x-1)^4}-\frac{2035d_1^2}{432(x-1)^5}-\frac{2035d_1^2}{432}+\frac{38d_1}{3(x-2)}+\frac{85 d_1}{24(x-1)}-\frac{76d_1}{9(x-2)^2}-\frac{317d_1}{108(x-1)^2}+\frac{313d_1}{108(x-1)^3}+$$

$$\frac{257d_1}{8(x-1)^4}+\frac{8705d_1}{216(x-1)^5}+\frac{5615d_1}{216}-\frac{4\pi^2}{x-2}-\frac{68}{3(x-2)}+\frac{13\pi^2}{8(x-1)}+\frac{37}{4(x-1)}+\frac{8\pi^2}{3(x-2)^2}+\frac{152}{9(x-2)^2}+\frac{5\pi^2}{12(x-1)^2}-$$

$$\frac{49}{108(x-1)^2}-\frac{8\pi^2}{3(x-2)^3}+\frac{3\pi^2}{4(x-1)^3}-\frac{949}{108(x-1)^3}+\frac{25\pi^2}{8(x-1)^4}-\frac{213}{4(x-1)^4}+\frac{25\pi^2}{8(x-1)^5}-\frac{3965}{54(x-1)^5}+\frac{3\zeta_3}{(x-1)^5}+$$

$$16\zeta_3+\frac{2\pi^2\ln 2}{(x-1)^5}-2\pi^2\ln 2-\frac{25\pi^2}{24}-\frac{940}{27}\Big)+H(2;x)\Big(-\frac{2\pi^2 d_1}{x-2}+\frac{4\pi^2d_1}{3(x-2)^2}+\frac{2\pi^2d_1}{3(x-1)^2}-\frac{4\pi^2d_1}{3(x-2)^3}+$$

$$\frac{2\pi^2d_1}{(x-1)^4}+\frac{4\pi^2}{x-2}-\frac{15\pi^2}{8(x-1)}-\frac{8\pi^2}{3(x-2)^2}-\frac{\pi^2}{12(x-1)^2}+\frac{8\pi^2}{3(x-2)^3}-\frac{5\pi^2}{4(x-1)^3}-\frac{17\pi^2}{8(x-1)^4}-\frac{25\pi^2}{8(x-1)^5}+\frac{7\zeta_3}{2(x-1)^5}-$$

$$\frac{7\zeta_3}{2}-\frac{3\pi^2\ln 2}{(x-1)^5}+3\pi^2\ln 2+\frac{25\pi^2}{8}\Big)+H(1;x)\Big(-\frac{2\pi^2d_1}{3(x-1)}+\frac{\pi^2 d_1}{3(x-1)^2}-\frac{2\pi^2d_1}{9(x-1)^3}+\frac{\pi^2d_1}{6(x-1)^4}-\frac{25\pi^2d_1}{18(x-1)^5}-$$

$$\frac{3\zeta_3d_1}{2(x-1)^5}-\frac{\pi^2\ln 2\, d_1}{(x-1)^5}+\Big(-\frac{4 d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36(x-1)^5}+\frac{46d_1}{3(x-2)}+\frac{3d_1}{4(x-1)}-$$

$$\frac{52d_1}{9(x-2)^2}-\frac{185d_1}{18(x-1)^2}+\frac{28d_1}{9(x-2)^3}+\frac{29 d_1}{18(x-1)^3}-\frac{27d_1}{4(x-1)^4}+\frac{835d_1}{36(x-1)^5}+\frac{205d_1}{36}-\frac{80}{3(x-2)}+\frac{70}{3(x-1)}+\frac{56}{9(x-2)^2}+$$

$$\frac{13}{18(x-1)^2}-\frac{56}{9(x-2)^3}+\frac{355}{18(x-1)^3}+\frac{10}{3(x-1)^4}-\frac{\pi^2}{6(x-1)^5}+\frac{155}{9(x-1)^5}+\frac{\pi^2}{6}-\frac{155}{9}\Big)H(0;\alpha_0)+\Big(-\frac{8 d_1}{x-1}+$$

$$\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+\frac{2 d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}+\frac{16}{x-2}-\frac{10}{x-1}-\frac{32}{3(x-2)^2}+\frac{4}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{20}{3(x-1)^3}-\frac{6}{(x-1)^4}-$$

$$\frac{50}{3(x-1)^5}+\frac{50}{3}\Big)H(0,0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2 d_1^2}{(x-1)^2}-\frac{4d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}+\frac{8 d_1}{x-2}-\frac{5d_1}{x-1}-\frac{16d_1}{3(x-2)^2}+$$

$$\frac{2d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{10d_1}{3(x-1)^3}-\frac{3 d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{3}\Big) H(0,1;\alpha_0)+\Big(\frac{16}{(x-1)^5}-16\Big)H(0,0,0;\alpha_0)+$$

$$\Big(\frac{8 d_1}{(x-1)^5}-8d_1\Big)H(0,0,1;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-8 d_1\Big)H(0,1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2\Big) H(0,1,1;\alpha_0)+$$

$$\frac{2\pi^2}{3(x-2)}+\frac{\pi^2}{4(x-1)}-\frac{4\pi^2}{9(x-2)^2}+\frac{4\pi^2}{9(x-2)^3}-\frac{11\pi^2}{18(x-1)^3}+\frac{5\pi^2}{6(x-1)^4}+\frac{25\pi^2}{18(x-1)^5}-\frac{21\zeta_3}{4(x-1)^5}+\frac{33\zeta_3}{4}+\frac{\pi^2\ln 2}{2(x-1)^5}+$$

$$\frac{3}{2}\pi^2\ln 2+\frac{125\pi^2}{36}\Big)-\frac{8d_1\pi^2}{3(x-2)}+\frac{37\pi^2}{6(x-2)}+\frac{65d_1\pi^2}{48(x-1)}-\frac{151\pi^2}{48(x-1)}+\frac{7d_1\pi^2}{9(x-2)^2}-\frac{10\pi^2}{9(x-2)^2}+\frac{37d_1\pi^2}{54(x-1)^2}-$$

$$\frac{847\pi^2}{432(x-1)^2}-\frac{7d_1\pi^2}{9(x-2)^3}+\frac{14\pi^2}{9(x-2)^3}+\frac{125d_1\pi^2}{108(x-1)^3}-\frac{1441\pi^2}{432(x-1)^3}+\frac{13d_1\pi^2}{8(x-1)^4}-\frac{109\pi^2}{24(x-1)^4}-\frac{241\pi^4}{720(x-1)^5}+$$

$$\frac{205d_1\pi^2}{216(x-1)^5}-\frac{155\pi^2}{54(x-1)^5}-\frac{7\zeta_3}{x-2}-\frac{85\zeta_3}{16(x-1)}+\frac{14\zeta_3}{3(x-2)^2}+\frac{61\zeta_3}{24(x-1)^2}-\frac{14\zeta_3}{3(x-2)^3}+\frac{25\zeta_3}{8(x-1)^3}-\frac{43\zeta_3}{16(x-1)^4}-$$

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$$\frac{275\zeta_3}{16\ (x-1)^5}-\frac{1175\zeta_3}{48}-\frac{4\text{Li}_4\frac{1}{2}}{(x-1)^5}+4\text{Li}_4\frac{1}{2}-\frac{\ln^4 2}{6(x-1)^5}+\frac{\ln\ ^4 2}{6}-\frac{4\pi^2\ln^2 2}{3(x-1)^5}+\frac{4}{3}\pi^2\ \ln^2 2+\frac{6\pi^2\ln 2}{x-2}-\frac{15\pi^2\ln 2}{8\ (x-1)}-\frac{4\pi^2\ln 2}{(x-2)^2}-\frac{3\pi^2\ln 2}{4\ (x-1)^2}+\frac{4\pi^2\ln 2}{(x-2)^3}-\frac{5\pi^2\ln 2}{4\ (x-1)^3}-\frac{33\pi^2\ln 2}{8(x-1)^4}-\frac{25\pi^2\ln 2}{8(x-1)^5}+\frac{25}{8}\pi^2\ln 2+\frac{\pi^4}{30}-\frac{205\ d_1\pi^2}{432}+\frac{305\pi^2}{432}.$$

### E.5 The $\mathcal{B}$ integral for $k=0$ and $\delta=1$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,0,1,g_B)&=x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;1,0)\\&=\frac{1}{\varepsilon}b_{-1}^{(1,0)}+b_0^{(1,0)}+\varepsilon b_1^{(1,0)}+\varepsilon^2 b_2^{(1,0)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned}\tag{E.5}$$

where

$$b_{-1}^{(1,0)}=-\tfrac{1}{2},$$

$$b_0^{(1,0)}=\frac{\alpha_0^4}{4\ (x-1)}+\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3\ (x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{3\alpha_0^2}{2\ (x-1)}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{2(x-1)^3}+3\ \alpha_0^2-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}-4\alpha_0+\left(1+\frac{1}{(x-1)^5}\right)H(0;\alpha_0)+\left(1-\frac{1}{(x-1)^5}\right)H(0;x)+\frac{H(c_1(\alpha_0);x)}{(x-1)^5}-1,$$

$$b_1^{(1,0)}=$$
$$-\frac{d_1\alpha_0^4}{8}-\frac{d_1\alpha_0^4}{8(x-1)}+\frac{3\alpha_0^4}{4\ (x-1)}+\frac{3\alpha_0^4}{4}+\frac{13d_1\alpha_0^3}{18}+\frac{d_1\alpha_0^3}{2\ (x-1)}-\frac{3\alpha_0^3}{x-1}-\frac{2d_1\alpha_0^3}{9(x-1)^2}+\frac{23\ \alpha_0^3}{18(x-1)^2}-\frac{77\alpha_0^3}{18}-\frac{23d_1\ \alpha_0^2}{12}-\frac{3d_1\alpha_0^2}{4(x-1)}+\frac{53\alpha_0^2}{12\ (x-1)}+\frac{2d_1\alpha_0^2}{3(x-1)^2}-\frac{47\alpha_0^2}{12\ (x-1)^2}-\frac{d_1\alpha_0^2}{2(x-1)^3}+\frac{31\alpha_0^2}{12\ (x-1)^3}+\frac{131\alpha_0^2}{12}+\frac{25d_1\alpha_0}{6}+\frac{d_1\alpha_0}{2\ (x-1)}-\frac{7\alpha_0}{3(x-1)}-\frac{2d_1\alpha_0}{3(x-1)^2}+\frac{4\ \alpha_0}{(x-1)^2}+\frac{d_1\alpha_0}{(x-1)^3}-\frac{17\alpha_0}{3\ (x-1)^3}-\frac{2d_1\alpha_0}{(x-1)^4}+\frac{49\alpha_0}{6(x-1)^4}-\frac{121\ \alpha_0}{6}+\left(-\frac{\alpha_0^4}{x-1}-\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\ \alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\ \alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2+\frac{4\ \alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\ \alpha_0}{(x-1)^4}+16\alpha_0-\frac{5}{2(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3\ (x-1)^3}+\frac{5}{2(x-1)^4}+\frac{37}{6(x-1)^5}-\frac{13}{6}\right)H(0;\alpha_0)+\left(\frac{37}{6}+\frac{5}{2(x-1)}-\frac{5}{3\ (x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}-\frac{37}{6(x-1)^5}\right)H(0;x)+\left(-\frac{d_1\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2\ (x-1)}+\frac{8d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{x-1}-\frac{2d_1\ \alpha_0^3}{3(x-1)^2}-6d_1\alpha_0^2-\frac{3d_1\alpha_0^2}{x-1}+\frac{2d_1\ \alpha_0^2}{(x-1)^2}-\frac{d_1\alpha_0^2}{(x-1)^3}+8d_1\alpha_0+\frac{2d_1\ \alpha_0}{x-1}-\frac{2d_1\alpha_0}{(x-1)^2}+\frac{2d_1\alpha_0}{(x-1)^3}-\frac{2\ d_1\alpha_0}{(x-1)^4}-\frac{25d_1}{6}-\frac{d_1}{2(x-1)}+\frac{2d_1}{3\ (x-1)^2}-\frac{d_1}{(x-1)^3}+\frac{2d_1}{(x-1)^4}\right)H(1;\alpha_0)+\left(\frac{2d_1}{(x-1)^5}-\frac{2}{(x-1)^5}+2\right)H(0;\alpha_0)\ H(1;x)+\left(-\frac{\alpha_0^4}{2(x-1)}-\frac{\alpha_0^4}{2}+\frac{2\ \alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}-\frac{3\ \alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}-6\ \alpha_0^2+\frac{2\alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\ \alpha_0}{(x-1)^3}-\frac{2\alpha_0}{(x-1)^4}+8\alpha_0-\frac{4H(0;\alpha_0)}{(x-1)^5}-\frac{2d_1H(1;\alpha_0)}{(x-1)^5}-\frac{5}{2(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2(x-1)^4}+\frac{37}{6\ (x-1)^5}-\frac{25}{6}\right)H(c_1(\alpha_0);x)+\left(-4-\frac{4}{(x-1)^5}\right)H(0,0;\alpha_0)+\left(\frac{4}{(x-1)^5}-4\right)H(0,0;x)+\left(-\frac{2\ d_1}{(x-1)^5}-2d_1\right)H(0,1;\alpha_0)+\left(2-\frac{2}{(x-1)^5}\right)H(0,c_1(\alpha_0);x)+\left(-\frac{2d_1}{(x-1)^5}+\frac{2}{(x-1)^5}-2\right)H(1,0;x)+\left(\frac{2d_1}{(x-1)^5}-\frac{2}{(x-1)^5}+2\right)H(1,c_1(\ \alpha_0);x)-\frac{2H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{\pi^2}{3\ (x-1)^5}-\frac{\pi^2}{3}-2,$$

$$b_2^{(1,0)}=\frac{d_1^2\alpha_0^4}{16}-\frac{d_1\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{16\ (x-1)}-\frac{d_1\alpha_0^4}{2(x-1)}-\frac{\pi^2\alpha_0^4}{24\ (x-1)}+\frac{7\alpha_0^4}{4(x-1)}-\frac{\pi^2\alpha_0^4}{24}+\frac{7\ \alpha_0^4}{4}-\frac{43d_1^2\alpha_0^3}{108}+\frac{349d_1\ \alpha_0^3}{108}-\frac{d_1^2\alpha_0^3}{4(x-1)}+\frac{2d_1\ \alpha_0^3}{x-1}+\frac{\pi^2\alpha_0^3}{6(x-1)}-\frac{7\alpha_0^3}{x-1}+\frac{4\ d_1^2\alpha_0^3}{27(x-1)^2}-\frac{133d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi\ ^2\alpha_0^3}{18(x-1)^2}+\frac{191\alpha_0^3}{54(x-1)^2}+\frac{2\pi^2\ \alpha_0^3}{9}-\frac{569\alpha_0^3}{54}+\frac{95d_1^2\alpha_0^2}{72}-\frac{85d_1\ \alpha_0^2}{8}+\frac{3d_1^2\alpha_0^2}{8(x-1)}-\frac{203d_1\alpha_0^2}{72\ (x-1)}-\frac{\pi^2\alpha_0^2}{4(x-1)}+\frac{353\alpha_0^2}{36\ (x-1)}-\frac{4d_1^2\alpha_0^2}{9(x-1)^2}+\frac{31d_1\alpha_0^2}{8\ (x-1)^2}+\frac{\pi^2\alpha_0^2}{6(x-1)^2}-\frac{407\alpha_0^2}{36(x-1)^2}+\frac{d_1^2\alpha_0^2}{2(x-1)^3}-\frac{283d_1\alpha_0^2}{72(x-1)^3}-\frac{\pi^2\alpha_0^2}{12(x-1)^3}+\frac{331\alpha_0^2}{36(x-1)^3}-\frac{\pi^2\ \alpha_0^2}{2}+\frac{1091\alpha_0^2}{36}-\frac{205d_1^2\alpha_0}{36}+\frac{475\ d_1\alpha_0}{12}+\frac{2\alpha_0}{3(x-2)}-\frac{d_1^2\alpha_0}{4\ (x-1)}-\frac{d_1\alpha_0}{9(x-1)}+\frac{\pi^2\alpha_0}{6(x-1)}-\frac{13\ \alpha_0}{36(x-1)}+\frac{4d_1^2\alpha_0}{9(x-1)^2}-\frac{73d_1\alpha_0}{18\ (x-1)^2}-\frac{\pi^2\alpha_0}{6(x-1)^2}+\frac{35\alpha_0}{3\ (x-1)^2}-\frac{d_1^2\alpha_0}{(x-1)^3}+\frac{173d_1\alpha_0}{18\ (x-1)^3}+\frac{\pi^2\alpha_0}{6(x-1)^3}-\frac{875\alpha_0}{36\ (x-1)^3}+\frac{4d_1^2\alpha_0}{(x-1)^4}-\frac{937d_1\alpha_0}{36\ (x-1)^4}-\frac{\pi^2\alpha_0}{6(x-1)^4}+\frac{413\alpha_0}{9\ (x-1)^4}+\frac{2\pi^2\alpha_0}{3}-\frac{737\alpha_0}{9}+\left(\frac{d_1\ \alpha_0^4}{2}+\frac{d_1\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{x-1}-3\ \alpha_0^4-\right.$$

$$\frac{26d_1\alpha_0^3}{9}-\frac{2d_1\alpha_0^3}{x-1}+\frac{12\alpha_0^3}{x-1}+\frac{8d_1\alpha_0^3}{9(x-1)^2}-\frac{46\alpha_0^3}{9(x-1)^2}+\frac{154\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{3}+\frac{3d_1\alpha_0^2}{x-1}-\frac{53\alpha_0^2}{3(x-1)}-\frac{8d_1\alpha_0^2}{3(x-1)^2}+\frac{47\alpha_0^2}{3(x-1)^2}+$$
$$\frac{2d_1\alpha_0^2}{(x-1)^3}-\frac{31\alpha_0^2}{3(x-1)^3}-\frac{131\alpha_0^2}{3}-\frac{50d_1\alpha_0}{3}-\frac{2d_1\alpha_0}{x-1}+\frac{28\alpha_0}{3(x-1)}+\frac{8d_1\alpha_0}{3(x-1)^2}-\frac{16\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{68\alpha_0}{3(x-1)^3}+\frac{8d_1\alpha_0}{(x-1)^4}-$$
$$\frac{98\alpha_0}{3(x-1)^4}+\frac{242\alpha_0}{3}+\frac{205d_1}{36}-\frac{4}{x-2}+\frac{17d_1}{4(x-1)}-\frac{53}{4(x-1)}+\frac{8}{3(x-2)^2}-\frac{13d_1}{9(x-1)^2}+\frac{317}{36(x-1)^2}+\frac{13d_1}{9(x-1)^3}-$$
$$\frac{371}{36(x-1)^3}-\frac{17d_1}{4(x-1)^4}+\frac{193}{12(x-1)^4}-\frac{205d_1}{36(x-1)^5}-\frac{\pi^2}{6(x-1)^5}+\frac{266}{9(x-1)^5}-\frac{\pi^2}{6}-\frac{194}{9}\Big)H(0;\alpha_0)+\Big(-\frac{17d_1}{4(x-1)}+$$
$$\frac{13d_1}{9(x-1)^2}-\frac{13d_1}{9(x-1)^3}+\frac{17d_1}{4(x-1)^4}+\frac{205d_1}{36(x-1)^5}-\frac{205d_1}{36}+\frac{4}{x-2}+\frac{53}{4(x-1)}-\frac{8}{3(x-2)^2}-\frac{317}{36(x-1)^2}+\frac{371}{36(x-1)^3}-$$
$$\frac{193}{12(x-1)^4}-\frac{7\pi^2}{6(x-1)^5}-\frac{266}{9(x-1)^5}+\frac{3\pi^2}{2}+\frac{266}{9}\Big)H(0;x)+\Big(\frac{d_1^2\alpha_0^4}{4}-\frac{3d_1\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{4(x-1)}-\frac{3d_1\alpha_0^4}{2(x-1)}-\frac{13d_1^2\alpha_0^3}{9}+$$
$$\frac{77d_1\alpha_0^3}{9}-\frac{d_1^2\alpha_0^3}{x-1}+\frac{6d_1\alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{9(x-1)^2}-\frac{23d_1\alpha_0^3}{9(x-1)^2}+\frac{23d_1^2\alpha_0^2}{6}-\frac{131d_1\alpha_0^2}{6}+\frac{3d_1^2\alpha_0^2}{2(x-1)}-\frac{53d_1\alpha_0^2}{6(x-1)}-\frac{4d_1^2\alpha_0^2}{3(x-1)^2}+$$
$$\frac{47d_1\alpha_0^2}{6(x-1)^2}+\frac{d_1^2\alpha_0^2}{(x-1)^3}-\frac{31d_1\alpha_0^2}{6(x-1)^3}-\frac{25d_1^2\alpha_0}{3}+\frac{121d_1\alpha_0}{3}-\frac{d_1^2\alpha_0}{x-1}+\frac{14d_1\alpha_0}{3(x-1)}+\frac{4d_1^2\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{(x-1)^2}-\frac{2d_1^2\alpha_0}{(x-1)^3}+$$
$$\frac{34d_1\alpha_0}{3(x-1)^3}+\frac{4d_1^2\alpha_0}{(x-1)^4}-\frac{49d_1\alpha_0}{3(x-1)^4}+\frac{205d_1^2}{36}-\frac{230d_1}{9}+\frac{d_1^2}{4(x-1)}-\frac{d_1}{3(x-1)}-\frac{4d_1^2}{9(x-1)^2}+\frac{49d_1}{18(x-1)^2}+\frac{d_1^2}{(x-1)^3}-$$
$$\frac{37d_1}{6(x-1)^3}-\frac{4d_1^2}{(x-1)^4}+\frac{49d_1}{3(x-1)^4}\Big)H(1;\alpha_0)+\Big(\frac{\pi^2}{2(x-1)^5}-\frac{\pi^2}{2}\Big)H(2;x)+\Big(\frac{4\alpha_0^4}{x-1}+4\alpha_0^4-\frac{16\alpha_0^3}{x-1}+\frac{16\alpha_0^3}{3(x-1)^2}-$$
$$\frac{64\alpha_0^3}{3}+\frac{24\alpha_0^2}{x-1}-\frac{16\alpha_0^2}{(x-1)^2}+\frac{8\alpha_0^2}{(x-1)^3}+48\alpha_0^2-\frac{16\alpha_0}{x-1}+\frac{16\alpha_0}{(x-1)^2}-\frac{16\alpha_0}{(x-1)^3}+\frac{16\alpha_0}{(x-1)^4}-64\alpha_0+\frac{10}{x-1}-\frac{20}{3(x-1)^2}+$$
$$\frac{20}{3(x-1)^3}-\frac{10}{(x-1)^4}-\frac{74}{3(x-1)^5}+\frac{26}{3}\Big)H(0,0;\alpha_0)+\Big(-\frac{74}{3}-\frac{10}{x-1}+\frac{20}{3(x-1)^2}-\frac{20}{3(x-1)^3}+\frac{10}{(x-1)^4}+$$
$$\frac{74}{3(x-1)^5}\Big)H(0,0;x)+\Big(2d_1\alpha_0^4+\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}-\frac{8d_1\alpha_0^3}{x-1}+\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2+\frac{12d_1\alpha_0^2}{x-1}-\frac{8d_1\alpha_0^2}{(x-1)^2}+$$
$$\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0-\frac{8d_1\alpha_0}{x-1}+\frac{8d_1\alpha_0}{(x-1)^2}-\frac{8d_1\alpha_0}{(x-1)^3}+\frac{8d_1\alpha_0}{(x-1)^4}+\frac{13d_1}{3}+\frac{5d_1}{x-1}-\frac{10d_1}{3(x-1)^2}+\frac{10d_1}{3(x-1)^3}-\frac{5d_1}{(x-1)^4}-$$
$$\frac{37d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0)+H(1;x)\Big(\frac{2\pi^2d_1}{3(x-1)^5}+\Big(-\frac{4d_1}{x-1}+\frac{2d_1}{(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{d_1}{(x-1)^4}+\frac{37d_1}{3(x-1)^5}+\frac{4}{x-2}+$$
$$\frac{5}{2(x-1)}-\frac{8}{3(x-2)^2}-\frac{3}{(x-1)^2}+\frac{8}{3(x-2)^3}+\frac{5}{3(x-1)^3}-\frac{13}{2(x-1)^4}-\frac{37}{3(x-1)^5}+\frac{37}{3}\Big)H(0;\alpha_0)+\Big(-\frac{8d_1}{(x-1)^5}+$$
$$\frac{8}{(x-1)^5}-8\Big)H(0,0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}-4d_1\Big)H(0,1;\alpha_0)-\frac{2\pi^2}{3(x-1)^5}+\frac{\pi^2}{3}\Big)+\Big(-\frac{4d_1}{(x-1)^5}+$$
$$4d_1+\frac{8}{(x-1)^5}-8\Big)H(0;\alpha_0)\,H(0,1;x)+\Big(\Big(\frac{8}{(x-1)^5}-8\Big)H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+$$
$$\frac{4}{x-2}+\frac{5}{2(x-1)}-\frac{8}{3(x-2)^2}-\frac{3}{(x-1)^2}+\frac{8}{3(x-2)^3}+\frac{5}{3(x-1)^3}-\frac{13}{2(x-1)^4}-\frac{37}{3(x-1)^5}+\frac{37}{3}\Big)H(0,c_1(\alpha_0);x)+$$
$$\Big(2d_1\alpha_0^4+\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}-\frac{8d_1\alpha_0^3}{x-1}+\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2+\frac{12d_1\alpha_0^2}{x-1}-\frac{8d_1\alpha_0^2}{(x-1)^2}+\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0-$$
$$\frac{8d_1\alpha_0}{x-1}+\frac{8d_1\alpha_0}{(x-1)^2}-\frac{8d_1\alpha_0}{(x-1)^3}+\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{2d_1}{x-1}-\frac{8d_1}{3(x-1)^2}+\frac{4d_1}{(x-1)^3}-\frac{8d_1}{(x-1)^4}\Big)H(1,0;\alpha_0)+\Big(\frac{4d_1}{x-1}-$$
$$\frac{2d_1}{(x-1)^2}+\frac{4d_1}{3(x-1)^3}-\frac{d_1}{(x-1)^4}-\frac{37d_1}{3(x-1)^5}-\frac{4}{x-2}-\frac{5}{2(x-1)}+\frac{8}{3(x-2)^2}+\frac{3}{(x-1)^2}-\frac{8}{3(x-2)^3}-\frac{5}{3(x-1)^3}+$$
$$\frac{13}{2(x-1)^4}+\frac{37}{3(x-1)^5}-\frac{37}{3}\Big)H(1,0;x)+\Big(d_1^2\alpha_0^4+\frac{d_1^2\alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}-\frac{4d_1^2\alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2+$$
$$\frac{6d_1^2\alpha_0^2}{x-1}-\frac{4d_1^2\alpha_0^2}{(x-1)^2}+\frac{2d_1^2\alpha_0^2}{(x-1)^3}-16d_1^2\alpha_0-\frac{4d_1^2\alpha_0}{x-1}+\frac{4d_1^2\alpha_0}{(x-1)^2}-\frac{4d_1^2\alpha_0}{(x-1)^3}+\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+\frac{d_1^2}{x-1}-\frac{4d_1^2}{3(x-1)^2}+$$
$$\frac{2d_1^2}{(x-1)^3}-\frac{4d_1^2}{(x-1)^4}\Big)H(1,1;\alpha_0)+H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{3\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{2}-\frac{13d_1\alpha_0^3}{9}-\frac{d_1\alpha_0^3}{x-1}+$$
$$\frac{6\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{9(x-1)^2}-\frac{23\alpha_0^3}{9(x-1)^2}+\frac{77\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{6}-\frac{\alpha_0^2}{3(x-2)}+\frac{3d_1\alpha_0^2}{2(x-1)}-\frac{103\alpha_0^2}{12(x-1)}-\frac{4d_1\alpha_0^2}{3(x-1)^2}+\frac{95\alpha_0^2}{12(x-1)^2}+$$
$$\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{31\alpha_0^2}{6(x-1)^3}-\frac{131\alpha_0^2}{6}-\frac{25d_1\alpha_0}{3}+\frac{2\alpha_0}{x-2}-\frac{d_1\alpha_0}{x-1}+\frac{10\alpha_0}{3(x-1)}-\frac{4\alpha_0}{3(x-2)^2}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{15\alpha_0}{2(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+$$
$$\frac{71\alpha_0}{6(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{49\alpha_0}{3(x-1)^4}+\frac{121\alpha_0}{3}+\frac{205d_1}{36}+\Big(\frac{2\alpha_0^4}{x-1}+2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-1)^2}-\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+$$
$$\frac{4\alpha_0^2}{(x-1)^3}+24\alpha_0^2-\frac{8\alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\alpha_0}{(x-1)^4}-32\alpha_0+\frac{10}{x-1}-\frac{20}{3(x-1)^2}+\frac{20}{3(x-1)^3}-\frac{10}{(x-1)^4}-$$
$$\frac{74}{3(x-1)^5}+\frac{50}{3}\Big)H(0;\alpha_0)+\Big(d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+$$
$$\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{3}+\frac{5d_1}{x-1}-\frac{10d_1}{3(x-1)^2}+\frac{10d_1}{3(x-1)^3}-\frac{5d_1}{(x-1)^4}-$$
$$\frac{37d_1}{3(x-1)^5}\Big)H(1;\alpha_0)+\frac{16H(0,0;\alpha_0)}{(x-1)^5}+\frac{8d_1H(0,1;\alpha_0)}{(x-1)^5}+\frac{8d_1H(1,0;\alpha_0)}{(x-1)^5}+\frac{4d_1^2H(1,1;\alpha_0)}{(x-1)^5}-\frac{4}{x-2}+\frac{17d_1}{4(x-1)}-$$

$$
\frac{53}{4(x-1)}+\frac{8}{3(x-2)^2}-\frac{13d_1}{9\,(x-1)^2}+\frac{317}{36(x-1)^2}+\frac{13d_1}{9\,(x-1)^3}-\frac{371}{36(x-1)^3}-\frac{17d_1}{4\,(x-1)^4}+\frac{193}{12(x-1)^4}-\frac{205d_1}{36(x-1)^5}-
$$

$$
\frac{\pi^2}{6(x-1)^5}+\frac{266}{9(x-1)^5}-\frac{230}{9}\Big)+\Big(\frac{4\,d_1^2}{(x-1)^5}-\frac{8d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-2\Big)\,H(0;\alpha_0)H(1,1;x)+\Big(-\frac{4d_1}{x-1}+
$$

$$
\frac{2\,d_1}{(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{d_1}{(x-1)^4}+\frac{37\,d_1}{3(x-1)^5}+\Big(-\frac{8d_1}{(x-1)^5}+\frac{8}{(x-1)^5}-8\Big)\,H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}-
$$

$$
4\,d_1\Big)H(1;\alpha_0)+\frac{4}{x-2}+\frac{5}{2(x-1)}-\frac{8}{3\,(x-2)^2}-\frac{3}{(x-1)^2}+\frac{8}{3(x-2)^3}+\frac{5}{3\,(x-1)^3}-\frac{13}{2(x-1)^4}-\frac{37}{3(x-1)^5}+
$$

$$
\frac{37}{3}\Big)\,H(1,c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(0;\alpha_0)H(2,1;x)+\Big(\frac{\alpha_0^4}{x-1}+\frac{3\alpha_0^4}{2}-\frac{4\alpha_0^3}{x-1}+\frac{4\,\alpha_0^3}{3(x-1)^2}-8\alpha_0^3+
$$

$$
\frac{6\alpha_0^2}{x-1}-\frac{4\,\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}+18\alpha_0^2-\frac{4\,\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\,\alpha_0}{(x-1)^4}-24\alpha_0+\frac{8H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\,H(1;\alpha_0)}{(x-1)^5}+
$$

$$
\frac{7}{x-1}-\frac{13}{3\,(x-1)^2}+\frac{4}{(x-1)^3}-\frac{11}{2(x-1)^4}-\frac{37}{3(x-1)^5}+\frac{25}{2}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{2\,(x-1)}-\frac{\alpha_0^4}{2}-\frac{2\alpha_0^3}{x-1}+
$$

$$
\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}+\frac{3\alpha_0^2}{x-1}-\frac{2\,\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}-6\alpha_0^2-\frac{2\,\alpha_0}{x-1}+\frac{2\alpha_0}{(x-1)^2}-\frac{2\alpha_0}{(x-1)^3}+\frac{2\,\alpha_0}{(x-1)^4}+8\alpha_0-\frac{4}{x-2}+
$$

$$
\frac{1}{2(x-1)}+\frac{8}{3\,(x-2)^2}+\frac{2}{3(x-1)^2}-\frac{8}{3\,(x-2)^3}+\frac{1}{(x-1)^3}+\frac{2}{(x-1)^4}-\frac{25}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(16+
$$

$$
\frac{16}{(x-1)^5}\Big)\,H(0,0,0;\alpha_0)+\Big(16-\frac{16}{(x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{8\,d_1}{(x-1)^5}+8d_1\Big)H(0,0,1;\alpha_0)+\Big(\frac{8}{(x-1)^5}-
$$

$$
8\Big)\,H(0,0,c_1(\alpha_0);x)+\Big(\frac{8d_1}{(x-1)^5}+8d_1\Big)H(0,1,0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1-\frac{8}{(x-1)^5}+8\Big)H(0,1,0;x)+
$$

$$
\Big(\frac{4d_1^2}{(x-1)^5}+4d_1^2\Big)H(0,1,1;\alpha_0)+\Big(-\frac{4\,d_1}{(x-1)^5}+4d_1+\frac{8}{(x-1)^5}-8\Big)\,H(0,1,c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-
$$

$$
6\Big)\,H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)\,H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8\,d_1}{(x-1)^5}-\frac{8}{(x-1)^5}+
$$

$$
8\Big)H(1,0,0;x)+\Big(-\frac{4\,d_1}{(x-1)^5}+\frac{4}{(x-1)^5}-2\Big)\,H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{8\,d_1}{(x-1)^5}-4d_1-
$$

$$
\frac{4}{(x-1)^5}+2\Big)H(1,1,0;x)+\Big(\frac{4\,d_1^2}{(x-1)^5}-\frac{8d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-2\Big)\,H(1,1,c_1(\alpha_0);x)+\Big(-
$$

$$
\frac{4\,d_1}{(x-1)^5}+\frac{4}{(x-1)^5}-6\Big)\,H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)\,H(2,0,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-
$$

$$
2\Big)\,H(2,1,0;x)+\Big(2-\frac{2}{(x-1)^5}\Big)\,H(2,1,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-2\Big)\,H(2,c_2(\alpha_0),c_1(\alpha_0);x)+
$$

$$
\frac{4\,H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{2\,H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{x-2}-\frac{3\,\pi^2}{8(x-1)}+\frac{2\pi^2}{3(x-2)^2}+\frac{5\pi^2}{9\,(x-1)^2}-
$$

$$
\frac{2\pi^2}{3(x-2)^3}-\frac{7\pi^2}{36\,(x-1)^3}+\frac{5\pi^2}{4(x-1)^4}+\frac{37\pi^2}{18\,(x-1)^5}-\frac{21\zeta_3}{4(x-1)^5}+\frac{17\zeta_3}{4}+\frac{\pi^2\ln 2}{2(x-1)^5}-\frac{1}{2}\pi^2\ln 2-\frac{173\pi^2}{72}-4.
$$

### E.6 The $\mathcal{B}$ integral for $k=1$ and $\delta=1$

The $\varepsilon$ expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,1,1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;1,1)\\
&=\frac{1}{\varepsilon}b_{-1}^{(1,1)}+b_0^{(1,1)}+\varepsilon b_1^{(1,1)}+\varepsilon^2 b_2^{(1,1)}+\mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{E.6}
$$

where

$$
b_{-1}^{(1,1)}=-\frac{1}{4},
$$

$$
b_0^{(1,1)}=
$$

$$
\frac{\alpha_0^4}{8(x-1)}+\frac{\alpha_0^4}{8}-\frac{\alpha_0^3}{2\,(x-1)}+\frac{\alpha_0^3}{6(x-1)^2}-\frac{2\alpha_0^3}{3}+\frac{3\alpha_0^2}{4\,(x-1)}-\frac{\alpha_0^2}{2(x-1)^2}+\frac{\alpha_0^2}{4(x-1)^3}+\frac{3\,\alpha_0^2}{2}-\frac{\alpha_0}{2(x-1)}+\frac{\alpha_0}{2(x-1)^2}-
$$

$$
\frac{\alpha_0}{2\,(x-1)^3}+\frac{\alpha_0}{2(x-1)^4}-2\alpha_0+\Big(\frac{1}{2}+\frac{1}{2\,(x-1)^5}\Big)H(0;\alpha_0)+\Big(\frac{1}{2}-\frac{1}{2(x-1)^5}\Big)\,H(0;x)+\frac{H(c_1(\alpha_0);x)}{2(x-1)^5}-\frac{3}{4},
$$

$$
b_1^{(1,1)}=-\frac{d_1\alpha_0^4}{16}-\frac{d_1\alpha_0^4}{16(x-1)}+\frac{\alpha_0^4}{2\,(x-1)}+\frac{\alpha_0^4}{2}+\frac{13d_1\alpha_0^3}{36}-\frac{\alpha_0^3}{6(x-2)}+\frac{d_1\alpha_0^3}{4(x-1)}-\frac{23\alpha_0^3}{12(x-1)}-\frac{d_1\,\alpha_0^3}{9(x-1)^2}+
$$

$$
\frac{29\alpha_0^3}{36(x-1)^2}-\frac{101\,\alpha_0^3}{36}-\frac{23d_1\alpha_0^2}{24}+\frac{5\alpha_0^2}{6(x-2)}-\frac{3\,d_1\alpha_0^2}{8(x-1)}+\frac{5\alpha_0^2}{2(x-1)}-\frac{2\alpha_0^2}{3\,(x-2)^2}+\frac{d_1\alpha_0^2}{3(x-1)^2}-\frac{7\alpha_0^2}{3\,(x-1)^2}-\frac{d_1\alpha_0^2}{4(x-1)^3}+
$$

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$$\frac{37\alpha_0^2}{24\ (x-1)^3}+\frac{167\alpha_0^2}{24}+\frac{25d_1\alpha_0}{12}-\frac{7\alpha_0}{3\ (x-2)}+\frac{d_1\alpha_0}{4(x-1)}-\frac{\alpha_0}{12(x-1)}+\frac{10\alpha_0}{3\ (x-2)^2}-\frac{d_1\alpha_0}{3(x-1)^2}+\frac{11\alpha_0}{6(x-1)^2}-\frac{4\ \alpha_0}{(x-2)^3}+$$
$$\frac{d_1\alpha_0}{2(x-1)^3}-\frac{37\alpha_0}{12\ (x-1)^3}-\frac{d_1\alpha_0}{(x-1)^4}+\frac{55\alpha_0}{12(x-1)^4}-\frac{145\ \alpha_0}{12}+\Bigg(-\frac{\alpha_0^4}{2(x-1)}-\frac{\alpha_0^4}{2}+\frac{2\ \alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}-$$
$$\frac{3\ \alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}-6\ \alpha_0^2+\frac{2\alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\ \alpha_0}{(x-1)^3}-\frac{2\alpha_0}{(x-1)^4}+8\ \alpha_0+\frac{4}{x-2}-\frac{5}{x-1}-\frac{16}{3(x-2)^2}+$$
$$\frac{7}{4\ (x-1)^2}+\frac{8}{(x-2)^3}-\frac{5}{4\ (x-1)^3}-\frac{16}{(x-2)^4}+\frac{3}{2(x-1)^4}+\frac{43}{12\ (x-1)^5}-\frac{7}{12}\Bigg)H(0;\alpha_0)+\Bigg(\frac{5}{x-1}-\frac{7}{4\ (x-1)^2}+$$
$$\frac{5}{4(x-1)^3}-\frac{3}{2(x-1)^4}-\frac{43}{12\ (x-1)^5}+\frac{43}{12}-\frac{4}{x-2}+\frac{16}{3\ (x-2)^2}-\frac{8}{(x-2)^3}+\frac{16}{(x-2)^4}\Bigg)\ H(0;x)+\Bigg(-\frac{d_1\alpha_0^4}{4}-$$
$$\frac{d_1\alpha_0^4}{4(x-1)}+\frac{4\ d_1\alpha_0^3}{3}+\frac{d_1\alpha_0^3}{x-1}-\frac{d_1\alpha_0^3}{3(x-1)^2}-3d_1\ \alpha_0^2-\frac{3d_1\alpha_0^2}{2(x-1)}+\frac{d_1\alpha_0^2}{(x-1)^2}-\frac{d_1\ \alpha_0^2}{2(x-1)^3}+4d_1\alpha_0+\frac{d_1\alpha_0}{x-1}-\frac{d_1\ \alpha_0}{(x-1)^2}+$$
$$\frac{d_1\alpha_0}{(x-1)^3}-\frac{d_1\ \alpha_0}{(x-1)^4}-\frac{25d_1}{12}-\frac{d_1}{4(x-1)}+\frac{d_1}{3\ (x-1)^2}-\frac{d_1}{2(x-1)^3}+\frac{d_1}{(x-1)^4}\Bigg)\ H(1;\alpha_0)+\Bigg(\frac{d_1}{(x-1)^5}-\frac{16}{(x-2)^5}-$$
$$\frac{1}{(x-1)^5}\ +1\Bigg)H(0;\alpha_0)H(1;x)+\Bigg(\frac{\alpha_0^4}{4(x-2)}-\frac{\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-2}+\frac{\alpha_0^3}{x-1}+\frac{2\ \alpha_0^3}{3(x-2)^2}-\frac{\alpha_0^3}{3(x-1)^2}+\frac{4\alpha_0^3}{3}+$$
$$\frac{3\ \alpha_0^2}{2(x-2)}-\frac{3\alpha_0^2}{2(x-1)}-\frac{2\ \alpha_0^2}{(x-2)^2}+\frac{\alpha_0^2}{(x-1)^2}+\frac{2\ \alpha_0^2}{(x-2)^3}-\frac{\alpha_0^2}{2(x-1)^3}-3\ \alpha_0^2-\frac{\alpha_0}{x-2}+\frac{\alpha_0}{x-1}+\frac{2\ \alpha_0}{(x-2)^2}-\frac{\alpha_0}{(x-1)^2}-$$
$$\frac{4\ \alpha_0}{(x-2)^3}+\frac{\alpha_0}{(x-1)^3}+\frac{8\ \alpha_0}{(x-2)^4}-\frac{\alpha_0}{(x-1)^4}+4\alpha_0-\frac{2\ H(0;\alpha_0)}{(x-1)^5}-\frac{d_1\ \ H(1;\alpha_0)}{(x-1)^5}+\frac{4}{x-2}-\frac{5}{x-1}-\frac{16}{3\ (x-2)^2}+$$
$$\frac{7}{4(x-1)^2}+\frac{8}{(x-2)^3}-\frac{5}{4\ (x-1)^3}-\frac{16}{(x-2)^4}+\frac{3}{2(x-1)^4}+\frac{43}{12\ (x-1)^5}-\frac{25}{12}\Bigg)\ H(c_1(\alpha_0);x)+\Bigg(-2-$$
$$\frac{2}{(x-1)^5}\Bigg)\ H(0,0;\alpha_0)+\Bigg(\frac{2}{(x-1)^5}-2\Bigg)\ H(0,0;x)+\Bigg(-\frac{d_1}{(x-1)^5}-d_1\Bigg)\ H(0,1;\alpha_0)+\Bigg(-\frac{1}{(x-1)^5}+$$
$$1-\frac{16}{(x-2)^5}\Bigg)H(0,c_1(\ \alpha_0);x)+\Bigg(-\frac{d_1}{(x-1)^5}+\frac{16}{(x-2)^5}+\frac{1}{(x-1)^5}\ -1\Bigg)H(1,0;x)+\Bigg(\frac{d_1}{(x-1)^5}-\frac{16}{(x-2)^5}-$$
$$\frac{1}{(x-1)^5}+1\Bigg)\ H(1,c_1(\alpha_0);x)-\frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{16\ \ H(c_2(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5}+\frac{4\pi^2}{(x-2)^5}+\frac{\pi\ ^2}{6(x-1)^5}-\frac{\pi^2}{6}-\frac{7}{4},$$

$$b_2^{(1,1)}=\frac{d_1^2\alpha_0^4}{32}-\frac{5d_1\alpha_0^4}{16}+\frac{d_1^2\alpha_0^4}{32\ (x-1)}-\frac{5d_1\alpha_0^4}{16(x-1)}-\frac{\pi^2\alpha_0^4}{48\ (x-1)}+\frac{11\alpha_0^4}{8(x-1)}-\frac{\pi^2\alpha_0^4}{48}+\frac{11\ \alpha_0^4}{8}-\frac{43d_1^2\alpha_0^3}{216}+$$
$$\frac{427d_1\ \alpha_0^3}{216}+\frac{7d_1\alpha_0^3}{36(x-2)}-\frac{5\alpha_0^3}{9\ (x-2)}-\frac{d_1^2\alpha_0^3}{8(x-1)}+\frac{83d_1\alpha_0^3}{72\ (x-1)}+\frac{\pi^2\alpha_0^3}{12(x-1)}-\frac{47\alpha_0^3}{9(x-1)}+\frac{2\ d_1^2\alpha_0^3}{27(x-1)^2}-\frac{157d_1\alpha_0^3}{216(x-1)^2}-$$
$$\frac{\pi\ ^2\alpha_0^3}{36(x-1)^2}+\frac{139\alpha_0^3}{54(x-1)^2}+\frac{\pi^2\ \alpha_0^3}{9}-\frac{218\alpha_0^3}{27}+\frac{95d_1^2\alpha_0^2}{144}-\frac{301\ d_1\alpha_0^2}{48}-\frac{41d_1\alpha_0^2}{36(x-2)}+\frac{28\alpha_0^2}{9\ (x-2)}+\frac{3d_1^2\alpha_0^2}{16(x-1)}-\frac{9d_1\alpha_0^2}{8\ (x-1)}-$$
$$\frac{\pi^2\alpha_0^2}{8(x-1)}+\frac{151\alpha_0^2}{24\ (x-1)}+\frac{10d_1\alpha_0^2}{9(x-2)^2}-\frac{26\alpha_0^2}{9\ (x-2)^2}-\frac{2d_1^2\alpha_0^2}{9(x-1)^2}+\frac{25d_1\alpha_0^2}{12\ (x-1)^2}+\frac{\pi^2\alpha_0^2}{12(x-1)^2}-\frac{533\alpha_0^2}{72\ (x-1)^2}+\frac{d_1^2\alpha_0^2}{4(x-1)^3}-$$
$$\frac{319d_1\alpha_0^2}{144\ (x-1)^3}-\frac{\pi^2\alpha_0^2}{24(x-1)^3}+\frac{221\alpha_0^2}{36\ (x-1)^3}-\frac{\pi^2\alpha_0^2}{4}+\frac{199\alpha_0^2}{9}-\frac{205d_1^2\ \alpha_0}{72}+\frac{175d_1\alpha_0}{8}+\frac{97d_1\alpha_0}{18(x-2)}-\frac{209\ \alpha_0}{18(x-2)}-\frac{d_1^2\alpha_0}{8(x-1)}-$$
$$\frac{281d_1\alpha_0}{72\ (x-1)}+\frac{\pi^2\alpha_0}{12(x-1)}+\frac{191\alpha_0}{36(x-1)}-\frac{74\ d_1\alpha_0}{9(x-2)^2}+\frac{178\alpha_0}{9(x-2)^2}+\frac{2d_1^2\alpha_0}{9\ (x-1)^2}-\frac{5d_1\alpha_0}{6(x-1)^2}-\frac{\pi^2\alpha_0}{12\ (x-1)^2}+\frac{65\alpha_0}{18(x-1)^2}+$$
$$\frac{12d_1\ \alpha_0}{(x-2)^3}-\frac{28\alpha_0}{(x-2)^3}-\frac{d_1^2\alpha_0}{2\ (x-1)^3}+\frac{337d_1\alpha_0}{72(x-1)^3}+\frac{\pi^2\alpha_0}{12\ (x-1)^3}-\frac{233\alpha_0}{18(x-1)^3}+\frac{2d_1^2\ \alpha_0}{(x-1)^4}-\frac{1009d_1\alpha_0}{72(x-1)^4}-\frac{\pi^2\alpha_0}{12\ (x-1)^4}+$$
$$\frac{991\alpha_0}{36(x-1)^4}+\frac{\pi^2\alpha_0}{3}-\frac{1909\ \alpha_0}{36}+\Bigg(\frac{d_1\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{2\ \alpha_0^4}{x-1}-2\alpha_0^4-\frac{13d_1\alpha_0^3}{9}+\frac{2\alpha_0^3}{3\ (x-2)}-\frac{d_1\alpha_0^3}{x-1}+\frac{23\alpha_0^3}{3(x-1)}+$$
$$\frac{4d_1\ \alpha_0^3}{9(x-1)^2}-\frac{29\alpha_0^3}{9(x-1)^2}+\frac{101\ \alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{6}-\frac{10\alpha_0^2}{3(x-2)}+\frac{3d_1\ \alpha_0^2}{2(x-1)}-\frac{10\alpha_0^2}{x-1}+\frac{8\alpha_0^2}{3\ (x-2)^2}-\frac{4d_1\alpha_0^2}{3(x-1)^2}+\frac{28\alpha_0^2}{3\ (x-1)^2}+$$
$$\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{37\alpha_0^2}{6\ (x-1)^3}-\frac{167\alpha_0^2}{6}-\frac{25d_1\alpha_0}{3}+\frac{28\alpha_0}{3\ (x-2)}-\frac{d_1\alpha_0}{x-1}+\frac{\alpha_0}{3(x-1)}-\frac{40\alpha_0}{3\ (x-2)^2}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{22\alpha_0}{3\ (x-1)^2}+$$
$$\frac{16\alpha_0}{(x-2)^3}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{37\ \alpha_0}{3(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{55\alpha_0}{3\ (x-1)^4}+\frac{145\alpha_0}{3}+\frac{205d_1}{72}-\frac{34d_1}{3(x-2)}+\frac{4}{x-2}+\frac{40d_1}{3(x-1)}-\frac{155}{12(x-1)}+$$
$$\frac{116\ d_1}{9(x-2)^2}-\frac{88}{9(x-2)^2}-\frac{47d_1}{24\ (x-1)^2}+\frac{103}{12(x-1)^2}-\frac{16\ d_1}{(x-2)^3}+\frac{24}{(x-2)^3}+\frac{25d_1}{24\ (x-1)^3}-\frac{103}{12(x-1)^3}+\frac{32\ d_1}{(x-2)^4}-\frac{80}{(x-2)^4}-$$
$$\frac{9d_1}{4\ (x-1)^4}+\frac{145}{12(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi\ ^2}{12(x-1)^5}+\frac{661}{36(x-1)^5}-\frac{\pi\ ^2}{12}-\frac{409}{36}\Bigg)H(0;\alpha_0)+\Bigg(\frac{34d_1}{3\ (x-2)}-\frac{40d_1}{3(x-1)}-$$
$$\frac{116d_1}{9(x-2)^2}+\frac{47\ d_1}{24(x-1)^2}+\frac{16d_1}{(x-2)^3}-\frac{25d_1}{24\ (x-1)^3}-\frac{32d_1}{(x-2)^4}+\frac{9d_1}{4(x-1)^4}+\frac{205\ d_1}{72(x-1)^5}-\frac{205d_1}{72}-\frac{4}{x-2}+\frac{155}{12\ (x-1)}+$$
$$\frac{88}{9(x-2)^2}-\frac{103}{12\ (x-1)^2}-\frac{24}{(x-2)^3}+\frac{103}{12\ (x-1)^3}+\frac{80}{(x-2)^4}-\frac{145}{12(x-1)^4}-\frac{16\pi\ ^2}{(x-2)^5}-\frac{7\pi^2}{12(x-1)^5}-\frac{661}{36\ (x-1)^5}+\frac{3\pi^2}{4}+$$
$$\frac{661}{36}\Bigg)\ H(0;x)+\Bigg(\frac{d_1^2\alpha_0^4}{8}-d_1\alpha_0^4+\frac{d_1^2\alpha_0^4}{8\ (x-1)}-\frac{d_1\alpha_0^4}{x-1}-\frac{13d_1^2\alpha_0^3}{18}+\frac{101d_1\ \alpha_0^3}{18}+\frac{d_1\alpha_0^3}{3(x-2)}-\frac{d_1^2\alpha_0^3}{2\ (x-1)}+\frac{23d_1\alpha_0^3}{6(x-1)}+$$
$$\frac{2d_1^2\alpha_0^3}{9\ (x-1)^2}-\frac{29d_1\alpha_0^3}{18(x-1)^2}+\frac{23d_1^2\ \alpha_0^2}{12}-\frac{167d_1\alpha_0^2}{12}-\frac{5d_1\alpha_0^2}{3\ (x-2)}+\frac{3d_1^2\alpha_0^2}{4(x-1)}-\frac{5d_1\alpha_0^2}{x-1}+\frac{4\ d_1\alpha_0^2}{3(x-2)^2}-\frac{2d_1^2\alpha_0^2}{3(x-1)^2}+\frac{14d_1\ \alpha_0^2}{3(x-1)^2}+$$
$$\frac{d_1^2\alpha_0^2}{2(x-1)^3}-\frac{37d_1\ \alpha_0^2}{12(x-1)^3}-\frac{25d_1^2\alpha_0}{6}+\frac{145d_1\ \alpha_0}{6}+\frac{14d_1\alpha_0}{3(x-2)}-\frac{d_1^2\alpha_0}{2\ (x-1)}+\frac{d_1\alpha_0}{6(x-1)}-\frac{20d_1\alpha_0}{3(x-2)^2}+\frac{2\ d_1^2\alpha_0}{3(x-1)^2}-\frac{11d_1\alpha_0}{3(x-1)^2}+$$

$$\frac{8d_1\alpha_0}{(x-2)^3} - \frac{d_1^2\alpha_0}{(x-1)^3} + \frac{37d_1\alpha_0}{6(x-1)^3} + \frac{2d_1^2\alpha_0}{(x-1)^4} - \frac{55d_1\alpha_0}{6(x-1)^4} + \frac{205 d_1^2}{72} - \frac{535d_1}{36} - \frac{10d_1}{3(x-2)} + \frac{d_1^2}{8(x-1)} + \frac{2d_1}{x-1} + \frac{16d_1}{3(x-2)^2} -$$

$$\frac{2d_1^2}{9(x-1)^2} + \frac{11d_1}{18(x-1)^2} - \frac{8d_1}{(x-2)^3} + \frac{d_1^2}{2(x-1)^3} - \frac{37d_1}{12(x-1)^3} - \frac{2d_1^2}{(x-1)^4} + \frac{55d_1}{6(x-1)^4}\Big) H(1;\alpha_0) + \Big( -\frac{8\pi^2 d_1}{(x-2)^5} +$$

$$\frac{16\pi^2}{(x-2)^5} + \frac{\pi^2}{4(x-1)^5} - \frac{\pi^2}{4}\Big) H(2;x) + \Big(\frac{2\alpha_0^4}{x-1} + 2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)^2} - \frac{32\alpha_0^3}{3} + \frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{4\alpha_0^2}{(x-1)^3} +$$

$$24\alpha_0^2 - \frac{8\alpha_0}{x-1} + \frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} - 32\alpha_0 - \frac{16}{x-2} + \frac{20}{x-1} + \frac{64}{3(x-2)^2} - \frac{7}{(x-1)^2} - \frac{32}{(x-2)^3} + \frac{5}{(x-1)^3} +$$

$$\frac{64}{(x-2)^4} - \frac{6}{(x-1)^4} - \frac{43}{3(x-1)^5} + \frac{7}{3}\Big) H(0,0;\alpha_0) + \Big( -\frac{20}{x-1} + \frac{7}{(x-1)^2} - \frac{5}{(x-1)^3} + \frac{6}{(x-1)^4} + \frac{43}{3(x-1)^5} -$$

$$\frac{43}{3} + \frac{16}{x-2} - \frac{64}{3(x-2)^2} + \frac{32}{(x-2)^3} - \frac{64}{(x-2)^4}\Big) H(0,0;x) + \Big( d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} - \frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} +$$

$$12d_1\alpha_0^2 + \frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} - 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} + \frac{7d_1}{6} - \frac{8d_1}{x-2} + \frac{10d_1}{x-1} +$$

$$\frac{32d_1}{3(x-2)^2} - \frac{7d_1}{2(x-1)^2} - \frac{16d_1}{(x-2)^3} + \frac{5d_1}{2(x-1)^3} + \frac{32d_1}{(x-2)^4} - \frac{3d_1}{(x-1)^4} - \frac{43d_1}{6(x-1)^5}\Big) H(0,1;\alpha_0) + H(1;x)\Big(\frac{\pi^2 d_1}{3(x-1)^5} +$$

$$\Big(\frac{15d_1}{2(x-2)} - \frac{19d_1}{2(x-1)} - \frac{28d_1}{3(x-2)^2} + \frac{17d_1}{6(x-1)^2} + \frac{12d_1}{(x-2)^3} - \frac{3d_1}{2(x-1)^3} - \frac{16d_1}{(x-2)^4} + \frac{d_1}{(x-1)^4} + \frac{43d_1}{6(x-1)^5} + \frac{11}{2(x-2)} -$$

$$\frac{5}{2(x-1)} - \frac{16}{3(x-2)^2} - \frac{7}{12(x-1)^2} + \frac{16}{3(x-2)^3} + \frac{5}{12(x-1)^3} - \frac{3}{(x-1)^4} - \frac{16}{(x-2)^5} - \frac{43}{6(x-1)^5} + \frac{43}{6}\Big) H(0;\alpha_0) +$$

$$\Big(-\frac{4d_1}{(x-1)^5} + \frac{64}{(x-2)^5} + \frac{4}{(x-1)^5} - 4\Big) H(0,0;\alpha_0) + \Big(-\frac{2d_1^2}{(x-1)^5} + \frac{32d_1}{(x-2)^5} + \frac{2d_1}{(x-1)^5} - 2d_1\Big) H(0,1;\alpha_0) +$$

$$\frac{8\pi^2}{3(x-2)^5} - \frac{\pi^2}{3(x-1)^5} + \frac{\pi^2}{6}\Big) + \Big(-\frac{32d_1}{(x-2)^5} - \frac{2d_1}{(x-1)^5} + 2d_1 + \frac{32}{(x-2)^5} + \frac{4}{(x-1)^5} - 4\Big) H(0;\alpha_0)\, H(0,1;x) +$$

$$\Big(\frac{\alpha_0^4}{2(x-2)} - \frac{2\alpha_0^3}{x-2} + \frac{4\alpha_0^3}{3(x-2)^2} + \frac{3\alpha_0^2}{x-2} - \frac{4\alpha_0^2}{(x-2)^2} + \frac{4\alpha_0^2}{(x-2)^3} - \frac{2\alpha_0}{x-2} + \frac{4\alpha_0}{(x-2)^2} - \frac{8\alpha_0}{(x-2)^3} + \frac{16\alpha_0}{(x-2)^4} + \Big(\frac{4}{(x-1)^5} -$$

$$4 + \frac{64}{(x-2)^5}\Big) H(0;\alpha_0) + \Big(\frac{32d_1}{(x-2)^5} + \frac{2d_1}{(x-1)^5} - 2d_1\Big) H(1;\alpha_0) + \frac{6}{x-2} - \frac{5}{2(x-1)} - \frac{20}{3(x-2)^2} - \frac{7}{12(x-1)^2} +$$

$$\frac{28}{3(x-2)^3} + \frac{5}{12(x-1)^3} - \frac{16}{(x-2)^4} - \frac{3}{(x-1)^4} - \frac{16}{(x-2)^5} - \frac{43}{6(x-1)^5} + \frac{43}{6}\Big) H(0,c_1(\alpha_0);x) + \Big(d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} -$$

$$\frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} + 12d_1\alpha_0^2 + \frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} - 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} -$$

$$\frac{4d_1\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} + \frac{25d_1}{3} + \frac{d_1}{x-1} - \frac{4d_1}{3(x-1)^2} + \frac{2d_1}{(x-1)^3} - \frac{4d_1}{(x-1)^4}\Big) H(1,0;\alpha_0) + \Big(-\frac{15d_1}{2(x-2)} + \frac{19d_1}{2(x-1)} +$$

$$\frac{28d_1}{3(x-2)^2} - \frac{17d_1}{6(x-1)^2} - \frac{12d_1}{(x-2)^3} + \frac{3d_1}{2(x-1)^3} + \frac{16d_1}{(x-2)^4} - \frac{d_1}{(x-1)^4} - \frac{43d_1}{6(x-1)^5} - \frac{11}{2(x-2)} + \frac{5}{2(x-1)} + \frac{16}{3(x-2)^2} +$$

$$\frac{7}{12(x-1)^2} - \frac{16}{3(x-2)^3} - \frac{5}{12(x-1)^3} + \frac{3}{(x-1)^4} + \frac{16}{(x-2)^5} + \frac{43}{6(x-1)^5} - \frac{43}{6}\Big) H(1,0;x) + \Big(\frac{d_1^2\alpha_0^4}{2} + \frac{d_1^2\alpha_0^4}{2(x-1)} -$$

$$\frac{8d_1^2\alpha_0^3}{3} - \frac{2d_1^2\alpha_0^3}{x-1} + \frac{2d_1^2\alpha_0^3}{3(x-1)^2} + 6d_1^2\alpha_0^2 + \frac{3d_1^2\alpha_0^2}{x-1} - \frac{2d_1^2\alpha_0^2}{(x-1)^2} + \frac{d_1^2\alpha_0^2}{(x-1)^3} - 8d_1^2\alpha_0 - \frac{2d_1^2\alpha_0}{x-1} + \frac{2d_1^2\alpha_0}{(x-1)^2} - \frac{2d_1^2\alpha_0}{(x-1)^3} +$$

$$\frac{2d_1^2\alpha_0}{(x-1)^4} + \frac{25d_1^2}{6} + \frac{d_1^2}{2(x-1)} - \frac{2d_1^2}{3(x-1)^2} + \frac{d_1^2}{(x-1)^3} - \frac{2d_1^2}{(x-1)^4}\Big) H(1,1;\alpha_0) + H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{8} -$$

$$\frac{d_1\alpha_0^4}{8(x-2)} + \frac{\alpha_0^4}{2(x-2)} + \frac{d_1\alpha_0^4}{8(x-1)} - \frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{13d_1\alpha_0^3}{18} + \frac{d_1\alpha_0^3}{2(x-2)} - \frac{5\alpha_0^3}{3(x-2)} - \frac{d_1\alpha_0^3}{2(x-1)} + \frac{43\alpha_0^3}{12(x-1)} - \frac{4d_1\alpha_0^3}{9(x-2)^2} +$$

$$\frac{14\alpha_0^3}{9(x-2)^2} + \frac{2d_1\alpha_0^3}{9(x-1)^2} - \frac{29\alpha_0^3}{18(x-1)^2} + \frac{101\alpha_0^3}{18} + \frac{23d_1\alpha_0^2}{12} - \frac{3d_1\alpha_0^2}{4(x-2)} + \frac{11\alpha_0^2}{12(x-2)} + \frac{3d_1\alpha_0^2}{4(x-1)} - \frac{7\alpha_0^2}{2(x-1)} + \frac{4d_1\alpha_0^2}{3(x-2)^2} -$$

$$\frac{10\alpha_0^2}{3(x-2)^2} - \frac{2d_1\alpha_0^2}{3(x-1)^2} + \frac{13\alpha_0^2}{3(x-1)^2} - \frac{2d_1\alpha_0^2}{(x-2)^3} + \frac{6\alpha_0^2}{(x-2)^3} + \frac{d_1\alpha_0^2}{2(x-1)^3} - \frac{37\alpha_0^2}{12(x-1)^3} - \frac{167\alpha_0^2}{12} - \frac{25d_1\alpha_0}{6} + \frac{d_1\alpha_0}{2(x-2)} +$$

$$\frac{37\alpha_0}{6(x-2)} - \frac{d_1\alpha_0}{2(x-1)} - \frac{21\alpha_0}{4(x-1)} - \frac{4d_1\alpha_0}{3(x-2)^2} - \frac{14\alpha_0}{3(x-2)^2} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{17\alpha_0}{12(x-1)^2} + \frac{4d_1\alpha_0}{(x-2)^3} - \frac{4\alpha_0}{(x-2)^3} - \frac{d_1\alpha_0}{(x-1)^3} +$$

$$\frac{17\alpha_0}{3(x-1)^3} - \frac{16d_1\alpha_0}{(x-2)^4} + \frac{40\alpha_0}{(x-2)^4} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{55\alpha_0}{6(x-1)^4} + \frac{145\alpha_0}{6} + \frac{205d_1}{72} + \Big(-\frac{\alpha_0^4}{x-2} + \frac{\alpha_0^4}{x-1} + \alpha_0^4 + \frac{4\alpha_0^3}{x-2} - \frac{4\alpha_0^3}{x-1} -$$

$$\frac{8\alpha_0^3}{3(x-2)^2} + \frac{4\alpha_0^3}{3(x-1)^2} - \frac{16\alpha_0^3}{3} - \frac{6\alpha_0^2}{x-2} + \frac{6\alpha_0^2}{x-1} + \frac{8\alpha_0^2}{(x-2)^2} - \frac{4\alpha_0^2}{(x-1)^2} - \frac{8\alpha_0^2}{(x-2)^3} + \frac{2\alpha_0^2}{(x-1)^3} + 12\alpha_0^2 + \frac{4\alpha_0}{x-2} - \frac{4\alpha_0}{x-1} -$$

$$\frac{8\alpha_0}{(x-2)^2} + \frac{4\alpha_0}{(x-1)^2} + \frac{16\alpha_0}{(x-2)^3} - \frac{4\alpha_0}{(x-1)^3} - \frac{32\alpha_0}{(x-2)^4} + \frac{4\alpha_0}{(x-1)^4} - 16\alpha_0 - \frac{16}{x-2} + \frac{20}{x-1} + \frac{64}{3(x-2)^2} - \frac{7}{(x-1)^2} -$$

$$\frac{32}{(x-2)^3} + \frac{5}{(x-1)^3} + \frac{64}{(x-2)^4} - \frac{6}{(x-1)^4} - \frac{43}{3(x-1)^5} + \frac{25}{3}\Big) H(0;\alpha_0) + \Big(\frac{d_1\alpha_0^4}{2} - \frac{d_1\alpha_0^4}{2(x-2)} + \frac{d_1\alpha_0^4}{2(x-1)} - \frac{8d_1\alpha_0^3}{3} +$$

$$\frac{2d_1\alpha_0^3}{x-2} - \frac{2d_1\alpha_0^3}{x-1} - \frac{4d_1\alpha_0^3}{3(x-2)^2} + \frac{2d_1\alpha_0^3}{3(x-1)^2} + 6d_1\alpha_0^2 - \frac{3d_1\alpha_0^2}{x-2} + \frac{3d_1\alpha_0^2}{x-1} + \frac{4d_1\alpha_0^2}{(x-2)^2} - \frac{2d_1\alpha_0^2}{(x-1)^2} - \frac{4d_1\alpha_0^2}{(x-2)^3} + \frac{d_1\alpha_0^2}{(x-1)^3} -$$

$$8d_1\alpha_0 + \frac{2d_1\alpha_0}{x-2} - \frac{2d_1\alpha_0}{x-1} - \frac{4d_1\alpha_0}{(x-2)^2} + \frac{2d_1\alpha_0}{(x-1)^2} + \frac{8d_1\alpha_0}{(x-2)^3} - \frac{2d_1\alpha_0}{(x-1)^3} - \frac{16d_1\alpha_0}{(x-2)^4} + \frac{2d_1\alpha_0}{(x-1)^4} + \frac{25d_1}{6} - \frac{8d_1}{x-2} +$$

$$\frac{10d_1}{x-1} + \frac{32d_1}{3(x-2)^2} - \frac{7d_1}{2(x-1)^2} - \frac{16d_1}{(x-2)^3} + \frac{5d_1}{2(x-1)^3} + \frac{32d_1}{(x-2)^4} - \frac{3d_1}{(x-1)^4} - \frac{43d_1}{6(x-1)^5}\Big) H(1;\alpha_0) + \frac{8H(0,0;\alpha_0)}{(x-1)^5} +$$

$$
\frac{4d_1H(0,1;\alpha_0)}{(x-1)^5}+\frac{4d_1\ H(1,0;\alpha_0)}{(x-1)^5}+\frac{2d_1^2H(1,1;\alpha_0)}{(x-1)^5}-\frac{34\ d_1}{3(x-2)}+\frac{4}{x-2}+\frac{40d_1}{3(x-1)}-\frac{155}{12\ (x-1)}+\frac{116d_1}{9(x-2)^2}-\frac{88}{9(x-2)^2}-
$$

$$
\frac{47\ d_1}{24(x-1)^2}+\frac{103}{12(x-1)^2}-\frac{16\ d_1}{(x-2)^3}+\frac{24}{(x-2)^3}+\frac{25d_1}{24\ (x-1)^3}-\frac{103}{12(x-1)^3}+\frac{32\ d_1}{(x-2)^4}-\frac{80}{(x-2)^4}-\frac{9d_1}{4\ (x-1)^4}+
$$

$$
\frac{145}{12(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^{\ 2}}{12(x-1)^5}+\frac{661}{36\ (x-1)^5}-\frac{535}{36}\Big)+\Big(\frac{2d_1^2}{(x-1)^5}-\frac{32\ d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2\ d_1-\frac{16}{(x-2)^5}+
$$

$$
\frac{2}{(x-1)^5}-1\Big)H(0;\alpha_0)\ H(1,1;x)+\Big(\frac{15d_1}{2(x-2)}-\frac{19d_1}{2(x-1)}-\frac{28\ d_1}{3(x-2)^2}+\frac{17d_1}{6(x-1)^2}+\frac{12\ d_1}{(x-2)^3}-\frac{3d_1}{2(x-1)^3}-
$$

$$
\frac{16\ d_1}{(x-2)^4}+\frac{d_1}{(x-1)^4}+\frac{43d_1}{6\ (x-1)^5}+\Big(-\frac{4\ d_1}{(x-1)^5}+\frac{64}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Big)\ H(0;\alpha_0)+\Big(-\frac{2d_1^2}{(x-1)^5}+\frac{32d_1}{(x-2)^5}+
$$

$$
\frac{2\ d_1}{(x-1)^5}-2d_1\Big)H(1;\alpha_0)+\frac{11}{2(x-2)}-\frac{5}{2\ (x-1)}-\frac{16}{3(x-2)^2}-\frac{7}{12(x-1)^2}+\frac{16}{3\ (x-2)^3}+\frac{5}{12\ (x-1)^3}-\frac{3}{(x-1)^4}-
$$

$$
\frac{16}{(x-2)^5}-\frac{43}{6\ (x-1)^5}+\frac{43}{6}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{32\ d_1}{(x-2)^5}-\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+1\Big)H(0;\alpha_0)\ H(2,1;x)+\Big(-
$$

$$
\frac{5\alpha_0^4}{4(x-2)}+\frac{\alpha_0^4}{2(x-1)}+\frac{3\ \alpha_0^4}{4}+\frac{5\alpha_0^3}{x-2}-\frac{2\alpha_0^3}{x-1}-\frac{10\alpha_0^3}{3\ (x-2)^2}+\frac{2\alpha_0^3}{3(x-1)^2}-4\alpha_0^3-\frac{15\alpha_0^2}{2\ (x-2)}+\frac{3\alpha_0^2}{x-1}+\frac{10\alpha_0^2}{(x-2)^2}-\frac{2\ \alpha_0^2}{(x-1)^2}-
$$

$$
\frac{10\alpha_0^2}{(x-2)^3}+\frac{\alpha_0^2}{(x-1)^3}+9\ \alpha_0^2+\frac{5\alpha_0}{x-2}-\frac{2\alpha_0}{x-1}-\frac{10\ \alpha_0}{(x-2)^2}+\frac{2\alpha_0}{(x-1)^2}+\frac{20\alpha_0}{(x-2)^3}-\frac{2\ \alpha_0}{(x-1)^3}-\frac{40\alpha_0}{(x-2)^4}+\frac{2\alpha_0}{(x-1)^4}-12\ \alpha_0+
$$

$$
\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1\ H(1;\alpha_0)}{(x-1)^5}-\frac{20}{x-2}+\frac{89}{4(x-1)}+\frac{80}{3\ (x-2)^2}-\frac{27}{4(x-1)^2}-\frac{40}{(x-2)^3}+\frac{49}{12\ (x-1)^3}+\frac{80}{(x-2)^4}-\frac{4}{(x-1)^4}-
$$

$$
\frac{43}{6\ (x-1)^5}+\frac{25}{4}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3\ (x-1)^2}+\frac{4\alpha_0^3}{3}+\frac{3\alpha_0^2}{2\ (x-1)}-\frac{\alpha_0^2}{(x-1)^2}+
$$

$$
\frac{\alpha_0^2}{2(x-1)^3}-3\ \alpha_0^2-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}+4\alpha_0-\frac{64H(0;\alpha_0)}{(x-2)^5}-\frac{32d_1\ H(1;\alpha_0)}{(x-2)^5}-\frac{2}{x-2}+\frac{1}{4(x-1)}+
$$

$$
\frac{4}{3\ (x-2)^2}+\frac{1}{3(x-1)^2}-\frac{4}{3(x-2)^3}+\frac{1}{2(x-1)^3}+\ \frac{1}{(x-1)^4}+\frac{16}{(x-2)^5}-\frac{25}{12}\Big)\ H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(8+
$$

$$
\frac{8}{(x-1)^5}\Big)\ H(0,0,0;\alpha_0)+\Big(8-\frac{8}{(x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{4\ d_1}{(x-1)^5}+4d_1\Big)\ H(0,0,1;\alpha_0)+\Big(\frac{4}{(x-1)^5}-4+
$$

$$
\frac{32}{(x-2)^5}\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}+4d_1\Big)H(0,1,0;\alpha_0)+\ \Big(\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-2\ d_1-\frac{32}{(x-2)^5}-
$$

$$
\frac{4}{(x-1)^5}+4\Big)\ H(0,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}+2d_1^2\Big)\ H(0,1,1;\alpha_0)+\Big(-\frac{32d_1}{(x-2)^5}-\frac{2d_1}{(x-1)^5}+2\ d_1+\frac{32}{(x-2)^5}+
$$

$$
\frac{4}{(x-1)^5}-4\Big)\ H(0,1,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-3+\frac{80}{(x-2)^5}\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{1}{(x-1)^5}+
$$

$$
1-\frac{64}{(x-2)^5}\ \Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4\ d_1}{(x-1)^5}-\frac{64}{(x-2)^5}-\frac{4}{(x-1)^5}+4\Big)H(1,0,0;x)+\ \Big(-\frac{2\ d_1}{(x-1)^5}-
$$

$$
\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)\ H(1,0,c_1(\alpha_0);x)+\Big(-\frac{2d_1^2}{(x-1)^5}+\frac{32\ d_1}{(x-2)^5}+\frac{4d_1}{(x-1)^5}-2\ d_1+\frac{16}{(x-2)^5}-\frac{2}{(x-1)^5}+
$$

$$
1\Big)\ H(1,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}-\frac{32\ d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2\ d_1-\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)\ H(1,1,c_1(\alpha_0);x)+
$$

$$
\Big(-\frac{2\ d_1}{(x-1)^5}+\frac{80}{(x-2)^5}+\frac{2}{(x-1)^5}-3\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{32\ d_1}{(x-2)^5}-\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+
$$

$$
1\Big)\ H(2,0,c_1(\alpha_0);x)+\Big(-\frac{32\ d_1}{(x-2)^5}+\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-1\Big)H(2,1,0;x)+\ \Big(\frac{32\ d_1}{(x-2)^5}-\frac{64}{(x-2)^5}-
$$

$$
\frac{1}{(x-1)^5}+1\Big)\ H(2,1,c_1(\alpha_0);x)+\Big(-\frac{32\ d_1}{(x-2)^5}+\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-1\Big)\ H(2,c_2(\alpha_0),c_1(\alpha_0);x)+
$$

$$
\frac{2\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{32\ H(c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-2)^5}-
$$

$$
\frac{80\ H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5}-\frac{7\pi^2}{6\ (x-2)}+\frac{7\pi^2}{16(x-1)}+\frac{11\pi^2}{9\ (x-2)^2}+\frac{\pi^2}{8(x-1)^2}-\frac{5\pi^2}{3\ (x-2)^3}-\frac{\pi^2}{36(x-1)^3}+\frac{8\pi^2}{3(x-2)^4}+
$$

$$
\frac{7\ \pi^2}{12(x-1)^4}+\frac{4\pi^2}{(x-2)^5}+\frac{43\pi^2}{36\ (x-1)^5}-\frac{28\zeta_3}{(x-2)^5}-\frac{21\zeta_3}{8\ (x-1)^5}+\frac{17\zeta_3}{8}+\frac{24\pi^2\ln 2}{(x-2)^5}+\frac{\pi^2\ln 2}{4(x-1)^5}-\frac{1}{4}\pi^2\ln 2\ -\frac{197\pi^2}{144}-\frac{15}{4}
$$

### E.7 The $\mathcal{B}$ integral for $k=2$ and $\delta=1$ and $d_1=-3$

The $\varepsilon$ expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,2,1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;1,2) \\
&= \frac{1}{\varepsilon}b_{-1}^{(1,2)}+b_0^{(1,2)}+\varepsilon b_1^{(1,2)}+\varepsilon^2 b_2^{(1,2)}+\mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{E.7}
$$

where

$$b_{-1}^{(1,2)}=-\frac{1}{6},$$

$$b_0^{(1,2)}=-\frac{\alpha_0^6}{3(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0^5}{3(x-2)}+\frac{5\ \alpha_0^5}{3(x\alpha_0-2\alpha_0-x)}-\frac{5\alpha_0^4}{4(x-2)}+\frac{\alpha_0^4}{12\ (x-1)}-\frac{10\alpha_0^4}{3(x\alpha_0-2\alpha_0-x)}+$$
$$\frac{5\alpha_0^4}{6\ (x-2)^2}+\frac{\alpha_0^4}{12}+\frac{5\alpha_0^3}{3(x-2)}-\frac{\alpha_0^3}{3\ (x-1)}+\frac{10\alpha_0^3}{3(x\alpha_0-2\alpha_0-x)}-\frac{20\alpha_0^3}{9(x-2)^2}+\frac{\alpha_0^3}{9(x-1)^2}+\frac{20\alpha_0^3}{9(x-2)^3}-\frac{4\alpha_0^3}{9}-$$
$$\frac{5\alpha_0^2}{6(x-2)}+\frac{\alpha_0^2}{2(x-1)}-\frac{5\alpha_0^2}{3(x\ \alpha_0-2\alpha_0-x)}+\frac{5\alpha_0^2}{3(x-2)^2}-\frac{\alpha_0^2}{3\ (x-1)^2}-\frac{10\alpha_0^2}{3(x-2)^3}+\frac{\alpha_0^2}{6(x-1)^3}+\frac{20\ \alpha_0^2}{3(x-2)^4}+\alpha_0^2-$$
$$\frac{\alpha_0}{3(x-1)}+\frac{\alpha_0}{3(x\alpha_0-2\ \alpha_0-x)}+\frac{\alpha_0}{3(x-1)^2}-\frac{\alpha_0}{3(x-1)^3}+\frac{\alpha_0}{3\ (x-1)^4}+\frac{80\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3}+\Bigg(\frac{1}{3\ (x-1)^5}+\frac{1}{3}+$$
$$\frac{80}{3(x-2)^5}+\frac{160}{3(x-2)^6}\Bigg)\ H(0;\alpha_0)+\Bigg(-\frac{1}{3(x-1)^5}+\frac{1}{3}-\frac{80}{3\ (x-2)^5}-\frac{160}{3(x-2)^6}\Bigg)H(0;x)+\frac{H(c_1(\alpha_0);x)}{3\ (x-1)^5}+$$
$$\Bigg(\frac{80}{3(x-2)^5}+\frac{160}{3(x-2)^6}\Bigg)\ H(c_2(\alpha_0);x)+\frac{80\ln 2}{3(x-2)^5}+\frac{160\ln 2}{3\ (x-2)^6}-\frac{11}{18},$$

$$b_1^{(1,2)}=\frac{1}{\alpha_0 x-x-2\alpha_0}\Bigg\{\frac{37x\alpha_0^5}{72}+\frac{31\alpha_0^5}{36(x-2)}-\frac{37\alpha_0^5}{72\ (x-1)}-\frac{\alpha_0^5}{12}-\frac{245x\alpha_0^4}{72}-\frac{5\alpha_0^4}{2\ (x-2)}+\frac{161\alpha_0^4}{72(x-1)}+$$
$$\frac{65\alpha_0^4}{18(x-2)^2}-\frac{5\ \alpha_0^4}{6(x-1)^2}+\frac{11\alpha_0^4}{12}+\frac{91x\alpha_0^3}{9}+\frac{13\ \alpha_0^3}{18(x-2)}-\frac{125\alpha_0^3}{36(x-1)}-\frac{40\alpha_0^3}{9\ (x-2)^2}+\frac{25\alpha_0^3}{8(x-1)^2}+\frac{20\alpha_0^3}{(x-2)^3}-\frac{59\ \alpha_0^3}{36(x-1)^3}-$$
$$\frac{307\alpha_0^3}{72}-\frac{61x\alpha_0^2}{3}+\frac{65\ \alpha_0^2}{9(x-2)}-\frac{\alpha_0^2}{6(x-1)}-\frac{43\alpha_0^2}{3\ (x-2)^2}-\frac{265\alpha_0^2}{72(x-1)^2}+\frac{400\alpha_0^2}{9\ (x-2)^3}+\frac{20\alpha_0^2}{3(x-1)^3}+\frac{1880\alpha_0^2}{9\ (x-2)^4}-\frac{95\alpha_0^2}{18(x-1)^4}+$$
$$\frac{1091\ \alpha_0^2}{72}-\frac{1}{9}\pi^2 x\alpha_0+\frac{623x\alpha_0}{54}+\frac{14\ \alpha_0}{9(x-2)}-\frac{35\alpha_0}{12(x-1)}+\frac{2\alpha_0}{3\ (x-2)^2}+\frac{61\alpha_0}{36(x-1)^2}-\frac{248\alpha_0}{9(x-2)^3}-\frac{9\ \alpha_0}{4(x-1)^3}+\frac{76\pi^2\alpha_0}{9(x-2)^4}-$$
$$\frac{3760\alpha_0}{9\ (x-2)^4}+\frac{\pi^2\alpha_0}{9(x-1)^4}-\frac{95\alpha_0}{18\ (x-1)^4}+\frac{80\pi^2\alpha_0}{9(x-2)^5}-\frac{5120\alpha_0}{9\ (x-2)^5}-\frac{\pi^2\alpha_0}{9(x-1)^5}+\frac{160\ln^2 2\,\alpha_0}{3\ (x-2)^4}+\frac{320\ln^2 2\,\alpha_0}{3(x-2)^5}+\frac{160\ln 2\ \ \alpha_0}{9(x-2)^4}+$$
$$\frac{320\ln 2\,\alpha_0}{9(x-2)^5}+\frac{2\pi^2\ \alpha_0}{9}+\frac{859\alpha_0}{108}+\frac{\pi^2 x}{9}+\frac{85x}{54}+\Bigg(-\ \frac{x\alpha_0^5}{3}-\frac{2\alpha_0^5}{3(x-2)}+\frac{\alpha_0^5}{3\ (x-1)}+\frac{19x\alpha_0^4}{9}+\frac{20\alpha_0^4}{9(x-2)}-\frac{13\ \alpha_0^4}{9(x-1)}-$$
$$\frac{20\alpha_0^4}{9(x-2)^2}+\frac{4\alpha_0^4}{9(x-1)^2}-\frac{2\alpha_0^4}{9}-\frac{52x\alpha_0^3}{9}-\frac{20\alpha_0^3}{9\ (x-2)}+\frac{22\alpha_0^3}{9(x-1)}+\frac{40\alpha_0^3}{9(x-2)^2}-\frac{14\ \alpha_0^3}{9(x-1)^2}-\frac{80\alpha_0^3}{9(x-2)^3}+\frac{2\alpha_0^3}{3\ (x-1)^3}+\frac{4\alpha_0^3}{3}+$$
$$\frac{28x\alpha_0^2}{3}-\frac{2\ \alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}-\frac{160\ \alpha_0^2}{3(x-2)^4}+\frac{4\alpha_0^2}{3(x-1)^4}-4\alpha_0^2-\frac{11x\ \alpha_0}{2}-\frac{128\alpha_0}{9(x-2)}+\frac{31\alpha_0}{2(x-1)}+\frac{152\ \alpha_0}{9(x-2)^2}-$$
$$\frac{37\alpha_0}{9(x-1)^2}-\frac{16\ \alpha_0}{(x-2)^3}+\frac{47\alpha_0}{18(x-1)^3}+\frac{2080\alpha_0}{9\ (x-2)^4}+\frac{97\alpha_0}{36(x-1)^4}+\frac{2240\alpha_0}{9\ (x-2)^5}-\frac{47\alpha_0}{18(x-1)^5}-\frac{37\ \alpha_0}{12}+\frac{x}{6}-\frac{88}{9(x-2)}+\frac{10}{x-1}+$$
$$\frac{104}{9\ (x-2)^2}-\frac{25}{18(x-1)^2}-\frac{160}{9(x-2)^3}+\frac{1}{9\ (x-1)^3}-\frac{832}{9(x-2)^4}-\frac{139}{36(x-1)^4}-\frac{2560}{9\ (x-2)^5}-\frac{47}{18(x-1)^5}-\frac{640}{9(x-2)^6}+$$
$$\frac{3}{4}\Bigg)\ H(0;\alpha_0)+\Bigg(\frac{x\alpha_0^5}{2}+\frac{\alpha_0^5}{x-2}-\frac{\alpha_0^5}{2\ (x-1)}-\frac{19x\alpha_0^4}{6}-\frac{10\alpha_0^4}{3(x-2)}+\frac{13\ \alpha_0^4}{6(x-1)}+\frac{10\alpha_0^4}{3(x-2)^2}-\frac{2\alpha_0^4}{3(x-1)^2}+\frac{\alpha_0^4}{3}+$$
$$\frac{26x\alpha_0^3}{3}+\frac{10\alpha_0^3}{3\ (x-2)}-\frac{11\alpha_0^3}{3(x-1)}-\frac{20\alpha_0^3}{3(x-2)^2}+\frac{7\ \alpha_0^3}{3(x-1)^2}+\frac{40\alpha_0^3}{3(x-2)^3}-\frac{\alpha_0^3}{(x-1)^3}-2\ \alpha_0^3-14x\alpha_0^2+\frac{3\alpha_0^2}{x-1}-\frac{3\alpha_0^2}{(x-1)^2}+$$
$$\frac{3\ \alpha_0^2}{(x-1)^3}+\frac{80\alpha_0^2}{(x-2)^4}-\frac{2\alpha_0^2}{(x-1)^4}+6\ \alpha_0^2+\frac{73x\alpha_0}{6}-\frac{5\alpha_0}{3(x-2)}-\frac{7\alpha_0}{6(x-1)}+\frac{20\alpha_0}{3(x-2)^2}+\frac{5\alpha_0}{3(x-1)^2}-\frac{40\ \alpha_0}{(x-2)^3}-\frac{3\alpha_0}{(x-1)^3}-$$
$$\frac{320\alpha_0}{(x-2)^4}-\frac{320\ \alpha_0}{(x-2)^5}-\frac{10\alpha_0}{3}-\frac{25x}{6}+\frac{2}{3\ (x-2)}+\frac{1}{6(x-1)}-\frac{10}{3(x-2)^2}-\frac{1}{3\ (x-1)^2}+\frac{80}{3\ (x-2)^3}+\frac{1}{(x-1)^3}+\frac{240}{(x-2)^4}+$$
$$\frac{2}{(x-1)^4}+\frac{320}{(x-2)^5}-1\Bigg)H(1;\alpha_0)+\Bigg(\frac{2x\alpha_0}{3}+\frac{112\ \alpha_0}{3(x-2)^4}-\frac{8\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3\ (x-2)^5}+\frac{8\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2\ x}{3}-$$
$$\frac{112}{3(x-2)^4}+\frac{8}{3(x-1)^4}-\frac{544}{3\ (x-2)^5}+\frac{8}{3(x-1)^5}-\frac{640}{3(x-2)^6}\Bigg)H(0;\alpha_0)\ H(1;x)+\Bigg(-\frac{x\alpha_0^5}{6}-\frac{\alpha_0^5}{3(x-2)}+\frac{\alpha_0^5}{6\ (x-1)}+$$
$$\frac{\alpha_0^5}{4}+\frac{19x\alpha_0^4}{18}+\frac{23\alpha_0^4}{18\ (x-2)}-\frac{13\alpha_0^4}{18(x-1)}-\frac{10\alpha_0^4}{9(x-2)^2}+\frac{2\ \alpha_0^4}{9(x-1)^2}-\frac{49\alpha_0^4}{36}-\frac{26x\alpha_0^3}{9}-\frac{16\ \alpha_0^3}{9(x-2)}+\frac{11\alpha_0^3}{9(x-1)}+\frac{26\alpha_0^3}{9\ (x-2)^2}-$$
$$\frac{7\alpha_0^3}{9(x-1)^2}-\frac{40\alpha_0^3}{9\ (x-2)^3}+\frac{\alpha_0^3}{3(x-1)^3}+\frac{19\alpha_0^3}{6}+\frac{14x\ \alpha_0^2}{3}+\frac{\alpha_0^2}{x-2}-\frac{\alpha_0^2}{x-1}-\frac{2\ \alpha_0^2}{(x-2)^2}+\frac{\alpha_0^2}{(x-1)^2}+\frac{4\ \alpha_0^2}{(x-2)^3}-\frac{\alpha_0^2}{(x-1)^3}-$$
$$\frac{80\alpha_0^2}{3\ (x-2)^4}+\frac{2\alpha_0^2}{3(x-1)^4}-\frac{9\alpha_0^2}{2}-\frac{73x\ \alpha_0}{18}-\frac{128\alpha_0}{9(x-2)}+\frac{31\alpha_0}{2(x-1)}+\frac{152\ \alpha_0}{9(x-2)^2}-\frac{37\alpha_0}{9(x-1)^2}-\frac{16\ \alpha_0}{(x-2)^3}+\frac{47\alpha_0}{18(x-1)^3}+\frac{144\ \alpha_0}{(x-2)^4}+$$
$$\frac{73\alpha_0}{36(x-1)^4}+\frac{320\alpha_0}{3\ (x-2)^5}-\frac{47\alpha_0}{18(x-1)^5}+\frac{61\alpha_0}{36}+\frac{25x}{18}+\ \Bigg(-\frac{4\alpha_0}{3(x-1)^4}+\frac{4\alpha_0}{3(x-1)^5}+\frac{4}{3\ (x-1)^4}+\frac{4}{3(x-1)^5}\Bigg)H(0;\alpha_0)+$$
$$\Bigg(\frac{2\ \alpha_0}{(x-1)^4}-\frac{2\ \alpha_0}{(x-1)^5}-\frac{2}{(x-1)^4}-\frac{2}{(x-1)^5}\Bigg)\ H(1;\alpha_0)-\frac{88}{9(x-2)}+\frac{10}{x-1}+\frac{104}{9\ (x-2)^2}-\frac{25}{18(x-1)^2}-\frac{160}{9(x-2)^3}+$$
$$\frac{1}{9\ (x-1)^3}-\frac{224}{3(x-2)^4}-\frac{139}{36(x-1)^4}-\frac{640}{3\ (x-2)^5}-\frac{47}{18(x-1)^5}+\frac{3}{4}\Bigg)\ H(c_1(\alpha_0);x)+\Bigg(\frac{160\alpha_0}{9(x-2)^4}+\frac{320\alpha_0}{9\ (x-2)^5}+\Bigg(-$$
$$\frac{320\alpha_0}{3(x-2)^4}-\frac{640\alpha_0}{3\ (x-2)^5}+\frac{320}{3(x-2)^4}+\frac{1280}{3(x-2)^5}+\frac{1280}{3\ (x-2)^6}\Bigg)H(0;\alpha_0)+\Bigg(\frac{160\alpha_0}{(x-2)^4}+\frac{320\ \alpha_0}{(x-2)^5}-\frac{160}{(x-2)^4}-\frac{640}{(x-2)^5}-$$
$$\frac{640}{(x-2)\ ^6}\Bigg)H(1;\alpha_0)-\frac{160}{9(x-2)^4}-\frac{640}{9\ (x-2)^5}-\frac{640}{9(x-2)^6}\Bigg)H(c_2(\alpha_0);x)+\Bigg(-\frac{4x\ \alpha_0}{3}-\frac{320\alpha_0}{3(x-2)^4}-\frac{4\alpha_0}{3(x-1)^4}-$$
$$\frac{640\ \alpha_0}{3(x-2)^5}+\frac{4\alpha_0}{3(x-1)^5}+\frac{8\alpha_0}{3}+\frac{4\ x}{3}+\frac{320}{3(x-2)^4}+\frac{4}{3(x-1)^4}+\frac{1280}{3\ (x-2)^5}+\frac{4}{3(x-1)^5}+\frac{1280}{3(x-2)^6}\Bigg)\ H(0,0;\alpha_0)+$$

$$\Big(-\frac{4x\alpha_0}{3}+\frac{320\alpha_0}{3(x-2)^4}+\frac{4\alpha_0}{3(x-1)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3(x-1)^5}+\frac{8\alpha_0}{3}+\frac{4x}{3}-\frac{320}{3(x-2)^4}-\frac{4}{3(x-1)^4}-\frac{1280}{3(x-2)^5}-$$
$$\frac{4}{3(x-1)^5}-\frac{1280}{3(x-2)^6}\Big)H(0,0;x)+\Big(2x\alpha_0+\frac{160\alpha_0}{(x-2)^4}+\frac{2\alpha_0}{(x-1)^4}+\frac{320\alpha_0}{(x-2)^5}-\frac{2\alpha_0}{(x-1)^5}-4\alpha_0-2x-\frac{160}{(x-2)^4}-$$
$$\frac{2}{(x-1)^4}-\frac{640}{(x-2)^5}-\frac{2}{(x-1)^5}-\frac{640}{(x-2)^6}\Big)H(0,1;\alpha_0)+\Big(\frac{2x\alpha_0}{3}+\frac{112\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-$$
$$\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{112}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{544}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{640}{3(x-2)^6}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{320\alpha_0}{3(x-2)^4}-$$
$$\frac{640\alpha_0}{3(x-2)^5}+\frac{320}{3(x-2)^4}+\frac{1280}{3(x-2)^5}+\frac{1280}{3(x-2)^6}\Big)H(0,c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-\frac{112\alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}-$$
$$\frac{8\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+\frac{112}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{544}{3(x-2)^5}-\frac{8}{3(x-1)^5}+\frac{640}{3(x-2)^6}\Big)H(1,0;x)+\Big(\frac{2x\alpha_0}{3}+$$
$$\frac{112\alpha_0}{3(x-2)^4}-\frac{8\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}+\frac{8\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{112}{3(x-2)^4}+\frac{8}{3(x-1)^4}-\frac{544}{3(x-2)^5}+\frac{8}{3(x-1)^5}-$$
$$\frac{640}{3(x-2)^6}\Big)H(1,c_1(\alpha_0);x)+\Big(-\frac{800\alpha_0}{3(x-2)^4}-\frac{1600\alpha_0}{3(x-2)^5}+\frac{800}{3(x-2)^4}+\frac{3200}{3(x-2)^5}+\frac{3200}{3(x-2)^6}\Big)H(2,0;x)+$$
$$\Big(\frac{800\alpha_0}{3(x-2)^4}+\frac{1600\alpha_0}{3(x-2)^5}-\frac{800}{3(x-2)^4}-\frac{3200}{3(x-2)^5}-\frac{3200}{3(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+\Big(-\frac{2\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3(x-1)^5}+$$
$$\frac{2}{3(x-1)^4}+\frac{2}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{112\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{112}{3(x-2)^4}+\frac{544}{3(x-2)^5}+$$
$$\frac{640}{3(x-2)^6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+H(0;x)\Big(\frac{47x\alpha_0}{18}+\frac{128\alpha_0}{9(x-2)}-\frac{31\alpha_0}{2(x-1)}-\frac{152\alpha_0}{9(x-2)^2}+\frac{37\alpha_0}{9(x-1)^2}+\frac{16\alpha_0}{(x-2)^3}-$$
$$\frac{47\alpha_0}{18(x-1)^3}-\frac{1120\alpha_0}{9(x-2)^4}-\frac{49\alpha_0}{36(x-1)^4}-\frac{320\alpha_0}{9(x-2)^5}+\frac{47\alpha_0}{18(x-1)^5}-\frac{320\ln 2\,\alpha_0}{3(x-2)^4}-\frac{640\ln 2\,\alpha_0}{3(x-2)^5}-\frac{161\alpha_0}{36}-\frac{47x}{18}+\frac{88}{9(x-2)}-$$
$$\frac{10}{x-1}-\frac{104}{9(x-2)^2}+\frac{25}{18(x-1)^2}+\frac{160}{9(x-2)^3}-\frac{1}{9(x-1)^3}+\frac{832}{9(x-2)^4}+\frac{139}{36(x-1)^4}+\frac{2560}{9(x-2)^5}+\frac{47}{18(x-1)^5}+\frac{640}{9(x-2)^6}+$$
$$\frac{320\ln 2}{3(x-2)^4}+\frac{1280\ln 2}{3(x-2)^5}+\frac{1280\ln 2}{3(x-2)^6}-\frac{3}{4}\Big)+H(2;x)\Big(\frac{800\ln 2\,\alpha_0}{3(x-2)^4}+\frac{1600\ln 2\,\alpha_0}{3(x-2)^5}+\Big(\frac{800\alpha_0}{3(x-2)^4}+\frac{1600\alpha_0}{3(x-2)^5}-$$
$$\frac{800}{3(x-2)^4}-\frac{3200}{3(x-2)^5}-\frac{3200}{3(x-2)^6}\Big)H(0;\alpha_0)-\frac{800\ln 2}{3(x-2)^4}-\frac{3200\ln 2}{3(x-2)^5}-\frac{3200\ln 2}{3(x-2)^6}\Big)-\frac{76\pi^2}{9(x-2)^4}-\frac{\pi^2}{9(x-1)^4}-$$
$$\frac{232\pi^2}{9(x-2)^5}-\frac{\pi^2}{9(x-1)^5}-\frac{160\pi^2}{9(x-2)^6}-\frac{160\ln^2 2}{3(x-2)^4}-\frac{640\ln^2 2}{3(x-2)^5}-\frac{640\ln^2 2}{3(x-2)^6}-\frac{160\ln 2}{9(x-2)^4}-\frac{640\ln 2}{9(x-2)^5}-\frac{640\ln 2}{9(x-2)^6}\Big\},$$

$$b_2^{(1,2)}=\frac{1}{\alpha_0 x-x-2\alpha_0}\Big\{-\frac{1}{72}\pi^2x\alpha_0^5+\frac{895x\alpha_0^5}{432}-\frac{\pi^2\alpha_0^5}{36(x-2)}+\frac{673\alpha_0^5}{216(x-2)}+\frac{\pi^2\alpha_0^5}{72(x-1)}-\frac{895\alpha_0^5}{432(x-1)}-\frac{37\alpha_0^5}{72}+$$
$$\frac{19}{216}\pi^2x\alpha_0^4-\frac{18829x\alpha_0^4}{1296}+\frac{5\pi^2\alpha_0^4}{54(x-2)}-\frac{2345\alpha_0^4}{324(x-2)}-\frac{13\pi^2\alpha_0^4}{216(x-1)}+\frac{12073\alpha_0^4}{1296(x-1)}-\frac{5\pi^2\alpha_0^4}{54(x-2)^2}+\frac{5405\alpha_0^4}{324(x-2)^2}+$$
$$\frac{\pi^2\alpha_0^4}{54(x-1)^2}-\frac{1351\alpha_0^4}{324(x-1)^2}-\frac{\pi^2\alpha_0^4}{108}+\frac{3691\alpha_0^4}{648}-\frac{13}{54}\pi^2x\alpha_0^3+\frac{7859x\alpha_0^3}{162}-\frac{5\pi^2\alpha_0^3}{54(x-2)}-\frac{3451\alpha_0^3}{324(x-2)}+\frac{11\pi^2\alpha_0^3}{108(x-1)}-$$
$$\frac{7985\alpha_0^3}{648(x-1)}+\frac{5\pi^2\alpha_0^3}{27(x-2)^2}-\frac{115\alpha_0^3}{81(x-2)^2}-\frac{7\pi^2\alpha_0^3}{108(x-1)^2}+\frac{22919\alpha_0^3}{1296(x-1)^2}-\frac{10\pi^2\alpha_0^3}{27(x-2)^3}+\frac{10580\alpha_0^3}{81(x-2)^3}+\frac{\pi^2\alpha_0^3}{36(x-1)^3}-$$
$$\frac{2401\alpha_0^3}{216(x-1)^3}+\frac{\pi^2\alpha_0^3}{18}-\frac{12859\alpha_0^3}{432}+\frac{7}{18}\pi^2x\alpha_0^2-\frac{7613x\alpha_0^2}{54}+\frac{211\alpha_0^2}{2(x-2)}-\frac{\pi^2\alpha_0^2}{12(x-1)}-\frac{823\alpha_0^2}{18(x-1)}-\frac{3931\alpha_0^2}{18(x-2)^2}+$$
$$\frac{\pi^2\alpha_0^2}{12(x-1)^2}-\frac{685\alpha_0^2}{48(x-1)^2}+\frac{7600\alpha_0^2}{9(x-2)^3}-\frac{\pi^2\alpha_0^2}{12(x-1)^3}+\frac{2507\alpha_0^2}{36(x-1)^3}-\frac{20\pi^2\alpha_0^2}{9(x-2)^4}+\frac{66760\alpha_0^2}{27(x-2)^4}+\frac{\pi^2\alpha_0^2}{18(x-1)^4}-\frac{6685\alpha_0^2}{108(x-1)^4}-$$
$$\frac{\pi^2\alpha_0^2}{6}+\frac{22817\alpha_0^2}{144}-\frac{29}{24}\pi^2x\alpha_0+\frac{16423x\alpha_0}{162}-\frac{10\pi^2\alpha_0}{9(x-2)}+\frac{65\alpha_0}{3(x-2)}+\frac{409\pi^2\alpha_0}{216(x-1)}-\frac{3017\alpha_0}{72(x-1)}+\frac{2\pi^2\alpha_0}{3(x-2)^2}+$$
$$\frac{13\alpha_0}{(x-2)^2}-\frac{4\pi^2\alpha_0}{9(x-1)^2}+\frac{1715\alpha_0}{72(x-1)^2}+\frac{8\pi^2\alpha_0}{3(x-2)^3}-\frac{4936\alpha_0}{9(x-2)^3}+\frac{55\pi^2\alpha_0}{108(x-1)^3}-\frac{1033\alpha_0}{24(x-1)^3}+\frac{1136\pi^2\alpha_0}{27(x-2)^4}-\frac{133520\alpha_0}{27(x-2)^4}+$$
$$\frac{55\pi^2\alpha_0}{108(x-1)^4}-\frac{6685\alpha_0}{108(x-1)^4}+\frac{400\pi^2\alpha_0}{27(x-2)^5}-\frac{154240\alpha_0}{27(x-2)^5}-\frac{47\pi^2\alpha_0}{54(x-1)^5}+\frac{17}{12}x\zeta_3\alpha_0+\frac{56\zeta_3\alpha_0}{3(x-2)^4}-\frac{7\zeta_3\alpha_0}{4(x-1)^4}+$$
$$\frac{280\zeta_3\alpha_0}{3(x-2)^5}+\frac{7\zeta_3\alpha_0}{4(x-1)^5}-\frac{17}{6}\zeta_3\alpha_0+\frac{640\ln^3 2\,\alpha_0}{9(x-2)^4}+\frac{1280\ln^3 2\,\alpha_0}{9(x-2)^5}+\frac{320\ln^2 2\,\alpha_0}{9(x-2)^4}+\frac{640\ln^2 2\,\alpha_0}{9(x-2)^5}-\frac{1}{6}\pi^2x\ln 2\,\alpha_0+$$
$$\frac{112\pi^2\ln 2\,\alpha_0}{3(x-2)^4}+\frac{320\ln 2\,\alpha_0}{27(x-2)^4}+\frac{\pi^2\ln 2\,\alpha_0}{6(x-1)^4}+\frac{80\pi^2\ln 2\,\alpha_0}{3(x-2)^5}+\frac{640\ln 2\,\alpha_0}{27(x-2)^5}-\frac{\pi^2\ln 2\,\alpha_0}{6(x-1)^5}+\frac{1}{3}\pi^2\ln 2\,\alpha_0+\frac{95\pi^2\alpha_0}{72}+$$
$$\frac{20569\alpha_0}{648}+\frac{71\pi^2x}{72}+\frac{575x}{162}+\Big(-\frac{37x\alpha_0^5}{18}-\frac{31\alpha_0^5}{9(x-2)}+\frac{37\alpha_0^5}{18(x-1)}+\frac{\alpha_0^5}{3}+\frac{245x\alpha_0^4}{18}+\frac{10\alpha_0^4}{x-2}-\frac{161\alpha_0^4}{18(x-1)}-\frac{130\alpha_0^4}{9(x-2)^2}+$$
$$\frac{10\alpha_0^4}{3(x-1)^2}-\frac{11\alpha_0^4}{3}-\frac{364x\alpha_0^3}{9}-\frac{26\alpha_0^3}{9(x-2)}+\frac{125\alpha_0^3}{9(x-1)}+\frac{160\alpha_0^3}{9(x-2)^2}-\frac{25\alpha_0^3}{2(x-1)^2}-\frac{80\alpha_0^3}{(x-2)^3}+\frac{59\alpha_0^3}{9(x-1)^3}+\frac{307\alpha_0^3}{18}+$$
$$\frac{244x\alpha_0^2}{3}-\frac{260\alpha_0^2}{9(x-2)}+\frac{2\alpha_0^2}{3(x-1)}+\frac{172\alpha_0^2}{3(x-2)^2}+\frac{265\alpha_0^2}{18(x-1)^2}-\frac{1600\alpha_0^2}{9(x-2)^3}-\frac{80\alpha_0^2}{3(x-1)^3}-\frac{7520\alpha_0^2}{9(x-2)^4}+\frac{190\alpha_0^2}{9(x-1)^4}-\frac{1091\alpha_0^2}{18}-$$
$$\frac{1}{18}\pi^2x\alpha_0-\frac{7109x\alpha_0}{108}-\frac{1804\alpha_0}{9(x-2)}+\frac{2002\alpha_0}{9(x-1)}+\frac{1936\alpha_0}{9(x-2)^2}-\frac{413\alpha_0}{9(x-1)^2}-\frac{496\alpha_0}{9(x-2)^3}+\frac{227\alpha_0}{6(x-1)^3}-\frac{40\pi^2\alpha_0}{9(x-2)^4}+$$
$$\frac{76160\alpha_0}{27(x-2)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{5381\alpha_0}{216(x-1)^4}-\frac{80\pi^2\alpha_0}{9(x-2)^5}+\frac{62080\alpha_0}{27(x-2)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}-\frac{2125\alpha_0}{108(x-1)^5}+\frac{\pi^2\alpha_0}{9}-\frac{811\alpha_0}{216}+$$

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$$\frac{\pi^2 x}{18}+\frac{1445x}{108}-\frac{1372}{9(x-2)}+\frac{5705}{36(x-1)}+\frac{512}{3(x-2)^2}-\frac{475}{36(x-1)^2}-\frac{2432}{9(x-2)^3}-\frac{35}{12(x-1)^3}+\frac{40\pi^2}{9(x-2)^4}-\frac{22112}{27(x-2)^4}+$$
$$\frac{\pi^2}{18(x-1)^4}-\frac{7679}{216(x-1)^4}+\frac{160\pi^2}{9(x-2)^5}-\frac{62720}{27(x-2)^5}+\frac{\pi^2}{18(x-1)^5}-\frac{2125}{108(x-1)^5}+\frac{160\pi^2}{9(x-2)^6}-\frac{1280}{27(x-2)^6}+$$
$$\frac{271}{24}\Big) H(0;\alpha_0)+\Big(\frac{37x\alpha_0^5}{12}+\frac{31\alpha_0^5}{6(x-2)}-\frac{37\alpha_0^5}{12(x-1)}-\frac{\alpha_0^5}{2}-\frac{245x\alpha_0^4}{12}-\frac{15\alpha_0^4}{x-2}+\frac{161\alpha_0^4}{12(x-1)}+\frac{65\alpha_0^4}{3(x-2)^2}-\frac{5\alpha_0^4}{(x-1)^2}+$$
$$\frac{11\alpha_0^4}{2}+\frac{182x\alpha_0^3}{3}+\frac{13\alpha_0^3}{3(x-2)}-\frac{125\alpha_0^3}{6(x-1)}-\frac{80\alpha_0^3}{3(x-2)^2}+\frac{75\alpha_0^3}{4(x-1)^2}+\frac{120\alpha_0^3}{(x-2)^3}-\frac{59\alpha_0^3}{6(x-1)^3}-\frac{307\alpha_0^3}{12}-122x\alpha_0^2+\frac{130\alpha_0^2}{3(x-2)}-$$
$$\frac{\alpha_0^2}{x-1}-\frac{86\alpha_0^2}{(x-2)^2}-\frac{265\alpha_0^2}{12(x-1)^2}+\frac{800\alpha_0^2}{3(x-2)^3}+\frac{40\alpha_0^2}{(x-1)^3}+\frac{3760\alpha_0^2}{3(x-2)^4}-\frac{95\alpha_0^2}{3(x-1)^4}+\frac{1091\alpha_0^2}{12}+\frac{513x\alpha_0}{4}-\frac{205\alpha_0}{6(x-2)}-$$
$$\frac{25\alpha_0}{12(x-1)}+\frac{344\alpha_0}{3(x-2)^2}+\frac{211\alpha_0}{12(x-1)^2}-\frac{792\alpha_0}{(x-2)^3}-\frac{107\alpha_0}{2(x-1)^3}-\frac{12640\alpha_0}{3(x-2)^4}-\frac{10240\alpha_0}{3(x-2)^5}-\frac{245\alpha_0}{4}-\frac{595x}{12}-\frac{11}{3(x-2)}+$$
$$\frac{163}{12(x-1)}-\frac{71}{3(x-2)^2}-\frac{37}{4(x-1)^2}+\frac{1216}{3(x-2)^3}+\frac{70}{3(x-1)^3}+\frac{2960}{(x-2)^4}+\frac{95}{3(x-1)^4}+\frac{10240}{3(x-2)^5}-\frac{109}{12}\Big)H(1;\alpha_0)+$$
$$\Big(\frac{4x\alpha_0^5}{3}+\frac{8\alpha_0^5}{3(x-2)}-\frac{4\alpha_0^5}{3(x-1)}-\frac{76x\alpha_0^4}{9}-\frac{80\alpha_0^4}{9(x-2)}+\frac{52\alpha_0^4}{9(x-1)}+\frac{80\alpha_0^4}{9(x-2)^2}-\frac{16\alpha_0^4}{9(x-1)^2}+\frac{8\alpha_0^4}{9}+\frac{208x\alpha_0^3}{9}+\frac{80\alpha_0^3}{9(x-2)}-$$
$$\frac{88\alpha_0^3}{9(x-1)}-\frac{160\alpha_0^3}{9(x-2)^2}+\frac{56\alpha_0^3}{9(x-1)^2}+\frac{320\alpha_0^3}{9(x-2)^3}-\frac{8\alpha_0^3}{3(x-1)^3}-\frac{16\alpha_0^3}{3}-\frac{112x\alpha_0^2}{3}+\frac{8\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+\frac{8\alpha_0^2}{(x-1)^3}+$$
$$\frac{640\alpha_0^2}{3(x-2)^4}-\frac{16\alpha_0^2}{3(x-1)^4}+16\alpha_0^2+22x\alpha_0+\frac{512\alpha_0}{9(x-2)}-\frac{62\alpha_0}{x-1}-\frac{608\alpha_0}{9(x-2)^2}+\frac{148\alpha_0}{9(x-1)^2}+\frac{64\alpha_0}{(x-2)^3}-\frac{94\alpha_0}{9(x-1)^3}-$$
$$\frac{8320\alpha_0}{9(x-2)^4}-\frac{97\alpha_0}{9(x-1)^4}-\frac{8960\alpha_0}{9(x-2)^5}+\frac{94\alpha_0}{9(x-1)^5}+\frac{37\alpha_0}{3}-\frac{2x}{3}+\frac{352}{9(x-2)}-\frac{40}{x-1}-\frac{416}{9(x-2)^2}+\frac{50}{9(x-1)^2}+\frac{640}{9(x-2)^3}-$$
$$\frac{4}{9(x-1)^3}+\frac{3328}{9(x-2)^4}+\frac{139}{9(x-1)^4}+\frac{10240}{9(x-2)^5}+\frac{94}{9(x-1)^5}+\frac{2560}{9(x-2)^6}-3\Big)H(0,0;\alpha_0)+\Big(-2x\alpha_0^5-\frac{4\alpha_0^5}{x-2}+$$
$$\frac{2\alpha_0^5}{x-1}+\frac{38x\alpha_0^4}{3}+\frac{40\alpha_0^4}{3(x-2)}-\frac{26\alpha_0^4}{3(x-1)}-\frac{40\alpha_0^4}{3(x-2)^2}+\frac{8\alpha_0^4}{3(x-1)^2}-\frac{4\alpha_0^4}{3}-\frac{104x\alpha_0^3}{3}-\frac{40\alpha_0^3}{3(x-2)}+\frac{44\alpha_0^3}{3(x-1)}+\frac{80\alpha_0^3}{3(x-2)^2}-$$
$$\frac{28\alpha_0^3}{3(x-1)^2}-\frac{160\alpha_0^3}{3(x-2)^3}+\frac{4\alpha_0^3}{(x-1)^3}+8\alpha_0^3+56x\alpha_0^2-\frac{12\alpha_0^2}{x-1}+\frac{12\alpha_0^2}{(x-1)^2}-\frac{12\alpha_0^2}{(x-1)^3}-\frac{320\alpha_0^2}{(x-2)^4}+\frac{8\alpha_0^2}{(x-1)^4}-24\alpha_0^2-$$
$$33x\alpha_0-\frac{256\alpha_0}{3(x-2)}+\frac{93\alpha_0}{x-1}+\frac{304\alpha_0}{3(x-2)^2}-\frac{74\alpha_0}{3(x-1)^2}-\frac{96\alpha_0}{(x-2)^3}+\frac{47\alpha_0}{3(x-1)^3}+\frac{4160\alpha_0}{3(x-2)^4}+\frac{97\alpha_0}{6(x-1)^4}+\frac{4480\alpha_0}{3(x-2)^5}-$$
$$\frac{47\alpha_0}{3(x-1)^5}-\frac{37\alpha_0}{2}+x-\frac{176}{3(x-2)}+\frac{60}{x-1}+\frac{208}{3(x-2)^2}-\frac{25}{3(x-1)^2}-\frac{320}{3(x-2)^3}+\frac{2}{3(x-1)^3}-\frac{1664}{3(x-2)^4}-\frac{139}{6(x-1)^4}-$$
$$\frac{5120}{3(x-2)^5}-\frac{47}{3(x-1)^5}-\frac{1280}{3(x-2)^6}+\frac{9}{2}\Big)H(0,1;\alpha_0)+H(1;x)\Big(\frac{1}{9}\pi^2x\alpha_0+\frac{16\pi^2\alpha_0}{(x-2)^4}-\frac{8\pi^2\alpha_0}{9(x-1)^4}+\frac{80\pi^2\alpha_0}{3(x-2)^5}+$$
$$\frac{8\pi^2\alpha_0}{9(x-1)^5}-\frac{2\pi^2\alpha_0}{9}-\frac{\pi^2 x}{9}+\Big(\frac{47x\alpha_0}{9}+\frac{838\alpha_0}{9(x-2)}-\frac{102\alpha_0}{x-1}-\frac{1000\alpha_0}{9(x-2)^2}+\frac{433\alpha_0}{18(x-1)^2}+\frac{128\alpha_0}{(x-2)^3}-\frac{113\alpha_0}{9(x-1)^3}-$$
$$\frac{4288\alpha_0}{9(x-2)^4}-\frac{137\alpha_0}{9(x-1)^4}+\frac{640\alpha_0}{9(x-2)^5}+\frac{188\alpha_0}{9(x-1)^5}-\frac{77\alpha_0}{18}-\frac{47x}{9}+\frac{578}{9(x-2)}-\frac{203}{3(x-1)}-\frac{676}{9(x-2)^2}+\frac{185}{18(x-1)^2}+$$
$$\frac{848}{9(x-2)^3}-\frac{11}{9(x-1)^3}+\frac{1984}{9(x-2)^4}+\frac{239}{9(x-1)^4}+\frac{7936}{9(x-2)^5}+\frac{188}{9(x-1)^5}-\frac{1280}{9(x-2)^6}-\frac{37}{6}\Big)H(0;\alpha_0)+\Big(-\frac{8x\alpha_0}{3}-$$
$$\frac{448\alpha_0}{3(x-2)^4}+\frac{32\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-\frac{32\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{448}{3(x-2)^4}-\frac{32}{3(x-1)^4}+\frac{2176}{3(x-2)^5}-\frac{32}{3(x-1)^5}+$$
$$\frac{2560}{3(x-2)^6}\Big)H(0,0;\alpha_0)+\Big(4x\alpha_0+\frac{224\alpha_0}{(x-2)^4}-\frac{16\alpha_0}{(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}+\frac{16\alpha_0}{(x-1)^5}-8\alpha_0-4x-\frac{224}{(x-2)^4}+\frac{16}{(x-1)^4}-$$
$$\frac{1088}{(x-2)^5}+\frac{16}{(x-1)^5}-\frac{1280}{(x-2)^6}\Big)H(0,1;\alpha_0)-\frac{16\pi^2}{(x-2)^4}+\frac{8\pi^2}{9(x-1)^4}-\frac{176\pi^2}{3(x-2)^5}+\frac{8\pi^2}{9(x-1)^5}-\frac{160\pi^2}{3(x-2)^6}\Big)+\Big(-$$
$$\frac{20x\alpha_0}{3}-\frac{1216\alpha_0}{3(x-2)^4}+\frac{20\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{20\alpha_0}{3(x-1)^5}+\frac{40\alpha_0}{3}+\frac{20x}{3}+\frac{1216}{3(x-2)^4}-\frac{20}{3(x-1)^4}+\frac{5632}{3(x-2)^5}-$$
$$\frac{20}{3(x-1)^5}+\frac{6400}{3(x-2)^6}\Big)H(0;\alpha_0)\,H(0,1;x)+\Big(\frac{\alpha_0^5}{2}+\frac{\alpha_0^4}{3(x-2)}-\frac{5\alpha_0^4}{2}-\frac{4\alpha_0^3}{3(x-2)}+\frac{4\alpha_0^3}{3(x-2)^2}+5\alpha_0^3+\frac{2\alpha_0^2}{x-2}-$$
$$\frac{4\alpha_0^2}{(x-2)^2}+\frac{8\alpha_0^2}{(x-2)^3}-5\alpha_0^2+\frac{47x\alpha_0}{9}+\frac{64\alpha_0}{9(x-2)}-\frac{34\alpha_0}{3(x-1)}-\frac{40\alpha_0}{9(x-2)^2}+\frac{49\alpha_0}{18(x-1)^2}-\frac{16\alpha_0}{(x-2)^3}-\frac{26\alpha_0}{9(x-1)^3}-\frac{1696\alpha_0}{9(x-2)^4}-$$
$$\frac{55\alpha_0}{18(x-1)^4}+\frac{640\alpha_0}{9(x-2)^5}+\frac{47\alpha_0}{9(x-1)^5}-\frac{52\alpha_0}{9}-\frac{47x}{9}+\Big(-\frac{8x\alpha_0}{3}-\frac{448\alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-\frac{8\alpha_0}{3(x-1)^5}+$$
$$\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{448}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{2176}{3(x-2)^5}-\frac{8}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(4x\alpha_0+\frac{224\alpha_0}{(x-2)^4}-$$
$$\frac{4\alpha_0}{(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}+\frac{4\alpha_0}{(x-1)^5}-8\alpha_0-4x-\frac{224}{(x-2)^4}+\frac{4}{(x-1)^4}-\frac{1088}{(x-2)^5}+\frac{4}{(x-1)^5}-\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+$$
$$\frac{56}{9(x-2)}-\frac{22}{3(x-1)}-\frac{88}{9(x-2)^2}+\frac{23}{18(x-1)^2}+\frac{224}{9(x-2)^3}+\frac{13}{9(x-1)^3}+\frac{1696}{9(x-2)^4}+\frac{133}{18(x-1)^4}+\frac{2176}{9(x-2)^5}+$$
$$\frac{47}{9(x-1)^5}-\frac{1280}{9(x-2)^6}-\frac{8}{3}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{640\alpha_0}{9(x-2)^4}-\frac{1280\alpha_0}{9(x-2)^5}+\Big(\frac{1280\alpha_0}{3(x-2)^4}+\frac{2560\alpha_0}{3(x-2)^5}-\frac{1280}{3(x-2)^4}-$$
$$\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{640}{(x-2)^4}+\frac{2560}{(x-2)^5}+\frac{2560}{(x-2)^6}\Big)H(1;\alpha_0)+$$
$$\frac{640}{9(x-2)^4}+\frac{2560}{9(x-2)^5}+\frac{2560}{9(x-2)^6}\Big)H(0,c_2(\alpha_0);x)+\Big(-2x\alpha_0^5-\frac{4\alpha_0^5}{x-2}+\frac{2\alpha_0^5}{x-1}+\frac{38x\alpha_0^4}{3}+\frac{40\alpha_0^4}{3(x-2)}-\frac{26\alpha_0^4}{3(x-1)}-$$

$$\frac{40\alpha_0^4}{3(x-2)^2}+\frac{8\alpha_0^4}{3(x-1)^2}-\frac{4\alpha_0^4}{3}-\frac{104x\alpha_0^3}{3}-\frac{40\alpha_0^3}{3(x-2)}+\frac{44\alpha_0^3}{3(x-1)}+\frac{80\alpha_0^3}{3(x-2)^2}-\frac{28\alpha_0^3}{3(x-1)^2}-\frac{160\alpha_0^3}{3(x-2)^3}+\frac{4\alpha_0^3}{(x-1)^3}+$$

$$8\alpha_0^3+56x\alpha_0^2-\frac{12\alpha_0^2}{x-1}+\frac{12\alpha_0^2}{(x-1)^2}-\frac{12\alpha_0^2}{(x-1)^3}-\frac{320\alpha_0^2}{(x-2)^4}+\frac{8\alpha_0^2}{(x-1)^4}-24\alpha_0^2-\frac{146x\alpha_0}{3}+\frac{20\alpha_0}{3(x-2)}+\frac{14\alpha_0}{3(x-1)}-$$

$$\frac{80\alpha_0}{3(x-2)^2}-\frac{20\alpha_0}{3(x-1)^2}+\frac{160\alpha_0}{(x-2)^3}+\frac{12\alpha_0}{(x-1)^3}+\frac{1280\alpha_0}{(x-2)^4}+\frac{1280\alpha_0}{(x-2)^5}+\frac{40\alpha_0}{3}+\frac{50x}{3}-\frac{8}{3(x-2)}-\frac{2}{3(x-1)}+\frac{40}{3(x-2)^2}+$$

$$\frac{4}{3(x-1)^2}-\frac{320}{3(x-2)^3}-\frac{4}{(x-1)^3}-\frac{960}{(x-2)^4}-\frac{8}{(x-1)^4}-\frac{1280}{(x-2)^5}+4\Big)H(1,0;\alpha_0)+\Big(-\frac{47x\alpha_0}{9}-\frac{838\alpha_0}{9(x-2)}+$$

$$\frac{102\alpha_0}{x-1}+\frac{1000\alpha_0}{9(x-2)^2}-\frac{433\alpha_0}{18(x-1)^2}-\frac{128\alpha_0}{(x-2)^3}+\frac{113\alpha_0}{9(x-1)^3}+\frac{4288\alpha_0}{9(x-2)^4}+\frac{137\alpha_0}{9(x-1)^4}-\frac{640\alpha_0}{9(x-2)^5}-\frac{188\alpha_0}{9(x-1)^5}+\frac{77\alpha_0}{18}+$$

$$\frac{47x}{9}-\frac{578}{9(x-2)}+\frac{203}{3(x-1)}+\frac{676}{9(x-2)^2}-\frac{185}{18(x-1)^2}-\frac{848}{9(x-2)^3}+\frac{11}{9(x-1)^3}-\frac{1984}{9(x-2)^4}-\frac{239}{9(x-1)^4}-\frac{7936}{9(x-2)^5}-$$

$$\frac{188}{9(x-1)^5}+\frac{1280}{9(x-2)^6}+\frac{37}{6}\Big)H(1,0;x)+\Big(3x\alpha_0^5+\frac{6\alpha_0^5}{x-2}-\frac{3\alpha_0^5}{x-1}-19x\alpha_0^4-\frac{20\alpha_0^4}{x-2}+\frac{13\alpha_0^4}{x-1}+\frac{20\alpha_0^4}{(x-2)^2}-$$

$$\frac{4\alpha_0^4}{(x-1)^2}+2\alpha_0^4+52x\alpha_0^3+\frac{20\alpha_0^3}{x-2}-\frac{22\alpha_0^3}{x-1}-\frac{40\alpha_0^3}{(x-2)^2}+\frac{14\alpha_0^3}{(x-1)^2}+\frac{80\alpha_0^3}{(x-2)^3}-\frac{6\alpha_0^3}{(x-1)^3}-12\alpha_0^3-84x\alpha_0^2+\frac{18\alpha_0^2}{x-1}-$$

$$\frac{18\alpha_0^2}{(x-1)^2}+\frac{18\alpha_0^2}{(x-1)^3}+\frac{480\alpha_0^2}{(x-2)^4}-\frac{12\alpha_0^2}{(x-1)^4}+36\alpha_0^2+73x\alpha_0-\frac{10\alpha_0}{x-2}-\frac{7\alpha_0}{x-1}+\frac{40\alpha_0}{(x-2)^2}+\frac{10\alpha_0}{(x-1)^2}-\frac{240\alpha_0}{(x-2)^3}-$$

$$\frac{18\alpha_0}{(x-1)^3}-\frac{1920\alpha_0}{(x-2)^4}-\frac{1920\alpha_0}{(x-2)^5}-20\alpha_0-25x+\frac{4}{x-2}+\frac{1}{x-1}-\frac{20}{(x-2)^2}-\frac{2}{(x-1)^2}+\frac{160}{(x-2)^3}+\frac{6}{(x-1)^3}+\frac{1440}{(x-2)^4}+$$

$$\frac{12}{(x-1)^4}+\frac{1920}{(x-2)^5}-6\Big)H(1,1;\alpha_0)+H(c_2(\alpha_0);x)\Big(-\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{320\alpha_0}{27(x-2)^4}-\frac{80\pi^2\alpha_0}{9(x-2)^5}+\frac{640\alpha_0}{27(x-2)^5}+$$

$$\Big(-\frac{640\alpha_0}{9(x-2)^4}-\frac{1280\alpha_0}{9(x-2)^5}+\frac{640}{9(x-2)^4}+\frac{2560}{9(x-2)^5}+\frac{2560}{9(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{320\alpha_0}{3(x-2)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{320}{3(x-2)^4}-$$

$$\frac{1280}{3(x-2)^5}-\frac{1280}{3(x-2)^6}\Big)H(1;\alpha_0)+\Big(\frac{1280\alpha_0}{3(x-2)^4}+\frac{2560\alpha_0}{3(x-2)^5}-\frac{1280}{3(x-2)^4}-\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0;\alpha_0)+$$

$$\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{640}{(x-2)^4}+\frac{2560}{(x-2)^5}+\frac{2560}{(x-2)^6}\Big)H(0,1;\alpha_0)+\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{640}{(x-2)^4}+$$

$$\frac{2560}{(x-2)^5}+\frac{2560}{(x-2)^6}\Big)H(1,0;\alpha_0)+\Big(\frac{960\alpha_0}{(x-2)^4}+\frac{1920\alpha_0}{(x-2)^5}-\frac{960}{(x-2)^4}-\frac{3840}{(x-2)^5}-\frac{3840}{(x-2)^6}\Big)H(1,1;\alpha_0)+$$

$$\frac{40\pi^2}{9(x-2)^4}-\frac{320}{27(x-2)^4}+\frac{160\pi^2}{9(x-2)^5}-\frac{1280}{27(x-2)^5}+\frac{160\pi^2}{9(x-2)^6}-\frac{1280}{27(x-2)^6}\Big)+H(c_1(\alpha_0);x)\Big(-\frac{37x\alpha_0^5}{36}-\frac{31\alpha_0^5}{18(x-2)}+$$

$$\frac{37\alpha_0^5}{36(x-1)}+\frac{9\alpha_0^5}{8}+\frac{245x\alpha_0^4}{36}+\frac{73\alpha_0^4}{12(x-2)}-\frac{151\alpha_0^4}{36(x-1)}-\frac{65\alpha_0^4}{9(x-2)^2}+\frac{5\alpha_0^4}{3(x-1)^2}-\frac{497\alpha_0^4}{72}-\frac{182x\alpha_0^3}{9}-\frac{52\alpha_0^3}{9(x-2)}+$$

$$\frac{187\alpha_0^3}{36(x-1)}+\frac{44\alpha_0^3}{3(x-2)^2}-\frac{211\alpha_0^3}{36(x-1)^2}-\frac{40\alpha_0^3}{(x-2)^3}+\frac{59\alpha_0^3}{18(x-1)^3}+\frac{353\alpha_0^3}{18}+\frac{122x\alpha_0^2}{3}-\frac{91\alpha_0^2}{9(x-2)}+\frac{275\alpha_0^2}{36(x-1)}+\frac{34\alpha_0^2}{3(x-2)^2}+$$

$$\frac{167\alpha_0^2}{36(x-1)^2}-\frac{268\alpha_0^2}{9(x-2)^3}-\frac{38\alpha_0^2}{3(x-1)^3}-\frac{3760\alpha_0^2}{9(x-2)^4}+\frac{95\alpha_0^2}{9(x-1)^4}-\frac{781\alpha_0^2}{18}-\frac{171x\alpha_0}{4}-\frac{610\alpha_0}{3(x-2)}+\frac{3965\alpha_0}{18(x-1)}+\frac{228\alpha_0}{(x-2)^2}-$$

$$\frac{797\alpha_0}{18(x-1)^2}-\frac{1312\alpha_0}{9(x-2)^3}+\frac{34\alpha_0}{(x-1)^3}+\frac{1808\alpha_0}{(x-2)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{3101\alpha_0}{216(x-1)^4}+\frac{10240\alpha_0}{9(x-2)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}-\frac{2125\alpha_0}{108(x-1)^5}+$$

$$\frac{1315\alpha_0}{72}+\frac{595x}{36}+\Big(\frac{2x\alpha_0^5}{3}+\frac{4\alpha_0^5}{3(x-2)}-\frac{2\alpha_0^5}{3(x-1)}-\alpha_0^5-\frac{38x\alpha_0^4}{9}-\frac{46\alpha_0^4}{9(x-2)}+\frac{26\alpha_0^4}{9(x-1)}+\frac{40\alpha_0^4}{9(x-2)^2}-\frac{8\alpha_0^4}{9(x-1)^2}+\frac{49\alpha_0^4}{9}+$$

$$\frac{104x\alpha_0^3}{9}+\frac{64\alpha_0^3}{9(x-2)}-\frac{44\alpha_0^3}{9(x-1)}-\frac{104\alpha_0^3}{9(x-2)^2}+\frac{28\alpha_0^3}{9(x-1)^2}+\frac{160\alpha_0^3}{9(x-2)^3}-\frac{4\alpha_0^3}{3(x-1)^3}-\frac{38\alpha_0^3}{3}-\frac{56x\alpha_0^2}{3}-\frac{4\alpha_0^2}{x-2}+\frac{4\alpha_0^2}{x-1}+$$

$$\frac{8\alpha_0^2}{(x-2)^2}-\frac{4\alpha_0^2}{(x-1)^2}-\frac{16\alpha_0^2}{(x-2)^3}+\frac{4\alpha_0^2}{(x-1)^3}+\frac{320\alpha_0^2}{3(x-2)^4}-\frac{8\alpha_0^2}{3(x-1)^4}+18\alpha_0^2+\frac{146x\alpha_0}{9}+\frac{512\alpha_0}{9(x-2)}-\frac{62\alpha_0}{x-1}-\frac{608\alpha_0}{9(x-2)^2}+$$

$$\frac{148\alpha_0}{9(x-1)^2}+\frac{64\alpha_0}{(x-2)^3}-\frac{94\alpha_0}{9(x-1)^3}-\frac{576\alpha_0}{(x-2)^4}-\frac{73\alpha_0}{9(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}+\frac{94\alpha_0}{9(x-1)^5}-\frac{61\alpha_0}{9}-\frac{50x}{9}+\frac{352}{9(x-2)}-\frac{40}{x-1}-$$

$$\frac{416}{9(x-2)^2}+\frac{50}{9(x-1)^2}+\frac{640}{9(x-2)^3}-\frac{4}{9(x-1)^3}+\frac{896}{3(x-2)^4}+\frac{139}{9(x-1)^4}+\frac{2560}{3(x-2)^5}+\frac{94}{9(x-1)^5}-3\Big)H(0;\alpha_0)+\Big(-$$

$$x\alpha_0^5-\frac{2\alpha_0^5}{x-2}+\frac{\alpha_0^5}{x-1}+\frac{3\alpha_0^5}{2}+\frac{19x\alpha_0^4}{3}+\frac{23\alpha_0^4}{3(x-2)}-\frac{13\alpha_0^4}{3(x-1)}-\frac{20\alpha_0^4}{3(x-2)^2}+\frac{4\alpha_0^4}{3(x-1)^2}-\frac{49\alpha_0^4}{6}-\frac{52x\alpha_0^3}{3}-\frac{32\alpha_0^3}{3(x-2)}+$$

$$\frac{22\alpha_0^3}{3(x-1)}+\frac{52\alpha_0^3}{3(x-2)^2}-\frac{14\alpha_0^3}{3(x-1)^2}-\frac{80\alpha_0^3}{3(x-2)^3}+\frac{2\alpha_0^3}{(x-1)^3}+19\alpha_0^3+28x\alpha_0^2+\frac{6\alpha_0^2}{x-2}-\frac{6\alpha_0^2}{x-1}-\frac{12\alpha_0^2}{(x-2)^2}+\frac{6\alpha_0^2}{(x-1)^2}+$$

$$\frac{24\alpha_0^2}{(x-2)^3}-\frac{6\alpha_0^2}{(x-1)^3}-\frac{160\alpha_0^2}{(x-2)^4}+\frac{4\alpha_0^2}{(x-1)^4}-27\alpha_0^2-\frac{73x\alpha_0}{3}-\frac{256\alpha_0}{3(x-2)}+\frac{93\alpha_0}{x-1}+\frac{304\alpha_0}{3(x-2)^2}-\frac{74\alpha_0}{3(x-1)^2}-\frac{96\alpha_0}{(x-2)^3}+$$

$$\frac{47\alpha_0}{3(x-1)^3}+\frac{864\alpha_0}{(x-2)^4}+\frac{73\alpha_0}{6(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}-\frac{47\alpha_0}{3(x-1)^5}+\frac{61\alpha_0}{6}+\frac{25x}{3}-\frac{176}{3(x-2)}+\frac{60}{x-1}+\frac{208}{3(x-2)^2}-\frac{25}{3(x-1)^2}-$$

$$\frac{320}{3(x-2)^3}+\frac{2}{3(x-1)^3}-\frac{448}{(x-2)^4}-\frac{139}{6(x-1)^4}-\frac{1280}{(x-2)^5}-\frac{47}{3(x-1)^5}+\frac{9}{2}\Big)H(1;\alpha_0)+\Big(\frac{16\alpha_0}{3(x-1)^4}-\frac{16\alpha_0}{3(x-1)^5}-$$

$$\frac{16}{3(x-1)^4}-\frac{16}{3(x-1)^5}\Big)H(0,0;\alpha_0)+\Big(-\frac{8\alpha_0}{(x-1)^4}+\frac{8\alpha_0}{(x-1)^5}+\frac{8}{(x-1)^4}+\frac{8}{(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(-\frac{8\alpha_0}{(x-1)^4}+$$

$$\frac{8\alpha_0}{(x-1)^5}+\frac{8}{(x-1)^4}+\frac{8}{(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(\frac{12\alpha_0}{(x-1)^4}-\frac{12\alpha_0}{(x-1)^5}-\frac{12}{(x-1)^4}-\frac{12}{(x-1)^5}\Big)H(1,1;\alpha_0)-$$

$$\frac{1372}{9(x-2)}+\frac{5705}{36(x-1)}+\frac{512}{3(x-2)^2}-\frac{475}{36(x-1)^2}-\frac{2432}{9(x-2)^3}-\frac{35}{12(x-1)^3}-\frac{7264}{9(x-2)^4}+\frac{\pi^2}{18(x-1)^4}-\frac{7679}{216(x-1)^4}-$$

$$\frac{20480}{9(x-2)^5}+\frac{\pi^2}{18(x-1)^5}-\frac{2125}{108(x-1)^5}+\frac{271}{24}\Big)+\Big(-\frac{14x\alpha_0}{3}-\frac{320\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{(x-2)^5}-\frac{64\alpha_0}{3(x-1)^5}+\frac{28\alpha_0}{3}+$$

$$\frac{14x}{3}+\frac{320}{(x-2)^4}-\frac{64}{3(x-1)^4}+\frac{1440}{(x-2)^5}-\frac{64}{3(x-1)^5}+\frac{1600}{(x-2)^6}\Big)H(0;\alpha_0)H(1,1;x)+\Big(\frac{47x\alpha_0}{9}+\frac{838\alpha_0}{9(x-2)}-$$

$$\frac{102\alpha_0}{x-1}-\frac{1000\alpha_0}{9(x-2)^2}+\frac{433\alpha_0}{18(x-1)^2}+\frac{128\alpha_0}{(x-2)^3}-\frac{113\alpha_0}{9(x-1)^3}-\frac{4288\alpha_0}{9(x-2)^4}-\frac{137\alpha_0}{9(x-1)^4}+\frac{640\alpha_0}{9(x-2)^5}+\frac{188\alpha_0}{9(x-1)^5}-\frac{77\alpha_0}{18}-$$

$$\frac{47x}{9}+\Big(-\frac{8x\alpha_0}{3}-\frac{448\alpha_0}{3(x-2)^4}+\frac{32\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-\frac{32\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{448}{3(x-2)^4}-\frac{32}{3(x-1)^4}+\frac{2176}{3(x-2)^5}-$$

$$\frac{32}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(4x\alpha_0+\frac{224\alpha_0}{(x-2)^4}-\frac{16\alpha_0}{(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}+\frac{16\alpha_0}{(x-1)^5}-8\alpha_0-4x-\frac{224}{(x-2)^4}+$$

$$\frac{16}{(x-1)^4}-\frac{1088}{(x-2)^5}+\frac{16}{(x-1)^5}-\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{578}{9(x-2)}-\frac{203}{3(x-1)}-\frac{676}{9(x-2)^2}+\frac{185}{18(x-1)^2}+\frac{848}{9(x-2)^3}-$$

$$\frac{11}{9(x-1)^3}+\frac{1984}{9(x-2)^4}+\frac{239}{9(x-1)^4}+\frac{7936}{9(x-2)^5}+\frac{188}{9(x-1)^5}-\frac{1280}{9(x-2)^6}-\frac{37}{6}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{2x\alpha_0}{3}+$$

$$\frac{1120\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{1120}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{5440}{3(x-2)^5}+\frac{2}{3(x-1)^5}-$$

$$\frac{6400}{3(x-2)^6}\Big)H(0;\alpha_0)H(2,1;x)+\Big(\frac{1600\alpha_0}{9(x-2)^4}+\frac{3200\alpha_0}{9(x-2)^5}+\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3(x-2)^5}+$$

$$\frac{12800}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{1600\alpha_0}{(x-2)^4}+\frac{3200\alpha_0}{(x-2)^5}-\frac{1600}{(x-2)^4}-\frac{6400}{(x-2)^5}-\frac{6400}{(x-2)^6}\Big)H(1;\alpha_0)-\frac{1600}{9(x-2)^4}-\frac{6400}{9(x-2)^5}-$$

$$\frac{6400}{9(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+\Big(\frac{x\alpha_0^5}{2}+\frac{5\alpha_0^5}{6(x-2)}-\frac{\alpha_0^5}{3(x-1)}-\frac{3\alpha_0^5}{2}-\frac{19x\alpha_0^4}{6}-\frac{65\alpha_0^4}{18(x-2)}+\frac{13\alpha_0^4}{9(x-1)}+\frac{25\alpha_0^4}{9(x-2)^2}-$$

$$\frac{4\alpha_0^4}{9(x-1)^2}+\frac{47\alpha_0^4}{6}+\frac{26x\alpha_0^3}{3}+\frac{55\alpha_0^3}{9(x-2)}-\frac{22\alpha_0^3}{9(x-1)}-\frac{80\alpha_0^3}{9(x-2)^2}+\frac{14\alpha_0^3}{9(x-1)^2}+\frac{100\alpha_0^3}{9(x-2)^3}-\frac{2\alpha_0^3}{3(x-1)^3}-17\alpha_0^3-$$

$$14x\alpha_0^2-\frac{5\alpha_0^2}{x-2}+\frac{2\alpha_0^2}{x-1}+\frac{10\alpha_0^2}{(x-2)^2}-\frac{2\alpha_0^2}{(x-1)^2}-\frac{20\alpha_0^2}{(x-2)^3}+\frac{2\alpha_0^2}{(x-1)^3}+\frac{200\alpha_0^2}{3(x-2)^4}-\frac{4\alpha_0^2}{3(x-1)^4}+21\alpha_0^2+\frac{73x\alpha_0}{6}+$$

$$\frac{440\alpha_0}{9(x-2)}-\frac{913\alpha_0}{18(x-1)}-\frac{560\alpha_0}{9(x-2)^2}+\frac{245\alpha_0}{18(x-1)^2}+\frac{80\alpha_0}{(x-2)^3}-\frac{71\alpha_0}{9(x-1)^3}-\frac{320\alpha_0}{(x-2)^4}-\frac{55\alpha_0}{18(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}+\frac{47\alpha_0}{9(x-1)^5}-$$

$$\frac{53\alpha_0}{6}-\frac{25x}{6}+\Big(\frac{8\alpha_0}{3(x-1)^4}-\frac{8\alpha_0}{3(x-1)^5}-\frac{8}{3(x-1)^4}-\frac{8}{3(x-1)^5}\Big)H(0;\alpha_0)+\Big(-\frac{4\alpha_0}{(x-1)^4}+\frac{4\alpha_0}{(x-1)^5}+\frac{4}{(x-1)^4}+$$

$$\frac{4}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{280}{9(x-2)}-\frac{581}{18(x-1)}-\frac{320}{9(x-2)^2}+\frac{29}{6(x-1)^2}+\frac{400}{9(x-2)^3}-\frac{8}{9(x-1)^3}+\frac{320}{3(x-2)^4}+\frac{157}{18(x-1)^4}+$$

$$\frac{1600}{3(x-2)^5}+\frac{47}{9(x-1)^5}-\frac{3}{2}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{x\alpha_0^5}{6}-\frac{\alpha_0^5}{6(x-1)}+\frac{\alpha_0^5}{2}+\frac{19x\alpha_0^4}{18}+\frac{13\alpha_0^4}{18(x-1)}-\frac{2\alpha_0^4}{9(x-1)^2}-$$

$$\frac{47\alpha_0^4}{18}-\frac{26x\alpha_0^3}{9}-\frac{11\alpha_0^3}{9(x-1)}+\frac{7\alpha_0^3}{9(x-1)^2}-\frac{\alpha_0^3}{3(x-1)^3}+\frac{17\alpha_0^3}{3}+\frac{14x\alpha_0^2}{3}+\frac{\alpha_0^2}{x-1}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}-\frac{2\alpha_0^2}{3(x-1)^4}-7\alpha_0^2-$$

$$\frac{73x\alpha_0}{18}+\frac{8\alpha_0}{9(x-2)}+\frac{\alpha_0}{18(x-1)}-\frac{8\alpha_0}{9(x-2)^2}+\frac{\alpha_0}{9(x-1)^2}+\frac{\alpha_0}{3(x-1)^3}-\frac{32\alpha_0}{9(x-2)^4}-\frac{4\alpha_0}{3(x-1)^4}-\frac{640\alpha_0}{9(x-2)^5}+\frac{41\alpha_0}{18}+$$

$$\frac{25x}{18}+\Big(\frac{448\alpha_0}{3(x-2)^4}+\frac{1280\alpha_0}{3(x-2)^5}-\frac{448}{3(x-2)^4}-\frac{2176}{3(x-2)^5}-\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{224\alpha_0}{(x-2)^4}-\frac{640\alpha_0}{(x-2)^5}+\frac{224}{(x-2)^4}+$$

$$\frac{1088}{(x-2)^5}+\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{16}{9(x-2)}-\frac{7}{18(x-1)}-\frac{8}{9(x-2)^2}-\frac{5}{9(x-1)^2}+\frac{16}{9(x-2)^3}-\frac{1}{(x-1)^3}+\frac{32}{9(x-2)^4}-$$

$$\frac{2}{3(x-1)^4}+\frac{704}{9(x-2)^5}+\frac{1280}{9(x-2)^6}+\frac{7}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{16x\alpha_0}{3}+\frac{1280\alpha_0}{3(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}+\frac{2560\alpha_0}{3(x-2)^5}-$$

$$\frac{16\alpha_0}{3(x-1)^5}-\frac{32\alpha_0}{3}-\frac{16x}{3}-\frac{1280}{3(x-2)^4}-\frac{16}{3(x-1)^4}-\frac{5120}{3(x-2)^5}-\frac{16}{3(x-1)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0,0;\alpha_0)+\Big(\frac{16x\alpha_0}{3}-$$

$$\frac{1280\alpha_0}{3(x-2)^4}-\frac{16\alpha_0}{3(x-1)^4}-\frac{2560\alpha_0}{3(x-2)^5}+\frac{16\alpha_0}{3(x-1)^5}-\frac{32\alpha_0}{3}-\frac{16x}{3}+\frac{1280}{3(x-2)^4}+\frac{16}{3(x-1)^4}+\frac{5120}{3(x-2)^5}+\frac{16}{3(x-1)^5}+$$

$$\frac{5120}{3(x-2)^6}\Big)H(0,0,0;x)+\Big(-8x\alpha_0-\frac{640\alpha_0}{(x-2)^4}-\frac{8\alpha_0}{(x-1)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{8\alpha_0}{(x-1)^5}+16\alpha_0+8x+\frac{640}{(x-2)^4}+$$

$$\frac{8}{(x-1)^4}+\frac{2560}{(x-2)^5}+\frac{8}{(x-1)^5}+\frac{2560}{(x-2)^6}\Big)H(0,0,1;\alpha_0)+\Big(-\frac{8x\alpha_0}{3}-\frac{544\alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-$$

$$\frac{8\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{544}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{2368}{3(x-2)^5}-\frac{8}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)H(0,0,c_1(\alpha_0);x)+$$

$$\Big(\frac{1280\alpha_0}{3(x-2)^4}+\frac{2560\alpha_0}{3(x-2)^5}-\frac{1280}{3(x-2)^4}-\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0,c_2(\alpha_0);x)+\Big(-8x\alpha_0-\frac{640\alpha_0}{(x-2)^4}-$$

$$\frac{8\alpha_0}{(x-1)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{8\alpha_0}{(x-1)^5}+16\alpha_0+8x+\frac{640}{(x-2)^4}+\frac{8}{(x-1)^4}+\frac{2560}{(x-2)^5}+\frac{8}{(x-1)^5}+$$

$$\frac{2560}{(x-2)^6}\Big)H(0,1,0;\alpha_0)+\Big(\frac{20x\alpha_0}{3}+\frac{1216\alpha_0}{3(x-2)^4}-\frac{20\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+\frac{20\alpha_0}{3(x-1)^5}-\frac{40\alpha_0}{3}-\frac{20x}{3}-\frac{1216}{3(x-2)^4}+$$

$$\frac{20}{3(x-1)^4}-\frac{5632}{3(x-2)^5}+\frac{20}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(0,1,0;x)+\Big(12x\alpha_0+\frac{960\alpha_0}{(x-2)^4}+\frac{12\alpha_0}{(x-1)^4}+\frac{1920\alpha_0}{(x-2)^5}-$$

$$\frac{12\alpha_0}{(x-1)^5}-24\alpha_0-12x-\frac{960}{(x-2)^4}-\frac{12}{(x-1)^4}-\frac{3840}{(x-2)^5}-\frac{12}{(x-1)^5}-\frac{3840}{\phantom{x}}(x-2)^6\Big)H(0,1,1;\alpha_0)+$$

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$$\Big( -\frac{20x\alpha_0}{3}-\frac{1216\ \alpha_0}{3(x-2)^4}+\frac{20\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3\ (x-2)^5}-\frac{20\alpha_0}{3(x-1)^5}+\frac{40\alpha_0}{3}+\frac{20\ x}{3}+\frac{1216}{3(x-2)^4}-\frac{20}{3(x-1)^4}+$$
$$\frac{5632}{3\ (x-2)^5}-\frac{20}{3(x-1)^5}+\frac{6400}{3(x-2)^6}\Big) H(0,1,c_1(\alpha_0);x)+\Big(\frac{3200\alpha_0}{3(x-2)^4}+\frac{6400\alpha_0}{3\ (x-2)^5}-\frac{3200}{3(x-2)^4}-\frac{12800}{3\ (x-2)^5}-$$
$$\frac{12800}{3(x-2)^6}\Big)H(0,2,0;x)+\Big(-\frac{3200\ \alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3\ (x-2)^4}+\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big) H(0,2,c_2(\alpha_0);x)+$$
$$\Big(-2x\alpha_0-\frac{160\alpha_0}{3(x-2)^4}+\frac{4\ \alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3(x-1)^5}+4\ \alpha_0+2x+\frac{160}{3(x-2)^4}-\frac{4}{3(x-1)^4}+\frac{1120}{3\ (x-2)^5}-$$
$$\frac{4}{3(x-1)^5}+\frac{1600}{3(x-2)^6}\Big) H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2x\alpha_0}{3}+\frac{448\alpha_0}{3\ (x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{1280\alpha_0}{3(x-2)^5}+\frac{2\ \alpha_0}{3(x-1)^5}-$$
$$\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{448}{3\ (x-2)^4}+\frac{2}{3(x-1)^4}-\frac{2176}{3(x-2)^5}+\frac{2}{3\ (x-1)^5}-\frac{2560}{3(x-2)^6}\Big) H(0,c_2(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(\frac{8x\alpha_0}{3}+\frac{448\alpha_0}{3\ (x-2)^4}-\frac{32\alpha_0}{3(x-1)^4}+\frac{1280\alpha_0}{3(x-2)^5}+\frac{32\ \alpha_0}{3(x-1)^5}-\frac{16\alpha_0}{3}-\frac{8x}{3}-\frac{448}{3(x-2)^4}+\frac{32}{3(x-1)^4}-\frac{2176}{3(x-2)^5}+$$
$$\frac{32}{3\ (x-1)^5}-\frac{2560}{3(x-2)^6}\Big)H(1,0,0;x)+\Big(-\frac{2x\ \alpha_0}{3}-\frac{96\alpha_0}{(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}-\frac{160\ \alpha_0}{(x-2)^5}-\frac{16\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+$$
$$\frac{96}{(x-2)^4}-\frac{16}{3\ (x-1)^4}+\frac{352}{(x-2)^5}-\frac{16}{3(x-1)^5}+\frac{320}{(x-2)^6}\Big)H(1,0,c_1(\alpha_0);x)+\Big(\frac{14x\alpha_0}{3}+\frac{320\ \alpha_0}{(x-2)^4}-\frac{64\alpha_0}{3(x-1)^4}+$$
$$\frac{800\ \alpha_0}{(x-2)^5}+\frac{64\alpha_0}{3(x-1)^5}-\frac{28\alpha_0}{3}-\frac{14\ x}{3}-\frac{320}{(x-2)^4}+\frac{64}{3\ (x-1)^4}-\frac{1440}{(x-2)^5}+\frac{64}{3\ (x-1)^5}-\frac{1600}{(x-2)^6}\Big)H(1,1,0;x)+$$
$$\Big(-\frac{14x\ \alpha_0}{3}-\frac{320\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{3(x-1)^4}-\frac{800\ \alpha_0}{(x-2)^5}-\frac{64\alpha_0}{3(x-1)^5}+\frac{28\alpha_0}{3}+\frac{14\ x}{3}+\frac{320}{(x-2)^4}-\frac{64}{3\ (x-1)^4}+\frac{1440}{(x-2)^5}-$$
$$\frac{64}{3\ (x-1)^5}+\frac{1600}{(x-2)^6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-2x\ \alpha_0-\frac{160\alpha_0}{3(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}-\frac{800\ \alpha_0}{3(x-2)^5}-\frac{16\alpha_0}{3(x-1)^5}+4\alpha_0+$$
$$2x+\frac{160}{3\ (x-2)^4}-\frac{16}{3(x-1)^4}+\frac{1120}{3(x-2)^5}-\frac{16}{3\ (x-1)^5}+\frac{1600}{3(x-2)^6}\Big) H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3200\alpha_0}{3(x-2)^4}+$$
$$\frac{6400\ \alpha_0}{3(x-2)^5}-\frac{3200}{3(x-2)^4}-\frac{12800}{3\ (x-2)^5}-\frac{12800}{3(x-2)^6}\Big)H(2,0,0;x)+\Big(\frac{2x\ \alpha_0}{3}+\frac{1120\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{3200\ \alpha_0}{3(x-2)^5}+$$
$$\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2\ x}{3}-\frac{1120}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{5440}{3\ (x-2)^5}+\frac{2}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big) H(2,0,c_1(\alpha_0);x)+$$
$$\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3\ (x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3\ (x-2)^5}+\frac{12800}{3(x-2)^6}\Big)H(2,0,c_2(\alpha_0);x)+\Big(-\frac{2\ x\alpha_0}{3}-$$
$$\frac{1120\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3\ (x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\ \alpha_0}{3}+\frac{2x}{3}+\frac{1120}{3(x-2)^4}-\frac{2}{3\ (x-1)^4}+\frac{5440}{3(x-2)^5}-\frac{2}{3(x-1)^5}+$$
$$\frac{6400}{3\ (x-2)^6}\Big)H(2,1,0;x)+\Big(\frac{2x\alpha_0}{3}+\frac{1120\alpha_0}{3\ (x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+\frac{2\ \alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{1120}{3(x-2)^4}+$$
$$\frac{2}{3(x-1)^4}-\frac{5440}{3(x-2)^5}+\frac{2}{3\ (x-1)^5}-\frac{6400}{3(x-2)^6}\Big) H(2,1,c_1(\alpha_0);x)+\Big(-\frac{8000\alpha_0}{3(x-2)^4}-\frac{16000\alpha_0}{3\ (x-2)^5}+$$
$$\frac{8000}{3(x-2)^4}+\frac{32000}{3\ (x-2)^5}+\frac{32000}{3(x-2)^6}\Big)H(2,2,0;x)+\Big(\frac{8000\ \alpha_0}{3(x-2)^4}+\frac{16000\alpha_0}{3(x-2)^5}-\frac{8000}{3\ (x-2)^4}-\frac{32000}{3(x-2)^5}-$$
$$\frac{32000}{3(x-2)^6}\Big) H(2,2,c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-\frac{1120\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3\ (x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+$$
$$\frac{1120}{3\ (x-2)^4}-\frac{2}{3(x-1)^4}+\frac{5440}{3(x-2)^5}-\frac{2}{3\ (x-1)^5}+\frac{6400}{3(x-2)^6}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4\alpha_0}{3(x-1)^4}-$$
$$\frac{4\alpha_0}{3\ (x-1)^5}-\frac{4}{3(x-1)^4}-\frac{4}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\ \alpha_0),c_1(\alpha_0);x)+\Big(\frac{2\alpha_0}{3(x-1)^4}-\frac{2\alpha_0}{3\ (x-1)^5}-\frac{2}{3(x-1)^4}-$$
$$\frac{2}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_2(\ \alpha_0),c_1(\alpha_0);x)+\Big(\frac{32\ \alpha_0}{(x-2)^4}-\frac{32}{(x-2)^4}-\frac{64}{(x-2)^5}\Big) H(c_2(\alpha_0),0,c_1(\alpha_0);x)+$$
$$\Big(\frac{160\alpha_0}{3(x-2)^4}+\frac{800\ \alpha_0}{3(x-2)^5}-\frac{160}{3(x-2)^4}-\frac{1120}{3\ (x-2)^5}-\frac{1600}{3(x-2)^6}\Big) H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+H(2,0;x)\Big(-$$
$$\frac{1600\alpha_0}{9\ (x-2)^4}-\frac{3200\alpha_0}{9(x-2)^5}-\frac{3200\ln 2\,\alpha_0}{3\ (x-2)^4}-\frac{6400\ln 2\,\alpha_0}{3(x-2)^5}+\frac{1600}{9\ (x-2)^4}+\frac{6400}{9(x-2)^5}+\frac{6400}{9(x-2)^6}+\frac{3200\ln\ 2}{3(x-2)^4}+\frac{12800\ln 2}{3(x-2)^5}+$$
$$\frac{12800\ln 2}{3(x-2)^6}\Big)+H(0,2;x)\Big(-\frac{3200\ln 2\,\alpha_0}{3(x-2)^4}-\frac{6400\ln 2\,\alpha_0}{3(x-2)^5}+\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3\ (x-2)^5}+$$
$$\frac{12800}{3(x-2)^6}\Big)H(0;\alpha_0)+\frac{3200\ln 2}{3\ (x-2)^4}+\frac{12800\ln 2}{3(x-2)^5}+\frac{12800\ln 2}{3\ (x-2)^6}\Big)+H(0,0;x)\Big(-\frac{94x\alpha_0}{9}-\frac{512\alpha_0}{9\ (x-2)}+\frac{62\alpha_0}{x-1}+$$
$$\frac{608\alpha_0}{9(x-2)^2}-\frac{148\alpha_0}{9\ (x-1)^2}-\frac{64\alpha_0}{(x-2)^3}+\frac{94\alpha_0}{9(x-1)^3}+\frac{4480\ \alpha_0}{9(x-2)^4}+\frac{49\alpha_0}{9(x-1)^4}+\frac{1280\alpha_0}{9\ (x-2)^5}-\frac{94\alpha_0}{9(x-1)^5}+\frac{1280\ln 2\,\alpha_0}{3\ (x-2)^4}+$$
$$\frac{2560\ln 2\,\alpha_0}{3(x-2)^5}+\frac{161\ \alpha_0}{9}+\frac{94x}{9}-\frac{352}{9\ (x-2)}+\frac{40}{x-1}+\frac{416}{9(x-2)^2}-\frac{50}{9\ (x-1)^2}-\frac{640}{9(x-2)^3}+\frac{4}{9(x-1)^3}-\frac{3328}{9\ (x-2)^4}-$$
$$\frac{139}{9(x-1)^4}-\frac{10240}{9(x-2)^5}-\frac{94}{9\ (x-1)^5}-\frac{2560}{9(x-2)^6}-\frac{1280\ln 2}{3\ (x-2)^4}-\frac{5120\ln 2}{3(x-2)^5}-\frac{5120\ln 2}{3\ (x-2)^6}+3\Big)+H(2,2;x)\Big(\frac{8000\ln 2\,\alpha_0}{3\ (x-2)^4}+$$

$$\frac{16000\ln 2\,\alpha_0}{3(x-2)^5}+\left(\frac{8000\alpha_0}{3\,(x-2)^4}+\frac{16000\alpha_0}{3(x-2)^5}-\frac{8000}{3\,(x-2)^4}-\frac{32000}{3(x-2)^5}-\frac{32000}{3(x-2)^6}\right)H(0;\alpha_0)-\frac{8000\ln 2}{3(x-2)^4}-$$
$$\frac{32000\ln 2}{3\,(x-2)^5}-\frac{32000\ln 2}{3(x-2)^6}\Big)+H(0;x)\,\Big(\frac{1}{2}\pi^2x\alpha_0+\frac{2125x\alpha_0}{108}+\frac{1748\,\alpha_0}{9(x-2)}-\frac{1897\alpha_0}{9(x-1)}-\frac{1960\alpha_0}{9\,(x-2)^2}+\frac{352\alpha_0}{9(x-1)^2}+$$
$$\frac{496\alpha_0}{3\,(x-2)^3}-\frac{173\alpha_0}{6(x-1)^3}-\frac{88\pi^2\alpha_0}{3\,(x-2)^4}-\frac{31040\alpha_0}{27(x-2)^4}-\frac{7\pi^2\alpha_0}{18\,(x-1)^4}-\frac{821\alpha_0}{216(x-1)^4}-\frac{80\pi^2\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{27(x-2)^5}+\frac{7\pi^2\alpha_0}{18(x-1)^5}+$$
$$\frac{2125\,\alpha_0}{108(x-1)^5}-\frac{640\ln^2 2\,\alpha_0}{3(x-2)^4}-\frac{1280\ln^2 2\,\alpha_0}{3(x-2)^5}-\frac{640\ln 2\,\alpha_0}{9(x-2)^4}-\frac{1280\,\ln 2\,\alpha_0}{9(x-2)^5}-\pi^2\alpha_0-\frac{6061\alpha_0}{216}-\frac{\pi^2\,x}{2}-\frac{2125x}{108}+$$
$$\frac{1372}{9(x-2)}-\frac{5705}{36\,(x-1)}-\frac{512}{3(x-2)^2}+\frac{475}{36(x-1)^2}+\frac{2432}{9\,(x-2)^3}+\frac{35}{12(x-1)^3}+\frac{88\pi^2}{3\,(x-2)^4}+\frac{22112}{27(x-2)^4}+\frac{7\pi^2}{18\,(x-1)^4}+$$
$$\frac{7679}{216(x-1)^4}+\frac{256\pi^2}{3\,(x-2)^5}+\frac{62720}{27(x-2)^5}+\frac{7\pi^2}{18\,(x-1)^5}+\frac{2125}{108(x-1)^5}+\frac{160\pi^2}{3\,(x-2)^6}+\frac{1280}{27(x-2)^6}+\frac{640\ln^2 2}{3\,(x-2)^4}+$$
$$\frac{2560\ln^2 2}{3(x-2)^5}+\frac{2560\ln^2 2}{3\,(x-2)^6}+\frac{640\ln 2}{9(x-2)^4}+\frac{2560\ln 2}{9\,(x-2)^5}+\frac{2560\ln 2}{9(x-2)^6}-\frac{271}{24}\Big)+H(2;x)\,\Big(-\frac{1}{6}\pi^2x\alpha_0+\frac{760\pi^2\alpha_0}{9\,(x-2)^4}+$$
$$\frac{\pi^2\alpha_0}{6(x-1)^4}+\frac{800\pi^2\alpha_0}{9\,(x-2)^5}-\frac{\pi^2\alpha_0}{6(x-1)^5}+\frac{1600\ln^2 2\,\alpha_0}{3\,(x-2)^4}+\frac{3200\ln^2 2\,\alpha_0}{3(x-2)^5}+\frac{1600\ln 2\,\alpha_0}{9(x-2)^4}+\frac{3200\ln 2\,\alpha_0}{9(x-2)^5}+\frac{\pi^2\,\alpha_0}{3}+\frac{\pi^2x}{6}+$$
$$\left(\frac{1600\alpha_0}{9(x-2)^4}+\frac{3200\,\alpha_0}{9(x-2)^5}-\frac{1600}{9(x-2)^4}-\frac{6400}{9\,(x-2)^5}-\frac{6400}{9(x-2)^6}\right)H(0;\alpha_0)+\Big(-\frac{3200\alpha_0}{3\,(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3\,(x-2)^4}+$$
$$\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big)\,H(0,0;\alpha_0)+\left(\frac{1600\alpha_0}{(x-2)^4}+\frac{3200\,\alpha_0}{(x-2)^5}-\frac{1600}{(x-2)^4}-\frac{6400}{(x-2)^5}-\frac{6400}{(\,x-2)^6}\right)H(0,1;\alpha_0)-$$
$$\frac{760\pi^2}{9(x-2)^4}-\frac{\pi^2}{6\,(x-1)^4}-\frac{2320\pi^2}{9(x-2)^5}-\frac{\pi^2}{6\,(x-1)^5}-\frac{1600\pi^2}{9(x-2)^6}-\frac{1600\ln^2 2}{3\,(x-2)^4}-\frac{6400\ln^2 2}{3(x-2)^5}-\frac{6400\ln^2 2}{3\,(x-2)^6}-\frac{1600\ln 2}{9(x-2)^4}-$$
$$\frac{6400\ln 2}{9\,(x-2)^5}-\frac{6400\ln 2}{9(x-2)^6}\Big)-\frac{8\pi^2}{9\,(x-2)}+\frac{257\pi^2}{216(x-1)}+\frac{14\pi^2}{9\,(x-2)^2}-\frac{7\pi^2}{27(x-1)^2}-\frac{4\pi^{\,2}}{(x-2)^3}-\frac{35\pi^2}{108(x-1)^3}-\frac{1160\pi^2}{27\,(x-2)^4}-$$
$$\frac{139\pi^2}{108(x-1)^4}-\frac{2192\pi^2}{27\,(x-2)^5}-\frac{47\pi^2}{54(x-1)^5}-\frac{320\pi^2}{27\,(x-2)^6}-\frac{17}{12}x\zeta_3-\frac{56\zeta_3}{3(x-2)^4}+\frac{7\,\zeta_3}{4(x-1)^4}-\frac{392\zeta_3}{3(x-2)^5}+\frac{7\zeta_3}{4\,(x-1)^5}-$$
$$\frac{560\zeta_3}{3(x-2)^6}-\frac{640\ln^3 2}{9\,(x-2)^4}-\frac{2560\ln^3 2}{9(x-2)^5}-\frac{2560\ln^3 2}{9\,(x-2)^6}-\frac{320\ln^2 2}{9(x-2)^4}-\frac{1280\ln^2 2}{9\,(x-2)^5}-\frac{1280\ln^2 2}{9(x-2)^6}+\frac{1}{6}\pi^2x\ln 2\;-$$
$$\frac{112\pi^2\ln 2}{3(x-2)^4}-\frac{320\ln 2}{27\,(x-2)^4}-\frac{\pi^2\ln 2}{6(x-1)^4}-\frac{304\pi^2\ln 2}{3(x-2)^5}-\frac{1280\ln 2}{27(x-2)^5}-\frac{\pi^2\ln 2}{6(x-1)^5}-\frac{160\pi^2\ln 2}{3(x-2)^6}-\frac{1280\ln 2}{27(x-2)^6}+\frac{13\pi^2}{24}\}.$$

### E.8 The $\mathcal{B}$ integral for $k=-1$ and $\delta=1$

The $\varepsilon$ expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,-1,1,g_B)&=x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;1,-1)\\&=\frac{1}{\varepsilon^2}b_{-2}^{(1,-1)}+\frac{1}{\varepsilon}b_{-1}^{(1,-1)}+b_0^{(1,-1)}+\varepsilon b_1^{(1,-1)}+\varepsilon^2b_2^{(1,-1)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned}\tag{E.8}$$

where

$$b_{-2}^{(1,-1)}=\frac{1}{8},$$

$$b_{-1}^{(1,-1)}=-H(0;x),$$

$$b_0^{(1,-1)}=\frac{\alpha_0^3}{12(x-1)^2}-\frac{\alpha_0^3}{12}+\frac{\alpha_0^2}{24\,(x-1)}-\frac{5\alpha_0^2}{24(x-1)^2}+\frac{7\alpha_0^2}{24(x-1)^3}+\frac{13\,\alpha_0^2}{24}-\frac{\alpha_0}{3(x-1)}+\frac{\alpha_0}{6(x-1)^2}-$$
$$\frac{\alpha_0}{3\,(x-1)^3}+\frac{13\alpha_0}{12(x-1)^4}-\frac{23\,\alpha_0}{12}+\Big(\frac{25}{12}+\frac{3}{4(x-1)}-\frac{1}{6\,(x-1)^2}-\frac{1}{6(x-1)^3}+\frac{3}{4(x-1)^4}+$$
$$\frac{25}{12\,(x-1)^5}\Big)H(0;\alpha_0)+\left(-\frac{25}{12}-\frac{3}{4\,(x-1)}+\frac{1}{6(x-1)^2}+\frac{1}{6(x-1)^3}-\frac{3}{4\,(x-1)^4}-\frac{25}{12(x-1)^5}\right)H(0;x)+$$
$$\left(\frac{1}{(x-1)^5}-1\right)H(0;\alpha_0)\,H(1;x)+\Big(-\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}+\frac{\alpha_0^3}{x-1}-\frac{\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}-\frac{3\alpha_0^2}{2\,(x-1)}+\frac{\alpha_0^2}{(x-1)^2}-$$
$$\frac{\alpha_0^2}{2(x-1)^3}+3\,\alpha_0^2+\frac{\alpha_0}{x-1}-\frac{\alpha_0}{(x-1)^2}+\frac{\alpha_0}{(x-1)^3}-\frac{\alpha_0}{(x-1)^4}-4\alpha_0+\frac{3}{4(x-1)}-\frac{1}{6(x-1)^2}-\frac{1}{6\,(x-1)^3}+$$
$$\frac{3}{4(x-1)^4}+\frac{25}{12(x-1)^5}+\frac{25}{12}\Big)\,H(c_1(\alpha_0);x)+4H(0,0;x)+\left(\frac{1}{(x-1)^5}-1\right)\,H(0,c_1(\alpha_0);x)+\Big(1-$$
$$\frac{1}{(x-1)^5}\Big)\,H(1,0;x)+\left(\frac{1}{(x-1)^5}-1\right)\,H(1,c_1(\alpha_0);x)-\frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^{\,2}}{6(x-1)^5}-\frac{\pi^2}{12},$$

$$b_1^{(1,-1)} =$$

$$\frac{7d_1\alpha_0^3}{72} - \frac{7d_1\alpha_0^3}{72(x-1)^2} + \frac{7\ \alpha_0^3}{36(x-1)^2} - \frac{7\alpha_0^3}{36} - \frac{109d_1\ \alpha_0^2}{144} - \frac{13d_1\alpha_0^2}{144(x-1)} - \frac{11\alpha_0^2}{72(x-1)} + \frac{29d_1\alpha_0^2}{144(x-1)^2} - \frac{53\alpha_0^2}{72(x-1)^2} -$$

$$\frac{67\ d_1\alpha_0^2}{144(x-1)^3} + \frac{79\alpha_0^2}{72(x-1)^3} + \frac{121\ \alpha_0^2}{72} + \frac{305d_1\alpha_0}{72} + \frac{2\alpha_0}{3(x-2)} + \frac{19d_1\ \alpha_0}{18(x-1)} - \frac{5\alpha_0}{18(x-1)} - \frac{d_1\alpha_0}{9\ (x-1)^2} + \frac{5\alpha_0}{9(x-1)^2} + \frac{d_1\alpha_0}{18(x-1)^3} -$$

$$\frac{41\ \alpha_0}{18(x-1)^3} - \frac{217d_1\alpha_0}{72(x-1)^4} + \frac{271\alpha_0}{36\ (x-1)^4} - \frac{371\alpha_0}{36} + \Bigg( - \frac{\alpha_0^3}{3\ (x-1)^2} + \frac{\alpha_0^3}{3} - \frac{\alpha_0^2}{6(x-1)} + \frac{5\alpha_0^2}{6\ (x-1)^2} - \frac{7\alpha_0^2}{6(x-1)^3} - \frac{13\alpha_0^2}{6} +$$

$$\frac{4\alpha_0}{3\ (x-1)} - \frac{2\alpha_0}{3(x-1)^2} + \frac{4\alpha_0}{3(x-1)^3} - \frac{13\ \alpha_0}{3(x-1)^4} + \frac{23\alpha_0}{3} - \frac{205\ d_1}{72} - \frac{4}{x-2} - \frac{15d_1}{8(x-1)} + \frac{7}{4\ (x-1)} + \frac{8}{3(x-2)^2} + \frac{5d_1}{18(x-1)^2} -$$

$$\frac{1}{18\ (x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{31}{18(x-1)^3} - \frac{15\ d_1}{8(x-1)^4} + \frac{13}{4(x-1)^4} - \frac{205d_1}{72\ (x-1)^5} + \frac{415}{36(x-1)^5} + \frac{205}{36}\Bigg)\ H(0;\alpha_0) +$$

$$\Bigg(\frac{15d_1}{8(x-1)} - \frac{5d_1}{18(x-1)^2} - \frac{5\ d_1}{18(x-1)^3} + \frac{15d_1}{8(x-1)^4} + \frac{205d_1}{72(x-1)^5} + \frac{205d_1}{72} + \frac{4}{x-2} - \frac{7}{4(x-1)} - \frac{8}{3\ (x-2)^2} + \frac{1}{18(x-1)^2} +$$

$$\frac{31}{18(x-1)^3} - \frac{13}{4\ (x-1)^4} + \frac{2\pi^2}{3(x-1)^5} - \frac{415}{36(x-1)^5} + \frac{\pi^{\ 2}}{3} - \frac{205}{36}\Bigg)H(0;x) + \Bigg(\frac{d_1\alpha_0^3}{6} - \frac{d_1\ \alpha_0^3}{6(x-1)^2} - \frac{13d_1\alpha_0^2}{12} - \frac{d_1\alpha_0^2}{12(x-1)} +$$

$$\frac{5d_1\alpha_0^2}{12(x-1)^2} - \frac{7d_1\alpha_0^2}{12\ (x-1)^3} + \frac{23d_1\alpha_0}{6} + \frac{2d_1\alpha_0}{3(x-1)} - \frac{d_1\ \alpha_0}{3(x-1)^2} + \frac{2d_1\alpha_0}{3(x-1)^3} - \frac{13d_1\alpha_0}{6\ (x-1)^4} - \frac{35d_1}{12} - \frac{7d_1}{12(x-1)} + \frac{d_1}{12\ (x-1)^2} -$$

$$\frac{d_1}{12(x-1)^3} + \frac{13d_1}{6(x-1)^4}\Bigg)\ H(1;\alpha_0) + \Bigg(\frac{\pi^2}{2(x-1)^5} - \frac{\pi^2}{2}\Bigg)\ H(2;x) + \Bigg( - \frac{d_1\alpha_0^4}{8} + \frac{d_1\alpha_0^4}{8\ (x-1)} - \frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} +$$

$$\frac{13d_1\alpha_0^3}{18} - \frac{d_1\alpha_0^3}{2(x-1)} + \frac{5\alpha_0^3}{3(x-1)} + \frac{2d_1\ \alpha_0^3}{9(x-1)^2} - \frac{7\alpha_0^3}{9(x-1)^2} - \frac{13\ \alpha_0^3}{9} - \frac{23d_1\alpha_0^2}{12} - \frac{\alpha_0^2}{3(x-2)} + \frac{3d_1\ \alpha_0^2}{4(x-1)} - \frac{9\alpha_0^2}{2(x-1)} - \frac{2d_1\alpha_0^2}{3\ (x-1)^2} +$$

$$\frac{7\alpha_0^2}{2(x-1)^2} + \frac{d_1\alpha_0^2}{2\ (x-1)^3} - \frac{13\alpha_0^2}{6(x-1)^3} + \frac{23\alpha_0^2}{6} + \frac{25d_1\ \alpha_0}{6} + \frac{2\alpha_0}{x-2} - \frac{d_1\alpha_0}{2(x-1)} + \frac{23\alpha_0}{3\ (x-1)} - \frac{4\alpha_0}{3(x-2)^2} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{20\ \alpha_0}{3(x-1)^2} -$$

$$\frac{d_1\alpha_0}{(x-1)^3} + \frac{22\alpha_0}{3\ (x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{25\alpha_0}{3(x-1)^4} - \frac{25\ \alpha_0}{3} - \frac{205d_1}{72} + \Bigg(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\ \alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} + \frac{6\ \alpha_0^2}{x-1} -$$

$$\frac{4\alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 - \frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\ \alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3\ (x-1)^3} - \frac{3}{(x-1)^4} -$$

$$\frac{25}{3(x-1)^5} - \frac{25}{3}\Bigg)\ H(0;\alpha_0) + \Bigg( - \frac{d_1\alpha_0^4}{2} + \frac{d_1\alpha_0^4}{2(x-1)} + \frac{8\ d_1\alpha_0^3}{3} - \frac{2d_1\alpha_0^3}{x-1} + \frac{2d_1\alpha_0^3}{3(x-1)^2} - 6\ d_1\alpha_0^2 + \frac{3d_1\alpha_0^2}{x-1} - \frac{2d_1\ \alpha_0^2}{(x-1)^2} +$$

$$\frac{d_1\alpha_0^2}{(x-1)^3} + 8d_1\alpha_0 - \frac{2d_1\ \alpha_0}{x-1} + \frac{2d_1\alpha_0}{(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{2\ d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{3d_1}{2(x-1)} + \frac{d_1}{3\ (x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} -$$

$$\frac{25\ d_1}{6(x-1)^5}\Bigg)H(1;\alpha_0) - \frac{4}{x-2} - \frac{15d_1}{8\ (x-1)} + \frac{7}{4(x-1)} + \frac{8}{3(x-2)^2} + \frac{5d_1}{18\ (x-1)^2} - \frac{1}{18(x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{31}{18\ (x-1)^3} -$$

$$\frac{15d_1}{8(x-1)^4} + \frac{13}{4(x-1)^4} - \frac{205\ d_1}{72(x-1)^5} + \frac{415}{36(x-1)^5} + \frac{205}{36}\Bigg)\ H(c_1(\alpha_0);x) + \Bigg( - \frac{25}{3} - \frac{3}{x-1} + \frac{2}{3\ (x-1)^2} + \frac{2}{3(x-1)^3} -$$

$$\frac{3}{(x-1)^4} - \frac{25}{3\ (x-1)^5}\Bigg)H(0,0;\alpha_0) + \Bigg(\frac{25}{3} + \frac{3}{x-1} - \frac{2}{3\ (x-1)^2} - \frac{2}{3(x-1)^3} + \frac{3}{(x-1)^4} + \frac{25}{3\ (x-1)^5}\Bigg)H(0,0;x) + \Bigg( -$$

$$\frac{3d_1}{2(x-1)} + \frac{d_1}{3\ (x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25\ d_1}{6(x-1)^5} - \frac{25d_1}{6}\Bigg)H(0,1;\alpha_0) + H(1;x)\ \Bigg( - \frac{\pi^2 d_1}{3(x-1)^5} + \Bigg(\frac{2\ d_1}{x-1} -$$

$$\frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2\ (x-1)^4} + \frac{25d_1}{6(x-1)^5} + \frac{4}{x-2} - \frac{8}{3\ (x-2)^2} - \frac{4}{3(x-1)^2} + \frac{8}{3\ (x-2)^3} - \frac{4}{(x-1)^4}\Bigg)\ H(0;\alpha_0) +$$

$$\Bigg(4 - \frac{4}{(x-1)^5}\Bigg)H(0,0;\alpha_0) + \Bigg(2d_1 - \frac{2\ d_1}{(x-1)^5}\Bigg)H(0,1;\alpha_0) + \frac{2\pi^2}{3\ (x-1)^5}\Bigg) + \Bigg(\frac{2d_1}{(x-1)^5} - 2\ d_1 - \frac{2}{(x-1)^5} +$$

$$2\Bigg)H(0;\alpha_0)H(0,1;x) + \Bigg( - \frac{\alpha_0^4}{2\ (x-1)} + \frac{\alpha_0^4}{2} + \frac{2\alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} - \frac{8\alpha_0^3}{3} - \frac{3\alpha_0^2}{x-1} + \frac{2\ \alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} + 6\alpha_0^2 +$$

$$\frac{2\ \alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\alpha_0}{(x-1)^3} - \frac{2\ \alpha_0}{(x-1)^4} - 8\alpha_0 + \Bigg(4 - \frac{4}{(x-1)^5}\Bigg)H(0;\alpha_0) + \Bigg(2\ d_1 - \frac{2d_1}{(x-1)^5}\Bigg)H(1;\alpha_0) +$$

$$\frac{4}{x-2} - \frac{1}{2\ (x-1)} - \frac{8}{3(x-2)^2} - \frac{2}{3(x-1)^2} + \frac{8}{3\ (x-2)^3} - \frac{1}{(x-1)^3} - \frac{2}{(x-1)^4} + \frac{25}{6}\Bigg)\ H(0,c_1(\alpha_0);x) + \Bigg( - \frac{2d_1}{x-1} +$$

$$\frac{d_1}{(x-1)^2} - \frac{2\ d_1}{3(x-1)^3} + \frac{d_1}{2(x-1)^4} - \frac{25d_1}{6\ (x-1)^5} - \frac{4}{x-2} + \frac{8}{3(x-2)^2} + \frac{4}{3\ (x-1)^2} - \frac{8}{3(x-2)^3} + \frac{4}{(x-1)^4}\Bigg)\ H(1,0;x) +$$

$$\Bigg(\frac{4d_1}{(x-1)^5} - 2d_1 - \frac{4}{(x-1)^5}\Bigg)H(0;\ \alpha_0)H(1,1;x) + \Bigg(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2\ d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} + \frac{25d_1}{6\ (x-1)^5} +$$

$$\Bigg(4 - \frac{4}{(x-1)^5}\Bigg)H(0;\alpha_0) + \Bigg(2d_1 - \frac{2\ d_1}{(x-1)^5}\Bigg)H(1;\alpha_0) + \frac{4}{x-2} - \frac{8}{3\ (x-2)^2} - \frac{4}{3(x-1)^2} + \frac{8}{3\ (x-2)^3} -$$

$$\frac{4}{(x-1)^4}\Bigg)\ H(1,c_1(\alpha_0);x) + \Bigg(2 - \frac{2}{(x-1)^5}\Bigg)H(0;\alpha_0)H(2,1;x) + \Bigg(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3\ (x-1)^2} + \frac{16\alpha_0^3}{3} +$$

$$\frac{6\alpha_0^2}{x-1} - \frac{4\ \alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 - \frac{4\ \alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\ \alpha_0}{(x-1)^4} + 16\alpha_0 + \frac{4H(0;\alpha_0)}{(x-1)^5} + \frac{2d_1\ H(1;\alpha_0)}{(x-1)^5} -$$

$$\frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3\ (x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{3}\Bigg)\ H(c_1(\alpha_0),c_1(\alpha_0);x) + \Bigg(\frac{\alpha_0^4}{2\ (x-1)} - \frac{\alpha_0^4}{2} - \frac{2\alpha_0^3}{x-1} +$$

$$\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}+\frac{3\alpha_0^2}{x-1}-\frac{2\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}-6\alpha_0^2-\frac{2\alpha_0}{x-1}+\frac{2\alpha_0}{(x-1)^2}-\frac{2\alpha_0}{(x-1)^3}+\frac{2\alpha_0}{(x-1)^4}+8\alpha_0-\frac{4}{x-2}+\frac{1}{2(x-1)}+$$
$$\frac{8}{3(x-2)^2}+\frac{2}{3(x-1)^2}-\frac{8}{3(x-2)^3}+\frac{1}{(x-1)^3}+\frac{2}{(x-1)^4}-\frac{25}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)-16H(0,0,0;x)+$$
$$\Big(2-\frac{2}{(x-1)^5}\Big)H(0,0,c_1(\alpha_0);x)+\Big(-\frac{2d_1}{(x-1)^5}+2d_1+\frac{2}{(x-1)^5}-2\Big)H(0,1,0;x)+\Big(\frac{2d_1}{(x-1)^5}-2d_1-$$
$$\frac{2}{(x-1)^5}+2\Big)H(0,1,c_1(\alpha_0);x)+4H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(\frac{4}{(x-1)^5}-4\Big)H(1,0,0;x)+\Big(\frac{2d_1}{(x-1)^5}-\frac{4}{(x-1)^5}\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+2d_1+$$
$$\frac{4}{(x-1)^5}\Big)H(1,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2d_1-\frac{4}{(x-1)^5}\Big)H(1,1,c_1(\alpha_0);x)+\Big(4-$$
$$\frac{2d_1}{(x-1)^5}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(2,0,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-$$
$$2\Big)H(2,1,0;x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(2,1,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-2\Big)H(2,c_2(\alpha_0),c_1(\alpha_0);x)-$$
$$\frac{2H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{4H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{2H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{x-2}+\frac{\pi^2}{8(x-1)}+$$
$$\frac{2\pi^2}{3(x-2)^2}+\frac{\pi^2}{6(x-1)^2}-\frac{2\pi^2}{3(x-2)^3}+\frac{\pi^2}{4(x-1)^3}+\frac{\pi^2}{2(x-1)^4}-\frac{21\zeta_3}{4(x-1)^5}-\frac{33\zeta_3}{4}+\frac{\pi^2\ln 2}{2(x-1)^5}-\frac{1}{2}\pi^2\ln 2-\frac{25\pi^2}{24},$$

$$b_2^{(1,-1)}=-\frac{37}{432}d_1^2\alpha_0^3+\frac{37d_1\alpha_0^3}{108}+\frac{37d_1^2\alpha_0^3}{432(x-1)^2}-\frac{37d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi^2\alpha_0^3}{72(x-1)^2}+\frac{37\alpha_0^3}{108(x-1)^2}+\frac{\pi^2\alpha_0^3}{72}-\frac{37\alpha_0^3}{108}+$$
$$\frac{715d_1^2\alpha_0^2}{864}-\frac{793d_1\alpha_0^2}{216}+\frac{115d_1^2\alpha_0^2}{864(x-1)}+\frac{41d_1\alpha_0^2}{216(x-1)}-\frac{\pi^2\alpha_0^2}{144(x-1)}-\frac{197\alpha_0^2}{216(x-1)}-\frac{107d_1^2\alpha_0^2}{864(x-1)^2}+\frac{263d_1\alpha_0^2}{216(x-1)^2}+\frac{5\pi^2\alpha_0^2}{144(x-1)^2}-$$
$$\frac{419\alpha_0^2}{216(x-1)^2}+\frac{493d_1^2\alpha_0^2}{864(x-1)^3}-\frac{571d_1\alpha_0^2}{216(x-1)^3}-\frac{7\pi^2\alpha_0^2}{144(x-1)^3}+\frac{649\alpha_0^2}{216(x-1)^3}-\frac{13\pi^2\alpha_0^2}{144}+\frac{871\alpha_0^2}{216}-\frac{3515d_1^2\alpha_0}{432}+\frac{1040d_1\alpha_0}{27}-$$
$$\frac{25d_1\alpha_0}{9(x-2)}+\frac{50\alpha_0}{9(x-2)}-\frac{265d_1^2\alpha_0}{108(x-1)}+\frac{523d_1\alpha_0}{108(x-1)}+\frac{\pi^2\alpha_0}{18(x-1)}+\frac{62\alpha_0}{27(x-1)}-\frac{d_1^2\alpha_0}{108(x-1)^2}-\frac{d_1\alpha_0}{54(x-1)^2}-\frac{\pi^2\alpha_0}{36(x-1)^2}+$$
$$\frac{2\alpha_0}{27(x-1)^2}+\frac{113d_1^2\alpha_0}{108(x-1)^3}+\frac{307d_1\alpha_0}{108(x-1)^3}+\frac{\pi^2\alpha_0}{18(x-1)^3}-\frac{325\alpha_0}{27(x-1)^3}+\frac{2911d_1^2\alpha_0}{432(x-1)^4}-\frac{1739d_1\alpha_0}{54(x-1)^4}-\frac{13\pi^2\alpha_0}{72(x-1)^4}+$$
$$\frac{4099\alpha_0}{108(x-1)^4}+\frac{23\pi^2\alpha_0}{72}-\frac{4859\alpha_0}{108}+\Big(-\frac{7d_1\alpha_0^3}{18}+\frac{7d_1\alpha_0^3}{18(x-1)^2}-\frac{7\alpha_0^3}{9(x-1)^2}+\frac{7\alpha_0^3}{9}+\frac{109d_1\alpha_0^2}{36}+\frac{13d_1\alpha_0^2}{36(x-1)}+\frac{11\alpha_0^2}{18(x-1)}-$$
$$\frac{29d_1\alpha_0^2}{36(x-1)^2}+\frac{53\alpha_0^2}{18(x-1)^2}+\frac{67d_1\alpha_0^2}{36(x-1)^3}-\frac{79\alpha_0^2}{18(x-1)^3}-\frac{121\alpha_0^2}{18}-\frac{305d_1\alpha_0}{18}-\frac{8\alpha_0}{3(x-2)}-\frac{38d_1\alpha_0}{9(x-1)}+\frac{10\alpha_0}{9(x-1)}+\frac{4d_1\alpha_0}{9(x-1)^2}-$$
$$\frac{20\alpha_0}{9(x-1)^2}-\frac{2d_1\alpha_0}{9(x-1)^3}+\frac{82\alpha_0}{9(x-1)^3}+\frac{217d_1\alpha_0}{18(x-1)^4}-\frac{271\alpha_0}{9(x-1)^4}+\frac{371\alpha_0}{9}+\frac{2035d_1^2}{432}-\frac{2035d_1}{108}+\frac{38d_1}{3(x-2)}-\frac{68}{3(x-2)}+$$
$$\frac{63d_1^2}{16(x-1)}-\frac{161d_1}{12(x-1)}-\frac{\pi^2}{8(x-1)}+\frac{3}{2(x-1)}-\frac{76d_1}{9(x-2)^2}+\frac{152}{9(x-2)^2}-\frac{19d_1^2}{54(x-1)^2}+\frac{323d_1}{108(x-1)^2}+\frac{\pi^2}{36(x-1)^2}-$$
$$\frac{215}{108(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}+\frac{605d_1}{108(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-\frac{1643}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{50d_1}{3(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{8}{(x-1)^4}+$$
$$\frac{2035d_1^2}{432(x-1)^5}-\frac{895d_1}{27(x-1)^5}-\frac{25\pi^2}{72(x-1)^5}+\frac{5665}{108(x-1)^5}-\frac{25\pi^2}{72}+\frac{1855}{108}\Big)H(0;\alpha_0)+\Big(-\frac{7}{36}d_1^2\alpha_0^3+\frac{7d_1\alpha_0^3}{18}+$$
$$\frac{7d_1^2\alpha_0^3}{36(x-1)^2}-\frac{7d_1\alpha_0^3}{18(x-1)^2}+\frac{109d_1^2\alpha_0^2}{72}-\frac{121d_1\alpha_0^2}{36}+\frac{13d_1^2\alpha_0^2}{72(x-1)}+\frac{11d_1\alpha_0^2}{36(x-1)}-\frac{29d_1^2\alpha_0^2}{72(x-1)^2}+\frac{53d_1\alpha_0^2}{36(x-1)^2}+\frac{67d_1^2\alpha_0^2}{72(x-1)^3}-$$
$$\frac{79d_1\alpha_0^2}{36(x-1)^3}-\frac{305d_1^2\alpha_0}{36}+\frac{371d_1\alpha_0}{18}-\frac{4d_1\alpha_0}{3(x-2)}-\frac{19d_1^2\alpha_0}{9(x-1)}+\frac{5d_1\alpha_0}{9(x-1)}+\frac{2d_1^2\alpha_0}{9(x-1)^2}-\frac{10d_1\alpha_0}{9(x-1)^2}-\frac{d_1^2\alpha_0}{9(x-1)^3}+\frac{41d_1\alpha_0}{9(x-1)^3}+$$
$$\frac{217d_1^2\alpha_0}{36(x-1)^4}-\frac{271d_1\alpha_0}{18(x-1)^4}+\frac{515d_1^2}{72}-\frac{635d_1}{36}+\frac{4d_1}{3(x-2)}+\frac{139d_1^2}{72(x-1)}-\frac{31d_1}{36(x-1)}-\frac{d_1^2}{72(x-1)^2}+\frac{d_1}{36(x-1)^2}-\frac{59d_1^2}{72(x-1)^3}-$$
$$\frac{85d_1}{36(x-1)^3}-\frac{217d_1^2}{36(x-1)^4}+\frac{271d_1}{18(x-1)^4}\Big)H(1;\alpha_0)+\Big(\frac{4\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{2\alpha_0^2}{3(x-1)}-\frac{10\alpha_0^2}{3(x-1)^2}+\frac{14\alpha_0^2}{3(x-1)^3}+\frac{26\alpha_0^2}{3}-$$
$$\frac{16\alpha_0}{3(x-1)}+\frac{8\alpha_0}{3(x-1)^2}-\frac{16\alpha_0}{3(x-1)^3}+\frac{52\alpha_0}{3(x-1)^4}-\frac{92\alpha_0}{3}+\frac{205d_1}{18}+\frac{16}{x-2}+\frac{15d_1}{2(x-1)}-\frac{7}{x-1}-\frac{32}{3(x-2)^2}-\frac{10d_1}{9(x-1)^2}+$$
$$\frac{2}{9(x-1)^2}-\frac{10d_1}{9(x-1)^3}+\frac{62}{9(x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{13}{(x-1)^4}+\frac{205d_1}{18(x-1)^5}-\frac{415}{9(x-1)^5}-\frac{205}{9}\Big)H(0,0;\alpha_0)+\Big(-$$
$$\frac{15d_1}{2(x-1)}+\frac{10d_1}{9(x-1)^2}+\frac{10d_1}{9(x-1)^3}-\frac{15d_1}{2(x-1)^4}-\frac{205d_1}{18(x-1)^5}-\frac{205d_1}{18}-\frac{16}{x-2}+\frac{7}{x-1}+\frac{32}{3(x-2)^2}-\frac{2}{9(x-1)^2}-$$
$$\frac{62}{9(x-1)^3}+\frac{13}{(x-1)^4}-\frac{8\pi^2}{3(x-1)^5}+\frac{415}{9(x-1)^5}-\frac{4\pi^2}{3}+\frac{205}{9}\Big)H(0,0;x)+\Big(-\frac{2d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+$$
$$\frac{d_1\alpha_0^2}{3(x-1)}-\frac{5d_1\alpha_0^2}{3(x-1)^2}+\frac{7d_1\alpha_0^2}{3(x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+\frac{26d_1\alpha_0}{3(x-1)^4}+\frac{205d_1^2}{36}-\frac{205d_1}{18}+\frac{8d_1}{x-2}+$$
$$\frac{15d_1^2}{4(x-1)}-\frac{7d_1}{2(x-1)}-\frac{16d_1}{3(x-2)^2}-\frac{5d_1^2}{9(x-1)^2}+\frac{d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}+\frac{31d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-\frac{13d_1}{2(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-$$
$$\frac{415d_1}{18(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(\frac{4\pi^2d_1}{3(x-1)^5}+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}-\frac{8}{x-2}+\frac{5}{x-1}+$$

$$\frac{16}{3(x-2)^2} - \frac{2}{3(x-1)^2} - \frac{16}{3(x-2)^3} + \frac{10}{3(x-1)^3} + \frac{3}{(x-1)^4} + \frac{25}{3(x-1)^5} - \frac{25}{3}\Big) H(0;\alpha_0) + \Big( -\frac{8d_1}{(x-1)^5} + 8d_1 +$$
$$\frac{8}{(x-1)^5} - 8\Big) H(0,0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} + 4d_1^2 + \frac{4d_1}{(x-1)^5} - 4d_1\Big) H(0,1;\alpha_0) - \frac{8\pi^2}{3(x-1)^5}\Big) H(0,1;x) +$$
$$\Big(\frac{\pi^2 d_1}{(x-1)^5} - \pi^2 d_1 - \frac{\pi^2}{(x-1)^5} + \pi^2\Big) H(0,2;x) + \Big(-\frac{2d_1\alpha_0^3}{3} + \frac{2d_1\alpha_0^3}{3(x-1)^2} + \frac{13 d_1\alpha_0^2}{3} + \frac{d_1\alpha_0^2}{3(x-1)} - \frac{5d_1\alpha_0^2}{3(x-1)^2} +$$
$$\frac{7d_1\alpha_0^2}{3(x-1)^3} - \frac{46 d_1\alpha_0}{3} - \frac{8d_1\alpha_0}{3(x-1)} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{8d_1\alpha_0}{3(x-1)^3} + \frac{26 d_1\alpha_0}{3(x-1)^4} + \frac{35d_1}{3} + \frac{7d_1}{3(x-1)} - \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} -$$
$$\frac{26d_1}{3(x-1)^4}\Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{x-1} - \frac{d_1^2}{(x-1)^2} + \frac{4d_1^2}{9(x-1)^3} - \frac{d_1^2}{4(x-1)^4} + \frac{205 d_1^2}{36(x-1)^5} + \frac{46d_1}{3(x-2)} - \frac{46d_1}{3(x-1)} - \frac{52d_1}{9(x-2)^2} +$$
$$\frac{40d_1}{9(x-1)^2} + \frac{28d_1}{9(x-2)^3} - \frac{98d_1}{9(x-1)^3} + \frac{13d_1}{6(x-1)^4} + \frac{4\pi^2 d_1}{3(x-1)^5} - \frac{415 d_1}{18(x-1)^5} - \frac{80}{3(x-2)} - \frac{43}{6(x-1)} + \frac{56}{9(x-2)^2} + \frac{299}{18(x-1)^2} -$$
$$\frac{56}{9(x-2)^3} + \frac{23}{6(x-1)^3} + \frac{203}{6(x-1)^4} - \frac{5\pi^2}{2(x-1)^5} + \frac{35}{6(x-1)^5} - \frac{\pi^2}{6} - \frac{35}{6}\Big) H(1,0;x) + \Big(-\frac{1}{3} d_1^2\alpha_0^3 + \frac{d_1^2\alpha_0^3}{3(x-1)^2} +$$
$$\frac{13d_1^2\alpha_0^2}{6} + \frac{d_1^2\alpha_0^2}{6(x-1)} - \frac{5d_1^2\alpha_0^2}{6(x-1)^2} + \frac{7d_1^2\alpha_0^2}{6(x-1)^3} - \frac{23d_1^2\alpha_0}{3} - \frac{4d_1^2\alpha_0}{3(x-1)} + \frac{2d_1^2\alpha_0}{3(x-1)^2} - \frac{4d_1^2\alpha_0}{3(x-1)^3} + \frac{13d_1^2\alpha_0}{3(x-1)^4} + \frac{35d_1^2}{6} +$$
$$\frac{7d_1^2}{6(x-1)} - \frac{d_1^2}{6(x-1)^2} + \frac{d_1^2}{6(x-1)^3} - \frac{13d_1^2}{3(x-1)^4}\Big) H(1,1;\alpha_0) + H(0,c_1(\alpha_0);x)\Big(-\frac{d_1\alpha_0^4}{4} + \frac{d_1\alpha_0^4}{4(x-1)} - \frac{\alpha_0^4}{2(x-1)} +$$
$$\frac{\alpha_0^4}{2} + \frac{13d_1\alpha_0^3}{9} - \frac{d_1\alpha_0^3}{x-1} + \frac{10\alpha_0^3}{3(x-1)} + \frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{11\alpha_0^3}{9(x-1)^2} - \frac{29\alpha_0^3}{9} - \frac{23d_1\alpha_0^2}{6} - \frac{2\alpha_0^2}{3(x-2)} + \frac{3d_1\alpha_0^2}{2(x-1)} - \frac{53\alpha_0^2}{6(x-1)} -$$
$$\frac{4d_1\alpha_0^2}{3(x-1)^2} + \frac{37\alpha_0^2}{6(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{19\alpha_0^2}{6(x-1)^3} + \frac{59\alpha_0^2}{6} + \frac{25d_1\alpha_0}{3} + \frac{4\alpha_0}{x-2} - \frac{d_1\alpha_0}{x-1} + \frac{14\alpha_0}{x-1} - \frac{8\alpha_0}{3(x-2)^2} + \frac{4d_1\alpha_0}{3(x-1)^2} -$$
$$\frac{38\alpha_0}{3(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{40\alpha_0}{3(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{37\alpha_0}{3(x-1)^4} - \frac{73\alpha_0}{3} - \frac{205d_1}{36} + \Big(\frac{2\alpha_0^4}{x-1} - 2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)^2} + \frac{32\alpha_0^3}{3} +$$
$$\frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{4\alpha_0^2}{(x-1)^3} - 24\alpha_0^2 - \frac{8\alpha_0}{x-1} + \frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} + 32\alpha_0 - \frac{16}{x-2} + \frac{2}{x-1} + \frac{32}{3(x-2)^2} +$$
$$\frac{8}{3(x-1)^2} - \frac{32}{3(x-2)^3} + \frac{4}{(x-1)^3} + \frac{8}{(x-1)^4} - \frac{50}{3}\Big) H(0;\alpha_0) + \Big(-d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} + \frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} -$$
$$12 d_1\alpha_0^2 + \frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} + 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{3} - \frac{8d_1}{x-2} + \frac{d_1}{x-1} +$$
$$\frac{16d_1}{3(x-2)^2} + \frac{4d_1}{3(x-1)^2} - \frac{16d_1}{3(x-2)^3} + \frac{2d_1}{(x-1)^3} + \frac{4d_1}{(x-1)^4}\Big) H(1;\alpha_0) + \Big(\frac{16}{(x-1)^5} - 16\Big) H(0,0;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} -$$
$$8d_1\Big) H(0,1;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} - 8d_1\Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} - 4d_1^2\Big) H(1,1;\alpha_0) - \frac{32d_1}{3(x-2)} + \frac{70}{3(x-2)} +$$
$$\frac{35d_1}{12(x-1)} - \frac{5}{6(x-1)} + \frac{28d_1}{9(x-2)^2} - \frac{32}{9(x-2)^2} + \frac{28d_1}{9(x-1)^2} - \frac{80}{9(x-1)^2} - \frac{28d_1}{9(x-2)^3} + \frac{56}{9(x-2)^3} + \frac{5d_1}{(x-1)^3} - \frac{14}{(x-1)^3} +$$
$$\frac{4d_1}{(x-1)^4} - \frac{43}{2(x-1)^4} - \frac{\pi^2}{6(x-1)^5} - \frac{35}{6(x-1)^5} + \frac{\pi^2}{6} + \frac{415}{18}\Big) + H(c_1(\alpha_0);x)\Big(\frac{d_1^2\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{4} - \frac{d_1^2\alpha_0^4}{16(x-1)} +$$
$$\frac{d_1\alpha_0^4}{4(x-1)} + \frac{\pi^2\alpha_0^4}{24(x-1)} - \frac{\alpha_0^4}{4(x-1)} - \frac{\pi^2\alpha_0^4}{24} + \frac{\alpha_0^4}{4} - \frac{43d_1^2\alpha_0^3}{108} + \frac{43d_1\alpha_0^3}{27} + \frac{d_1^2\alpha_0^3}{4(x-1)} - \frac{16d_1\alpha_0^3}{9(x-1)} - \frac{\pi^2\alpha_0^3}{6(x-1)} + \frac{23\alpha_0^3}{9(x-1)} -$$
$$\frac{4d_1^2\alpha_0^3}{27(x-1)^2} + \frac{53d_1\alpha_0^3}{54(x-1)^2} + \frac{\pi^2\alpha_0^3}{18(x-1)^2} - \frac{37\alpha_0^3}{27(x-1)^2} + \frac{2\pi^2\alpha_0^3}{9} - \frac{43\alpha_0^3}{27} + \frac{95d_1^2\alpha_0^2}{72} - \frac{95d_1\alpha_0^2}{18} + \frac{13d_1\alpha_0^2}{18(x-2)} - \frac{13\alpha_0^2}{9(x-2)} -$$
$$\frac{3d_1^2\alpha_0^2}{8(x-1)} + \frac{16d_1\alpha_0^2}{3(x-1)} + \frac{\pi^2\alpha_0^2}{4(x-1)} - \frac{59\alpha_0^2}{6(x-1)} + \frac{4d_1^2\alpha_0^2}{9(x-1)^2} - \frac{173d_1\alpha_0^2}{36(x-1)^2} - \frac{\pi^2\alpha_0^2}{6(x-1)^2} + \frac{59\alpha_0^2}{6(x-1)^2} - \frac{d_1^2\alpha_0^2}{2(x-1)^3} + \frac{139d_1\alpha_0^2}{36(x-1)^3} +$$
$$\frac{\pi^2\alpha_0^2}{12(x-1)^3} - \frac{56\alpha_0^2}{9(x-1)^3} - \frac{\pi^2\alpha_0^2}{2} + \frac{46\alpha_0^2}{9} - \frac{205d_1^2\alpha_0}{36} + \frac{205d_1\alpha_0}{9} - \frac{17d_1\alpha_0}{3(x-2)} + \frac{10\alpha_0}{x-2} + \frac{d_1^2\alpha_0}{4(x-1)} - \frac{127d_1\alpha_0}{9(x-1)} -$$
$$\frac{\pi^2\alpha_0}{6(x-1)} + \frac{1247\alpha_0}{36(x-1)} + \frac{38d_1\alpha_0}{9(x-2)^2} - \frac{76\alpha_0}{9(x-2)^2} - \frac{4d_1^2\alpha_0}{9(x-1)^2} + \frac{34d_1\alpha_0}{3(x-1)^2} + \frac{\pi^2\alpha_0}{6(x-1)^2} - \frac{565\alpha_0}{18(x-1)^2} + \frac{d_1^2\alpha_0}{(x-1)^3} - \frac{146d_1\alpha_0}{9(x-1)^3} -$$
$$\frac{\pi^2\alpha_0}{6(x-1)^3} + \frac{1495\alpha_0}{36(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{505d_1\alpha_0}{18(x-1)^4} + \frac{\pi^2\alpha_0}{6(x-1)^4} - \frac{803\alpha_0}{18(x-1)^4} + \frac{2\pi^2\alpha_0}{3} - \frac{377\alpha_0}{18} + \frac{2035d_1^2}{432} - \frac{2035d_1}{108} +$$
$$\Big(\frac{d_1\alpha_0^4}{2} - \frac{d_1\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{26d_1\alpha_0^3}{9} + \frac{2d_1\alpha_0^3}{x-1} - \frac{20\alpha_0^3}{3(x-1)} - \frac{8d_1\alpha_0^3}{9(x-1)^2} + \frac{28\alpha_0^3}{9(x-1)^2} + \frac{52\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{3} + \frac{4\alpha_0^2}{3(x-2)} -$$
$$\frac{3d_1\alpha_0^2}{x-1} + \frac{18\alpha_0^2}{x-1} + \frac{8d_1\alpha_0^2}{3(x-1)^2} - \frac{14\alpha_0^2}{(x-1)^2} - \frac{2d_1\alpha_0^2}{(x-1)^3} + \frac{26\alpha_0^2}{3(x-1)^3} - \frac{46\alpha_0^2}{3} - \frac{50d_1\alpha_0}{3} - \frac{8\alpha_0}{x-2} + \frac{2d_1\alpha_0}{x-1} - \frac{92\alpha_0}{3(x-1)} +$$
$$\frac{16\alpha_0}{3(x-2)^2} - \frac{8d_1\alpha_0}{3(x-1)^2} + \frac{80\alpha_0}{3(x-1)^2} + \frac{4d_1\alpha_0}{(x-1)^3} - \frac{88\alpha_0}{3(x-1)^3} - \frac{8d_1\alpha_0}{(x-1)^4} + \frac{100\alpha_0}{3(x-1)^4} + \frac{100\alpha_0}{3} + \frac{205d_1}{18} + \frac{16}{x-2} + \frac{15d_1}{2(x-1)} -$$
$$\frac{7}{x-1} - \frac{32}{3(x-2)^2} - \frac{10d_1}{9(x-1)^2} + \frac{2}{9(x-1)^2} - \frac{10d_1}{9(x-1)^3} + \frac{62}{9(x-1)^3} + \frac{15d_1}{2(x-1)^4} - \frac{13}{(x-1)^4} + \frac{205d_1}{18(x-1)^5} - \frac{415}{9(x-1)^5} -$$
$$\frac{205}{9}\Big) H(0;\alpha_0) + \Big(\frac{d_1^2\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{2} - \frac{d_1^2\alpha_0^4}{4(x-1)} + \frac{d_1\alpha_0^4}{2(x-1)} - \frac{13d_1^2\alpha_0^3}{9} + \frac{26d_1\alpha_0^3}{9} + \frac{d_1^2\alpha_0^3}{x-1} - \frac{10d_1\alpha_0^3}{3(x-1)} - \frac{4d_1^2\alpha_0^3}{9(x-1)^2} +$$
$$\frac{14d_1\alpha_0^3}{9(x-1)^2} + \frac{23d_1^2\alpha_0^2}{6} - \frac{23d_1\alpha_0^2}{3} + \frac{2d_1\alpha_0^2}{3(x-2)} - \frac{3d_1^2\alpha_0^2}{2(x-1)} + \frac{9d_1\alpha_0^2}{x-1} + \frac{4d_1^2\alpha_0^2}{3(x-1)^2} - \frac{7d_1\alpha_0^2}{(x-1)^2} - \frac{d_1^2\alpha_0^2}{(x-1)^3} + \frac{13d_1\alpha_0^2}{3(x-1)^3} -$$
$$\frac{25d_1^2\alpha_0}{3} + \frac{50d_1\alpha_0}{3} - \frac{4d_1\alpha_0}{x-2} + \frac{d_1^2\alpha_0}{x-1} - \frac{46d_1\alpha_0}{3(x-1)} + \frac{8d_1\alpha_0}{3(x-2)^2} - \frac{4d_1^2\alpha_0}{3(x-1)^2} + \frac{40d_1\alpha_0}{3(x-1)^2} + \frac{2d_1^2\alpha_0}{(x-1)^3} - \frac{44d_1\alpha_0}{3(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} +$$

$$\frac{50 d_1 \alpha_0}{3(x-1)^4}+\frac{205 d_1^2}{36}-\frac{205 d_1}{18}+\frac{8 d_1}{x-2}+\frac{15 d_1^2}{4(x-1)}-\frac{7d_1}{2(x-1)}-\frac{16 d_1}{3(x-2)^2}-\frac{5d_1^2}{9(x-1)^2}+\frac{d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}+\frac{31 d_1}{9(x-1)^3}+$$

$$\frac{15 d_1^2}{4(x-1)^4}-\frac{13d_1}{2(x-1)^4}+\frac{205 d_1^2}{36(x-1)^5}-\frac{415 d_1}{18(x-1)^5}\Big)H(1;\alpha_0)+\Big(-\frac{4\alpha_0^4}{x-1}+4\alpha_0^4+\frac{16\alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3(x-1)^2}-\frac{64\alpha_0^3}{3}-$$

$$\frac{24\alpha_0^2}{x-1}+\frac{16\alpha_0^2}{(x-1)^2}-\frac{8\alpha_0^2}{(x-1)^3}+48\alpha_0^2+\frac{16\alpha_0}{x-1}-\frac{16\alpha_0}{(x-1)^2}+\frac{16\alpha_0}{(x-1)^3}-\frac{16\alpha_0}{(x-1)^4}-64\alpha_0+\frac{12}{x-1}-\frac{8}{3(x-1)^2}-\frac{8}{3(x-1)^3}+$$

$$\frac{12}{(x-1)^4}+\frac{100}{3(x-1)^5}+\frac{100}{3}\Big)H(0,0;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{2d_1\alpha_0^4}{x-1}-\frac{32 d_1\alpha_0^3}{3}+\frac{8d_1\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24 d_1\alpha_0^2-$$

$$\frac{12 d_1\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-$$

$$\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50 d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+\frac{8d_1\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-$$

$$\frac{12d_1\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-$$

$$\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(d_1^2\alpha_0^4-\frac{d_1^2\alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}+\frac{4d_1^2\alpha_0^3}{x-1}-\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2-$$

$$\frac{6d_1^2\alpha_0^2}{x-1}+\frac{4d_1^2\alpha_0^2}{(x-1)^2}-\frac{2d_1^2\alpha_0^2}{(x-1)^3}-16d_1^2\alpha_0+\frac{4d_1^2\alpha_0}{x-1}-\frac{4d_1^2\alpha_0}{(x-1)^2}+\frac{4d_1^2\alpha_0}{(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-$$

$$\frac{2d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}\Big)H(1,1;\alpha_0)+\frac{38d_1}{3(x-2)}-\frac{68}{3(x-2)}+\frac{63d_1^2}{16(x-1)}-\frac{161d_1}{12(x-1)}-\frac{\pi^2}{8(x-1)}+\frac{3}{2(x-1)}-$$

$$\frac{76d_1}{9(x-2)^2}+\frac{152}{9(x-2)^2}-\frac{19d_1^2}{54(x-1)^2}+\frac{323d_1}{108(x-1)^2}+\frac{\pi^2}{36(x-1)^2}-\frac{215}{108(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}+\frac{605d_1}{108(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-$$

$$\frac{1643}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{50d_1}{3(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{8}{(x-1)^4}+\frac{2035d_1^2}{432(x-1)^5}-\frac{895d_1}{27(x-1)^5}-\frac{25\pi^2}{72(x-1)^5}+\frac{5665}{108(x-1)^5}-$$

$$\frac{25\pi^2}{72}+\frac{1855}{108}\Big)+\Big(-\frac{2\pi^2 d_1^2}{3(x-1)^5}+\frac{8\pi^2 d_1}{3(x-1)^5}+\Big(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-$$

$$\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}+\frac{4}{x-2}-\frac{7}{2(x-1)}-\frac{8}{3(x-2)^2}+\frac{8}{3(x-2)^3}-\frac{1}{3(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-$$

$$\frac{25}{6}\Big)H(0;\alpha_0)+\Big(-\frac{16d_1}{(x-1)^5}+8d_1+\frac{16}{(x-1)^5}\Big)H(0,0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{8d_1}{(x-1)^5}\Big)H(0,1;\alpha_0)-$$

$$\frac{2\pi^2}{(x-1)^5}-\frac{2\pi^2}{3}\Big)H(1,1;x)+\Big(\frac{\pi^2 d_1}{(x-1)^5}-\frac{\pi^2}{2(x-1)^5}-\frac{3\pi^2}{2}\Big)H(1,2;x)+\Big(-\frac{4d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9(x-1)^3}+$$

$$\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36(x-1)^5}-\frac{46d_1}{3(x-2)}+\frac{46d_1}{3(x-1)}+\frac{52d_1}{9(x-2)^2}-\frac{40d_1}{9(x-1)^2}-\frac{28d_1}{9(x-2)^3}+\frac{98d_1}{9(x-1)^3}-\frac{13d_1}{6(x-1)^4}+$$

$$\frac{415d_1}{18(x-1)^5}+\Big(-\frac{8d_1}{x-1}+\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}-\frac{16}{x-2}+\frac{32}{3(x-2)^2}+\frac{16}{3(x-1)^2}-\frac{32}{3(x-2)^3}+$$

$$\frac{16}{(x-1)^4}\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}-\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-$$

$$\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}\Big)H(1;\alpha_0)+\Big(\frac{16}{(x-1)^5}-16\Big)H(0,0;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-8d_1\Big)H(0,1;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-$$

$$8d_1\Big)H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2\Big)H(1,1;\alpha_0)+\frac{80}{3(x-2)}+\frac{43}{6(x-1)}-\frac{56}{9(x-2)^2}-\frac{299}{18(x-1)^2}+\frac{56}{9(x-2)^3}-$$

$$\frac{23}{6(x-1)^3}-\frac{203}{6(x-1)^4}-\frac{\pi^2}{6(x-1)^5}-\frac{35}{6(x-1)^5}+\frac{\pi^2}{6}+\frac{35}{6}\Big)H(1,c_1(\alpha_0);x)+\Big(2\pi^2-\frac{2\pi^2}{(x-1)^5}\Big)H(2,0;x)+$$

$$\Big(\Big(-\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}+\frac{16}{x-2}-\frac{15}{2(x-1)}-\frac{32}{3(x-2)^2}-\frac{1}{3(x-1)^2}+$$

$$\frac{32}{3(x-2)^3}-\frac{5}{(x-1)^3}-\frac{17}{2(x-1)^4}-\frac{25}{2(x-1)^5}+\frac{25}{2}\Big)H(0;\alpha_0)+\Big(\frac{8}{(x-1)^5}-8\Big)H(0,0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-$$

$$4d_1\Big)H(0,1;\alpha_0)+\frac{\pi^2}{3(x-1)^5}-\frac{\pi^2}{3}\Big)H(2,1;x)+\Big(-\frac{\pi^2 d_1}{(x-1)^5}+\pi^2 d_1+\frac{2\pi^2}{(x-1)^5}-2\pi^2\Big)H(2,2;x)+$$

$$\Big(\frac{d_1\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{26d_1\alpha_0^3}{9}+\frac{2d_1\alpha_0^3}{x-1}-\frac{41\alpha_0^3}{6(x-1)}-\frac{8d_1\alpha_0^3}{9(x-1)^2}+\frac{25\alpha_0^3}{9(x-1)^2}+\frac{107\alpha_0^3}{18}+\frac{23d_1\alpha_0^2}{3}+$$

$$\frac{5\alpha_0^2}{3(x-2)}-\frac{3d_1\alpha_0^2}{x-1}+\frac{221\alpha_0^2}{12(x-1)}+\frac{8d_1\alpha_0^2}{3(x-1)^2}-\frac{27\alpha_0^2}{2(x-1)^2}-\frac{2d_1\alpha_0^2}{(x-1)^3}+\frac{15\alpha_0^2}{2(x-1)^3}-\frac{197\alpha_0^2}{12}-\frac{50d_1\alpha_0}{3}-\frac{10\alpha_0}{x-2}+\frac{2d_1\alpha_0}{x-1}-$$

$$\frac{181\alpha_0}{6(x-1)}+\frac{20\alpha_0}{3(x-2)^2}-\frac{8d_1\alpha_0}{3(x-1)^2}+\frac{80\alpha_0}{3(x-1)^2}+\frac{4d_1\alpha_0}{(x-1)^3}-\frac{29\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{29\alpha_0}{(x-1)^4}+\frac{223\alpha_0}{6}+\frac{205d_1}{18}+\Big(-$$

$$\frac{4\alpha_0^4}{x-1}+4\alpha_0^4+\frac{16\alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3(x-1)^2}-\frac{64\alpha_0^3}{3}-\frac{24\alpha_0^2}{x-1}+\frac{16\alpha_0^2}{(x-1)^2}-\frac{8\alpha_0^2}{(x-1)^3}+48\alpha_0^2+\frac{16\alpha_0}{x-1}-\frac{16\alpha_0}{(x-1)^2}+\frac{16\alpha_0}{(x-1)^3}-$$

$$\frac{16\alpha_0}{(x-1)^4}-64\alpha_0+\frac{12}{x-1}-\frac{8}{3(x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3(x-1)^5}+\frac{100}{3}\Big)H(0;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{2d_1\alpha_0^4}{x-1}-$$

$$\frac{32d_1\alpha_0^3}{3}+\frac{8d_1\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-\frac{12d_1\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-$$

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$$\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6\ d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6\ d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}\Big)H(1;\alpha_0)-\frac{16\ H(0,0;\alpha_0)}{(x-1)^5}-\frac{8d_1H(0,1;\alpha_0)}{(x-1)^5}-$$
$$\frac{8d_1\ H(1,0;\alpha_0)}{(x-1)^5}-\frac{4d_1^2\ H(1,1;\alpha_0)}{(x-1)^5}+\frac{20}{x-2}+\frac{15d_1}{2\ (x-1)}-\frac{49}{4(x-1)}-\frac{40}{3(x-2)^2}-\frac{10d_1}{9\ (x-1)^2}+\frac{5}{36(x-1)^2}-\frac{10d_1}{9(x-1)^3}+$$
$$\frac{275}{36\ (x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{6}{(x-1)^4}+\frac{205d_1}{18\ (x-1)^5}+\frac{\pi^2}{6(x-1)^5}-\frac{725}{18\ (x-1)^5}-\frac{925}{36}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(\frac{d_1\ \alpha_0^4}{4}-\frac{d_1\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{2\ (x-1)}-\frac{\alpha_0^4}{2}-\frac{13d_1\alpha_0^3}{9}+\frac{d_1\ \alpha_0^3}{x-1}-\frac{3\alpha_0^3}{x-1}-\frac{4d_1\alpha_0^3}{9\ (x-1)^2}+\frac{25\alpha_0^3}{18(x-1)^2}+\frac{61\alpha_0^3}{18}+\frac{23d_1\ \alpha_0^2}{6}-$$
$$\frac{3d_1\alpha_0^2}{2(x-1)}+\frac{31\alpha_0^2}{4\ (x-1)}+\frac{4d_1\alpha_0^2}{3(x-1)^2}-\frac{71\alpha_0^2}{12\ (x-1)^2}-\frac{d_1\alpha_0^2}{(x-1)^3}+\frac{15\alpha_0^2}{4\ (x-1)^3}-\frac{131\alpha_0^2}{12}-\frac{25d_1\alpha_0}{3}+\frac{d_1\ \alpha_0}{x-1}-\frac{13\alpha_0}{x-1}-$$
$$\frac{4d_1\alpha_0}{3(x-1)^2}+\frac{35\ \alpha_0}{3(x-1)^2}+\frac{2d_1\alpha_0}{(x-1)^3}-\frac{12\ \alpha_0}{(x-1)^3}-\frac{4d_1\alpha_0}{(x-1)^4}+\frac{29\alpha_0}{2\ (x-1)^4}+\frac{169\alpha_0}{6}+\frac{205d_1}{36}+\Big(-\frac{2\ \alpha_0^4}{x-1}+2\alpha_0^4+\frac{8\alpha_0^3}{x-1}-$$
$$\frac{8\alpha_0^3}{3\ (x-1)^2}-\frac{32\alpha_0^3}{3}-\frac{12\alpha_0^2}{x-1}+\frac{8\ \alpha_0^2}{(x-1)^2}-\frac{4\alpha_0^2}{(x-1)^3}+24\alpha_0^2+\frac{8\ \alpha_0}{x-1}-\frac{8\alpha_0}{(x-1)^2}+\frac{8\alpha_0}{(x-1)^3}-\frac{8\ \alpha_0}{(x-1)^4}-32\alpha_0+\frac{16}{x-2}-$$
$$\frac{2}{x-1}-\frac{32}{3\ (x-2)^2}-\frac{8}{3(x-1)^2}+\frac{32}{3\ (x-2)^3}-\frac{4}{(x-1)^3}-\frac{8}{(x-1)^4}+\frac{50}{3}\Big)\ H(0;\alpha_0)+\Big(d_1\alpha_0^4-\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}+$$
$$\frac{4d_1\alpha_0^3}{x-1}-\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\ \alpha_0^2-\frac{6d_1\alpha_0^2}{x-1}+\frac{4d_1\alpha_0^2}{(x-1)^2}-\frac{2d_1\ \alpha_0^2}{(x-1)^3}-16d_1\alpha_0+\frac{4d_1\alpha_0}{x-1}-\frac{4d_1\ \alpha_0}{(x-1)^2}+\frac{4d_1\alpha_0}{(x-1)^3}-\frac{4d_1\ \alpha_0}{(x-1)^4}+$$
$$\frac{25d_1}{3}+\frac{8\ d_1}{x-2}-\frac{d_1}{x-1}-\frac{16d_1}{3(x-2)^2}-\frac{4d_1}{3\ (x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{2d_1}{(x-1)^3}-\frac{4\ d_1}{(x-1)^4}\Big)H(1;\alpha_0)+\frac{32d_1}{3(x-2)}-\frac{82}{3\ (x-2)}-$$
$$\frac{35d_1}{12(x-1)}+\frac{73}{12(x-1)}-\frac{28d_1}{9\ (x-2)^2}+\frac{56}{9(x-2)^2}-\frac{28d_1}{9(x-1)^2}+\frac{323}{36\ (x-1)^2}+\frac{28d_1}{9(x-2)^3}-\frac{56}{9(x-2)^3}-\frac{5\ d_1}{(x-1)^3}+\frac{53}{4(x-1)^3}-$$
$$\frac{4d_1}{(x-1)^4}+\frac{29}{2\ (x-1)^4}-\frac{725}{36}\Big)\ H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{100}{3}+\frac{12}{x-1}-\frac{8}{3\ (x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+$$
$$\frac{100}{3(x-1)^5}\Big)H(0,0,0;\alpha_0)+\Big(-\frac{100}{3}-\frac{12}{x-1}+\frac{8}{3\ (x-1)^2}+\frac{8}{3(x-1)^3}-\frac{12}{(x-1)^4}-\frac{100}{3(x-1)^5}\Big)H(0,0,0;x)+$$
$$\Big(\frac{6d_1}{x-1}-\frac{4d_1}{3\ (x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50\ d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,0,1;\alpha_0)+\Big(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{12}{(x-1)^5}-$$
$$12\Big)H(0;\alpha_0)\ H(0,0,1;x)+\Big(-\frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\ \alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\ \alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+$$
$$\frac{4\ \alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\ \alpha_0}{(x-1)^4}-16\alpha_0+\Big(\frac{8}{(x-1)^5}-8\Big)\ H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)\ H(1;\alpha_0)-\frac{8}{x-2}+$$
$$\frac{4}{x-1}+\frac{16}{3(x-2)^2}+\frac{2}{3\ (x-1)^2}-\frac{16}{3(x-2)^3}+\frac{4}{3\ (x-1)^3}+\frac{7}{(x-1)^4}+\frac{25}{3(x-1)^5}\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(\frac{6d_1}{x-1}-$$
$$\frac{4d_1}{3\ (x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50\ d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,1,0;\alpha_0)+\Big(-\frac{8\ d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16\ d_1}{3(x-2)^3}+$$
$$\frac{8\ d_1}{(x-1)^4}+\frac{8}{x-2}-\frac{5}{x-1}-\frac{16}{3\ (x-2)^2}+\frac{2}{3(x-1)^2}+\frac{16}{3(x-2)^3}-\frac{10}{3\ (x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3(x-1)^5}+\frac{25}{3}\Big)\ H(0,1,0;x)+$$
$$\Big(\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-\frac{2\ d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{25d_1^2}{3}\Big)H(0,1,1;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4\ d_1^2-\frac{12d_1}{(x-1)^5}+$$
$$4d_1+\frac{16}{(x-1)^5}\Big)H(0;\alpha_0)\ H(0,1,1;x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8\ d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}+\Big(-\frac{8d_1}{(x-1)^5}+$$
$$8d_1+\frac{8}{(x-1)^5}-8\Big)\ H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{4\ d_1}{(x-1)^5}-4d_1\Big)\ H(1;\alpha_0)-\frac{8}{x-2}+\frac{5}{x-1}+\frac{16}{3(x-2)^2}-$$
$$\frac{2}{3\ (x-1)^2}-\frac{16}{3(x-2)^3}+\frac{10}{3(x-1)^3}+\frac{3}{(x-1)^4}+\frac{25}{3(x-1)^5}-\frac{25}{3}\Big)\ H(0,1,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+4\ d_1+$$
$$\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)H(0,2,1;x)+\Big(\frac{2\ \alpha_0^4}{x-1}-2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3\ (x-1)^2}+\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\ \alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}-$$
$$24\alpha_0^2-\frac{8\ \alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\ \alpha_0}{(x-1)^4}+32\alpha_0-16H(0;\alpha_0)-8d_1\ H(1;\alpha_0)-\frac{20}{x-2}+\frac{11}{2(x-1)}+$$
$$\frac{40}{3\ (x-2)^2}+\frac{8}{3(x-1)^2}-\frac{40}{3(x-2)^3}+\frac{13}{3\ (x-1)^3}+\frac{13}{(x-1)^4}+\frac{25}{3(x-1)^5}-\frac{25}{2}\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{x-1}-$$
$$\alpha_0^4-\frac{4\ \alpha_0^3}{x-1}+\frac{4\alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}+\frac{6\ \alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\frac{4\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\ \alpha_0}{(x-1)^4}+$$
$$16\alpha_0+\Big(\frac{8}{(x-1)^5}-8\Big)\ H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)\ H(1;\alpha_0)+\frac{16}{x-2}-\frac{13}{2(x-1)}-\frac{32}{3\ (x-2)^2}-\frac{5}{3(x-1)^2}+$$
$$\frac{32}{3\ (x-2)^3}-\frac{3}{(x-1)^3}-\frac{25}{2(x-1)^4}-\frac{25}{2(x-1)^5}+\frac{25}{6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8\ d_1}{x-1}-\frac{4d_1}{(x-1)^2}+\frac{8d_1}{3(x-1)^3}-$$
$$\frac{2\ d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}+\frac{16}{x-2}-\frac{32}{3\ (x-2)^2}-\frac{16}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{16}{(x-1)^4}\Big)H(1,0,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{12d_1}{(x-1)^5}+$$
$$\frac{12}{(x-1)^5}-4\Big)H(0;\alpha_0)\ H(1,0,1;x)+\Big(\Big(\frac{16}{(x-1)^5}-\frac{8d_1}{(x-1)^5}\Big)\ H(0;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-\frac{4d_1^2}{(x-1)^5}\Big)H(1;\ \alpha_0)+$$



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$$\frac{4}{x-2} - \frac{7}{2(x-1)} - \frac{8}{3(x-2)^2} + \frac{8}{3(x-2)^3} - \frac{1}{3(x-1)^3} - \frac{5}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{6}\Big) H(1,0,c_1(\alpha_0);x) + \Big(-$$
$$\frac{4d_1^2}{x-1} + \frac{2d_1^2}{(x-1)^2} - \frac{4d_1^2}{3(x-1)^3} + \frac{d_1^2}{(x-1)^4} - \frac{25d_1^2}{3(x-1)^5} - \frac{8d_1}{x-2} + \frac{16d_1}{3(x-2)^2} + \frac{8d_1}{3(x-1)^2} - \frac{16d_1}{3(x-2)^3} + \frac{8d_1}{(x-1)^4} - \frac{4}{x-2} +$$
$$\frac{7}{2(x-1)} + \frac{8}{3(x-2)^2} - \frac{8}{3(x-2)^3} + \frac{1}{3(x-1)^3} + \frac{5}{(x-1)^4} + \frac{25}{3(x-1)^5} + \frac{25}{6}\Big) H(1,1,0;x) + \Big(\frac{12d_1^2}{(x-1)^5} - 4d_1^2 -$$
$$\frac{24d_1}{(x-1)^5} + \frac{12}{(x-1)^5} + 4\Big) H(0;\alpha_0)\, H(1,1,1;x) + \Big(\frac{4d_1^2}{x-1} - \frac{2d_1^2}{(x-1)^2} + \frac{4d_1^2}{3(x-1)^3} - \frac{d_1^2}{(x-1)^4} + \frac{25d_1^2}{3(x-1)^5} +$$
$$\frac{8d_1}{x-2} - \frac{16d_1}{3(x-2)^2} - \frac{8d_1}{3(x-1)^2} + \frac{16d_1}{3(x-2)^3} - \frac{8d_1}{(x-1)^4} + \Big(-\frac{16d_1}{(x-1)^5} + 8d_1 + \frac{16}{(x-1)^5}\Big) H(0;\alpha_0) + \Big(-\frac{8d_1^2}{(x-1)^5} +$$
$$4d_1^2 + \frac{8d_1}{(x-1)^5}\Big) H(1;\alpha_0) + \frac{4}{x-2} - \frac{7}{2(x-1)} - \frac{8}{3(x-2)^2} + \frac{8}{3(x-2)^3} - \frac{1}{3(x-1)^3} - \frac{5}{(x-1)^4} - \frac{25}{3(x-1)^5} -$$
$$\frac{25}{6}\Big) H(1,1,c_1(\alpha_0);x) + \Big(-\frac{4d_1}{(x-1)^5} + \frac{2}{(x-1)^5} + 6\Big) H(0;\alpha_0)\, H(1,2,1;x) + \Big(-\frac{8d_1}{x-1} + \frac{4d_1}{(x-1)^2} -$$
$$\frac{8d_1}{3(x-1)^3} + \frac{2d_1}{(x-1)^4} - \frac{50d_1}{3(x-1)^5} + \Big(\frac{8d_1}{(x-1)^5} - 16\Big) H(0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} - 8d_1\Big) H(1;\alpha_0) - \frac{20}{x-2} + \frac{7}{2(x-1)} +$$
$$\frac{40}{3(x-2)^2} + \frac{16}{3(x-1)^2} - \frac{40}{3(x-2)^3} + \frac{1}{3(x-1)^3} + \frac{21}{(x-1)^4} + \frac{25}{3(x-1)^5} + \frac{25}{6}\Big) H(1,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(-$$
$$\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{4}{(x-1)^5} - 4\Big) H(0;\alpha_0)\, H(2,0,1;x) + \Big(-\frac{8d_1}{x-2} + \frac{16d_1}{3(x-2)^2} + \frac{8d_1}{3(x-1)^2} - \frac{16d_1}{3(x-2)^3} + \frac{8d_1}{(x-1)^4} +$$
$$\Big(\frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1\Big) H(1;\alpha_0) + \frac{16}{x-2} - \frac{15}{2(x-1)} - \frac{32}{3(x-2)^2} - \frac{1}{3(x-1)^2} + \frac{32}{3(x-2)^3} -$$
$$\frac{5}{(x-1)^3} - \frac{17}{2(x-1)^4} - \frac{25}{2(x-1)^5} + \frac{25}{2}\Big) H(2,0,c_1(\alpha_0);x) + \Big(\frac{8d_1}{x-2} - \frac{16d_1}{3(x-2)^2} - \frac{8d_1}{3(x-1)^2} + \frac{16d_1}{3(x-2)^3} - \frac{8d_1}{(x-1)^4} -$$
$$\frac{16}{x-2} + \frac{15}{2(x-1)} + \frac{32}{3(x-2)^2} + \frac{1}{3(x-1)^2} - \frac{32}{3(x-2)^3} + \frac{5}{(x-1)^3} + \frac{17}{2(x-1)^4} + \frac{25}{2(x-1)^5} - \frac{25}{2}\Big) H(2,1,0;x) +$$
$$\Big(-\frac{4d_1}{(x-1)^5} + 4d_1 - \frac{2}{(x-1)^5} + 2\Big) H(0;\alpha_0) H(2,1,1;x) + \Big(-\frac{8d_1}{x-2} + \frac{16d_1}{3(x-2)^2} + \frac{8d_1}{3(x-1)^2} - \frac{16d_1}{3(x-2)^3} +$$
$$\frac{8d_1}{(x-1)^4} + \Big(\frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1\Big) H(1;\alpha_0) + \frac{16}{x-2} - \frac{15}{2(x-1)} - \frac{32}{3(x-2)^2} - \frac{1}{3(x-1)^2} +$$
$$\frac{32}{3(x-2)^3} - \frac{5}{(x-1)^3} - \frac{17}{2(x-1)^4} - \frac{25}{2(x-1)^5} + \frac{25}{2}\Big) H(2,1,c_1(\alpha_0);x) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 - \frac{8}{(x-1)^5} +$$
$$8\Big) H(0;\alpha_0) H(2,2,1;x) + \Big(\frac{8d_1}{x-2} - \frac{16d_1}{3(x-2)^2} - \frac{8d_1}{3(x-1)^2} + \frac{16d_1}{3(x-2)^3} - \frac{8d_1}{(x-1)^4} + \Big(8 - \frac{8}{(x-1)^5}\Big) H(0;\alpha_0) +$$
$$\Big(4d_1 - \frac{4d_1}{(x-1)^5}\Big) H(1;\alpha_0) - \frac{16}{x-2} + \frac{15}{2(x-1)} + \frac{32}{3(x-2)^2} + \frac{1}{3(x-1)^2} - \frac{32}{3(x-2)^3} + \frac{5}{(x-1)^3} + \frac{17}{2(x-1)^4} +$$
$$\frac{25}{2(x-1)^5} - \frac{25}{2}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} + \frac{6\alpha_0^2}{x-1} - \frac{4\alpha_0^2}{(x-1)^2} +$$
$$\frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 - \frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\alpha_0}{(x-1)^4} + 16\alpha_0 + \frac{8H(0;\alpha_0)}{(x-1)^5} + \frac{4d_1\, H(1;\alpha_0)}{(x-1)^5} - \frac{3}{x-1} + \frac{2}{3(x-1)^2} +$$
$$\frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{3}\Big) H(c_1(\alpha_0),0,c_1(\alpha_0);x) + \Big(-\frac{3\alpha_0^4}{x-1} + 3\alpha_0^4 + \frac{12\alpha_0^3}{x-1} - \frac{4\alpha_0^3}{(x-1)^2} -$$
$$16\alpha_0^3 - \frac{18\alpha_0^2}{x-1} + \frac{12\alpha_0^2}{(x-1)^2} - \frac{6\alpha_0^2}{(x-1)^3} + 36\alpha_0^2 + \frac{12\alpha_0}{x-1} - \frac{12\alpha_0}{(x-1)^2} + \frac{12\alpha_0}{(x-1)^3} - \frac{12\alpha_0}{(x-1)^4} - 48\alpha_0 - \frac{16\, H(0;\alpha_0)}{(x-1)^5} -$$
$$\frac{8d_1\, H(1;\alpha_0)}{(x-1)^5} + \frac{9}{x-1} - \frac{2}{(x-1)^2} - \frac{2}{(x-1)^3} + \frac{9}{(x-1)^4} + \frac{25}{(x-1)^5} + 25\Big) H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + \Big(-$$
$$\frac{3\alpha_0^4}{2(x-1)} + \frac{3\alpha_0^4}{2} + \frac{6\alpha_0^3}{x-1} - \frac{2\alpha_0^3}{(x-1)^2} - 8\alpha_0^3 - \frac{9\alpha_0^2}{x-1} + \frac{6\alpha_0^2}{(x-1)^2} - \frac{3\alpha_0^2}{(x-1)^3} + 18\alpha_0^2 + \frac{6\alpha_0}{x-1} - \frac{6\alpha_0}{(x-1)^2} + \frac{6\alpha_0}{(x-1)^3} -$$
$$\frac{6\alpha_0}{(x-1)^4} - 24\alpha_0 - \frac{8H(0;\alpha_0)}{(x-1)^5} - \frac{4d_1\, H(1;\alpha_0)}{(x-1)^5} + \frac{9}{2(x-1)} - \frac{1}{(x-1)^2} - \frac{1}{(x-1)^3} + \frac{9}{2(x-1)^4} + \frac{25}{2(x-1)^5} +$$
$$\frac{25}{2}\Big) H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} + \frac{6\alpha_0^2}{x-1} - \frac{4\alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} -$$
$$12\alpha_0^2 - \frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{8}{x-2} + \frac{1}{x-1} + \frac{16}{3(x-2)^2} + \frac{4}{3(x-1)^2} - \frac{16}{3(x-2)^3} +$$
$$\frac{2}{(x-1)^3} + \frac{4}{(x-1)^4} - \frac{25}{3}\Big) H(c_2(\alpha_0),0,c_1(\alpha_0);x) + \Big(-\frac{5\alpha_0^4}{2(x-1)} + \frac{5\alpha_0^4}{2} + \frac{10\alpha_0^3}{x-1} - \frac{10\alpha_0^3}{3(x-1)^2} - \frac{40\alpha_0^3}{3} -$$
$$\frac{15\alpha_0^2}{x-1} + \frac{10\alpha_0^2}{(x-1)^2} - \frac{5\alpha_0^2}{(x-1)^3} + 30\alpha_0^2 + \frac{10\alpha_0}{x-1} - \frac{10\alpha_0}{(x-1)^2} + \frac{10\alpha_0}{(x-1)^3} - \frac{10\alpha_0}{(x-1)^4} - 40\alpha_0 + \frac{20}{x-2} - \frac{5}{2(x-1)} - \frac{40}{3(x-2)^2} -$$
$$\frac{10}{3(x-1)^2} + \frac{40}{3(x-2)^3} - \frac{5}{(x-1)^3} - \frac{10}{(x-1)^4} + \frac{125}{6}\Big) H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + 64\, H(0,0,0,0;x) +$$
$$\Big(\frac{12}{(x-1)^5} - 12\Big) H(0,0,0,c_1(\alpha_0);x) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 - \frac{12}{(x-1)^5} + 12\Big) H(0,0,1,0;x) + \Big(-\frac{4d_1}{(x-1)^5} +$$

$$4d_1+\frac{12}{(x-1)^5}-12\Big) H(0,0,1,c_1(\alpha_0);x)+\Big(-8-\frac{8}{(x-1)^5}\Big) H(0,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-$$

$$4\Big) H(0,0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8d_1}{(x-1)^5}-8\,d_1-\frac{8}{(x-1)^5}+8\Big) H(0,1,0,0;x)+\Big(\frac{16}{(x-1)^5}-$$

$$\frac{8d_1}{(x-1)^5}\Big) H(0,1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{12\,d_1}{(x-1)^5}-4d_1-\frac{16}{(x-1)^5}\Big)H(0,1,1,0;x)+$$

$$\Big(\frac{4\,d_1^2}{(x-1)^5}-4d_1^2-\frac{12d_1}{(x-1)^5}+4\,d_1+\frac{16}{(x-1)^5}\Big)H(0,1,1,c_1(\alpha_0);x)+\Big(8\,d_1-\frac{8}{(x-1)^5}-$$

$$8\Big)H(0,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4\,d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-4\Big) H(0,2,0,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-$$

$$4\,d_1-\frac{4}{(x-1)^5}+4\Big)H(0,2,1,0;x)+\Big(-\frac{4\,d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-4\Big) H(0,2,1,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-$$

$$4\,d_1-\frac{4}{(x-1)^5}+4\Big) H(0,2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(4+\frac{4}{(x-1)^5}\Big) H(0,c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(-$$

$$12-\frac{4}{(x-1)^5}\Big) H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-6-\frac{2}{(x-1)^5}\Big) H(0,c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(4-\frac{4}{(x-1)^5}\Big) H(0,c_2(\alpha_0),0,c_1(\alpha_0);x)+\Big(\frac{10}{(x-1)^5}-10\Big) H(0,c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(16-\frac{16}{(x-1)^5}\Big) H(1,0,0,0;x)+\Big(-\frac{4d_1}{(x-1)^5}+\frac{12}{(x-1)^5}-4\Big) H(1,0,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+$$

$$\frac{12\,d_1}{(x-1)^5}-\frac{12}{(x-1)^5}+4\Big)H(1,0,1,0;x)+\Big(\frac{4\,d_1^2}{(x-1)^5}-\frac{12d_1}{(x-1)^5}+\frac{12}{(x-1)^5}-4\Big) H(1,0,1,c_1(\alpha_0);x)+$$

$$\Big(\frac{4}{(x-1)^5}-4\Big)H(1,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+6\Big) H(1,0,c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(\frac{16d_1}{(x-1)^5}-8\,d_1-\frac{16}{(x-1)^5}\Big)H(1,1,0,0;x)+\Big(\frac{4\,d_1^2}{(x-1)^5}-\frac{16d_1}{(x-1)^5}+\frac{12}{(x-1)^5}+4\Big) H(1,1,0,c_1(\alpha_0);x)+$$

$$\Big(-\frac{12d_1^2}{(x-1)^5}+4d_1^2+\frac{24\,d_1}{(x-1)^5}-\frac{12}{(x-1)^5}-4\Big)H(1,1,1,0;x)+\Big(\frac{12\,d_1^2}{(x-1)^5}-4d_1^2-\frac{24\,d_1}{(x-1)^5}+\frac{12}{(x-1)^5}+$$

$$4\Big) H(1,1,1,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+8\,d_1+\frac{4}{(x-1)^5}-4\Big)H(1,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4\,d_1}{(x-1)^5}+$$

$$\frac{2}{(x-1)^5}+6\Big) H(1,2,0,c_1(\alpha_0);x)+\Big(\frac{4\,d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Big)H(1,2,1,0;x)+\Big(-\frac{4\,d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+$$

$$6\Big) H(1,2,1,c_1(\alpha_0);x)+\Big(\frac{4\,d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Big) H(1,2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4\,d_1}{(x-1)^5}+$$

$$\frac{4}{(x-1)^5}+4\Big) H(1,c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(\frac{8\,d_1}{(x-1)^5}-\frac{4}{(x-1)^5}-12\Big) H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(\frac{4\,d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Big) H(1,c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-4\Big) H(2,0,0,c_1(\alpha_0);x)+$$

$$\Big(\frac{4d_1}{(x-1)^5}-4\,d_1-\frac{4}{(x-1)^5}+4\Big)H(2,0,1,0;x)+\Big(-\frac{4\,d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-4\Big) H(2,0,1,c_1(\alpha_0);x)+$$

$$\Big(\frac{10}{(x-1)^5}-10\Big) H(2,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(8-\frac{8}{(x-1)^5}\Big) H(2,0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(8-$$

$$\frac{8}{(x-1)^5}\Big) H(2,1,0,0;x)+\Big(2-\frac{2}{(x-1)^5}\Big) H(2,1,0,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-4\,d_1+\frac{2}{(x-1)^5}-$$

$$2\Big)H(2,1,1,0;x)+\Big(-\frac{4\,d_1}{(x-1)^5}+4d_1-\frac{2}{(x-1)^5}+2\Big) H(2,1,1,c_1(\alpha_0);x)+\Big(\frac{10}{(x-1)^5}-$$

$$10\Big) H(2,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-4\,d_1-\frac{8}{(x-1)^5}+8\Big)H(2,2,0,c_1(\alpha_0);x)+\Big(-\frac{4\,d_1}{(x-1)^5}+$$

$$4d_1+\frac{8}{(x-1)^5}-8\Big) H(2,2,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-4\,d_1-\frac{8}{(x-1)^5}+8\Big)H(2,2,1,c_1(\alpha_0);x)+\Big(-\frac{4\,d_1}{(x-1)^5}+$$

$$4d_1+\frac{8}{(x-1)^5}-8\Big) H(2,2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-4\Big) H(2,c_2(\alpha_0),0,c_1(\alpha_0);x)+\Big(10-$$

$$\frac{10}{(x-1)^5}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\frac{4\,H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{8\,H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+$$

$$\frac{4H(c_1(\alpha_0),0,c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{4\,H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-\frac{12\,H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-$$

$$\frac{6\,H(c_1(\alpha_0),c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{4\,H(c_1(\alpha_0),c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-\frac{10\,H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+$$

$$H(2;x)\,\Big(\frac{2\pi^2 d_1}{x-2}-\frac{4\pi^2 d_1}{3(x-2)^2}-\frac{2\,\pi^2 d_1}{3(x-1)^2}+\frac{4\pi^2 d_1}{3(x-2)^3}-\frac{2\pi^2\,d_1}{(x-1)^4}-\frac{4\pi^2}{x-2}+\frac{15\pi^2}{8(x-1)}+\frac{8\,\pi^2}{3(x-2)^2}+\frac{\pi^2}{12(x-1)^2}-$$

$$\frac{8\pi^2}{3\,(x-2)^3}+\frac{5\pi^2}{4(x-1)^3}+\frac{17\pi^2}{8\,(x-1)^4}+\frac{25\pi^2}{8(x-1)^5}-\frac{7\zeta_3}{2\,(x-1)^5}+\frac{7\zeta_3}{2}+\frac{3\pi^2\ln 2}{(x-1)^5}-3\pi^{\,2}\ln 2-\frac{25\pi^2}{8}\Big)+H(0;x)\Big(-$$

$$\frac{63d_1^2}{16\ (x-1)}+\frac{19d_1^2}{54(x-1)^2}+\frac{19d_1^2}{54\ (x-1)^3}-\frac{63d_1^2}{16(x-1)^4}-\frac{2035d_1^2}{432\ (x-1)^5}-\frac{2035d_1^2}{432}-\frac{38d_1}{3(x-2)}+\frac{161\ d_1}{12(x-1)}+\frac{76d_1}{9(x-2)^2}-$$
$$\frac{323d_1}{108\ (x-1)^2}-\frac{605d_1}{108(x-1)^3}+\frac{50d_1}{3\ (x-1)^4}+\frac{895d_1}{27(x-1)^5}+\frac{2035d_1}{108}+\frac{4\pi^2}{x-2}+\frac{68}{3(x-2)}-\frac{3\pi^2}{8(x-1)}-\frac{3}{2\ (x-1)}-\frac{8\pi^2}{3(x-2)^2}-$$
$$\frac{152}{9(x-2)^2}-\frac{25\pi^2}{36(x-1)^2}+\frac{215}{108(x-1)^2}+\frac{8\pi^2}{3\ (x-2)^3}-\frac{37\pi^2}{36(x-1)^3}+\frac{1643}{108\ (x-1)^3}-\frac{15\pi^2}{8(x-1)^4}-\frac{8}{(x-1)^4}+\frac{25\pi^2}{72(x-1)^5}-$$
$$\frac{5665}{108(x-1)^5}+\frac{21\ \zeta_3}{(x-1)^5}+33\zeta_3-\frac{2\pi^2\ln 2}{(x-1)^5}+2\pi^2\ln 2+\frac{325\pi^2}{72}-\frac{1855}{108}\Big)+H(1;x)\Big(-\frac{21\zeta_3 d_1}{2(x-1)^5}+\frac{\pi^2\ln 2\, d_1}{(x-1)^5}+$$
$$\Big(-\frac{4d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9\ (x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\ (x-1)^5}-\frac{46d_1}{3(x-2)}+\frac{46d_1}{3(x-1)}+\frac{52\ d_1}{9(x-2)^2}-\frac{40d_1}{9(x-1)^2}-$$
$$\frac{28d_1}{9\ (x-2)^3}+\frac{98d_1}{9(x-1)^3}-\frac{13d_1}{6(x-1)^4}+\frac{415\ d_1}{18(x-1)^5}+\frac{80}{3(x-2)}+\frac{43}{6(x-1)}-\frac{56}{9\ (x-2)^2}-\frac{299}{18(x-1)^2}+\frac{56}{9(x-2)^3}-$$
$$\frac{23}{6\ (x-1)^3}-\frac{203}{6(x-1)^4}-\frac{\pi^2}{6(x-1)^5}-\frac{35}{6\ (x-1)^5}+\frac{\pi^2}{6}+\frac{35}{6}\Big)H(0;\alpha_0)+\Big(-\frac{8\ d_1}{x-1}+\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+$$
$$\frac{2\ d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}-\frac{16}{x-2}+\frac{32}{3\ (x-2)^2}+\frac{16}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{16}{(x-1)^4}\Big)H(0,0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2\ d_1^2}{(x-1)^2}-$$
$$\frac{4d_1^2}{3\ (x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}-\frac{8\ d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16\ d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}\Big)\ H(0,1;\alpha_0)+\Big(\frac{16}{(x-1)^5}-$$
$$16\Big)H(0,0,0;\alpha_0)+\Big(\frac{8\ d_1}{(x-1)^5}-8d_1\Big)H(0,0,1;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-8\ d_1\Big)H(0,1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-$$
$$4d_1^2\Big)\ H(0,1,1;\alpha_0)-\frac{2\pi^2}{3(x-2)}+\frac{7\pi^2}{12\ (x-1)}+\frac{4\pi^2}{9(x-2)^2}-\frac{4\pi^2}{9\ (x-2)^3}+\frac{\pi^2}{18(x-1)^3}+\frac{5\pi^2}{6\ (x-1)^4}+\frac{25\pi^2}{18(x-1)^5}+$$
$$\frac{21\zeta_3}{4\ (x-1)^5}+\frac{63\zeta_3}{4}-\frac{\pi^2\ln 2}{2\ (x-1)^5}-\frac{3}{2}\pi^2\ln 2+\frac{25\pi^2}{36}\Big)+\frac{8d_1\pi^2}{3(x-2)}-\frac{37\pi^2}{6\ (x-2)}-\frac{35d_1\pi^2}{48(x-1)}+\frac{31\pi^2}{48\ (x-1)}-\frac{7d_1\pi^2}{9(x-2)^2}+$$
$$\frac{10\pi^2}{9\ (x-2)^2}-\frac{7d_1\pi^2}{9(x-1)^2}+\frac{107\pi^2}{48\ (x-1)^2}+\frac{7d_1\pi^2}{9(x-2)^3}-\frac{14\pi^2}{9\ (x-2)^3}-\frac{5d_1\pi^2}{4(x-1)^3}+\frac{55\pi^2}{16(x-1)^3}-\frac{d_1\pi^2}{(x-1)^4}+\frac{115\pi^2}{24(x-1)^4}-$$
$$\frac{263\ \pi^4}{720(x-1)^5}+\frac{35\pi^2}{36(x-1)^5}+\frac{7\ \zeta_3}{x-2}-\frac{203\zeta_3}{16(x-1)}-\frac{14\zeta_3}{3\ (x-2)^2}+\frac{35\zeta_3}{24(x-1)^2}+\frac{14\zeta_3}{3\ (x-2)^3}+\frac{7\zeta_3}{8(x-1)^3}-\frac{245\zeta_3}{16\ (x-1)^4}-$$
$$\frac{525\zeta_3}{16(x-1)^5}-\frac{1225\ \zeta_3}{48}+\frac{4\mathrm{Li}_4\Big(\frac{1}{2}\Big)}{(x-1)^5}-4\mathrm{Li}_4\frac{1}{2}+\frac{\ln^4 2}{6(x-1)^5}-\frac{\ln^4 2}{6}+\frac{4\pi^2\ln^2 2}{3(x-1)^5}-\frac{4}{3}\pi^2\ \ln^2 2-\frac{6\pi^2\ln 2}{x-2}+\frac{15\pi^2\ln 2}{8\ (x-1)}+$$
$$\frac{4\pi^2\ln 2}{(x-2)^2}+\frac{3\pi^2\ln 2}{4\ (x-1)^2}-\frac{4\pi^2\ln 2}{(x-2)^3}+\frac{5\pi^2\ln 2}{4\ (x-1)^3}+\frac{33\pi^2\ln 2}{8(x-1)^4}+\frac{25\pi^2\ln 2}{8(x-1)^5}-\frac{25}{8}\pi^2\ln 2-\frac{21\pi^4}{80}+\frac{205d_1\pi^2}{144}-\frac{265\pi^2}{48}.$$

## F. The $\mathcal{J}{*}\mathcal{I}$-type integrals

### F.1 The $\mathcal{J}{*}\mathcal{I}$ integral for $k=0$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;0)=\frac{1}{\varepsilon^3}(j*i)^{(0)}_{-3}+\frac{1}{\varepsilon^2}(j*i)^{(0)}_{-2}+\frac{1}{\varepsilon}(j*i)^{(0)}_{-1}+(j*i)^{(0)}_{0}+\mathcal{O}\left(\varepsilon\right), \quad \text{(F.1)}$$

where

$$(j*i)^{(0)}_{-3}=\tfrac{1}{2},$$

$$(j*i)^{(0)}_{-2}=\tfrac{2y_0^3}{3}-3y_0^2+6y_0-\tfrac{1}{2}H(0;Y)-2H(0;y_0)+1,$$

$$(j*i)^{(0)}_{-1}=-\tfrac{1}{6}y_0^3\alpha_0^4+\tfrac{y_0^2\alpha_0^4}{2}-\tfrac{y_0\ \alpha_0^4}{2}+\tfrac{8y_0^3\alpha_0^3}{9}-3y_0^2\alpha_0^3+\tfrac{10y_0\ \alpha_0^3}{3}-2y_0^3\alpha_0^2+\tfrac{15y_0^2\alpha_0^2}{2}-$$
$$10y_0\alpha_0^2+\tfrac{8\ y_0^3\alpha_0}{3}-11y_0^2\alpha_0+18y_0\alpha_0-\tfrac{2d_1'y_0^3}{9}+2y_0^3+\tfrac{7d_1'y_0^2}{6}-\tfrac{21y_0^2}{2}-\tfrac{11d_1'y_0}{3}+30\ y_0+\Big(-\tfrac{2y_0^3}{3}+$$
$$3y_0^2-6y_0+\tfrac{2}{y_0-1}+2\Big)H(0;\ \alpha_0)-\tfrac{2}{3}y_0^3H(0;Y)+3y_0^2H(0;Y)-6y_0\ H(0;Y)-H(0;Y)+\Big(-$$
$$2y_0^3+9y_0^2-18y_0+2H(0;Y)-\tfrac{2}{y_0-1}-6\ \Big)H(0;y_0)+\Big(-\tfrac{2d_1'y_0^3}{3}+3d_1'y_0^2-6d_1'\ y_0+\tfrac{11d_1'}{3}-$$
$$2H(0;\alpha_0)\Big)H(1;y_0)+\Big(-2\ \alpha_0+\tfrac{2}{y_0-1}+2\Big)H(c_1(\alpha_0);y_0)+\tfrac{1}{2}H(0,0;Y)+8\ H(0,0;y_0)+$$
$$2d_1'H(0,1;y_0)-2H(0,c_1(\alpha_0);y_0)+\tfrac{1}{2}\ H(1,0;Y)+2H(1,0;y_0)-2H(1,c_1(\alpha_0);y_0)+\tfrac{\pi^2}{12}+2,$$

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$$
\begin{aligned}
&(j*i)_0^{(0)} = \\
&\tfrac{1}{12}d_1y_0^3\alpha_0^4+\tfrac{1}{18}d_1'y_0^3\alpha_0^4-\tfrac{7\ y_0^3\alpha_0^4}{12}-\tfrac{1}{4}d_1y_0^2\alpha_0^4-\tfrac{1}{6}d_1'y_0^2\ \alpha_0^4+\tfrac{23y_0^2\alpha_0^4}{12}+\tfrac{1}{4}d_1y_0\alpha_0^4+\tfrac{1}{6}\ d_1'y_0\alpha_0^4-\tfrac{29y_0\alpha_0^4}{12}+ \\
&\tfrac{1}{6}y_0^3H(0;Y)\ \alpha_0^4-\tfrac{1}{2}y_0^2H(0;Y)\alpha_0^4+\tfrac{1}{2}y_0H(0;Y)\ \alpha_0^4-\tfrac{13}{27}d_1y_0^3\alpha_0^3-\tfrac{8}{27}d_1'y_0^3\ \alpha_0^3+\tfrac{173y_0^3\alpha_0^3}{54}+\tfrac{5}{3}d_1y_0^2\ \alpha_0^3+ \\
&\tfrac{19}{18}d_1'y_0^2\alpha_0^3-\tfrac{217y_0^2\ \alpha_0^3}{18}-\tfrac{17}{9}d_1y_0\alpha_0^3-\tfrac{11}{9}d_1'y_0\ \alpha_0^3+\tfrac{305y_0\alpha_0^3}{18}-\tfrac{8}{9}y_0^3H(0;Y)\alpha_0^3+3y_0^2\ H(0;Y)\alpha_0^3- \\
&\tfrac{10}{3}y_0H(0;Y)\alpha_0^3+\tfrac{23}{18}d_1y_0^3\ \alpha_0^2+\tfrac{2}{3}d_1'y_0^3\alpha_0^2-\tfrac{275y_0^3\alpha_0^2}{36}-5d_1\ y_0^2\alpha_0^2-\tfrac{11}{4}d_1'y_0^2\alpha_0^2+\tfrac{581y_0^2\alpha_0^2}{18}+\tfrac{43}{6}d_1y_0\alpha_0^2+ \\
&\tfrac{9}{2}d_1'y_0\alpha_0^2-\tfrac{1003y_0\ \alpha_0^2}{18}+2y_0^3H(0;Y)\alpha_0^2-\tfrac{15}{2}y_0^2H(0;Y)\alpha_0^2+10\ y_0H(0;Y)\alpha_0^2-\tfrac{25}{9}d_1y_0^3\alpha_0- \\
&\tfrac{8}{9}d_1'y_0^3\ \alpha_0+\tfrac{217y_0^3\alpha_0}{18}+12d_1y_0^2\alpha_0+\tfrac{25}{6}d_1'y_0^2\ \alpha_0-\tfrac{503y_0^2\alpha_0}{9}-\tfrac{65d_1y_0\alpha_0}{3}-\tfrac{29d_1'\ y_0\alpha_0}{3}+\tfrac{237y_0\alpha_0}{2}- \\
&\tfrac{8}{3}y_0^3H(0;Y)\alpha_0+11\ y_0^2H(0;Y)\alpha_0-18y_0H(0;Y)\alpha_0+\tfrac{2d_1'^2y_0^3}{27}-\tfrac{8\ d_1'y_0^3}{9}+\tfrac{14y_0^3}{3}-\tfrac{17d_1'^2y_0^2}{36}+6d_1'\ y_0^2- \\
&\tfrac{111y_0^2}{4}+\tfrac{49d_1'^2y_0}{18}-\tfrac{65d_1'\ y_0}{2}+114y_0+\tfrac{2}{9}d_1'y_0^3H(0;Y)-2y_0^3\ H(0;Y)-\tfrac{7}{6}d_1'y_0^2H(0;Y)+\tfrac{21}{2}y_0^2\ H(0;Y)+ \\
&\tfrac{11}{3}d_1'y_0H(0;Y)-30y_0H(0;Y)-\tfrac{1}{12}\pi^2\ H(0;Y)-2H(0;Y)+H(0;\alpha_0)\Big(\tfrac{y_0^3\alpha_0^4}{3}-y_0^2\alpha_0^4+y_0\ \alpha_0^4- \\
&\tfrac{16y_0^3\alpha_0^3}{9}+6y_0^2\alpha_0^3-\tfrac{20y_0\alpha_0^3}{3}+4\ y_0^3\alpha_0^2-15y_0^2\alpha_0^2+20y_0\alpha_0^2-\tfrac{16y_0^3\alpha_0}{3}+22\ y_0^2\alpha_0-36y_0\alpha_0+\tfrac{2d_1'y_0^3}{9}-\tfrac{11\ y_0^3}{18}- \\
&\tfrac{7d_1'y_0^2}{6}+\tfrac{31y_0^2}{6}-4d_1+2\ d_1'+\tfrac{11d_1'y_0}{3}-\tfrac{131y_0}{6}+\tfrac{2}{3}y_0^3\ H(0;Y)-3y_0^2H(0;Y)+6y_0H(0;Y)-\tfrac{2H(0;Y)}{y_0-1}- \\
&2\ H(0;Y)-\tfrac{4d_1}{y_0-1}+\tfrac{2d_1'}{y_0-1}+\tfrac{61}{6(y_0-1)}+\tfrac{61}{6}\Big)+\Big(\tfrac{1}{3}d_1y_0^3\alpha_0^4-d_1y_0^2\ \alpha_0^4+d_1y_0\alpha_0^4-\tfrac{16}{9}d_1y_0^3\alpha_0^3+6d_1y_0^2\ \alpha_0^3- \\
&\tfrac{20}{3}d_1y_0\alpha_0^3+4d_1y_0^3\alpha_0^2-15d_1y_0^2\ \alpha_0^2+20d_1y_0\alpha_0^2-\tfrac{16}{3}d_1y_0^3\alpha_0+22d_1y_0^2\alpha_0-36\ d_1y_0\alpha_0+\tfrac{25d_1y_0^3}{9}- \\
&12d_1y_0^2+\tfrac{65d_1\ y_0}{3}\Big)H(1;\alpha_0)-\tfrac{1}{12}\pi^2H(1;Y)+\Big(\tfrac{y_0^3\ \alpha_0^4}{6}-\tfrac{y_0^2\alpha_0^4}{2}+\tfrac{y_0\ \alpha_0^4}{2}-\tfrac{\alpha_0^4}{6}-\tfrac{8y_0^3\alpha_0^3}{9}+3y_0^2\ \alpha_0^3-\tfrac{10y_0\alpha_0^3}{3}+ \\
&\tfrac{11\alpha_0^3}{9}+2y_0^3\ \alpha_0^2-\tfrac{15y_0^2\alpha_0^2}{2}+10y_0\alpha_0^2-\tfrac{9\alpha_0^2}{2}-\tfrac{8\ y_0^3\alpha_0}{3}+11y_0^2\alpha_0+4d_1\alpha_0-2d_1'\alpha_0-18y_0\alpha_0+2H(0;Y)\ \alpha_0- \\
&2\alpha_0+\tfrac{25y_0^3}{18}-\tfrac{16y_0^2}{3}-4d_1+2\ d_1'+\tfrac{49y_0}{6}+\Big(4\alpha_0-\tfrac{4}{y_0-1}-4\Big)\ H(0;\alpha_0)-\tfrac{2H(0;Y)}{y_0-1}-2H(0;Y)+ \\
&\Big(4\alpha_0d_1-\tfrac{4d_1}{y_0-1}-4d_1\Big)H(1;\alpha_0)-\tfrac{4d_1}{y_0-1}+\tfrac{2\ d_1'}{y_0-1}+\tfrac{61}{6(y_0-1)}+\tfrac{61}{6}\Big)\ H(c_1(\alpha_0);y_0)+\Big(\tfrac{4y_0^3}{3}-6y_0^2+ \\
&12\ y_0-\tfrac{4}{y_0-1}-4\Big)H(0,0;\alpha_0)+\tfrac{2}{3}y_0^3H(0,0;Y)-3\ y_0^2H(0,0;Y)+6y_0H(0,0;Y)+H(0,0;Y)+ \\
&\Big(\tfrac{20y_0^3}{3}-30\ y_0^2+60y_0-8H(0;Y)+\tfrac{12}{y_0-1}+28\Big)\ H(0,0;y_0)+\Big(\tfrac{4d_1y_0^3}{3}-6d_1y_0^2+12d_1y_0-4\ d_1- \\
&\tfrac{4d_1}{y_0-1}\Big)H(0,1;\alpha_0)+H(1;y_0)\Big(\tfrac{1}{6}\ d_1'y_0^3\alpha_0^4-\tfrac{1}{2}d_1'y_0^2\alpha_0^4-\tfrac{d_1'\ \alpha_0^4}{6}+\tfrac{1}{2}d_1'y_0\alpha_0^4-\tfrac{8}{9}d_1'y_0^3\alpha_0^3+3\ d_1'y_0^2\alpha_0^3+ \\
&\tfrac{11d_1'\alpha_0^3}{9}-\tfrac{10}{3}d_1'y_0\ \alpha_0^3+2d_1'y_0^3\alpha_0^2-\tfrac{15}{2}d_1'y_0^2\alpha_0^2-\tfrac{9d_1'\ \alpha_0^2}{2}+10d_1'y_0\alpha_0^2-\tfrac{8}{3}d_1'y_0^3\alpha_0+11d_1'y_0^2\ \alpha_0+\tfrac{23d_1'\alpha_0}{3}- \\
&18d_1'y_0\alpha_0+\tfrac{2d_1'^2y_0^3}{9}-2\ d_1'y_0^3-\tfrac{49d_1'^2}{18}-\tfrac{7d_1'^2y_0^2}{6}+\tfrac{21\ d_1'y_0^2}{2}+\tfrac{43d_1'}{2}+\tfrac{11d_1'^2y_0}{3}-30d_1'y_0+\tfrac{2}{3}d_1'y_0^3H(0;Y)- \\
&3d_1'y_0^2H(0;Y)-\tfrac{11}{3}d_1'\ H(0;Y)+6d_1'y_0H(0;Y)+H(0;\alpha_0)\Big(\tfrac{2d_1'y_0^3}{3}-\tfrac{2\ y_0^3}{3}-3d_1'y_0^2+3y_0^2+ \\
&6d_1'y_0-6y_0-\tfrac{11d_1'}{3}+2\ H(0;Y)+\tfrac{4d_1}{y_0-1}-\tfrac{2\ d_1'}{y_0-1}-\tfrac{2}{y_0-1}-10\Big)+4H(0,0;\alpha_0)+4d_1\ H(0,1;\alpha_0)- \\
&\tfrac{\pi^2}{3}\Big)+\Big(2d_1'y_0^3-9d_1'y_0^2+18\ d_1'y_0+6d_1'+(4-4d_1)H(0;\alpha_0)-2d_1'H(0;Y)+\tfrac{2d_1'}{y_0-1}\ \Big)H(0,1;y_0)+ \\
&\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6y_0+4H(0;\alpha_0)+2\ H(0;Y)+4d_1H(1;\alpha_0)-\tfrac{6}{y_0-1}-10\Big)\ H(0,c_1(\alpha_0);y_0)+ \\
&H(0;y_0)\Big(\tfrac{y_0^3\alpha_0^4}{3}-y_0^2\alpha_0^4+y_0\ \alpha_0^4-\tfrac{16y_0^3\alpha_0^3}{9}+6y_0^2\alpha_0^3-\tfrac{20y_0\alpha_0^3}{3}+4\ y_0^3\alpha_0^2-15y_0^2\alpha_0^2+20y_0\alpha_0^2-\tfrac{16y_0^3\alpha_0}{3}+ \\
&22\ y_0^2\alpha_0-36y_0\alpha_0+\tfrac{2d_1'y_0^3}{3}-\tfrac{133\ y_0^3}{18}-\tfrac{7d_1'y_0^2}{2}+\tfrac{221y_0^2}{6}+4d_1-2d_1'+11\ d_1'y_0-\tfrac{589y_0}{6}+\Big(\tfrac{4y_0^3}{3}- \\
&6y_0^2+12\ y_0-\tfrac{4}{y_0-1}-4\Big)H(0;\alpha_0)+2y_0^3H(0;Y)-9y_0^2H(0;Y)+18\ y_0H(0;Y)+\tfrac{2H(0;Y)}{y_0-1}+ \\
&6H(0;Y)-2H(0,0;Y)-2\ H(1,0;Y)+\tfrac{4d_1}{y_0-1}-\tfrac{2d_1'}{y_0-1}-\tfrac{61}{6\ (y_0-1)}-\tfrac{\pi^2}{3}-\tfrac{109}{6}\Big)+\tfrac{2}{3}y_0^3\ H(1,0;Y)- \\
&3y_0^2H(1,0;Y)+6y_0H(1,0;Y)+H(1,0;Y)+\Big(2d_1'\ y_0^3+\tfrac{2y_0^3}{3}-9d_1'y_0^2-3y_0^2+18d_1'y_0+6y_0- \\
&11\ d_1'+4H(0;\alpha_0)-2H(0;Y)-\tfrac{4d_1}{y_0-1}+\tfrac{2\ d_1'}{y_0-1}+\tfrac{2}{y_0-1}+10\Big)H(1,0;y_0)+\Big(\tfrac{2d_1'^2\ y_0^3}{3}-3d_1'^2y_0^2+6d_1'^2y_0-
\end{aligned}
$$

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$\frac{11d_1'^2}{3}+(-4d_1+2\ d_1'+2)H(0;\alpha_0)\Big)H(1,1;y_0)+\Big(-\frac{2y_0^3}{3}+3y_0^2-6\ y_0+4H(0;\alpha_0)+2H(0;Y)+ 4d_1H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2\ d_1'}{y_0-1}-\frac{2}{y_0-1}-10\Big)H(1,c_1(\alpha_0);y_0)+\Big(4\ \alpha_0-\frac{4}{y_0-1}-4\Big)H(c_1(\alpha_0),0;y_0)+ \Big(2\alpha_0d_1'-\frac{2\ d_1'}{y_0-1}-2d_1'\Big)H(c_1(\alpha_0),1;y_0)+\Big(2\ \alpha_0-\frac{2}{y_0-1}-2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)- \frac{1}{2}\ H(0,0,0;Y)-32H(0,0,0;y_0)-8d_1'H(0,0,1;y_0)+8H(0,0,c_1(\alpha_0);y_0)-\ \frac{1}{2}H(0,1,0;Y)+ (4d_1-8d_1'-4)H(0,1,0;y_0)-2d_1'^2\ H(0,1,1;y_0)+(-4d_1+2d_1'+4)H(0,1,c_1(\alpha_0);y_0)+ 4\ H(0,c_1(\alpha_0),0;y_0)+2d_1'H(0,c_1(\alpha_0),1;y_0)+2\ H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac{1}{2}H(1,0,0;Y)- 12H(1,0,0;y_0)-2\ d_1'H(1,0,1;y_0)+6H(1,0,c_1(\alpha_0);y_0)-\frac{1}{2}H(1,1,0;Y)+(4\ d_1-2d_1'- 2)H(1,1,0;y_0)+(-4d_1+2d_1'+2)H(1,1,c_1(\alpha_0);y_0)+4\ H(1,c_1(\alpha_0),0;y_0)+ 2d_1'H(1,c_1(\alpha_0),1;y_0)+2\ H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\frac{\pi^2}{3(y_0-1)}-3\ \zeta_3+\frac{\pi^2}{2}+4.$

### F.2 The $\mathcal{J}{*}\mathcal{I}$ integral for $k=1$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;1)=\frac{1}{\varepsilon^3}(j*i)_{-3}^{(1)}+\frac{1}{\varepsilon^2}(j*i)_{-2}^{(1)}+\frac{1}{\varepsilon}(j*i)_{-1}^{(1)}+(j*i)_{0}^{(1)}+\mathcal{O}(\varepsilon)\,, \quad \text{(F.2)}$$

where

$$(j*i)_{-3}^{(1)}=\frac{1}{4},$$

$$(j*i)_{-2}^{(1)}=\frac{y_0^3}{3}-\frac{3y_0^2}{2}+3y_0-\frac{1}{4}\ H(0;Y)-H(0;y_0)+\frac{1}{2},$$

$(j*i)_{-1}^{(1)}=-\frac{1}{12}y_0^3\alpha_0^4+\frac{y_0^2\alpha_0^4}{4}-\frac{y_0\ \alpha_0^4}{4}+\frac{4y_0^3\alpha_0^3}{9}-\frac{3y_0^2\alpha_0^3}{2}+\frac{5y_0\ \alpha_0^3}{3}-y_0^3\alpha_0^2+\frac{15y_0^2\alpha_0^2}{4}-5y_0\alpha_0^2+ \frac{4\ y_0^3\alpha_0}{3}-\frac{11y_0^2\alpha_0}{2}+9y_0\alpha_0-\frac{d_1'\ y_0^3}{9}+y_0^3+\frac{7d_1'y_0^2}{12}-\frac{21y_0^2}{4}-\frac{11\ d_1'y_0}{6}+15y_0+\Big(-\frac{y_0^3}{3}+\frac{3y_0^2}{2}-3\ y_0+ \frac{1}{y_0-1}+1\Big)H(0;\alpha_0)-\frac{1}{3}y_0^3\ H(0;Y)+\frac{3}{2}y_0^2H(0;Y)-3y_0H(0;Y)-\frac{1}{2}\ H(0;Y)+\Big(-y_0^3+ \frac{9y_0^2}{2}-9\ y_0+H(0;Y)-\frac{1}{y_0-1}-3\Big)H(0;y_0)+\Big(-\frac{d_1'\ y_0^3}{3}+\frac{3d_1'y_0^2}{2}-3d_1'y_0+\frac{11\ d_1'}{6}- H(0;\alpha_0)\Big)H(1;y_0)+\Big(-\alpha_0+\frac{1}{y_0-1}+1\Big)\ H(c_1(\alpha_0);y_0)+\frac{1}{4}H(0,0;Y)+4H(0,0;y_0)+ d_1'\ H(0,1;y_0)-H(0,c_1(\alpha_0);y_0)+\frac{1}{4}H(1,0;Y)+H(1,0;y_0)-H(1,c_1(\ \alpha_0);y_0)+\frac{\pi^2}{24}+1,$

$(j*i)_{0}^{(1)}=\frac{1}{24}d_1y_0^3\alpha_0^4+\frac{1}{36}d_1'y_0^3\alpha_0^4-\frac{7\ y_0^3\alpha_0^4}{24}-\frac{1}{8}d_1y_0^2\alpha_0^4-\frac{1}{12}d_1'y_0^2\ \alpha_0^4+\frac{23y_0^2\alpha_0^4}{24}+\frac{1}{8}d_1y_0\ \alpha_0^4+ \frac{1}{12}d_1'y_0\alpha_0^4-\frac{29y_0\ \alpha_0^4}{24}+\frac{1}{12}y_0^3H(0;Y)\alpha_0^4-\frac{1}{4}y_0^2H(0;Y)\ \alpha_0^4+\frac{1}{4}y_0H(0;Y)\alpha_0^4-\frac{13}{54}d_1y_0^3\ \alpha_0^3- \frac{4}{27}d_1'y_0^3\alpha_0^3+\frac{173y_0^3\ \alpha_0^3}{108}+\frac{5}{6}d_1y_0^2\alpha_0^3+\frac{19}{36}d_1'y_0^2\ \alpha_0^3-\frac{217y_0^2\alpha_0^3}{36}-\frac{17}{18}d_1y_0\ \alpha_0^3-\frac{11}{18}d_1'y_0\alpha_0^3+\frac{305y_0\ \alpha_0^3}{36}- \frac{4}{9}y_0^3H(0;Y)\alpha_0^3+\frac{3}{2}y_0^2H(0;Y)\ \alpha_0^3-\frac{5}{3}y_0H(0;Y)\alpha_0^3+\frac{23}{36}d_1y_0^3\ \alpha_0^2+\frac{1}{3}d_1'y_0^3\alpha_0^2-\frac{275y_0^3\ \alpha_0^2}{72}-\frac{5}{2}d_1y_0^2\alpha_0^2- \frac{11}{8}d_1'y_0^2\alpha_0^2+\frac{581y_0^2\alpha_0^2}{36}+\frac{43}{12}d_1y_0\alpha_0^2+\frac{9}{4}\ d_1'y_0\alpha_0^2-\frac{1003y_0\alpha_0^2}{36}+y_0^3H(0;Y)\ \alpha_0^2-\frac{15}{4}y_0^2H(0;Y)\alpha_0^2+ 5y_0H(0;Y)\ \alpha_0^2-\frac{25}{18}d_1y_0^3\alpha_0-\frac{4}{9}d_1'y_0^3\ \alpha_0+\frac{217y_0^3\alpha_0}{36}+6d_1y_0^2\alpha_0+\frac{25}{12}d_1'y_0^2\ \alpha_0-\frac{503y_0^2\alpha_0}{18}-\frac{65d_1y_0\alpha_0}{6}- \frac{29d_1'\ y_0\alpha_0}{6}+\frac{237y_0\alpha_0}{4}-\frac{4}{3}y_0^3H(0;Y)\ \alpha_0+\frac{11}{2}y_0^2H(0;Y)\alpha_0-9y_0H(0;Y)\alpha_0+\frac{d_1'^2\ y_0^3}{27}-\frac{4d_1'y_0^3}{9}+ \frac{7y_0^3}{3}-\frac{17d_1'^2\ y_0^2}{72}+3d_1'y_0^2-\frac{111y_0^2}{8}+\frac{49d_1'^2y_0}{36}-\frac{65d_1'y_0}{4}+57y_0+\frac{1}{9}d_1'y_0^3H(0;Y)-y_0^3\ H(0;Y)- \frac{7}{12}d_1'y_0^2H(0;Y)+\frac{21}{4}y_0^2\ H(0;Y)+\frac{11}{6}d_1'y_0H(0;Y)-15y_0H(0;Y)-\frac{1}{24}\pi^2\ H(0;Y)-H(0;Y)+ H(0;\alpha_0)\Big(\frac{y_0^3\alpha_0^4}{6}-\frac{y_0^2\ \alpha_0^4}{2}+\frac{y_0\alpha_0^4}{2}-\frac{8y_0^3\alpha_0^3}{9}+3y_0^2\ \alpha_0^3-\frac{10y_0\alpha_0^3}{3}+2y_0^3\alpha_0^2-\frac{15y_0^2\ \alpha_0^2}{2}+10y_0\alpha_0^2-\frac{8y_0^3\alpha_0}{3}+ 11y_0^2\alpha_0-18y_0\alpha_0+\ \frac{d_1'y_0^3}{9}-\frac{11y_0^3}{36}-\frac{7d_1'\ y_0^2}{12}+\frac{31y_0^2}{12}-2d_1+d_1'+\frac{11d_1'\ y_0}{6}-\frac{131y_0}{12}+\frac{1}{3}y_0^3H(0;Y)-$



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$$\tfrac{3}{2}y_0^2\ H(0;Y)+3y_0H(0;Y)-\tfrac{H(0;Y)}{y_0-1}-H(0;Y)-\tfrac{2\ d_1}{y_0-1}+\tfrac{d_1'}{y_0-1}+\tfrac{61}{12\ (y_0-1)}+\tfrac{61}{12}\Big)+\Big(\tfrac{1}{6}d_1y_0^3\ \alpha_0^4-$$
$$\tfrac{1}{2}d_1y_0^2\alpha_0^4+\tfrac{1}{2}d_1y_0\ \alpha_0^4-\tfrac{8}{9}d_1y_0^3\alpha_0^3+3d_1y_0^2\alpha_0^3-\tfrac{10}{3}d_1\ y_0\alpha_0^3+2d_1y_0^3\alpha_0^2-\tfrac{15}{2}d_1y_0^2\alpha_0^2+10d_1y_0\ \alpha_0^2-$$
$$\tfrac{8}{3}d_1y_0^3\alpha_0+11d_1y_0^2\alpha_0-18d_1y_0\ \alpha_0+\tfrac{25d_1y_0^3}{18}-6d_1y_0^2+\tfrac{65d_1y_0}{6}\Big)\ H(1;\alpha_0)-\tfrac{1}{24}\pi^2H(1;Y)+\Big(\tfrac{y_0^3\ \alpha_0^4}{12}-$$
$$\tfrac{y_0^2\alpha_0^4}{4}+\tfrac{y_0\ \alpha_0^4}{4}-\tfrac{\alpha_0^4}{12}-\tfrac{4y_0^3\alpha_0^3}{9}+\tfrac{3y_0^2\ \alpha_0^3}{2}-\tfrac{5y_0\alpha_0^3}{3}+\tfrac{11\alpha_0^3}{18}+y_0^3\ \alpha_0^2-\tfrac{15y_0^2\alpha_0^2}{4}+5y_0\alpha_0^2-\tfrac{9\alpha_0^2}{4}-\tfrac{4\ y_0^3\alpha_0}{3}+$$
$$\tfrac{11y_0^2\alpha_0}{2}+2d_1\alpha_0-d_1'\alpha_0-9y_0\ \alpha_0+H(0;Y)\alpha_0-\alpha_0+\tfrac{25y_0^3}{36}-\tfrac{8y_0^2}{3}-2\ d_1+d_1'+\tfrac{49y_0}{12}+\Big(2\alpha_0-\tfrac{2}{y_0-1}-$$
$$2\Big)\ H(0;\alpha_0)-\tfrac{H(0;Y)}{y_0-1}-H(0;Y)+\Big(2\alpha_0d_1-\tfrac{2\ d_1}{y_0-1}-2d_1\Big)H(1;\alpha_0)-\tfrac{2\ d_1}{y_0-1}+\tfrac{d_1'}{y_0-1}+\tfrac{61}{12\ (y_0-1)}+$$
$$\tfrac{61}{12}\Big)H(c_1(\alpha_0);y_0)+\Big(\tfrac{2y_0^3}{3}-3\ y_0^2+6y_0-\tfrac{2}{y_0-1}-2\Big)H(0,0;\alpha_0)+\tfrac{1}{3}y_0^3\ H(0,0;Y)-\tfrac{3}{2}y_0^2H(0,0;Y)+$$
$$3y_0H(0,0;Y)+\tfrac{1}{2}\ H(0,0;Y)+\Big(\tfrac{10y_0^3}{3}-15y_0^2+30y_0-4\ H(0;Y)+\tfrac{6}{y_0-1}+14\Big)H(0,0;y_0)+$$
$$\Big(\tfrac{2d_1\ y_0^3}{3}-3d_1y_0^2+6d_1y_0-2d_1-\tfrac{2d_1}{y_0-1}\Big)H(0,1;\ \alpha_0)+H(1;y_0)\Big(\tfrac{1}{12}d_1'y_0^3\alpha_0^4-\tfrac{1}{4}d_1'\ y_0^2\alpha_0^4-\tfrac{d_1'\alpha_0^4}{12}+$$
$$\tfrac{1}{4}d_1'y_0\ \alpha_0^4-\tfrac{4}{9}d_1'y_0^3\alpha_0^3+\tfrac{3}{2}d_1'y_0^2\ \alpha_0^3+\tfrac{11d_1'\alpha_0^3}{18}-\tfrac{5}{3}d_1'y_0\alpha_0^3+d_1'y_0^3\ \alpha_0^2-\tfrac{15}{4}d_1'y_0^2\alpha_0^2-\tfrac{9d_1'\alpha_0^2}{4}+5d_1'y_0\ \alpha_0^2-$$
$$\tfrac{4}{3}d_1'y_0^3\alpha_0+\tfrac{11}{2}d_1'y_0^2\alpha_0+\tfrac{23\ d_1'\alpha_0}{6}-9d_1'y_0\alpha_0+\tfrac{d_1'^2y_0^3}{9}-d_1'\ y_0^3-\tfrac{49d_1'^2}{36}-\tfrac{7d_1'^2y_0^2}{12}+\tfrac{21d_1'\ y_0^2}{4}+\tfrac{43d_1'}{4}+\tfrac{11d_1'^2y_0}{6}-$$
$$15d_1'\ y_0+\tfrac{1}{3}d_1'y_0^3H(0;Y)-\tfrac{3}{2}d_1'y_0^2\ H(0;Y)-\tfrac{11}{6}d_1'H(0;Y)+3d_1'y_0H(0;Y)+H(0;\alpha_0)\ \Big(\tfrac{d_1'y_0^3}{3}-$$
$$\tfrac{y_0^3}{3}-\tfrac{3d_1'\ y_0^2}{2}+\tfrac{3y_0^2}{2}+3d_1'y_0-3y_0-\tfrac{11\ d_1'}{6}+H(0;Y)+\tfrac{2\ d_1}{y_0-1}-\tfrac{d_1'}{y_0-1}-\tfrac{1}{y_0-1}-5\Big)+2H(0,0;\alpha_0)+$$
$$2\ d_1H(0,1;\alpha_0)-\tfrac{\pi^2}{6}\Big)+\Big(d_1'y_0^3-\tfrac{9d_1'\ y_0^2}{2}+9d_1'y_0+3d_1'+(2-2d_1)H(0;\alpha_0)-d_1'\ H(0;Y)+$$
$$\tfrac{d_1'}{y_0-1}\Big)\ H(0,1;y_0)+\Big(-\tfrac{y_0^3}{3}+\tfrac{3y_0^2}{2}-3y_0+2\ H(0;\alpha_0)+H(0;Y)+2d_1H(1;\alpha_0)-\tfrac{3}{y_0-1}-$$
$$5\Big)\ H(0,c_1(\alpha_0);y_0)+H(0;y_0)\Big(\tfrac{y_0^3\alpha_0^4}{6}-\tfrac{y_0^2\ \alpha_0^4}{2}+\tfrac{y_0\alpha_0^4}{2}-\tfrac{8y_0^3\alpha_0^3}{9}+3y_0^2\ \alpha_0^3-\tfrac{10y_0\alpha_0^3}{3}+2y_0^3\alpha_0^2-\tfrac{15y_0^2\ \alpha_0^2}{2}+$$
$$10y_0\alpha_0^2-\tfrac{8y_0^3\alpha_0}{3}+11y_0^2\alpha_0-18y_0\alpha_0+\tfrac{d_1'y_0^3}{3}-\tfrac{133y_0^3}{36}-\tfrac{7d_1'\ y_0^2}{4}+\tfrac{221y_0^2}{12}+2d_1-d_1'+\tfrac{11d_1'\ y_0}{2}-\tfrac{589y_0}{12}+$$
$$\Big(\tfrac{2y_0^3}{3}-3y_0^2+6\ y_0-\tfrac{2}{y_0-1}-2\Big)H(0;\alpha_0)+y_0^3H(0;Y)-\tfrac{9}{2}y_0^2\ H(0;Y)+9y_0H(0;Y)+\tfrac{H(0;Y)}{y_0-1}+$$
$$3\ H(0;Y)-H(0,0;Y)-H(1,0;Y)+\tfrac{2\ d_1}{y_0-1}-\tfrac{d_1'}{y_0-1}-\tfrac{61}{12(y_0-1)}-\tfrac{\pi\ ^2}{6}-\tfrac{109}{12}\Big)+\tfrac{1}{3}y_0^3H(1,0;Y)-$$
$$\tfrac{3}{2}\ y_0^2H(1,0;Y)+3y_0H(1,0;Y)+\tfrac{1}{2}H(1,0;Y)+\Big(d_1'\ y_0^3+\tfrac{y_0^3}{3}-\tfrac{9d_1'y_0^2}{2}-\tfrac{3y_0^2}{2}+9d_1'\ y_0+3y_0-$$
$$\tfrac{11d_1'}{2}+2H(0;\alpha_0)-H(0;Y)-\tfrac{2\ d_1}{y_0-1}+\tfrac{d_1'}{y_0-1}+\tfrac{1}{y_0-1}+5\Big)\ H(1,0;y_0)+\Big(\tfrac{d_1'^2y_0^3}{3}-\tfrac{3d_1'^2y_0^2}{2}+3\ d_1'^2y_0-$$
$$\tfrac{11d_1'^2}{6}+(-2d_1+d_1'+1)H(0;\alpha_0)\Big)\ H(1,1;y_0)+\Big(-\tfrac{y_0^3}{3}+\tfrac{3y_0^2}{2}-3y_0+2\ H(0;\alpha_0)+H(0;Y)+$$
$$2d_1H(1;\alpha_0)+\tfrac{2\ d_1}{y_0-1}-\tfrac{d_1'}{y_0-1}-\tfrac{1}{y_0-1}-5\Big)\ H(1,c_1(\alpha_0);y_0)+\Big(2\alpha_0-\tfrac{2}{y_0-1}-2\Big)\ H(c_1(\alpha_0),0;y_0)+$$
$$\Big(\alpha_0d_1'-\tfrac{d_1'}{y_0-1}-d_1'\Big)\ H(c_1(\alpha_0),1;y_0)+\Big(\alpha_0-\tfrac{1}{y_0-1}-1\Big)\ H(c_1(\alpha_0),c_1(\alpha_0);y_0)-$$
$$\tfrac{1}{4}H(0,0,0;Y)-16H(0,0,0;y_0)-4\ d_1'H(0,0,1;y_0)+4H(0,0,c_1(\alpha_0);y_0)-\tfrac{1}{4}H(0,1,0;Y)+$$
$$(2\ d_1-4d_1'-2)H(0,1,0;y_0)-d_1'^2H(0,1,1;y_0)+(-2d_1+d_1'+2)\ H(0,1,c_1(\alpha_0);y_0)+$$
$$2H(0,c_1(\alpha_0),0;y_0)+d_1'\ H(0,c_1(\alpha_0),1;y_0)+H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)-\tfrac{1}{4}\ H(1,0,0;Y)-$$
$$6H(1,0,0;y_0)-d_1'H(1,0,1;y_0)+3\ H(1,0,c_1(\alpha_0);y_0)-\tfrac{1}{4}H(1,1,0;Y)+(2d_1-d_1'-$$
$$1)\ H(1,1,0;y_0)+(-2d_1+d_1'+1)H(1,1,c_1(\alpha_0);y_0)+2\ H(1,c_1(\alpha_0),0;y_0)+$$
$$d_1'\ H(1,c_1(\alpha_0),1;y_0)+H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\tfrac{\pi^2}{6\ (y_0-1)}-\tfrac{3\zeta_3}{2}+\tfrac{\pi^2}{4}+2.$$

### F.3 The $\mathcal{J}{*}\mathcal{I}$ integral for $k=2$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;2)=\frac{1}{\varepsilon^3}(j*i)_{-3}^{(2)}+\frac{1}{\varepsilon^2}(j*i)_{-2}^{(2)}+\frac{1}{\varepsilon}(j*i)_{-1}^{(2)}+(j*i)_0^{(2)}+\mathcal{O}\left(\varepsilon\right), \quad \text{(F.3)}$$

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where

$$(j*i)^{(2)}_{-3} = \frac{1}{6},$$

$$(j*i)^{(2)}_{-2} = \frac{2y_0^3}{9} - y_0^2 + 2y_0 - \frac{1}{6}H(0;Y) - \frac{2}{3}\ H(0;y_0) + \frac{4}{9},$$

$$(j*i)^{(2)}_{-1} = -\frac{1}{18}y_0^3\alpha_0^4 + \frac{y_0^2\alpha_0^4}{12} - \frac{y_0\alpha_0^4}{3} + \frac{\alpha_0^4}{6(y_0-2)} + \frac{\alpha_0^4}{12} + \frac{8y_0^3\ \alpha_0^3}{27} - \frac{2y_0^2\alpha_0^3}{3} + \frac{8y_0\ \alpha_0^3}{9} + \frac{\alpha_0^3}{y_0-2} + \frac{4\alpha_0^3}{9(y_0-2)^2} + \frac{7\ \alpha_0^3}{18} - \frac{2y_0^3\alpha_0^2}{3} + 2y_0^2\alpha_0^2 - \frac{5y_0\ \alpha_0^2}{3} + \frac{8\alpha_0^2}{3(y_0-2)} + \frac{11\alpha_0^2}{3\ (y_0-2)^2} + \frac{4\alpha_0^2}{3(y_0-2)^3} + \frac{7\alpha_0^2}{12} + \frac{8\ y_0^3\alpha_0}{9} - \frac{10y_0^2\alpha_0}{3} + 4y_0\alpha_0 + \frac{13\alpha_0}{3\ (y_0-2)} + \frac{18\alpha_0}{(y_0-2)^2} + \frac{52\alpha_0}{3(y_0-2)^3} + \frac{16\ \alpha_0}{3(y_0-2)^4} - \frac{\alpha_0}{2} - \frac{2d_1' y_0^3}{27} + \frac{19\ y_0^3}{27} + \frac{7d_1' y_0^2}{18} - \frac{11y_0^2}{3} - \frac{11d_1'\ y_0}{9} + \frac{31y_0}{3} + \Big(-\frac{2y_0^3}{9} + y_0^2 - 2\ y_0 + \frac{2}{3(y_0-1)} + \frac{80}{3(y_0-2)^2} + \frac{160}{3\ (y_0-2)^3} + \frac{40}{(y_0-2)^4} + \frac{32}{3\ (y_0-2)^5} - \frac{3}{2}\Big)H(0;\alpha_0) - \frac{2}{9}y_0^3H(0;Y) + y_0^2\ H(0;Y) - 2y_0H(0;Y) - \frac{4}{9}H(0;Y) + \Big(-\frac{2y_0^3}{3} + 3\ y_0^2 - 6y_0 + \frac{2}{3}H(0;Y) - \frac{2}{3(y_0-1)} - \frac{80}{3\ (y_0-2)^2} - \frac{160}{3(y_0-2)^3} - \frac{40}{(y_0-2)^4} - \frac{32}{3(\ y_0-2)^5} - \frac{5}{18}\Big)H(0;y_0) + \Big(-\frac{2d_1'\ y_0^3}{9} + d_1'y_0^2 - 2d_1'y_0 + \frac{11d_1'}{9} - \frac{2}{3}\ H(0;\alpha_0)\Big)H(1;y_0) + \Big(-\frac{2\alpha_0}{3} + \frac{2}{3\ (y_0-1)} + \frac{2}{3}\Big)\ H(c_1(\alpha_0);y_0) + \Big(-\frac{\alpha_0^4}{2} - \frac{2\alpha_0^3}{3} + \alpha_0^2 + 2\ \alpha_0 + \frac{80}{3(y_0-2)^2} + \frac{160}{3\ (y_0-2)^3} + \frac{40}{(y_0-2)^4} + \frac{32}{3\ (y_0-2)^5} - \frac{11}{6}\Big)H(c_2(\alpha_0);y_0) + \frac{1}{6}\ H(0,0;Y) + \frac{8}{3}H(0,0;y_0) + \frac{2}{3}d_1'\ H(0,1;y_0) - \frac{2}{3}H(0,c_1(\alpha_0);y_0) + \frac{1}{6}\ H(1,0;Y) + \frac{2}{3}H(1,0;y_0) - \frac{2}{3}\ H(1,c_1(\alpha_0);y_0) + \frac{80\ln 2}{3(y_0-2)^2} + \frac{160\ln 2}{3(y_0-2)^3} + \frac{40\ln 2}{(y_0-2)^4} + \frac{32\ln 2}{3\ (y_0-2)^5} - \frac{13\ln 2}{6} + \frac{\pi^2}{36} + \frac{26}{27},$$

$$(j*i)^{(2)}_{0} = \frac{1}{36}d_1y_0^3\alpha_0^4 + \frac{1}{54}d_1'y_0^3\alpha_0^4 - \frac{11\ y_0^3\alpha_0^4}{54} - \frac{1}{24}d_1y_0^2\alpha_0^4 - \frac{1}{72}d_1'y_0^2\ \alpha_0^4 + \frac{5y_0^2\alpha_0^4}{18} - \frac{d_1\alpha_0^4}{24} + \frac{1}{6}d_1\ y_0\alpha_0^4 + \frac{11}{36}d_1'y_0\alpha_0^4 - \frac{35y_0\ \alpha_0^4}{18} + \frac{1}{18}y_0^3H(0;Y)\alpha_0^4 - \frac{1}{12}y_0^2H(0;Y)\ \alpha_0^4 + \frac{1}{3}y_0H(0;Y)\alpha_0^4 - \frac{H(0;Y)\alpha_0^4}{6\ (y_0-2)} - \frac{1}{12}H(0;Y)\alpha_0^4 - \frac{d_1\alpha_0^4}{12\ (y_0-2)} + \frac{19\alpha_0^4}{36(y_0-2)} + \frac{19\ \alpha_0^4}{72} - \frac{13}{81}d_1y_0^3\alpha_0^3 - \frac{8}{81}d_1'y_0^3\ \alpha_0^3 + \frac{181y_0^3\alpha_0^3}{162} + \frac{7}{18}d_1y_0^2\ \alpha_0^3 + \frac{5}{27}d_1'y_0^2\alpha_0^3 - \frac{281y_0^2\ \alpha_0^3}{108} - \frac{43d_1\alpha_0^3}{108} + \frac{d_1'\ \alpha_0^3}{18} - \frac{10}{27}d_1y_0\alpha_0^3 - \frac{14}{27}d_1'y_0\ \alpha_0^3 + \frac{493y_0\alpha_0^3}{108} - \frac{8}{27}y_0^3H(0;Y)\ \alpha_0^3 + \frac{2}{3}y_0^2H(0;Y)\alpha_0^3 - \frac{8}{9}y_0H(0;Y)\ \alpha_0^3 - \frac{H(0;Y)\alpha_0^3}{y_0-2} - \frac{4H(0;Y)\alpha_0^3}{9\ (y_0-2)^2} - \frac{7}{18}H(0;Y)\alpha_0^3 - \frac{17d_1\alpha_0^3}{18(y_0-2)} + \frac{d_1'\alpha_0^3}{9(y_0-2)} + \frac{61\alpha_0^3}{18(y_0-2)} - \frac{8d_1\ \alpha_0^3}{27(y_0-2)^2} + \frac{40\alpha_0^3}{27(y_0-2)^2} + \frac{143\ \alpha_0^3}{108} + \frac{23}{54}d_1y_0^3\alpha_0^2 + \frac{2}{9}d_1'y_0^3\ \alpha_0^2 - \frac{287y_0^3\alpha_0^2}{108} - \frac{17}{12}d_1y_0^2\ \alpha_0^2 - \frac{2}{3}d_1'y_0^2\alpha_0^2 + \frac{1883y_0^2\ \alpha_0^2}{216} - \frac{113d_1\alpha_0^2}{72} + \frac{13d_1'\ \alpha_0^2}{36} + \frac{10}{9}d_1y_0\alpha_0^2 + \frac{1}{3}d_1'y_0\ \alpha_0^2 - \frac{224y_0\alpha_0^2}{27} + \frac{2}{3}y_0^3H(0;Y)\alpha_0^2 - 2y_0^2\ H(0;Y)\alpha_0^2 + \frac{5}{3}y_0H(0;Y)\alpha_0^2 - \frac{8H(0;Y)\alpha_0^2}{3\ (y_0-2)} - \frac{11H(0;Y)\alpha_0^2}{3(y_0-2)^2} - \frac{4H(0;Y)\alpha_0^2}{3\ (y_0-2)^3} - \frac{7}{12}H(0;Y)\alpha_0^2 - \frac{46d_1\alpha_0^2}{9\ (y_0-2)} + \frac{8d_1'\alpha_0^2}{9(y_0-2)} + \frac{179\alpha_0^2}{18(y_0-2)} - \frac{83d_1\alpha_0^2}{18(y_0-2)^2} + \frac{d_1'\alpha_0^2}{3\ (y_0-2)^2} + \frac{247\alpha_0^2}{18(y_0-2)^2} - \frac{4d_1\alpha_0^2}{3\ (y_0-2)^3} + \frac{44\alpha_0^2}{9(y_0-2)^3} + \frac{155\ \alpha_0^2}{72} - \frac{25}{27}d_1y_0^3\alpha_0 - \frac{8}{27}d_1'y_0^3\ \alpha_0 + \frac{25y_0^3\alpha_0}{6} + \frac{23}{6}d_1y_0^2\alpha_0 + \frac{11}{9}\ d_1'y_0^2\alpha_0 - \frac{1883y_0^2\alpha_0}{108} - \frac{83d_1\ \alpha_0}{36} + \frac{19d_1'\alpha_0}{18} - \frac{52d_1y_0\alpha_0}{9} - \frac{14\ d_1'y_0\alpha_0}{9} + \frac{949y_0\alpha_0}{36} - \frac{8}{9}y_0^3H(0;Y)\alpha_0 + \frac{10}{3}y_0^2H(0;Y)\alpha_0 - 4y_0H(0;Y)\alpha_0 - \frac{13H(0;Y)\alpha_0}{3\ (y_0-2)} - \frac{18H(0;Y)\alpha_0}{(y_0-2)^2} - \frac{52H(0;Y)\alpha_0}{3\ (y_0-2)^3} - \frac{16H(0;Y)\alpha_0}{3(y_0-2)^4} + \frac{1}{2}H(0;Y)\ \alpha_0 - \frac{383d_1\alpha_0}{18(y_0-2)} + \frac{35d_1'\alpha_0}{9\ (y_0-2)} + \frac{113\alpha_0}{6(y_0-2)} - \frac{151d_1\alpha_0}{3\ (y_0-2)^2} + \frac{38d_1'\alpha_0}{9(y_0-2)^2} + \frac{263\alpha_0}{3\ (y_0-2)^2} - \frac{118d_1\alpha_0}{3(y_0-2)^3} + \frac{4d_1'\alpha_0}{3\ (y_0-2)^3} + \frac{746\alpha_0}{9(y_0-2)^3} - \frac{32d_1\alpha_0}{3\ (y_0-2)^4} + \frac{224\alpha_0}{9(y_0-2)^4} - \frac{133\alpha_0}{36} + \frac{2\ d_1'^2y_0^3}{81} - \frac{25d_1'y_0^3}{81} + \frac{137\ y_0^3}{81} - \frac{17d_1'^2y_0^2}{108} + \frac{223d_1'\ y_0^2}{108} - \frac{179y_0^2}{18} + \frac{49d_1'^2y_0}{54} - \frac{298\ d_1'y_0}{27} + \frac{359y_0}{9} + \frac{2}{27}d_1'y_0^3\ H(0;Y) - \frac{19}{27}y_0^3H(0;Y) - \frac{7}{18}d_1'y_0^2\ H(0;Y) + \frac{11}{3}y_0^2H(0;Y) + \frac{11}{9}d_1'y_0\ H(0;Y) - \frac{31}{3}y_0H(0;Y) - \frac{1}{36}\pi^2\ H(0;Y) - \frac{26}{27}H(0;Y) + H(0;\alpha_0)\Big(\frac{y_0^3\ \alpha_0^4}{9} - \frac{y_0^2\alpha_0^4}{6} + \frac{2y_0\alpha_0^4}{3} - \frac{\alpha_0^4}{3\ (y_0-2)} - \frac{\alpha_0^4}{6} - \frac{16y_0^3\alpha_0^3}{27} + \frac{4y_0^2\ \alpha_0^3}{3} - \frac{16y_0\alpha_0^3}{9} - \frac{2\alpha_0^3}{y_0-2} - \frac{8\ \alpha_0^3}{9(y_0-2)^2} - \frac{7\alpha_0^3}{9} + \frac{4y_0^3\alpha_0^2}{3} - 4y_0^2\ \alpha_0^2 + \frac{10y_0\alpha_0^2}{3} - \frac{16\alpha_0^2}{3(y_0-2)} - \frac{22\ \alpha_0^2}{3(y_0-2)^2} - \frac{8\alpha_0^2}{3(y_0-2)^3} - \frac{7\ \alpha_0^2}{6} - \frac{16y_0^3\alpha_0}{9} + \frac{20y_0^2\alpha_0}{3} - 8y_0\ \alpha_0 - \frac{26\alpha_0}{3(y_0-2)} - \frac{36\alpha_0}{(y_0-2)^2} - \frac{104\ \alpha_0}{3(y_0-2)^3} - \frac{32\alpha_0}{3(y_0-2)^4} + \alpha_0 + \frac{2d_1'\ y_0^3}{27} - \frac{13y_0^3}{54} - \frac{7d_1'y_0^2}{18} + \frac{71\ y_0^2}{36} + \frac{41d_1}{36} + \frac{d_1'}{18} + \frac{11d_1'\ y_0}{9} - \frac{25y_0}{3} + \frac{2}{9}y_0^3H(0;Y) - y_0^2H(0;Y) + 2y_0\ H(0;Y) - \frac{2H(0;Y)}{3(y_0-1)} - \frac{80H(0;Y)}{3\ (y_0-2)^2} - \frac{160H(0;Y)}{3(y_0-2)^3} - \frac{40\ H(0;Y)}{(y_0-2)^4} -$$

$$
\begin{aligned}
&\tfrac{32H(0;Y)}{3(y_0-2)^5}+\tfrac{3}{2}H(0;Y)+\tfrac{8d_1'}{3(y_0-2)}-\tfrac{20}{3(y_0-2)}-\tfrac{4d_1}{3(y_0-1)}+\tfrac{2d_1'}{3(y_0-1)}+\tfrac{7}{2(y_0-1)}-\tfrac{16d_1}{(y_0-2)^2}+\tfrac{12d_1'}{(y_0-2)^2}+\\
&\tfrac{88}{(y_0-2)^2}-\tfrac{128d_1}{9(y_0-2)^3}+\tfrac{88d_1'}{9(y_0-2)^3}+\tfrac{168}{(y_0-2)^3}-\tfrac{4d_1}{(y_0-2)^4}+\tfrac{8d_1'}{3(y_0-2)^4}+\tfrac{116}{(y_0-2)^4}+\tfrac{256}{9(y_0-2)^5}-\tfrac{259}{36}\Big)+\\
&\Big(\tfrac{1}{9}d_1y_0^3\alpha_0^4-\tfrac{1}{6}d_1y_0^2\alpha_0^4-\tfrac{d_1\alpha_0^4}{6}+\tfrac{2}{3}d_1y_0\alpha_0^4-\tfrac{d_1\alpha_0^4}{3(y_0-2)}-\tfrac{16}{27}d_1y_0^3\alpha_0^3+\tfrac{4}{3}d_1y_0^2\alpha_0^3-\tfrac{7d_1\alpha_0^3}{9}-\tfrac{16}{9}d_1y_0\alpha_0^3-\\
&\tfrac{2d_1\alpha_0^3}{y_0-2}-\tfrac{8d_1\alpha_0^3}{9(y_0-2)^2}+\tfrac{4}{3}d_1y_0^3\alpha_0^2-4d_1y_0^2\alpha_0^2-\tfrac{7d_1\alpha_0^2}{6}+\tfrac{10}{3}d_1y_0\alpha_0^2-\tfrac{16d_1\alpha_0^2}{3(y_0-2)}-\tfrac{22d_1\alpha_0^2}{3(y_0-2)^2}-\tfrac{8d_1\alpha_0^2}{3(y_0-2)^3}-\\
&\tfrac{16}{9}d_1y_0^3\alpha_0+\tfrac{20}{3}d_1y_0^2\alpha_0+d_1\alpha_0-8d_1y_0\alpha_0-\tfrac{26d_1\alpha_0}{3(y_0-2)}-\tfrac{36d_1\alpha_0}{(y_0-2)^2}-\tfrac{104d_1\alpha_0}{3(y_0-2)^3}-\tfrac{32d_1\alpha_0}{3(y_0-2)^4}+\tfrac{25d_1y_0^3}{27}-\\
&\tfrac{23d_1y_0^2}{6}+\tfrac{10d_1}{9}+\tfrac{52d_1y_0}{9}+\tfrac{49d_1}{3(y_0-2)}+\tfrac{398d_1}{9(y_0-2)^2}+\tfrac{112d_1}{3(y_0-2)^3}+\tfrac{32d_1}{3(y_0-2)^4}\Big)H(1;\alpha_0)-\tfrac{1}{36}\pi^2H(1;Y)+\\
&\Big(\tfrac{y_0^3\alpha_0^4}{18}-\tfrac{y_0^2\alpha_0^4}{12}+\tfrac{y_0\alpha_0^4}{3}-\tfrac{\alpha_0^4}{6(y_0-2)}-\tfrac{17\alpha_0^4}{36}-\tfrac{8y_0^3\alpha_0^3}{27}+\tfrac{2y_0^2\alpha_0^3}{3}-\tfrac{8y_0\alpha_0^3}{9}-\tfrac{\alpha_0^3}{y_0-2}-\tfrac{4\alpha_0^3}{9(y_0-2)^2}-\tfrac{29\alpha_0^3}{54}+\\
&\tfrac{2y_0^3\alpha_0^2}{3}-2y_0^2\alpha_0^2+\tfrac{5y_0\alpha_0^2}{3}-\tfrac{8\alpha_0^2}{3(y_0-2)}-\tfrac{11\alpha_0^2}{3(y_0-2)^2}-\tfrac{4\alpha_0^2}{3(y_0-2)^3}-\tfrac{13\alpha_0^2}{12}-\tfrac{8y_0^3\alpha_0}{9}+\tfrac{10y_0^2\alpha_0}{3}+\tfrac{4d_1\alpha_0}{3}-\tfrac{2d_1'\alpha_0}{3}-\\
&4y_0\alpha_0+\tfrac{2}{3}H(0;Y)\alpha_0-\tfrac{13\alpha_0}{3(y_0-2)}-\tfrac{18\alpha_0}{(y_0-2)^2}-\tfrac{52\alpha_0}{3(y_0-2)^3}-\tfrac{16\alpha_0}{3(y_0-2)^4}+\tfrac{7\alpha_0}{18}+\tfrac{25y_0^3}{54}-\tfrac{61y_0^2}{36}-\tfrac{4d_1}{3}+\tfrac{2d_1'}{3}+\\
&2y_0+\Big(\tfrac{4\alpha_0}{3}-\tfrac{4}{3(y_0-1)}-\tfrac{4}{3}\Big)H(0;\alpha_0)-\tfrac{2H(0;Y)}{3(y_0-1)}-\tfrac{2}{3}H(0;Y)+\Big(\tfrac{4\alpha_0d_1}{3}-\tfrac{4d_1}{3(y_0-1)}-\tfrac{4d_1}{3}\Big)H(1;\alpha_0)+\\
&\tfrac{32}{3(y_0-2)}-\tfrac{4d_1}{3(y_0-1)}+\tfrac{2d_1'}{3(y_0-1)}+\tfrac{7}{2(y_0-1)}+\tfrac{332}{9(y_0-2)^2}+\tfrac{104}{3(y_0-2)^3}+\tfrac{32}{3(y_0-2)^4}+\tfrac{59}{18}\Big)H(c_1(\alpha_0);y_0)+\\
&\Big(\tfrac{d_1\alpha_0^4}{4}-\tfrac{d_1'\alpha_0^4}{6}+\tfrac{1}{2}H(0;Y)\alpha_0^4-\tfrac{5\alpha_0^4}{4}+\tfrac{7d_1\alpha_0^3}{9}-\tfrac{5d_1'\alpha_0^3}{9}+\tfrac{2}{3}H(0;Y)\alpha_0^3-\alpha_0^3+\tfrac{d_1\alpha_0^2}{6}-\tfrac{d_1'\alpha_0^2}{3}-\\
&H(0;Y)\alpha_0^2+\tfrac{29\alpha_0^2}{6}-\tfrac{11d_1\alpha_0}{3}+\tfrac{5d_1'\alpha_0}{3}-2H(0;Y)\alpha_0+7\alpha_0+\tfrac{89d_1}{36}-\tfrac{11d_1'}{18}+\Big(\alpha_0^4+\tfrac{4\alpha_0^3}{3}-2\alpha_0^2-4\alpha_0-\\
&\tfrac{160}{3(y_0-2)^2}-\tfrac{320}{3(y_0-2)^3}-\tfrac{80}{(y_0-2)^4}-\tfrac{64}{3(y_0-2)^5}+\tfrac{11}{3}\Big)H(0;\alpha_0)-\tfrac{80H(0;Y)}{3(y_0-2)^2}-\tfrac{160H(0;Y)}{3(y_0-2)^3}-\tfrac{40H(0;Y)}{(y_0-2)^4}-\\
&\tfrac{32H(0;Y)}{3(y_0-2)^5}+\tfrac{11}{6}H(0;Y)+\Big(d_1\alpha_0^4+\tfrac{4d_1\alpha_0^3}{3}-2d_1\alpha_0^2-4d_1\alpha_0+\tfrac{11d_1}{3}-\tfrac{160d_1}{3(y_0-2)^2}-\tfrac{320d_1}{3(y_0-2)^3}-\tfrac{80d_1}{(y_0-2)^4}-\\
&\tfrac{64d_1}{3(y_0-2)^5}\Big)H(1;\alpha_0)+\tfrac{8d_1'}{3(y_0-2)}-\tfrac{52}{3(y_0-2)}-\tfrac{16d_1}{(y_0-2)^2}+\tfrac{12d_1'}{(y_0-2)^2}+\tfrac{460}{9(y_0-2)^2}-\tfrac{128d_1}{9(y_0-2)^3}+\tfrac{88d_1'}{9(y_0-2)^3}+\\
&\tfrac{400}{3(y_0-2)^3}-\tfrac{4d_1}{(y_0-2)^4}+\tfrac{8d_1'}{3(y_0-2)^4}+\tfrac{316}{3(y_0-2)^4}+\tfrac{256}{9(y_0-2)^5}-\tfrac{115}{12}\Big)H(c_2(\alpha_0);y_0)+\Big(\tfrac{4y_0^3}{9}-2y_0^2+\\
&4y_0-\tfrac{4}{3(y_0-1)}-\tfrac{160}{3(y_0-2)^2}-\tfrac{320}{3(y_0-2)^3}-\tfrac{80}{(y_0-2)^4}-\tfrac{64}{3(y_0-2)^5}+3\Big)H(0,0;\alpha_0)+\tfrac{2}{9}y_0^3H(0,0;Y)-\\
&y_0^2H(0,0;Y)+2y_0H(0,0;Y)+\tfrac{4}{9}H(0,0;Y)+\Big(\tfrac{20y_0^3}{9}-10y_0^2+20y_0-\tfrac{8}{3}H(0;Y)+\tfrac{4}{y_0-1}+\tfrac{160}{(y_0-2)^2}+\\
&\tfrac{320}{(y_0-2)^3}+\tfrac{240}{(y_0-2)^4}+\tfrac{64}{(y_0-2)^5}-\tfrac{17}{9}\Big)H(0,0;y_0)+\Big(\tfrac{4d_1y_0^3}{9}-2d_1y_0^2+4d_1y_0+3d_1-\tfrac{4d_1}{3(y_0-1)}-\tfrac{160d_1}{3(y_0-2)^2}-\\
&\tfrac{320d_1}{3(y_0-2)^3}-\tfrac{80d_1}{(y_0-2)^4}-\tfrac{64d_1}{3(y_0-2)^5}\Big)H(0,1;\alpha_0)+\Big(\tfrac{2d_1'y_0^3}{3}-3d_1'y_0^2+6d_1'y_0+\tfrac{5d_1'}{18}+\Big(\tfrac{4}{3}-\tfrac{4d_1}{3}\Big)H(0;\alpha_0)-\\
&\tfrac{2}{3}d_1'H(0;Y)+\tfrac{2d_1'}{3(y_0-1)}+\tfrac{80d_1'}{3(y_0-2)^2}+\tfrac{160d_1'}{3(y_0-2)^3}+\tfrac{40d_1'}{(y_0-2)^4}+\tfrac{32d_1'}{3(y_0-2)^5}\Big)H(0,1;y_0)+\Big(-\tfrac{2y_0^3}{9}+y_0^2-\\
&2y_0+\tfrac{4}{3}H(0;\alpha_0)+\tfrac{2}{3}H(0;Y)+\tfrac{4}{3}d_1H(1;\alpha_0)-\tfrac{2}{y_0-1}+\tfrac{80}{3(y_0-2)^2}+\tfrac{160}{3(y_0-2)^3}+\tfrac{40}{(y_0-2)^4}+\tfrac{32}{3(y_0-2)^5}-\\
&\tfrac{107}{18}\Big)H(0,c_1(\alpha_0);y_0)+\Big(\tfrac{26}{3}-\tfrac{320}{3(y_0-2)^2}-\tfrac{640}{3(y_0-2)^3}-\tfrac{160}{(y_0-2)^4}-\tfrac{128}{3(y_0-2)^5}\Big)H(0,c_2(\alpha_0);y_0)+\\
&\tfrac{2}{9}y_0^3H(1,0;Y)-y_0^2H(1,0;Y)+2y_0H(1,0;Y)+\tfrac{4}{9}H(1,0;Y)+\Big(\tfrac{2d_1'y_0^3}{3}+\tfrac{2y_0^3}{9}-3d_1'y_0^2-y_0^2+\\
&6d_1'y_0+2y_0-\tfrac{19d_1'}{3}+\tfrac{4}{3}H(0;\alpha_0)-\tfrac{2}{3}H(0;Y)-\tfrac{4d_1}{3(y_0-1)}+\tfrac{2d_1'}{3(y_0-1)}+\tfrac{2}{3(y_0-1)}+\tfrac{80d_1'}{3(y_0-2)^2}-\tfrac{80}{3(y_0-2)^2}+\\
&\tfrac{160d_1'}{3(y_0-2)^3}-\tfrac{160}{3(y_0-2)^3}+\tfrac{40d_1'}{(y_0-2)^4}-\tfrac{40}{(y_0-2)^4}+\tfrac{32d_1'}{3(y_0-2)^5}-\tfrac{32}{3(y_0-2)^5}+\tfrac{107}{18}\Big)H(1,0;y_0)+\Big(\tfrac{2d_1'^2y_0^3}{9}-d_1'^2y_0^2+\\
&2d_1'^2y_0-\tfrac{11d_1'^2}{9}+\Big(-\tfrac{4d_1}{3}+\tfrac{2d_1'}{3}+\tfrac{2}{3}\Big)H(0;\alpha_0)\Big)H(1,1;y_0)+\Big(-\tfrac{2y_0^3}{9}+y_0^2-2y_0+\tfrac{4}{3}H(0;\alpha_0)+\\
&\tfrac{2}{3}H(0;Y)+\tfrac{4}{3}d_1H(1;\alpha_0)+\tfrac{4d_1}{3(y_0-1)}-\tfrac{2d_1'}{3(y_0-1)}-\tfrac{2}{3(y_0-1)}+\tfrac{80}{3(y_0-2)^2}+\tfrac{160}{3(y_0-2)^3}+\tfrac{40}{(y_0-2)^4}+\tfrac{32}{3(y_0-2)^5}-\\
&\tfrac{107}{18}\Big)H(1,c_1(\alpha_0);y_0)+\Big(-\tfrac{80d_1'}{3(y_0-2)^2}-\tfrac{160d_1'}{3(y_0-2)^3}-\tfrac{40d_1'}{(y_0-2)^4}-\tfrac{32d_1'}{3(y_0-2)^5}+\tfrac{8d_1'}{3}\Big)H(1,c_2(\alpha_0);y_0)+\\
&\Big(\tfrac{160d_1}{3(y_0-2)^2}+\tfrac{320d_1}{3(y_0-2)^3}+\tfrac{80d_1}{(y_0-2)^4}+\tfrac{64d_1}{3(y_0-2)^5}-\tfrac{8d_1'}{3}-\tfrac{160}{3(y_0-2)^2}-\tfrac{320}{3(y_0-2)^3}-\tfrac{80}{(y_0-2)^4}-\tfrac{64}{3(y_0-2)^5}+
\end{aligned}
$$

$$\frac{26}{3}\Big) H(2,0;y_0) + \Big( - \frac{160 d_1}{3\,(y_0-2)^2} - \frac{320 d_1}{3(y_0-2)^3} - \frac{80\ d_1}{(y_0-2)^4} - \frac{64 d_1}{3(y_0-2)^5} + \frac{8\ d_1'}{3} + \frac{160}{3(y_0-2)^2} + \frac{320}{3\ (y_0-2)^3} +$$

$$\frac{80}{(y_0-2)^4} + \frac{64}{3\ (y_0-2)^5} - \frac{26}{3}\Big) H(2,c_2(\alpha_0);y_0) + \Big(\frac{4\ \alpha_0}{3} - \frac{4}{3(y_0-1)} - \frac{4}{3}\Big)\ H(c_1(\alpha_0),0;y_0) + \Big(\frac{2\alpha_0 d_1'}{3} -$$

$$\frac{2d_1'}{3(y_0-1)} - \ \frac{2d_1'}{3}\Big) H(c_1(\alpha_0),1;y_0) + \Big(\frac{2\ \alpha_0}{3} - \frac{2}{3(y_0-1)} - \frac{2}{3}\Big)\ H(c_1(\alpha_0),c_1(\alpha_0);y_0) + \Big(\alpha_0^4 + \frac{4\alpha_0^3}{3} -$$

$$2\alpha_0^2 - 4\ \alpha_0 - \frac{160}{3(y_0-2)^2} - \frac{320}{3\ (y_0-2)^3} - \frac{80}{(y_0-2)^4} - \frac{64}{3\ (y_0-2)^5} + \frac{11}{3}\Big) H(c_2(\alpha_0),0;y_0) + \Big(\frac{d_1'\ \alpha_0^4}{2} +$$

$$\frac{2d_1'\alpha_0^3}{3} - d_1'\alpha_0^2 - 2d_1'\alpha_0 + \frac{11\ d_1'}{6} - \frac{80 d_1'}{3(y_0-2)^2} - \frac{160 d_1'}{3\ (y_0-2)^3} - \frac{40 d_1'}{(y_0-2)^4} - \frac{32 d_1'}{3(y_0-2)^5}\Big)\ H(c_2(\alpha_0),1;y_0) +$$

$$\Big(\frac{\alpha_0^4}{2} + \frac{2\alpha_0^3}{3} - \alpha_0^2 - 2\alpha_0 - \ \frac{80}{3(y_0-2)^2} - \frac{160}{3\ (y_0-2)^3} - \frac{40}{(y_0-2)^4} - \frac{32}{3\ (y_0-2)^5} + \frac{11}{6}\Big) H(c_2(\alpha_0),c_1(\alpha_0);y_0) -$$

$$\frac{1}{6}\ H(0,0,0;Y) - \frac{32}{3} H(0,0,0;y_0) - \frac{8}{3} d_1'\ H(0,0,1;y_0) + \frac{8}{3} H(0,0,c_1(\alpha_0);y_0) - \frac{1}{6}\ H(0,1,0;Y) +$$

$$\Big(\frac{4d_1}{3} - \frac{8d_1'}{3} - \frac{4}{3}\Big)\ H(0,1,0;y_0) - \frac{2}{3} d_1'^2 H(0,1,1;y_0) + \Big( - \frac{4\ d_1}{3} + \frac{2d_1'}{3} + \frac{4}{3}\Big)\ H(0,1,c_1(\alpha_0);y_0) +$$

$$\frac{4}{3} H(0,c_1(\alpha_0),0;y_0) + \frac{2}{3} d_1'\ H(0,c_1(\alpha_0),1;y_0) + \frac{2}{3}\ H(0,c_1(\alpha_0),c_1(\alpha_0);y_0) - \frac{1}{6} H(1,0,0;Y) -$$

$$4\ H(1,0,0;y_0) - \frac{2}{3} d_1' H(1,0,1;y_0) + 2\ H(1,0,c_1(\alpha_0);y_0) - \frac{1}{6} H(1,1,0;Y) + \Big(\frac{4\ d_1}{3} - \frac{2d_1'}{3} -$$

$$\frac{2}{3}\Big) H(1,1,0;y_0) + \Big( - \frac{4\ d_1}{3} + \frac{2d_1'}{3} + \frac{2}{3}\Big)\ H(1,1,c_1(\alpha_0);y_0) + \frac{4}{3} H(1,c_1(\alpha_0),0;y_0) +$$

$$\frac{2}{3} d_1'\ H(1,c_1(\alpha_0),1;y_0) + \frac{2}{3} H(1,c_1(\alpha_0),c_1(\alpha_0);y_0) + H(0;y_0)\ \Big(\frac{y_0^3\alpha_0^4}{9} - \frac{y_0^2\alpha_0^4}{6} + \frac{2y_0\ \alpha_0^4}{3} - \frac{\alpha_0^4}{3(y_0-2)} -$$

$$\frac{\alpha_0^4}{6} - \frac{16y_0^3\ \alpha_0^3}{27} + \frac{4y_0^2\alpha_0^3}{3} - \frac{16y_0\alpha_0^3}{9} - \frac{2\ \alpha_0^3}{y_0-2} - \frac{8\alpha_0^3}{9(y_0-2)^2} - \frac{7\alpha_0^3}{9} + \frac{4\ y_0^3\alpha_0^2}{3} - 4y_0^2\alpha_0^2 + \frac{10y_0\alpha_0^2}{3} - \frac{16\ \alpha_0^2}{3(y_0-2)} - \frac{22\alpha_0^2}{3(y_0-2)^2} -$$

$$\frac{8\alpha_0^2}{3\ (y_0-2)^3} - \frac{7\alpha_0^2}{6} - \frac{16y_0^3\alpha_0}{9} + \frac{20y_0^2\ \alpha_0}{3} - 8y_0\alpha_0 - \frac{26\alpha_0}{3(y_0-2)} - \frac{36\ \alpha_0}{(y_0-2)^2} - \frac{104\alpha_0}{3(y_0-2)^3} - \frac{32\alpha_0}{3\ (y_0-2)^4} + \alpha_0 + \frac{2d_1'y_0^3}{9} -$$

$$\frac{139y_0^3}{54} - \frac{7\ d_1'y_0^2}{6} + \frac{457y_0^2}{36} - \frac{41\ d_1}{36} - \frac{d_1'}{18} + \frac{11d_1'y_0}{3} - 33y_0 + \Big(\frac{4\ y_0^3}{9} - 2y_0^2 + 4y_0 - \frac{4}{3(y_0-1)} - \frac{160}{3\ (y_0-2)^2} -$$

$$\frac{320}{3(y_0-2)^3} - \frac{80}{(y_0-2)^4} - \frac{64}{3(\ y_0-2)^5} + 3\Big) H(0;\alpha_0) + \frac{2}{3} y_0^3 H(0;Y) - 3y_0^2 H(0;Y) + 6\ y_0 H(0;Y) + \frac{2H(0;Y)}{3(y_0-1)} +$$

$$\frac{80H(0;Y)}{3\ (y_0-2)^2} + \frac{160H(0;Y)}{3(y_0-2)^3} + \frac{40\ H(0;Y)}{(y_0-2)^4} + \frac{32H(0;Y)}{3(y_0-2)^5} + \frac{5}{18} H(0;Y) - \frac{2}{3} H(0,0;Y) - \frac{2}{3} H(1,0;Y) - \frac{8d_1'}{3\ (y_0-2)} +$$

$$\frac{20}{3(y_0-2)} + \frac{4d_1}{3(y_0-1)} - \frac{2d_1'}{3\ (y_0-1)} - \frac{7}{2(y_0-1)} + \frac{16d_1}{(y_0-2)^2} - \frac{12\ d_1'}{(y_0-2)^2} - \frac{88}{(y_0-2)^2} + \frac{128d_1}{9\ (y_0-2)^3} - \frac{88d_1'}{9(y_0-2)^3} - \frac{168}{(y_0-2)^3} +$$

$$\frac{4\ d_1}{(y_0-2)^4} - \frac{8d_1'}{3\ (y_0-2)^4} - \frac{116}{(y_0-2)^4} - \frac{256}{9(y_0-2)^5} - \frac{320\ \ln 2}{3(y_0-2)^2} - \frac{640\ln 2}{3(y_0-2)^3} - \frac{160\ln\ 2}{(y_0-2)^4} - \frac{128\ln 2}{3(y_0-2)^5} + \frac{26\ln 2}{3} -$$

$$\frac{\pi^2}{9} + \frac{361}{108}\Big) + H(2;y_0)\Big( - \frac{160\ \ln 2\, d_1}{3(y_0-2)^2} - \frac{320\ln 2\, d_1}{3\ (y_0-2)^3} - \frac{80\ln 2\, d_1}{(y_0-2)^4} - \frac{64\ln 2\, d_1}{3\ (y_0-2)^5} + \Big( - \frac{160 d_1}{3(y_0-2)^2} - \frac{320 d_1}{3\ (y_0-2)^3} -$$

$$\frac{80 d_1}{(y_0-2)^4} - \frac{64 d_1}{3\ (y_0-2)^5} + \frac{8d_1'}{3} + \frac{160}{3(y_0-2)^2} + \frac{320}{3\ (y_0-2)^3} + \frac{80}{(y_0-2)^4} + \frac{64}{3\ (y_0-2)^5} - \frac{26}{3}\Big) H(0;\alpha_0) + \frac{8}{3} d_1' \ln 2\ +$$

$$\frac{160\ln 2}{3(y_0-2)^2} + \frac{320\ln 2}{3\ (y_0-2)^3} + \frac{80\ln 2}{(y_0-2)^4} + \frac{64\ln 2}{3\ (y_0-2)^5} - \frac{26\ln 2}{3}\Big) + H(1;y_0)\Big(\frac{1}{18} d_1'\ y_0^3\alpha_0^4 - \frac{1}{12} d_1' y_0^2\alpha_0^4 - \frac{17d_1'\ \alpha_0^4}{36} +$$

$$\frac{1}{3} d_1' y_0\alpha_0^4 - \frac{d_1'\alpha_0^4}{6\ (y_0-2)} - \frac{8}{27} d_1' y_0^3\alpha_0^3 + \frac{2}{3} d_1' y_0^2\ \alpha_0^3 - \frac{d_1'\alpha_0^3}{27} - \frac{8}{9} d_1' y_0\alpha_0^3 - \frac{d_1'\ \alpha_0^3}{y_0-2} - \frac{4d_1'\alpha_0^3}{9(y_0-2)^2} + \frac{2}{3} d_1' y_0^3\ \alpha_0^2 -$$

$$2d_1' y_0^2\alpha_0^2 - \frac{2d_1'\alpha_0^2}{3} + \frac{5}{3} d_1' y_0\ \alpha_0^2 - \frac{8d_1'\alpha_0^2}{3(y_0-2)} - \frac{11d_1'\alpha_0^2}{3\ (y_0-2)^2} - \frac{4d_1'\alpha_0^2}{3(y_0-2)^3} - \frac{8}{9} d_1' y_0^3\ \alpha_0 + \frac{10}{3} d_1' y_0^2\alpha_0 + \frac{23d_1'\alpha_0}{9} -$$

$$4d_1' y_0\alpha_0 - \frac{13d_1'\alpha_0}{3(y_0-2)} - \frac{18d_1'\alpha_0}{(y_0-2)^2} - \frac{52\ d_1'\alpha_0}{3(y_0-2)^3} - \frac{16d_1'\alpha_0}{3(y_0-2)^4} + \frac{2d_1'^2\ y_0^3}{27} - \frac{19d_1' y_0^3}{27} - \frac{49d_1'^2}{54} - \frac{7\ d_1'^2 y_0^2}{18} + \frac{11d_1' y_0^2}{3} +$$

$$\frac{199\ d_1'}{27} + \frac{11d_1'^2 y_0}{9} - \frac{31d_1' y_0}{3} + H(0;\alpha_0)\ \Big(\frac{2d_1' y_0^3}{9} - \frac{2y_0^3}{9} - d_1' y_0^2 + y_0^2 + 2d_1'\ y_0 - 2y_0 + \frac{13d_1'}{9} + \frac{2}{3} H(0;Y) +$$

$$\frac{4d_1}{3\ (y_0-1)} - \frac{2d_1'}{3(y_0-1)} - \frac{2}{3(y_0-1)} - \frac{80\ d_1'}{3(y_0-2)^2} + \frac{80}{3(y_0-2)^2} - \frac{160d_1'}{3\ (y_0-2)^3} + \frac{160}{3(y_0-2)^3} - \frac{40\ d_1'}{(y_0-2)^4} + \frac{40}{(y_0-2)^4} -$$

$$\frac{32d_1'}{3\ (y_0-2)^5} + \frac{32}{3(y_0-2)^5} - \frac{107}{18}\Big) + \frac{2}{9}\ d_1' y_0^3 H(0;Y) - d_1' y_0^2 H(0;Y) - \frac{11}{9} d_1' H(0;Y) + 2d_1'\ y_0 H(0;Y) +$$

$$\frac{4}{3} H(0,0;\alpha_0) + \frac{4}{3} d_1\ H(0,1;\alpha_0) + \frac{8}{3} d_1' \ln 2 - \frac{80d_1'\ln 2}{3\ (y_0-2)^2} - \frac{160d_1'\ln 2}{3(y_0-2)^3} - \frac{40d_1'\ln\ 2}{(y_0-2)^4} - \frac{32d_1'\ln 2}{3(y_0-2)^5} - \frac{\pi^{\ 2}}{9}\Big) +$$

$$\frac{\pi^2}{9(y_0-1)} + \frac{20\pi^2}{9\ (y_0-2)^2} + \frac{40\pi^2}{9(y_0-2)^3} + \frac{10\pi^2}{3\ (y_0-2)^4} + \frac{8\pi^2}{9(y_0-2)^5} - \zeta_3 + \frac{80\ln^2 2}{3(y_0-2)^2} + \frac{160\ln^2 2}{3(y_0-2)^3} + \frac{40\ln^2 2}{(y_0-2)^4} +$$

$$\frac{32\ln^2 2}{3(y_0-2)^5} - \frac{13\ln^2 2}{6} + \frac{89}{36} d_1 \ln 2 - \frac{11}{18} d_1' \ln 2 - \frac{80\ H(0;Y)\ln 2}{3(y_0-2)^2} - \frac{160H(0;Y)\ln 2}{3\ (y_0-2)^3} - \frac{40H(0;Y)\ln 2}{(y_0-2)^4} -$$

$$\frac{32H(0;Y)\ln 2}{3(y_0-2)^5} + \frac{13}{6} H(0;Y)\ln 2 + \frac{8d_1'\ln 2}{3(y_0-2)} - \frac{52\ln 2}{3(y_0-2)} - \frac{16d_1\ln 2}{(y_0-2)^2} + \frac{12d_1'\ln 2}{(y_0-2)^2} + \frac{460\ln 2}{9\ (y_0-2)^2} -$$

$\frac{128 d_1 \ln 2}{9(y_0-2)^3}+\frac{88 d_1' \ln 2}{9(y_0-2)^3}+\frac{400 \ln 2}{3(y_0-2)^3}-\frac{4 d_1 \ln 2}{(y_0-2)^4}+\frac{8 d_1' \ln 2}{3(y_0-2)^4}+\frac{316 \ln 2}{3(y_0-2)^4}+\frac{256 \ln 2}{9(y_0-2)^5}-\frac{377 \ln 2}{36}+\frac{\pi^2}{216}+\frac{160}{81}.$

### F.4 The $\mathcal{J}{*}\mathcal{I}$ integral for $k=-1$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{J\!I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;-1)=\frac{1}{\varepsilon^4}(j{*}i)^{(-1)}_{-4}+\frac{1}{\varepsilon^3}(j{*}i)^{(-1)}_{-3}+\frac{1}{\varepsilon^2}(j{*}i)^{(-1)}_{-2}+\frac{1}{\varepsilon}(j{*}i)^{(-1)}_{-1}+(j{*}i)^{(-1)}_{0}+\mathcal{O}(\varepsilon)\,, \tag{F.4}$$

where

$$(j*i)^{(-1)}_{-4}=-\tfrac{1}{4},$$

$$(j*i)^{(-1)}_{-3}=-\tfrac{y_0^3}{3}+\tfrac{3y_0^2}{2}-3y_0+\tfrac{1}{4}H(0;Y)+H(0;y_0),$$

$$(j*i)^{(-1)}_{-2}=\tfrac{d_1' y_0^3}{9}+\tfrac{1}{3}H(0;Y)y_0^3-\tfrac{4\,y_0^3}{9}-\tfrac{7d_1' y_0^2}{12}-\tfrac{3}{2}H(0;Y)y_0^2+3\,y_0^2+\tfrac{11 d_1' y_0}{6}+ 3H(0;Y)y_0-12y_0+\Big(\tfrac{4\,y_0^3}{3}-6y_0^2+12y_0-H(0;Y)\Big)H(0;y_0)+\Big(\tfrac{d_1'\,y_0^3}{3}-\tfrac{3d_1' y_0^2}{2}+3d_1' y_0- \tfrac{11 d_1'}{6}\Big)\,H(1;y_0)-\tfrac{1}{4}H(0,0;Y)-4H(0,0;y_0)-d_1'\,H(0,1;y_0)-\tfrac{1}{4}H(1,0;Y)-\tfrac{\pi^2}{24},$$

$$(j*i)^{(-1)}_{-1}=\tfrac{y_0^3\alpha_0^4}{18}-\tfrac{5y_0^2\alpha_0^4}{12}+\tfrac{5y_0\,\alpha_0^4}{3}-\tfrac{13y_0^3\alpha_0^3}{54}+\tfrac{17y_0^2\alpha_0^3}{9}-\tfrac{80\,y_0\alpha_0^3}{9}+\tfrac{11y_0^3\alpha_0^2}{36}-\tfrac{109y_0^2\,\alpha_0^2}{36}+ \tfrac{158y_0\alpha_0^2}{9}+\tfrac{7y_0^3\alpha_0}{18}+\tfrac{7\,y_0^2\alpha_0}{18}-\tfrac{43y_0\alpha_0}{3}-\tfrac{d_1'^2y_0^3}{27}+\tfrac{8\,d_1' y_0^3}{27}+\tfrac{\pi^2y_0^3}{18}-\tfrac{14y_0^3}{27}+\tfrac{17\,d_1'^2y_0^2}{72}-\tfrac{22d_1' y_0^2}{9}-\tfrac{\pi^2\,y_0^2}{4}+ \tfrac{21y_0^2}{4}-\tfrac{49d_1'^2y_0}{36}+\tfrac{151d_1'\,y_0}{9}+\tfrac{\pi^2y_0}{2}-42y_0+\Big(-\tfrac{7y_0^3}{6}+\tfrac{13\,y_0^2}{3}-\tfrac{11y_0}{2}+\tfrac{13}{6(y_0-1)}+\tfrac{13}{6}\Big)\,H(0;\alpha_0)- \tfrac{1}{9}d_1' y_0^3H(0;Y)+\tfrac{4}{9}y_0^3\,H(0;Y)+\tfrac{7}{12}d_1' y_0^2H(0;Y)-3y_0^2H(0;Y)-\tfrac{11}{6}\,d_1' y_0H(0;Y)+ 12y_0H(0;Y)+\tfrac{1}{24}\pi^2H(0;Y)+\tfrac{1}{24}\,\pi^2H(1;Y)+\Big(-\tfrac{1}{9}d_1'^2y_0^3+\tfrac{4d_1'\,y_0^3}{9}-\tfrac{1}{3}d_1' H(0;Y)y_0^3+\tfrac{7d_1'^2y_0^2}{12}- 3\,d_1' y_0^2+\tfrac{3}{2}d_1' H(0;Y)y_0^2-\tfrac{11d_1'^2y_0}{6}+12\,d_1' y_0-3d_1' H(0;Y)y_0+\tfrac{49d_1'^2}{36}-\tfrac{85\,d_1'}{9}+\Big(\tfrac{2y_0^3}{3}-3y_0^2+ 6\,y_0+\tfrac{2}{y_0-1}-\tfrac{19}{3}\Big)H(0;\alpha_0)+\tfrac{11}{6}d_1'\,H(0;Y)+\tfrac{\pi^2}{3}\Big)H(1;y_0)+\Big(-\tfrac{1}{6}y_0^3\,\alpha_0^4+y_0^2\alpha_0^4-\tfrac{5y_0\alpha_0^4}{2}+\tfrac{5\alpha_0^4}{3}+ \tfrac{8\,y_0^3\alpha_0^3}{9}-5y_0^2\alpha_0^3+\tfrac{38y_0\alpha_0^3}{3}-\tfrac{68\,\alpha_0^3}{9}-2y_0^3\alpha_0^2+\tfrac{21y_0^2\alpha_0^2}{2}-26y_0\,\alpha_0^2+\tfrac{38\alpha_0^2}{3}+\tfrac{8y_0^3\alpha_0}{3}-13y_0^2\alpha_0+30y_0\,\alpha_0- \tfrac{41\alpha_0}{3}-\tfrac{25y_0^3}{18}+\tfrac{35y_0^2}{6}-\tfrac{23\,y_0}{2}+\tfrac{13}{6(y_0-1)}+\tfrac{13}{6}\Big)\,H(c_1(\alpha_0);y_0)-\tfrac{1}{3}y_0^3H(0,0;Y)+\tfrac{3}{2}y_0^2\,H(0,0;Y)- 3y_0H(0,0;Y)+\Big(-\tfrac{16y_0^3}{3}+24y_0^2-48y_0+4\,H(0;Y)\Big)H(0,0;y_0)+\Big(-\tfrac{4d_1' y_0^3}{3}+6d_1' y_0^2- 12\,d_1' y_0-4H(0;\alpha_0)+d_1' H(0;Y)\Big)H(0,1;y_0)+\Big(\alpha_0^4-\tfrac{16\,\alpha_0^3}{3}+12\alpha_0^2-16\alpha_0+\tfrac{2y_0^3}{3}-3y_0^2+6\,y_0+ \tfrac{2}{y_0-1}+2\Big)H(0,c_1(\alpha_0);y_0)-\tfrac{1}{3}y_0^3\,H(1,0;Y)+\tfrac{3}{2}y_0^2H(1,0;Y)-3y_0H(1,0;Y)+H(0;y_0)\,\Big(- \tfrac{4d_1' y_0^3}{9}-\tfrac{4}{3}H(0;Y)y_0^3+\tfrac{53\,y_0^3}{18}+\tfrac{7d_1' y_0^2}{3}+6H(0;Y)y_0^2-\tfrac{49\,y_0^2}{3}-\tfrac{22d_1' y_0}{3}-12H(0;Y)y_0+\tfrac{107\,y_0}{2}+ H(0,0;Y)+H(1,0;Y)-\tfrac{13}{6(y_0-1)}+\tfrac{\pi^{\,2}}{6}-\tfrac{13}{6}\Big)+\Big(-\tfrac{4d_1' y_0^3}{3}-\tfrac{2\,y_0^3}{3}+6d_1' y_0^2+3y_0^2-12d_1' y_0-6y_0+ \tfrac{22\,d_1'}{3}-\tfrac{2}{y_0-1}+\tfrac{19}{3}\Big)\,H(1,0;y_0)+\Big(-\tfrac{1}{3}d_1'^2y_0^3+\tfrac{3d_1'^2y_0^2}{2}-3\,d_1'^2y_0+\tfrac{11d_1'^2}{6}-2H(0;\alpha_0)\Big)\,H(1,1;y_0)+ \Big(\tfrac{2y_0^3}{3}-3y_0^2+6\,y_0+\tfrac{2}{y_0-1}-\tfrac{19}{3}\Big)H(1,c_1(\alpha_0);y_0)+\Big(2\,\alpha_0-\tfrac{2}{y_0-1}-2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)+ \tfrac{1}{4}\,H(0,0,0;Y)+16H(0,0,0;y_0)+4d_1' H(0,0,1;y_0)-4H(0,0,c_1(\alpha_0);y_0)+ \tfrac{1}{4}H(0,1,0;Y)+(4d_1'+4)H(0,1,0;y_0)+d_1'^2H(0,1,1;y_0)-4\,H(0,1,c_1(\alpha_0);y_0)+ 2H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+\tfrac{1}{4}\,H(1,0,0;Y)-2H(1,0,c_1(\alpha_0);y_0)+\tfrac{1}{4}H(1,1,0;Y)+ 2\,H(1,1,0;y_0)-2H(1,1,c_1(\alpha_0);y_0)+2\,H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)-\tfrac{\pi^2}{3(y_0-1)}+\tfrac{3\,\zeta_3}{2}-\tfrac{\pi^2}{3},$$

$$(j*i)_0^{(-1)} = -\frac{1}{36}d_1y_0^3\alpha_0^4 - \frac{1}{27}d_1'y_0^3\alpha_0^4 + \frac{13y_0^3\alpha_0^4}{108} + \frac{5}{24}d_1y_0^2\alpha_0^4 + \frac{13}{36}d_1'y_0^2\alpha_0^4 - \frac{7y_0^2\alpha_0^4}{6} -$$
$$\frac{5}{6}d_1y_0\alpha_0^4 - \frac{47}{18}d_1'y_0\alpha_0^4 + \frac{97y_0\alpha_0^4}{12} - \frac{1}{18}y_0^3H(0;Y)\alpha_0^4 + \frac{5}{12}y_0^2H(0;Y)\alpha_0^4 - \frac{5}{3}y_0H(0;Y)\alpha_0^4 +$$
$$\frac{31}{324}d_1y_0^3\alpha_0^3 + \frac{29}{162}d_1'y_0^3\alpha_0^3 - \frac{185y_0^3\alpha_0^3}{324} - \frac{91}{108}d_1y_0^2\alpha_0^3 - \frac{187}{108}d_1'y_0^2\alpha_0^3 + \frac{631y_0^2\alpha_0^3}{108} + \frac{245}{54}d_1y_0\alpha_0^3 +$$
$$\frac{1549}{108}d_1'y_0\alpha_0^3 - \frac{5095y_0\alpha_0^3}{108} + \frac{13}{54}y_0^3H(0;Y)\alpha_0^3 - \frac{17}{9}y_0^2H(0;Y)\alpha_0^3 + \frac{80}{9}y_0H(0;Y)\alpha_0^3 + \frac{17}{216}d_1y_0^3\alpha_0^2 -$$
$$\frac{35}{108}d_1'y_0^3\alpha_0^2 + \frac{179y_0^3\alpha_0^2}{216} + \frac{17}{27}d_1y_0^2\alpha_0^2 + \frac{707}{216}d_1'y_0^2\alpha_0^2 - \frac{589y_0^2\alpha_0^2}{54} - \frac{895}{108}d_1y_0\alpha_0^2 - \frac{809}{27}d_1'y_0\alpha_0^2 +$$
$$\frac{2836y_0\alpha_0^2}{27} - \frac{11}{36}y_0^3H(0;Y)\alpha_0^2 + \frac{109}{36}y_0^2H(0;Y)\alpha_0^2 - \frac{158}{9}y_0H(0;Y)\alpha_0^2 - \frac{205}{108}d_1y_0^3\alpha_0 + \frac{1}{6}d_1'y_0^3\alpha_0 +$$
$$\frac{95y_0^3\alpha_0}{54} + \frac{659}{108}d_1y_0^2\alpha_0 - \frac{74}{27}d_1'y_0^2\alpha_0 + \frac{187y_0^2\alpha_0}{108} + \frac{d_1y_0\alpha_0}{36} + \frac{278d_1'y_0\alpha_0}{9} - \frac{219y_0\alpha_0}{2} - \frac{7}{18}y_0^3H(0;Y)\alpha_0 -$$
$$\frac{7}{18}y_0^2H(0;Y)\alpha_0 + \frac{43}{3}y_0H(0;Y)\alpha_0 + \frac{d_1'^3y_0^3}{81} - \frac{4d_1'^2y_0^3}{27} + \frac{14d_1'y_0^3}{27} - \frac{1}{54}d_1'\pi^2y_0^3 + \frac{29\pi^2y_0^3}{108} - \frac{46y_0^3}{81} - \frac{43d_1'^3y_0^2}{432} +$$
$$\frac{167d_1'^2y_0^2}{108} - \frac{1435d_1'y_0^2}{216} + \frac{7}{72}d_1'\pi^2y_0^2 - \frac{11\pi^2y_0^2}{9} + \frac{69y_0^2}{8} + \frac{251d_1'^3y_0}{216} - \frac{542d_1'^2y_0}{27} + \frac{10367d_1'y_0}{108} - \frac{11}{36}d_1'\pi^2y_0 +$$
$$\frac{35\pi^2y_0}{12} - 138y_0 + \frac{1}{27}d_1'^2y_0^3H(0;Y) - \frac{8}{27}d_1'y_0^3H(0;Y) - \frac{1}{18}\pi^2y_0^3H(0;Y) + \frac{14}{27}y_0^3H(0;Y) -$$
$$\frac{17}{72}d_1'^2y_0^2H(0;Y) + \frac{22}{9}d_1'y_0^2H(0;Y) + \frac{1}{4}\pi^2y_0^2H(0;Y) - \frac{21}{4}y_0^2H(0;Y) + \frac{49}{36}d_1'^2y_0H(0;Y) -$$
$$\frac{151}{9}d_1'y_0H(0;Y) - \frac{1}{2}\pi^2y_0H(0;Y) + 42y_0H(0;Y) + \frac{\pi^2H(0;Y)}{3(y_0-1)} + \frac{1}{3}\pi^2H(0;Y) + H(0;\alpha_0)\Big(-$$
$$\frac{1}{9}y_0^3\alpha_0^4 + \frac{5y_0^2\alpha_0^4}{6} - \frac{10y_0\alpha_0^4}{3} + \frac{13y_0^3\alpha_0^3}{27} - \frac{34y_0^2\alpha_0^3}{9} + \frac{160y_0\alpha_0^3}{9} - \frac{11y_0^3\alpha_0^2}{18} + \frac{109y_0^2\alpha_0^2}{18} - \frac{316y_0\alpha_0^2}{9} - \frac{7y_0^3\alpha_0}{9} -$$
$$\frac{7y_0^2\alpha_0}{9} + \frac{86y_0\alpha_0}{3} + \frac{205d_1y_0^3}{108} + \frac{17d_1'y_0^3}{54} - \frac{35y_0^3}{9} - \frac{22d_1y_0^2}{3} - \frac{10d_1'y_0^2}{9} + \frac{649y_0^2}{36} - \frac{217d_1}{36} + \frac{d_1'}{6} + \frac{469d_1y_0}{36} -$$
$$\frac{7d_1'y_0}{18} - \frac{299y_0}{9} + \frac{7}{6}y_0^3H(0;Y) - \frac{13}{3}y_0^2H(0;Y) + \frac{11}{2}y_0H(0;Y) - \frac{13H(0;Y)}{6(y_0-1)} - \frac{13}{6}H(0;Y) - \frac{217d_1}{36(y_0-1)} +$$
$$\frac{d_1'}{6(y_0-1)} + \frac{149}{18(y_0-1)} + \frac{149}{18}\Big) + \Big(-\frac{1}{9}d_1y_0^3\alpha_0^4 + \frac{5}{6}d_1y_0^2\alpha_0^4 - \frac{10}{3}d_1y_0\alpha_0^4 + \frac{13}{27}d_1y_0^3\alpha_0^3 - \frac{34}{9}d_1y_0^2\alpha_0^3 +$$
$$\frac{160}{9}d_1y_0\alpha_0^3 - \frac{11}{18}d_1y_0^3\alpha_0^2 + \frac{109}{18}d_1y_0^2\alpha_0^2 - \frac{316}{9}d_1y_0\alpha_0^2 - \frac{7}{9}d_1y_0^3\alpha_0 - \frac{7}{9}d_1y_0^2\alpha_0 + \frac{86d_1y_0\alpha_0}{3} + \frac{55d_1y_0^3}{54} -$$
$$\frac{7d_1y_0^2}{3} - 8d_1y_0\Big)H(1;\alpha_0) + \frac{1}{18}\pi^2y_0^3H(1;Y) - \frac{1}{4}\pi^2y_0^2H(1;Y) + \frac{1}{2}\pi^2y_0H(1;Y) + \Big(\frac{1}{12}d_1y_0^3\alpha_0^4 +$$
$$\frac{1}{18}d_1'y_0^3\alpha_0^4 - \frac{y_0^3\alpha_0^4}{4} - \frac{1}{2}d_1y_0^2\alpha_0^4 - \frac{5}{12}d_1'y_0^2\alpha_0^4 + \frac{7y_0^2\alpha_0^4}{4} - \frac{5d_1\alpha_0^4}{6} - \frac{47d_1'\alpha_0^4}{36} + \frac{5}{4}d_1y_0\alpha_0^4 + \frac{5}{3}d_1'y_0\alpha_0^4 -$$
$$\frac{25y_0\alpha_0^4}{4} + \frac{1}{6}y_0^3H(0;Y)\alpha_0^4 - y_0^2H(0;Y)\alpha_0^4 + \frac{5}{2}y_0H(0;Y)\alpha_0^4 - \frac{5}{3}H(0;Y)\alpha_0^4 + \frac{19\alpha_0^4}{4} - \frac{13}{27}d_1y_0^3\alpha_0^3 -$$
$$\frac{8}{27}d_1'y_0^3\alpha_0^3 + \frac{77y_0^3\alpha_0^3}{54} + \frac{8}{3}d_1y_0^2\alpha_0^3 + \frac{37}{18}d_1'y_0^2\alpha_0^3 - \frac{29y_0^2\alpha_0^3}{3} + \frac{221d_1\alpha_0^3}{54} + \frac{313d_1'\alpha_0^3}{54} - \frac{61}{9}d_1y_0\alpha_0^3 -$$
$$\frac{77}{9}d_1'y_0\alpha_0^3 + \frac{331y_0\alpha_0^3}{9} - \frac{8}{9}y_0^3H(0;Y)\alpha_0^3 + 5y_0^2H(0;Y)\alpha_0^3 - \frac{38}{3}y_0H(0;Y)\alpha_0^3 + \frac{68}{9}H(0;Y)\alpha_0^3 -$$
$$\frac{676\alpha_0^3}{27} + \frac{23}{18}d_1y_0^3\alpha_0^2 + \frac{2}{3}d_1'y_0^3\alpha_0^2 - \frac{131y_0^3\alpha_0^2}{36} - \frac{13}{2}d_1y_0^2\alpha_0^2 - \frac{17}{4}d_1'y_0^2\alpha_0^2 + \frac{283y_0^2\alpha_0^2}{12} - \frac{287d_1\alpha_0^2}{36} - \frac{28d_1'\alpha_0^2}{3} +$$
$$\frac{95}{6}d_1y_0\alpha_0^2 + \frac{35}{2}d_1'y_0\alpha_0^2 - \frac{533y_0\alpha_0^2}{6} + 2y_0^3H(0;Y)\alpha_0^2 - \frac{21}{2}y_0^2H(0;Y)\alpha_0^2 + 26y_0H(0;Y)\alpha_0^2 -$$
$$\frac{38}{3}H(0;Y)\alpha_0^2 + \frac{149\alpha_0^2}{3} - \frac{25}{9}d_1y_0^3\alpha_0 - \frac{8}{9}d_1'y_0^3\alpha_0 + \frac{121y_0^3\alpha_0}{18} + 13d_1y_0^2\alpha_0 + \frac{31}{6}d_1'y_0^2\alpha_0 - \frac{241y_0^2\alpha_0}{6} +$$
$$\frac{343d_1\alpha_0}{18} + \frac{47d_1'\alpha_0}{6} - \frac{85d_1y_0\alpha_0}{3} - \frac{59d_1'y_0\alpha_0}{3} + \frac{404y_0\alpha_0}{3} - \frac{8}{3}y_0^3H(0;Y)\alpha_0 + 13y_0^2H(0;Y)\alpha_0 -$$
$$30y_0H(0;Y)\alpha_0 + \frac{41}{3}H(0;Y)\alpha_0 - \frac{143\alpha_0}{2} + \frac{205d_1y_0^3}{108} + \frac{25d_1'y_0^3}{54} - \frac{115y_0^3}{27} - \frac{22d_1y_0^2}{3} - \frac{7d_1'y_0^2}{3} + \frac{196y_0^2}{9} -$$
$$\frac{217d_1}{36} + \frac{d_1'}{6} + \frac{469d_1y_0}{36} + 8d_1'y_0 - \frac{569y_0}{9} + \Big(\frac{y_0^3\alpha_0^4}{3} - 2y_0^2\alpha_0^4 + 5y_0\alpha_0^4 - \frac{10\alpha_0^4}{3} - \frac{16y_0^3\alpha_0^3}{9} + 10y_0^2\alpha_0^3 -$$
$$\frac{76y_0\alpha_0^3}{3} + \frac{136\alpha_0^3}{9} + 4y_0^3\alpha_0^2 - 21y_0^2\alpha_0^2 + 52y_0\alpha_0^2 - \frac{76\alpha_0^2}{3} - \frac{16y_0^3\alpha_0}{3} + 26y_0^2\alpha_0 - 60y_0\alpha_0 + \frac{82\alpha_0}{3} +$$
$$\frac{25y_0^3}{9} - \frac{35y_0^2}{3} + 23y_0 - \frac{13}{3(y_0-1)} - \frac{13}{3}\Big)H(0;\alpha_0) + \frac{25}{18}y_0^3H(0;Y) - \frac{35}{6}y_0^2H(0;Y) + \frac{23}{2}y_0H(0;Y) -$$
$$\frac{13H(0;Y)}{6(y_0-1)} - \frac{13}{6}H(0;Y) + \Big(\frac{1}{3}d_1y_0^3\alpha_0^4 - 2d_1y_0^2\alpha_0^4 - \frac{10d_1\alpha_0^4}{3} + 5d_1y_0\alpha_0^4 - \frac{16}{9}d_1y_0^3\alpha_0^3 + 10d_1y_0^2\alpha_0^3 +$$
$$\frac{136d_1\alpha_0^3}{9} - \frac{76}{3}d_1y_0\alpha_0^3 + 4d_1y_0^3\alpha_0^2 - 21d_1y_0^2\alpha_0^2 - \frac{76d_1\alpha_0^2}{3} + 52d_1y_0\alpha_0^2 - \frac{16}{3}d_1y_0^3\alpha_0 + 26d_1y_0^2\alpha_0 +$$
$$\frac{82d_1\alpha_0}{3} - 60d_1y_0\alpha_0 + \frac{25d_1y_0^3}{9} - \frac{35d_1y_0^2}{3} - \frac{13d_1}{3} + 23d_1y_0 - \frac{13d_1}{3(y_0-1)}\Big)H(1;\alpha_0) - \frac{217d_1}{36(y_0-1)} +$$
$$\frac{d_1'}{6(y_0-1)} + \frac{149}{18(y_0-1)} + \frac{149}{18}\Big)H(c_1(\alpha_0);y_0) + \Big(\frac{7y_0^3}{3} - \frac{26y_0^2}{3} + 11y_0 - \frac{13}{3(y_0-1)} - \frac{13}{3}\Big)H(0,0;\alpha_0) +$$
$$\frac{1}{9}d_1'y_0^3H(0,0;Y) - \frac{4}{9}y_0^3H(0,0;Y) - \frac{7}{12}d_1'y_0^2H(0,0;Y) + 3y_0^2H(0,0;Y) + \frac{11}{6}d_1'y_0H(0,0;Y) -$$

$$12y_0\ H(0,0;Y)-\tfrac{1}{24}\pi^2H(0,0;Y)+\Big(\tfrac{7d_1\ y_0^3}{3}-\tfrac{26d_1y_0^2}{3}+11d_1y_0-\tfrac{13d_1}{3}-\tfrac{13\ d_1}{3(y_0-1)}\Big)H(0,1;\alpha_0)-$$
$$\tfrac{1}{24}\pi^2\ H(0,1;Y)+\Big(-\tfrac{d_1\alpha_0^4}{2}-H(0;Y)\ \alpha_0^4+\tfrac{\alpha_0^4}{2}+\tfrac{26d_1\alpha_0^3}{9}+\tfrac{16}{3}H(0;Y)\ \alpha_0^3-\tfrac{38\alpha_0^3}{9}-\tfrac{23d_1\alpha_0^2}{3}-$$
$$12H(0;Y)\ \alpha_0^2+\tfrac{49\alpha_0^2}{3}+\tfrac{50d_1\alpha_0}{3}+16H(0;Y)\alpha_0-\tfrac{142\ \alpha_0}{3}-\tfrac{2d_1'y_0^3}{9}+\tfrac{37y_0^3}{18}+\tfrac{7d_1'\ y_0^2}{6}-\tfrac{31y_0^2}{3}-4d_1+$$
$$2d_1'-\tfrac{11d_1'\ y_0}{3}+\tfrac{59y_0}{2}+\Big(-2\alpha_0^4+\tfrac{32\alpha_0^3}{3}-24\alpha_0^2+32\ \alpha_0-\tfrac{4y_0^3}{3}+6y_0^2-12y_0-\tfrac{4}{y_0-1}-4\Big)H(0;\alpha_0)-$$
$$\tfrac{2}{3}y_0^3H(0;Y)+3y_0^2H(0;Y)-6y_0H(0;Y)-\tfrac{2H(0;Y)}{y_0-1}-2H(0;Y)+\Big(-2d_1\alpha_0^4+\tfrac{32d_1\alpha_0^3}{3}-$$
$$24d_1\ \alpha_0^2+32d_1\alpha_0-\tfrac{4d_1y_0^3}{3}+6d_1y_0^2-4d_1-12d_1\ y_0-\tfrac{4d_1}{y_0-1}\Big)H(1;\alpha_0)-\tfrac{4d_1}{y_0-1}+\tfrac{2\ d_1'}{y_0-1}+\tfrac{11}{6(y_0-1)}+$$
$$\tfrac{11}{6}\Big)\ H(0,c_1(\alpha_0);y_0)+H(0,0;y_0)\Big(\tfrac{16d_1'\ y_0^3}{9}+\tfrac{16}{3}H(0;Y)y_0^3-\tfrac{127y_0^3}{9}-\tfrac{28d_1'\ y_0^2}{3}-24H(0;Y)y_0^2+$$
$$74y_0^2+\tfrac{88d_1'y_0}{3}+48H(0;Y)\ y_0-225y_0-4H(0,0;Y)-4H(1,0;Y)+\tfrac{13}{y_0-1}-\tfrac{2\pi^{\ 2}}{3}+13\Big)+$$
$$\tfrac{1}{9}d_1'y_0^3H(1,0;Y)-\tfrac{4}{9}y_0^3\ H(1,0;Y)-\tfrac{7}{12}d_1'y_0^2H(1,0;Y)+3y_0^2\ H(1,0;Y)+\tfrac{11}{6}d_1'y_0H(1,0;Y)-$$
$$12y_0H(1,0;Y)-\tfrac{1}{24}\ \pi^2H(1,0;Y)+H(0,1;y_0)\Big(\tfrac{4d_1'^2y_0^3}{9}-\tfrac{53\ d_1'y_0^3}{18}+\tfrac{4}{3}d_1'H(0;Y)y_0^3-\tfrac{7d_1'^2\ y_0^2}{3}+$$
$$\tfrac{49d_1'y_0^2}{3}-6d_1'H(0;Y)y_0^2+\tfrac{22d_1'^2\ y_0}{3}-\tfrac{107d_1'y_0}{2}+12d_1'H(0;Y)y_0+\tfrac{13\ d_1'}{6}+H(0;\alpha_0)\Big(\tfrac{4d_1y_0^3}{3}-$$
$$\tfrac{4y_0^3}{3}-6d_1\ y_0^2+6y_0^2+12d_1y_0-12y_0-\tfrac{38d_1}{3}+4H(0;Y)+\tfrac{4\ d_1}{y_0-1}-\tfrac{4}{y_0-1}-\tfrac{62}{3}\Big)+8H(0,0;\alpha_0)-$$
$$d_1'\ H(0,0;Y)+8d_1H(0,1;\alpha_0)-d_1'H(1,0;Y)+\tfrac{13d_1'}{6\ (y_0-1)}+\tfrac{2d_1\pi^2}{3}-\tfrac{d_1'\pi^{\ 2}}{6}\Big)+\Big(\tfrac{4d_1'^2y_0^3}{9}-\tfrac{49d_1'\ y_0^3}{18}+$$
$$\tfrac{4}{3}d_1'H(0;Y)y_0^3+\tfrac{2}{3}H(0;Y)\ y_0^3-\tfrac{37y_0^3}{18}-\tfrac{7d_1'^2y_0^2}{3}+\tfrac{4d_1\ y_0^2}{3}+\tfrac{91d_1'y_0^2}{6}-6d_1'H(0;Y)y_0^2-3H(0;Y)y_0^2+$$
$$\tfrac{35y_0^2}{3}+\tfrac{22d_1'^2y_0}{3}-\tfrac{16d_1\ y_0}{3}-\tfrac{299d_1'y_0}{6}+12d_1'H(0;Y)y_0+6H(0;Y)\ y_0-\tfrac{209y_0}{6}-\tfrac{49d_1'^2}{9}+\tfrac{37d_1}{18}+\tfrac{673\ d_1'}{18}+$$
$$\Big(-\tfrac{4y_0^3}{3}+6y_0^2-12\ y_0-\tfrac{4}{y_0-1}+\tfrac{38}{3}\Big)H(0;\alpha_0)-\tfrac{22}{3}d_1'\ H(0;Y)+\tfrac{2H(0;Y)}{y_0-1}-\tfrac{19}{3}H(0;Y)-\tfrac{d_1}{3\ (y_0-1)}+$$
$$\tfrac{d_1'}{6(y_0-1)}-\tfrac{37}{6(y_0-1)}-\tfrac{4\pi^{\ 2}}{3}+\tfrac{127}{3}\Big)H(1,0;y_0)-\tfrac{1}{24}\pi^2\ H(1,1;Y)+\Big(\tfrac{y_0^3d_1'^3}{9}-\tfrac{7y_0^2\ d_1'^3}{12}+\tfrac{11y_0d_1'^3}{6}-\tfrac{49d_1'^3}{36}-$$
$$\tfrac{4\ y_0^3d_1'^2}{9}+3y_0^2d_1'^2-12y_0d_1'^2+\tfrac{1}{3}y_0^3\ H(0;Y)d_1'^2-\tfrac{3}{2}y_0^2H(0;Y)d_1'^2+3y_0H(0;Y)\ d_1'^2-\tfrac{11}{6}H(0;Y)d_1'^2+$$
$$\tfrac{85d_1'^2}{9}-\tfrac{\pi^2\ d_1'}{3}+H(0;\alpha_0)\Big(\tfrac{4d_1y_0^3}{3}-\tfrac{4d_1'\ y_0^3}{3}+\tfrac{2y_0^3}{3}-6d_1y_0^2+6d_1'y_0^2-3y_0^2+12d_1\ y_0-12d_1'y_0+6y_0-$$
$$\tfrac{38d_1}{3}+10d_1'+2H(0;Y)+\tfrac{8d_1}{y_0-1}-\tfrac{4d_1'}{y_0-1}-\tfrac{2}{y_0-1}-\tfrac{43}{3}\Big)+4\ H(0,0;\alpha_0)+4d_1H(0,1;\alpha_0)+\tfrac{2d_1\pi^2}{3}-$$
$$\tfrac{\pi^{\ 2}}{3}\Big)H(1,1;y_0)+\Big(\tfrac{1}{6}d_1'y_0^3\alpha_0^4-d_1'y_0^2\ \alpha_0^4-\tfrac{5d_1'\alpha_0^4}{3}+\tfrac{5}{2}d_1'y_0\alpha_0^4-\tfrac{8}{9}\ d_1'y_0^3\alpha_0^3+5d_1'y_0^2\alpha_0^3+\tfrac{77d_1'\ \alpha_0^3}{9}-$$
$$\tfrac{38}{3}d_1'y_0\alpha_0^3+2d_1'y_0^3\alpha_0^2-\tfrac{21}{2}\ d_1'y_0^2\alpha_0^2-\tfrac{35d_1'\alpha_0^2}{2}+26d_1'y_0\ \alpha_0^2-\tfrac{8}{3}d_1'y_0^3\alpha_0+13d_1'y_0^2\alpha_0+\tfrac{65d_1'\ \alpha_0}{3}-$$
$$30d_1'y_0\alpha_0+\tfrac{7d_1'y_0^3}{6}+\tfrac{37\ y_0^3}{18}-\tfrac{4d_1y_0^2}{3}-\tfrac{14d_1'y_0^2}{3}-\tfrac{35\ y_0^2}{3}-\tfrac{37d_1}{18}-\tfrac{13d_1'}{3}+\tfrac{16d_1\ y_0}{3}+\tfrac{47d_1'y_0}{6}+\tfrac{209y_0}{6}+\Big(-$$
$$\tfrac{4\ y_0^3}{3}+6y_0^2-12y_0-\tfrac{4}{y_0-1}+\tfrac{38}{3}\Big)\ H(0;\alpha_0)-\tfrac{2}{3}y_0^3H(0;Y)+3y_0^2H(0;Y)-6y_0H(0;Y)-\tfrac{2\ H(0;Y)}{y_0-1}+$$
$$\tfrac{19}{3}H(0;Y)+\Big(-\tfrac{4d_1y_0^3}{3}+6d_1\ y_0^2-12d_1y_0+\tfrac{38d_1}{3}-\tfrac{4d_1}{y_0-1}\Big)\ H(1;\alpha_0)+\tfrac{d_1}{3(y_0-1)}-\tfrac{d_1'}{6(y_0-1)}+\tfrac{37}{6\ (y_0-1)}-$$
$$\tfrac{127}{3}\Big)H(1,c_1(\alpha_0);y_0)+\Big(\tfrac{y_0^3\ \alpha_0^4}{3}-2y_0^2\alpha_0^4+5y_0\alpha_0^4-\tfrac{10\alpha_0^4}{3}-\tfrac{16y_0^3\ \alpha_0^3}{9}+10y_0^2\alpha_0^3-\tfrac{76y_0\alpha_0^3}{3}+\tfrac{136\alpha_0^3}{9}+$$
$$4\ y_0^3\alpha_0^2-21y_0^2\alpha_0^2+52y_0\alpha_0^2-\tfrac{76\alpha_0^2}{3}-\tfrac{16\ y_0^3\alpha_0}{3}+26y_0^2\alpha_0-60y_0\alpha_0+\tfrac{82\alpha_0}{3}+\tfrac{25\ y_0^3}{9}-\tfrac{35y_0^2}{3}+23y_0-$$
$$\tfrac{13}{3(y_0-1)}-\tfrac{13}{3}\ \Big)H(c_1(\alpha_0),0;y_0)+\Big(\tfrac{1}{6}d_1'y_0^3\alpha_0^4-d_1'y_0^2\ \alpha_0^4-\tfrac{5d_1'\alpha_0^4}{3}+\tfrac{5}{2}d_1'y_0\alpha_0^4-\tfrac{8}{9}\ d_1'y_0^3\alpha_0^3+5d_1'y_0^2\alpha_0^3+$$
$$\tfrac{68d_1'\ \alpha_0^3}{9}-\tfrac{38}{3}d_1'y_0\alpha_0^3+2d_1'y_0^3\alpha_0^2-\tfrac{21}{2}\ d_1'y_0^2\alpha_0^2-\tfrac{38d_1'\alpha_0^2}{3}+26d_1'y_0\ \alpha_0^2-\tfrac{8}{3}d_1'y_0^3\alpha_0+13d_1'y_0^2\alpha_0+$$
$$\tfrac{41d_1'\ \alpha_0}{3}-30d_1'y_0\alpha_0+\tfrac{25d_1'y_0^3}{18}-\tfrac{35d_1'\ y_0^2}{6}-\tfrac{13d_1'}{6}+\tfrac{23d_1'y_0}{2}-\tfrac{13d_1'}{6\ (y_0-1)}\Big)H(c_1(\alpha_0),1;y_0)+\Big(\tfrac{y_0^3\alpha_0^4}{2}-$$
$$3y_0^2\ \alpha_0^4+\tfrac{15y_0\alpha_0^4}{2}-5\alpha_0^4-\tfrac{8y_0^3\alpha_0^3}{3}+15y_0^2\ \alpha_0^3-38y_0\alpha_0^3+\tfrac{68\alpha_0^3}{3}+6y_0^3\alpha_0^2-\tfrac{63y_0^2\ \alpha_0^2}{2}+78y_0\alpha_0^2-38\alpha_0^2-$$
$$8y_0^3\alpha_0+39y_0^2\alpha_0-4d_1\alpha_0+2\ d_1'\alpha_0-90y_0\alpha_0-2H(0;Y)\alpha_0+45\alpha_0+\tfrac{25y_0^3}{6}-\tfrac{35\ y_0^2}{2}+4d_1-2d_1'+$$

$$
\frac{69y_0}{2}+\Big(-4\alpha_0+\frac{4}{y_0-1}+4\Big)H(0;\alpha_0)+\frac{2H(0;Y)}{y_0-1}+2H(0;Y)+\Big(-4\alpha_0\,d_1+\frac{4d_1}{y_0-1}+4d_1\Big)H(1;\alpha_0)+
$$

$$
\frac{4\,d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{21}{2\,(y_0-1)}-\frac{21}{2}\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)+\frac{1}{3}y_0^3\,H(0,0,0;Y)-\frac{3}{2}y_0^2H(0,0,0;Y)+
$$

$$
3y_0\,H(0,0,0;Y)+\Big(\frac{64y_0^3}{3}-96y_0^2+192y_0-16H(0;Y)\Big)\,H(0,0,0;y_0)+\Big(\frac{16d_1'y_0^3}{3}-24d_1'y_0^2+
$$

$$
48d_1'\,y_0+(8-8d_1)H(0;\alpha_0)-4d_1'H(0;Y)\Big)H(0,0,1;y_0)+\Big(-\frac{8\,y_0^3}{3}+12y_0^2-24y_0+8H(0;\alpha_0)+
$$

$$
4H(0;Y)+8d_1\,H(1;\alpha_0)-\frac{8}{y_0-1}-8\Big)H(0,0,c_1(\alpha_0);y_0)+\frac{1}{3}y_0^3\,H(0,1,0;Y)-\frac{3}{2}y_0^2H(0,1,0;Y)+
$$

$$
3y_0\,H(0,1,0;Y)+\Big(-\frac{4d_1y_0^3}{3}+\frac{16d_1'\,y_0^3}{3}+\frac{4y_0^3}{3}+6d_1y_0^2-24d_1'y_0^2-6y_0^2-12d_1\,y_0+48d_1'y_0+12y_0+
$$

$$
\frac{38d_1}{3}+8H(0;\alpha_0)-4d_1'H(0;Y)-4\,H(0;Y)-\frac{4d_1}{y_0-1}+\frac{4}{y_0-1}+\frac{62}{3}\Big)H(0,1,0;\;y_0)+\Big(\frac{4d_1'^2y_0^3}{3}-
$$

$$
6d_1'^2y_0^2+12d_1'^2y_0+(8\,d_1'-12d_1)H(0;\alpha_0)-d_1'^2H(0;Y)\Big)H(0,1,1;y_0)+\Big(-d_1'\,\alpha_0^4+\frac{16d_1'\alpha_0^3}{3}-
$$

$$
12d_1'\alpha_0^2+16d_1'\alpha_0+\frac{4d_1\,y_0^3}{3}-\frac{2d_1'y_0^3}{3}-\frac{4y_0^3}{3}-6d_1y_0^2+3d_1'\,y_0^2+6y_0^2-\frac{38d_1}{3}-2d_1'+12d_1y_0-6d_1'y_0-
$$

$$
12y_0+8\,H(0;\alpha_0)+4H(0;Y)+8d_1H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2\,d_1'}{y_0-1}-\frac{4}{y_0-1}-\frac{62}{3}\Big)\,H(0,1,c_1(\alpha_0);y_0)+
$$

$$
\Big(-2\alpha_0^4+\frac{32\alpha_0^3}{3}-24\alpha_0^2+32\alpha_0-\frac{4y_0^3}{3}+6y_0^2-12y_0-\frac{4}{y_0-1}-4\Big)\,H(0,c_1(\alpha_0),0;y_0)+\Big(-d_1'\alpha_0^4+
$$

$$
\frac{16d_1'\alpha_0^3}{3}-12d_1'\,\alpha_0^2+16d_1'\alpha_0-\frac{2d_1'y_0^3}{3}+3d_1'y_0^2-2d_1'-6d_1'\,y_0-\frac{2d_1'}{y_0-1}\Big)H(0,c_1(\alpha_0),1;y_0)+\Big(-
$$

$$
3\alpha_0^4+16\,\alpha_0^3-36\alpha_0^2+48\alpha_0-2y_0^3+9y_0^2-18y_0-4H(0;\alpha_0)-2H(0;Y)-4\,d_1H(1;\alpha_0)+\frac{2}{y_0-1}+
$$

$$
2\Big)\,H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+\frac{1}{3}y_0^3H(1,0,0;Y)-\frac{3}{2}\,y_0^2H(1,0,0;Y)+3y_0H(1,0,0;Y)+\Big(\frac{16d_1'y_0^3}{3}+
$$

$$
4\,y_0^3-24d_1'y_0^2-18y_0^2+48d_1'y_0+36y_0-\frac{88\,d_1'}{3}+\frac{12}{y_0-1}-38\Big)H(1,0,0;y_0)+\Big(\frac{4d_1'^2\,y_0^3}{3}+\frac{2d_1'y_0^3}{3}-
$$

$$
6d_1'^2y_0^2-3d_1'y_0^2+12\,d_1'^2y_0+6d_1'y_0-\frac{22d_1'^2}{3}-\frac{19d_1'}{3}+(4-4d_1)\,H(0;\alpha_0)+\frac{2d_1'}{y_0-1}\Big)H(1,0,1;y_0)+\Big(-
$$

$$
\frac{2d_1'\,y_0^3}{3}-\frac{2y_0^3}{3}+3d_1'y_0^2+3y_0^2-6d_1'y_0-6\,y_0+\frac{11d_1'}{3}+4H(0;\alpha_0)+2H(0;Y)+4d_1H(1;\alpha_0)+\frac{4\,d_1}{y_0-1}-
$$

$$
\frac{2d_1'}{y_0-1}-\frac{6}{y_0-1}-\frac{5}{3}\Big)\,H(1,0,c_1(\alpha_0);y_0)+\frac{1}{3}y_0^3H(1,1,0;Y)-\frac{3}{2}y_0^2\,H(1,1,0;Y)+3y_0H(1,1,0;Y)+
$$

$$
\Big(\frac{4d_1'^2y_0^3}{3}-\frac{4d_1\,y_0^3}{3}+\frac{4d_1'y_0^3}{3}-\frac{2y_0^3}{3}-6d_1'^2y_0^2+6\,d_1y_0^2-6d_1'y_0^2+3y_0^2+12d_1'^2y_0-12d_1y_0+12d_1'y_0-6\,y_0-
$$

$$
\frac{22d_1'^2}{3}+\frac{38d_1}{3}-10d_1'+4H(0;\alpha_0)-2H(0;Y)-\frac{8d_1}{y_0-1}+\frac{4d_1'}{y_0-1}+\frac{2}{y_0-1}+\frac{43}{3}\Big)H(1,1,0;y_0)+\Big(\frac{y_0^3d_1'^3}{3}-
$$

$$
\frac{3y_0^2\,d_1'^3}{2}+3y_0d_1'^3-\frac{11d_1'^3}{6}+(-8d_1+4d_1'+2)\,H(0;\alpha_0)\Big)H(1,1,1;y_0)+\Big(\frac{4d_1y_0^3}{3}-\frac{4d_1'\,y_0^3}{3}+\frac{2y_0^3}{3}-6d_1y_0^2+
$$

$$
6d_1'y_0^2-3y_0^2+12d_1\,y_0-12d_1'y_0+6y_0-\frac{38d_1}{3}+10d_1'+4H(0;\alpha_0)+2H(0;Y)+4\,d_1H(1;\alpha_0)+\frac{8d_1}{y_0-1}-
$$

$$
\frac{4\,d_1'}{y_0-1}-\frac{2}{y_0-1}-\frac{43}{3}\Big)\,H(1,1,c_1(\alpha_0);y_0)+\Big(-\frac{4y_0^3}{3}+6y_0^2-12\,y_0-\frac{4}{y_0-1}+\frac{38}{3}\Big)\,H(1,c_1(\alpha_0),0;y_0)+
$$

$$
\Big(-\frac{2d_1'y_0^3}{3}+3d_1'y_0^2-6d_1'\,y_0+\frac{19d_1'}{3}-\frac{2d_1'}{y_0-1}\Big)\,H(1,c_1(\alpha_0),1;y_0)+\Big(-2y_0^3+9y_0^2-18y_0-4H(0;\alpha_0)-
$$

$$
2\,H(0;Y)-4d_1H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2\,d_1'}{y_0-1}-\frac{2}{y_0-1}+27\Big)\,H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\Big(-2\alpha_0d_1'+
$$

$$
\frac{2d_1'}{y_0-1}+2\,d_1'\Big)H(c_1(\alpha_0),1,c_1(\alpha_0);y_0)+\Big(-4\,\alpha_0+\frac{4}{y_0-1}+4\Big)H(c_1(\alpha_0),c_1(\alpha_0),0;y_0)+\Big(-2\alpha_0\,d_1'+
$$

$$
\frac{2d_1'}{y_0-1}+2d_1'\Big)\,H(c_1(\alpha_0),c_1(\alpha_0),1;y_0)+\Big(-6\alpha_0+\frac{6}{y_0-1}+6\Big)\,H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)-
$$

$$
\frac{1}{4}H(0,0,0,0;Y)-64\,H(0,0,0,0;y_0)-16d_1'H(0,0,0,1;y_0)+16\,H(0,0,0,c_1(\alpha_0);y_0)-
$$

$$
\frac{1}{4}H(0,0,1,0;Y)+(8d_1-16d_1'-8)\,H(0,0,1,0;y_0)-4d_1'^2H(0,0,1,1;y_0)+(-8d_1+4d_1'+
$$

$$
8)H(0,0,1,c_1(\,\alpha_0);y_0)+8H(0,0,c_1(\alpha_0),0;y_0)+4d_1'H(0,0,c_1(\alpha_0),1;y_0)+
$$

$$
4\,H(0,0,c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac{1}{4}H(0,1,0,0;Y)+(-16d_1'-24)\,H(0,1,0,0;y_0)+\Big(-4d_1'^2-
$$

$$
4d_1'\Big)H(0,1,0,1;y_0)+(-4d_1+4\,d_1'+8)H(0,1,0,c_1(\alpha_0);y_0)-\frac{1}{4}H(0,1,1,0;Y)+\Big(-4\,d_1'^2-
$$

$$
\begin{aligned}
&8d_1' + 12d_1\Big)H(0,1,1,0;y_0) - d_1'^3 H(0,1,1,1;y_0) + (8\,d_1' - 12d_1)H(0,1,1,c_1(\alpha_0);y_0) + \\
&8H(0,1,c_1(\alpha_0),0;y_0) + 4d_1'\,H(0,1,c_1(\alpha_0),1;y_0) + (4d_1 - 2d_1' + 8)H(0,1,c_1(\alpha_0),c_1(\alpha_0);y_0) - \\
&2\,d_1' H(0,c_1(\alpha_0),1,c_1(\alpha_0);y_0) - 4H(0,c_1(\alpha_0),c_1(\alpha_0),0;y_0) - 2\,d_1' H(0,c_1(\alpha_0),c_1(\alpha_0),1;y_0) - \\
&6\,H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0) - \tfrac{1}{4}H(1,0,0,0;Y) + 8\,H(1,0,0,c_1(\alpha_0);y_0) - \\
&\tfrac{1}{4}H(1,0,1,0;Y) + (4d_1 - 4)\,H(1,0,1,0;y_0) + (-4d_1 + 2d_1' + 4)H(1,0,1,c_1(\alpha_0);y_0) + \\
&4\,H(1,0,c_1(\alpha_0),0;y_0) + 2d_1' H(1,0,c_1(\alpha_0),1;y_0) - 2\,H(1,0,c_1(\alpha_0),c_1(\alpha_0);y_0) - \\
&\tfrac{1}{4}H(1,1,0,0;Y) - 12\,H(1,1,0,0;y_0) - 2d_1' H(1,1,0,1;y_0) + (-4d_1 + 2d_1' + \\
&6)\,H(1,1,0,c_1(\alpha_0);y_0) - \tfrac{1}{4}H(1,1,1,0;Y) + (8d_1 - 4d_1' - 2)\,H(1,1,1,0;y_0) + (-8d_1 + 4d_1' + \\
&2)H(1,1,1,c_1(\alpha_0);y_0) + 4\,H(1,1,c_1(\alpha_0),0;y_0) + 2d_1' H(1,1,c_1(\alpha_0),1;y_0) + (4d_1 - 2d_1' + \\
&2)\,H(1,1,c_1(\alpha_0),c_1(\alpha_0);y_0) - 2d_1' H(1,c_1(\alpha_0),1,c_1(\alpha_0);y_0) - 4\,H(1,c_1(\alpha_0),c_1(\alpha_0),0;y_0) - \\
&2d_1' H(1,c_1(\alpha_0),c_1(\alpha_0),1;y_0) - 6\,H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0) + H(0;y_0)\Big( - \tfrac{1}{9}y_0^3\,\alpha_0^4 + \\
&\tfrac{5y_0^2\alpha_0^4}{6} - \tfrac{10y_0\alpha_0^4}{3} + \tfrac{13y_0^3\,\alpha_0^3}{27} - \tfrac{34y_0^2\alpha_0^3}{9} + \tfrac{160y_0\alpha_0^3}{9} - \tfrac{11\,y_0^3\alpha_0^2}{18} + \tfrac{109y_0^2\alpha_0^2}{18} - \tfrac{316y_0\,\alpha_0^2}{9} - \tfrac{7y_0^3\alpha_0}{9} - \tfrac{7y_0^2\alpha_0}{9} + \\
&\tfrac{86y_0\,\alpha_0}{3} + \tfrac{4d_1'^2y_0^3}{27} - \tfrac{205d_1y_0^3}{108} - \tfrac{3\,d_1'y_0^3}{2} - \tfrac{2\pi^2y_0^3}{9} + \tfrac{161y_0^3}{27} - \tfrac{17\,d_1'^2y_0^2}{18} + \tfrac{22d_1y_0^2}{3} + \tfrac{98d_1'y_0^2}{9} + \pi\,^2y_0^2 - \\
&\tfrac{1405y_0^2}{36} + \tfrac{217\,d_1}{36} - \tfrac{d_1'}{6} + \tfrac{49d_1'^2y_0}{9} - \tfrac{469d_1\,y_0}{36} - \tfrac{1201d_1'y_0}{18} - 2\pi^2y_0 + \tfrac{1811\,y_0}{9} + \Big(\tfrac{7y_0^3}{3} - \tfrac{26y_0^2}{3} + 11y_0 - \\
&\tfrac{13}{3\,(y_0-1)} - \tfrac{13}{3}\Big)H(0;\alpha_0) + \tfrac{4}{9}d_1'y_0^3\,H(0;Y) - \tfrac{53}{18}y_0^3H(0;Y) - \tfrac{7}{3}d_1'y_0^2\,H(0;Y) + \tfrac{49}{3}y_0^2H(0;Y) + \\
&\tfrac{22}{3}d_1'y_0\,H(0;Y) - \tfrac{107}{2}y_0H(0;Y) + \tfrac{13H(0;Y)}{6\,(y_0-1)} - \tfrac{1}{6}\pi^2H(0;Y) + \tfrac{13}{6}H(0;Y) - \tfrac{1}{6}\,\pi^2H(1;Y) + \\
&\tfrac{4}{3}y_0^3H(0,0;Y) - 6y_0^2H(0,0;Y) + 12y_0\,H(0,0;Y) + \tfrac{4}{3}y_0^3H(1,0;Y) - 6y_0^2H(1,0;Y) + \\
&12y_0\,H(1,0;Y) - H(0,0,0;Y) - H(0,1,0;Y) - H(1,0,0;Y) - H(1,1,0;Y) + \tfrac{217\,d_1}{36(y_0-1)} - \\
&\tfrac{d_1'}{6(y_0-1)} + \tfrac{4\pi^2}{3\,(y_0-1)} - \tfrac{149}{18(y_0-1)} - 6\zeta_3 + \tfrac{4\pi\,^2}{3} - \tfrac{149}{18}\Big) + H(1;y_0)\Big( - \tfrac{1}{18}d_1'y_0^3\,\alpha_0^4 + \tfrac{5}{12}d_1'y_0^2\alpha_0^4 + \tfrac{47d_1'\,\alpha_0^4}{36} - \\
&\tfrac{5}{3}d_1'y_0\alpha_0^4 + \tfrac{13}{54}d_1'y_0^3\alpha_0^3 - \tfrac{17}{9}d_1'y_0^2\alpha_0^3 - \tfrac{391d_1'\alpha_0^3}{54} + \tfrac{80}{9}\,d_1'y_0\alpha_0^3 - \tfrac{11}{36}d_1'y_0^3\alpha_0^2 + \tfrac{109}{36}d_1'\,y_0^2\alpha_0^2 + \tfrac{89d_1'\alpha_0^2}{6} - \\
&\tfrac{158}{9}d_1'y_0\,\alpha_0^2 - \tfrac{7}{18}d_1'y_0^3\alpha_0 - \tfrac{7}{18}d_1'y_0^2\,\alpha_0 - \tfrac{247d_1'\alpha_0}{18} + \tfrac{43d_1'y_0\alpha_0}{3} - \tfrac{251\,d_1'^3}{216} + \tfrac{d_1'^3y_0^3}{27} - \tfrac{8d_1'^2\,y_0^3}{27} + \tfrac{14d_1'y_0^3}{27} - \\
&\tfrac{1}{18}d_1'\pi^2\,y_0^3 - \tfrac{\pi^2y_0^3}{9} + \tfrac{395d_1'^2}{27} - \tfrac{17d_1'^3\,y_0^2}{72} + \tfrac{22d_1'^2y_0^2}{9} - \tfrac{21d_1'\,y_0^2}{4} + \tfrac{1}{4}d_1'\pi^2y_0^2 + \tfrac{\pi^2\,y_0^2}{2} - \tfrac{4025d_1'}{108} + \tfrac{49d_1'^3y_0}{36} - \\
&\tfrac{151\,d_1'^2y_0}{9} + 42d_1'y_0 - \tfrac{1}{2}d_1'\pi^2y_0 - \pi^2\,y_0 + \tfrac{1}{9}d_1'^2y_0^3H(0;Y) - \tfrac{4}{9}d_1'y_0^3\,H(0;Y) - \tfrac{49}{36}d_1'^2H(0;Y) - \\
&\tfrac{7}{12}d_1'^2y_0^2H(0;Y) + 3\,d_1'y_0^2H(0;Y) + \tfrac{85}{9}d_1'H(0;Y) + \tfrac{11}{6}d_1'^2y_0\,H(0;Y) - 12d_1'y_0H(0;Y) - \\
&\tfrac{1}{3}\pi^2H(0;Y) + H(0;\alpha_0)\,\Big(\tfrac{17d_1'y_0^3}{18} - \tfrac{2}{3}H(0;Y)y_0^3 + \tfrac{37\,y_0^3}{18} - \tfrac{4d_1y_0^2}{3} - \tfrac{19d_1'y_0^2}{6} + 3H(0;Y)\,y_0^2 - \\
&\tfrac{35y_0^2}{3} + \tfrac{16d_1y_0}{3} + \tfrac{11d_1'y_0}{6} - 6\,H(0;Y)y_0 + \tfrac{209y_0}{6} - \tfrac{37d_1}{18} + \tfrac{7\,d_1'}{18} - \tfrac{2H(0;Y)}{y_0-1} + \tfrac{19}{3}H(0;Y) + \tfrac{d_1}{3\,(y_0-1)} - \\
&\tfrac{d_1'}{6(y_0-1)} + \tfrac{37}{6\,(y_0-1)} - \tfrac{127}{3}\Big) + \Big( - \tfrac{4y_0^3}{3} + 6y_0^2 - 12\,y_0 - \tfrac{4}{y_0-1} + \tfrac{38}{3}\Big)H(0,0;\alpha_0) + \tfrac{1}{3}d_1'\,y_0^3H(0,0;Y) - \\
&\tfrac{3}{2}d_1'y_0^2H(0,0;Y) - \tfrac{11}{6}d_1'\,H(0,0;Y) + 3d_1'y_0H(0,0;Y) + \Big( - \tfrac{4d_1y_0^3}{3} + 6d_1\,y_0^2 - 12d_1y_0 + \\
&\tfrac{38d_1}{3} - \tfrac{4d_1}{y_0-1}\Big)\,H(0,1;\alpha_0) + \tfrac{1}{3}d_1'y_0^3H(1,0;Y) - \tfrac{3}{2}d_1'y_0^2\,H(1,0;Y) - \tfrac{11}{6}d_1'H(1,0;Y) + \\
&3d_1'y_0H(1,0;Y) - \tfrac{2d_1\,\pi^2}{3(y_0-1)} + \tfrac{d_1'\pi^2}{3(y_0-1)} + \tfrac{\pi^2}{3\,(y_0-1)} + 6\zeta_3 + \tfrac{11d_1'\pi^2}{36} + \tfrac{43\pi\,^2}{18}\Big) + \tfrac{2d_1\pi^2}{3(y_0-1)} - \tfrac{d_1'\pi^2}{3\,(y_0-1)} - \\
&\tfrac{37\pi^2}{36(y_0-1)} + 4y_0^3\zeta_3 - 18y_0^2\,\zeta_3 + 36y_0\zeta_3 - \tfrac{3}{2}H(0;Y)\zeta_3 - \tfrac{6\,\zeta_3}{y_0-1} - 6\zeta_3 + \tfrac{\pi^4}{288} + \tfrac{2d_1\pi\,^2}{3} - \tfrac{d_1'\pi^2}{3} - \tfrac{37\pi^2}{36}.
\end{aligned}
$$

## G. The $\mathcal{K}{*}\mathcal{I}$-type integrals

### G.1 The $\mathcal{K}{*}\mathcal{I}$ integral for $k = 0$

The $\varepsilon$ expansion for this integral reads

$$
\mathcal{K}{*}\mathcal{I}(\epsilon; y_0, d_0', \alpha_0, d_0; 0) = \frac{1}{\varepsilon^3}(k*i)^{(0)}_{-3} + \frac{1}{\varepsilon^2}(k*i)^{(0)}_{-2} + \frac{1}{\varepsilon}(k*i)^{(0)}_{-1} + (k*i)^{(0)}_{0} + \mathcal{O}(\varepsilon)\,, \quad \text{(G.1)}
$$

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where

$$(k*i)^{(0)}_{-3} = -\frac{1}{2},$$

$$(k*i)^{(0)}_{-2} = -\frac{2y_0^3}{3} + 3y_0^2 - 6y_0 + 2H(0;y_0) - 1,$$

$$(k*i)^{(0)}_{-1} = \frac{y_0^3\alpha_0^4}{6} - \frac{y_0^2\alpha_0^4}{2} + \frac{y_0\alpha_0^4}{2} - \frac{8y_0^3\alpha_0^3}{9} + 3y_0^2\alpha_0^3 - \frac{10y_0\alpha_0^3}{3} + 2y_0^3\alpha_0^2 - \frac{15y_0^2\alpha_0^2}{2} + 10y_0\alpha_0^2 - \frac{8y_0^3\alpha_0}{3} + 11y_0^2\alpha_0 - 18y_0\alpha_0 + \frac{2d_1'y_0^3}{9} - \frac{8y_0^3}{3} - \frac{7d_1'y_0^2}{6} + \frac{25y_0^2}{2} + \frac{11d_1'y_0}{3} - 32y_0 + \Big(\frac{2y_0^3}{3} - 3y_0^2 + 6y_0 - \frac{2}{y_0-1} - 2\Big)H(0;\alpha_0) + \Big(2y_0^3 - 9y_0^2 + 18y_0 + \frac{2}{y_0-1} + 6\Big)H(0;y_0) + \Big(\frac{2d_1'y_0^3}{3} - 3d_1'y_0^2 + 6d_1'y_0 - \frac{11d_1'}{3} + 2H(0;\alpha_0)\Big)H(1;y_0) + \Big(2\alpha_0 - \frac{2}{y_0-1} - 2\Big)H(c_1(\alpha_0);y_0) - 8H(0,0;y_0) - 2d_1'H(0,1;y_0) + 2H(0,c_1(\alpha_0);y_0) - 2H(1,0;y_0) + 2H(1,c_1(\alpha_0);y_0) - 2,$$

$$(k*i)^{(0)}_{0} = -\frac{1}{12}d_1y_0^3\alpha_0^4 - \frac{1}{18}d_1'y_0^3\alpha_0^4 + \frac{3y_0^3\alpha_0^4}{4} + \frac{1}{4}d_1y_0^2\alpha_0^4 + \frac{1}{6}d_1'y_0^2\alpha_0^4 - \frac{13y_0^2\alpha_0^4}{6} - \frac{1}{4}d_1y_0\alpha_0^4 - \frac{1}{6}d_1'y_0\alpha_0^4 + \frac{29y_0\alpha_0^4}{12} + \frac{13}{27}d_1y_0^3\alpha_0^3 + \frac{8}{27}d_1'y_0^3\alpha_0^3 - \frac{221y_0^3\alpha_0^3}{54} - \frac{5}{3}d_1y_0^2\alpha_0^3 - \frac{19}{18}d_1'y_0^2\alpha_0^3 + \frac{247y_0^2\alpha_0^3}{18} + \frac{17}{9}d_1y_0\alpha_0^3 + \frac{11}{9}d_1'y_0\alpha_0^3 - \frac{305y_0\alpha_0^3}{18} - \frac{23}{18}d_1y_0^3\alpha_0^2 - \frac{2}{3}d_1'y_0^3\alpha_0^2 + \frac{347y_0^3\alpha_0^2}{36} + 5d_1y_0^2\alpha_0^2 + \frac{11}{4}d_1'y_0^2\alpha_0^2 - \frac{331y_0^2\alpha_0^2}{9} - \frac{43}{6}d_1y_0\alpha_0^2 - \frac{9}{2}d_1'y_0\alpha_0^2 + \frac{1021y_0\alpha_0^2}{18} + \frac{25}{9}d_1y_0^3\alpha_0 + \frac{8}{9}d_1'y_0^3\alpha_0 - \frac{265y_0^3\alpha_0}{18} - 12d_1y_0^2\alpha_0 - \frac{25}{6}d_1'y_0^2\alpha_0 + \frac{566y_0^2\alpha_0}{9} + \frac{65d_1y_0\alpha_0}{3} + \frac{29d_1'y_0\alpha_0}{3} - \frac{245y_0\alpha_0}{2} - \frac{\alpha_0}{y_0-1} - \alpha_0 - \frac{2d_1'^2y_0^3}{27} + \frac{10d_1'y_0^3}{9} + \frac{\pi^2y_0^3}{9} - 8y_0^3 + \frac{17d_1'^2y_0^2}{36} - \frac{20d_1'y_0^2}{3} - \frac{\pi^2y_0^2}{2} + \frac{155y_0^2}{4} - \frac{49d_1'^2y_0}{18} + \frac{199d_1'y_0}{6} + \pi^2y_0 - 128y_0 + \Big(-\frac{1}{3}y_0^3\alpha_0^4 + y_0^2\alpha_0^4 - y_0\alpha_0^4 + \frac{16y_0^3\alpha_0^3}{9} - 6y_0^2\alpha_0^3 + \frac{20y_0\alpha_0^3}{3} - 4y_0^3\alpha_0^2 + 15y_0^2\alpha_0^2 - 20y_0\alpha_0^2 + \frac{16y_0^3\alpha_0}{3} - 22y_0^2\alpha_0 + 36y_0\alpha_0 - \frac{2d_1'y_0^3}{9} + \frac{23y_0^3}{18} + \frac{7d_1'y_0^2}{6} - \frac{43y_0^2}{6} + 4d_1 - 2d_1' - \frac{11d_1'y_0}{3} + \frac{143y_0}{6} + \frac{4d_1}{y_0-1} - \frac{2d_1'}{y_0-1} - \frac{61}{6(y_0-1)} - \frac{1}{(y_0-1)^2} - \frac{55}{6}\Big)H(0;\alpha_0) + \Big(-\frac{1}{3}y_0^3\alpha_0^4 + y_0^2\alpha_0^4 - y_0\alpha_0^4 + \frac{16y_0^3\alpha_0^3}{9} - 6y_0^2\alpha_0^3 + \frac{20y_0\alpha_0^3}{3} - 4y_0^3\alpha_0^2 + 15y_0^2\alpha_0^2 - 20y_0\alpha_0^2 + \frac{16y_0^3\alpha_0}{3} - 22y_0^2\alpha_0 + 36y_0\alpha_0 - \frac{2d_1'y_0^3}{3} + \frac{169y_0^3}{18} + \frac{7d_1'y_0^2}{2} - \frac{257y_0^2}{6} - 4d_1 + 2d_1' - 11d_1'y_0 + \frac{625y_0}{6} + \Big(-\frac{4y_0^3}{3} + 6y_0^2 - 12y_0 + \frac{4}{y_0-1} + 4\Big)H(0;\alpha_0) - \frac{4d_1}{y_0-1} + \frac{2d_1'}{y_0-1} + \frac{61}{6(y_0-1)} + \frac{1}{(y_0-1)^2} + \frac{103}{6}\Big)H(0;y_0) + \Big(-\frac{1}{3}d_1y_0^3\alpha_0^4 + d_1y_0^2\alpha_0^4 - d_1y_0\alpha_0^4 + \frac{16}{9}d_1y_0^3\alpha_0^3 - 6d_1y_0^2\alpha_0^3 + \frac{20}{3}d_1y_0\alpha_0^3 - 4d_1y_0^3\alpha_0^2 + 15d_1y_0^2\alpha_0^2 - 20d_1y_0\alpha_0^2 + \frac{16}{3}d_1y_0^3\alpha_0 - 22d_1y_0^2\alpha_0 + 36d_1y_0\alpha_0 - \frac{25d_1y_0^3}{9} + 12d_1y_0^2 - \frac{65d_1y_0}{3}\Big)H(1;\alpha_0) + \Big(-\frac{1}{6}y_0^3\alpha_0^4 + \frac{y_0^2\alpha_0^4}{2} - \frac{y_0\alpha_0^4}{2} + \frac{\alpha_0^4}{6} + \frac{8y_0^3\alpha_0^3}{9} - 3y_0^2\alpha_0^3 + \frac{10y_0\alpha_0^3}{3} - \frac{11\alpha_0^3}{9} - 2y_0^3\alpha_0^2 + \frac{15y_0^2\alpha_0^2}{2} - 10y_0\alpha_0^2 + \frac{11\alpha_0^2}{2} + \frac{8y_0^3\alpha_0}{3} - 11y_0^2\alpha_0 - 4d_1\alpha_0 + 2d_1'\alpha_0 + 18y_0\alpha_0 - \frac{25y_0^3}{18} + \frac{16y_0^2}{3} + 4d_1 - 2d_1' - \frac{49y_0}{6} + \Big(-4\alpha_0 + \frac{4}{y_0-1} + 4\Big)H(0;\alpha_0) + \Big(-4\alpha_0d_1 + \frac{4d_1}{y_0-1} + 4d_1\Big)H(1;\alpha_0) + \frac{4d_1}{y_0-1} - \frac{2d_1'}{y_0-1} - \frac{61}{6(y_0-1)} - \frac{1}{(y_0-1)^2} - \frac{55}{6}\Big)H(c_1(\alpha_0);y_0) + \Big(-\frac{4y_0^3}{3} + 6y_0^2 - 12y_0 + \frac{4}{y_0-1} + 4\Big)H(0,0;\alpha_0) + \Big(-\frac{20y_0^3}{3} + 30y_0^2 - 60y_0 - \frac{12}{y_0-1} - 28\Big)H(0,0;y_0) + \Big(-\frac{4d_1y_0^3}{3} + 6d_1y_0^2 - 12d_1y_0 + 4d_1 + \frac{4d_1}{y_0-1}\Big)H(0,1;\alpha_0) + H(1;y_0)\Big(-\frac{1}{6}d_1'y_0^3\alpha_0^4 + \frac{1}{2}d_1'y_0^2\alpha_0^4 + \frac{d_1'\alpha_0^4}{6} - \frac{1}{2}d_1'y_0\alpha_0^4 + \frac{8}{9}d_1'y_0^3\alpha_0^3 - 3d_1'y_0^2\alpha_0^3 - \frac{11d_1'\alpha_0^3}{9} + \frac{10}{3}d_1'y_0\alpha_0^3 - 2d_1'y_0^3\alpha_0^2 + \frac{15}{2}d_1'y_0^2\alpha_0^2 + \frac{9d_1'\alpha_0^2}{2} - 10d_1'y_0\alpha_0^2 + \frac{8}{3}d_1'y_0^3\alpha_0 - 11d_1'y_0^2\alpha_0 - \frac{23d_1'\alpha_0}{3} + 18d_1'y_0\alpha_0 - \frac{2d_1'^2y_0^3}{9} + \frac{8d_1'y_0^3}{3} + \frac{49d_1'^2}{18} + \frac{7d_1'^2y_0^2}{6} - \frac{25d_1'y_0^2}{2} - \frac{133d_1'}{6} - \frac{11d_1'^2y_0}{3} + 32d_1'y_0 + \Big(-\frac{2d_1'y_0^3}{3} + \frac{2y_0^3}{3} + 3d_1'y_0^2 - 3y_0^2 - 6d_1'y_0 + 6y_0 + \frac{11d_1'}{3} - \frac{4d_1}{y_0-1} + \frac{2d_1'}{y_0-1} + \frac{2}{y_0-1} + 10\Big)H(0;\alpha_0) - 4H(0,0;\alpha_0) - 4d_1H(0,1;\alpha_0) + \frac{\pi^2}{3}\Big) + \Big(-2d_1'y_0^3 + 9d_1'y_0^2 - 18d_1'y_0 - 6d_1' + (4d_1-4)H(0;\alpha_0) - \frac{2d_1'}{y_0-1}\Big)H(0,1;y_0) + \Big(\frac{2y_0^3}{3} - 3y_0^2 + 6y_0 - 4H(0;\alpha_0) - 4d_1H(1;\alpha_0) + \frac{6}{y_0-1} + 10\Big)H(0,c_1(\alpha_0);y_0) + \Big(-2d_1'y_0^3 - \frac{2y_0^3}{3} + 9d_1'y_0^2 + 3y_0^2 - 18d_1'y_0 -$$

$$6y_0+11\, d_1'-4H(0;\alpha_0)+\tfrac{4d_1}{y_0-1}-\tfrac{2\, d_1'}{y_0-1}-\tfrac{2}{y_0-1}-10\Big)H(1,0;y_0)+\Big(-\tfrac{2}{3}\, d_1'^2y_0^3+3d_1'^2y_0^2-6d_1'^2y_0+ \tfrac{11d_1'^2}{3}+(4d_1-2\, d_1'-2)H(0;\alpha_0)\Big)H(1,1;y_0)+\Big(\tfrac{2y_0^3}{3}-3y_0^2+6\, y_0-4H(0;\alpha_0)-4d_1H(1;\alpha_0)- \tfrac{4d_1}{y_0-1}+\tfrac{2\, d_1'}{y_0-1}+\tfrac{2}{y_0-1}+10\Big)H(1,c_1(\alpha_0);y_0)+\Big(-4\,\alpha_0+\tfrac{4}{y_0-1}+4\Big)H(c_1(\alpha_0),0;y_0)+\Big(-2\alpha_0d_1'+ \tfrac{2\, d_1'}{y_0-1}+2d_1'\Big)H(c_1(\alpha_0),1;y_0)+\Big(-2\,\alpha_0+\tfrac{2}{y_0-1}+2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)+32H(0,0,0;y_0)+ 8\, d_1'H(0,0,1;y_0)-8H(0,0,c_1(\alpha_0);y_0)+(-4d_1+8d_1'+4)\, H(0,1,0;y_0)+2d_1'^2H(0,1,1;y_0)+ (4d_1-2d_1'-4)\, H(0,1,c_1(\alpha_0);y_0)-4H(0,c_1(\alpha_0),0;y_0)-2d_1'\, H(0,c_1(\alpha_0),1;y_0)- 2H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+12H(1,0,0;y_0)+2\, d_1'H(1,0,1;y_0)-6H(1,0,c_1(\alpha_0);y_0)+ (-4d_1+2d_1'+2)\, H(1,1,0;y_0)+(4d_1-2d_1'-2)H(1,1,c_1(\alpha_0);y_0)-4\, H(1,c_1(\alpha_0),0;y_0)- 2d_1'H(1,c_1(\alpha_0),1;y_0)-2\, H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)-\tfrac{\pi^2}{3(y_0-1)}+3\,\zeta_3-\tfrac{\pi^2}{3}-4.$$

### G.2 The $\mathcal{K}{*}\mathcal{I}$ integral for $k=1$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{K}{*}\mathcal{I}(\epsilon;y_0,d_0',\alpha_0,d_0;1)=\frac{1}{\varepsilon^3}(k*i)^{(1)}_{-3}+\frac{1}{\varepsilon^2}(k*i)^{(1)}_{-2}+\frac{1}{\varepsilon}(k*i)^{(1)}_{-1}+(k*i)^{(1)}_{0}+\mathcal{O}(\varepsilon)\,,\quad \text{(G.2)}$$

where

$$(k*i)^{(1)}_{-3}=-\tfrac{1}{4},$$

$$(k*i)^{(1)}_{-2}=-\tfrac{y_0^3}{3}+\tfrac{3y_0^2}{2}-3y_0+H(0;y_0)-\tfrac{1}{2},$$

$$(k*i)^{(1)}_{-1}=\tfrac{y_0^3\alpha_0^4}{12}-\tfrac{y_0^2\alpha_0^4}{4}+\tfrac{y_0\,\alpha_0^4}{4}-\tfrac{4y_0^3\alpha_0^3}{9}+\tfrac{3y_0^2\alpha_0^3}{2}-\tfrac{5y_0\,\alpha_0^3}{3}+y_0^3\alpha_0^2-\tfrac{15y_0^2\alpha_0^2}{4}+5y_0\alpha_0^2- \tfrac{4\,y_0^3\alpha_0}{3}+\tfrac{11y_0^2\alpha_0}{2}-9y_0\alpha_0+\tfrac{d_1'\,y_0^3}{9}-\tfrac{4y_0^3}{3}-\tfrac{7d_1'y_0^2}{12}+\tfrac{25\,y_0^2}{4}+\tfrac{11d_1'y_0}{6}-16y_0+\Big(\tfrac{y_0^3}{3}-\tfrac{3\,y_0^2}{2}+3y_0- \tfrac{1}{y_0-1}-1\Big)H(0;\alpha_0)+\Big(y_0^3-\tfrac{9\,y_0^2}{2}+9y_0+\tfrac{1}{y_0-1}+3\Big)H(0;y_0)+\Big(\tfrac{d_1'\,y_0^3}{3}-\tfrac{3d_1'y_0^2}{2}+3d_1'y_0- \tfrac{11\,d_1'}{6}+H(0;\alpha_0)\Big)H(1;y_0)+\Big(\alpha_0-\tfrac{1}{y_0-1}-1\Big)\,H(c_1(\alpha_0);y_0)-4H(0,0;y_0)-d_1'H(0,1;y_0)+ H(0,c_1(\alpha_0);y_0)-H(1,0;\,y_0)+H(1,c_1(\alpha_0);y_0)-1,$$

$$(k*i)^{(1)}_{0}= -\tfrac{1}{24}d_1y_0^3\alpha_0^4-\tfrac{1}{36}d_1'y_0^3\alpha_0^4+\tfrac{3\,y_0^3\alpha_0^4}{8}+\tfrac{1}{8}d_1y_0^2\alpha_0^4+\tfrac{1}{12}d_1'y_0^2\,\alpha_0^4-\tfrac{13y_0^2\alpha_0^4}{12}-\tfrac{1}{8}d_1y_0\,\alpha_0^4-\tfrac{1}{12}d_1'y_0\alpha_0^4+ \tfrac{29y_0\,\alpha_0^4}{24}+\tfrac{13}{54}d_1y_0^3\alpha_0^3+\tfrac{4}{27}d_1'y_0^3\,\alpha_0^3-\tfrac{221y_0^3\alpha_0^3}{108}-\tfrac{5}{6}d_1y_0^2\,\alpha_0^3-\tfrac{19}{36}d_1'y_0^2\alpha_0^3+\tfrac{247y_0^2\,\alpha_0^3}{36}+\tfrac{17}{18}d_1y_0\alpha_0^3+ \tfrac{11}{18}d_1'y_0\,\alpha_0^3-\tfrac{305y_0\alpha_0^3}{36}-\tfrac{23}{36}d_1y_0^3\,\alpha_0^2-\tfrac{1}{3}d_1'y_0^3\alpha_0^2+\tfrac{347y_0^3\,\alpha_0^2}{72}+\tfrac{5}{2}d_1y_0^2\alpha_0^2+\tfrac{11}{8}d_1'y_0^2\alpha_0^2-\tfrac{331y_0^2\alpha_0^2}{18}- \tfrac{43}{12}d_1y_0\alpha_0^2-\tfrac{9}{4}\,d_1'y_0\alpha_0^2+\tfrac{1021y_0\alpha_0^2}{36}+\tfrac{25}{18}d_1y_0^3\alpha_0+\tfrac{4}{9}d_1'y_0^3\alpha_0-\tfrac{265y_0^3\alpha_0}{36}-6d_1y_0^2\,\alpha_0-\tfrac{25}{12}d_1'y_0^2\alpha_0+ \tfrac{283y_0^2\alpha_0}{9}+\tfrac{65d_1\,y_0\alpha_0}{6}+\tfrac{29d_1'y_0\alpha_0}{6}-\tfrac{245y_0\,\alpha_0}{4}-\tfrac{\alpha_0}{2(y_0-1)}-\tfrac{\alpha_0}{2}-\tfrac{d_1'^2\,y_0^3}{27}+\tfrac{5d_1'y_0^3}{9}+\tfrac{\pi^2y_0^3}{18}-4\,y_0^3+\tfrac{17d_1'^2y_0^2}{72}- \tfrac{10d_1'y_0^2}{3}-\tfrac{\pi^2\,y_0^2}{4}+\tfrac{155y_0^2}{8}-\tfrac{49d_1'^2y_0}{36}+\tfrac{199d_1'\,y_0}{12}+\tfrac{\pi^2y_0}{2}-64y_0+\Big(-\tfrac{1}{6}y_0^3\,\alpha_0^4+\tfrac{y_0^2\alpha_0^4}{2}-\tfrac{y_0\alpha_0^4}{2}+\tfrac{8y_0^3\,\alpha_0^3}{9}- 3y_0^2\alpha_0^3+\tfrac{10y_0\alpha_0^3}{3}-2y_0^3\alpha_0^2+\tfrac{15\,y_0^2\alpha_0^2}{2}-10y_0\alpha_0^2+\tfrac{8y_0^3\alpha_0}{3}-11y_0^2\alpha_0+18\,y_0\alpha_0-\tfrac{d_1'y_0^3}{9}+\tfrac{23y_0^3}{36}+\tfrac{7d_1'\,y_0^2}{12}- \tfrac{43y_0^2}{12}+2d_1-d_1'-\tfrac{11d_1'\,y_0}{6}+\tfrac{143y_0}{12}+\tfrac{2\,d_1}{y_0-1}-\tfrac{d_1'}{y_0-1}-\tfrac{61}{12(y_0-1)}-\tfrac{1}{2\,(y_0-1)^2}-\tfrac{55}{12}\Big)H(0;\alpha_0)+\Big(-\tfrac{1}{6}y_0^3\alpha_0^4+ \tfrac{y_0^2\alpha_0^4}{2}-\tfrac{y_0\alpha_0^4}{2}+\tfrac{8y_0^3\alpha_0^3}{9}-3\,y_0^2\alpha_0^3+\tfrac{10y_0\alpha_0^3}{3}-2y_0^3\alpha_0^2+\tfrac{15y_0^2\,\alpha_0^2}{2}-10y_0\alpha_0^2+\tfrac{8y_0^3\alpha_0}{3}-11y_0^2\alpha_0+18y_0\alpha_0- \tfrac{d_1'y_0^3}{3}+\tfrac{169y_0^3}{36}+\tfrac{7d_1'\,y_0^2}{4}-\tfrac{257y_0^2}{12}-2d_1+d_1'-\tfrac{11d_1'\,y_0}{2}+\tfrac{625y_0}{12}+\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6\,y_0+\tfrac{2}{y_0-1}+2\Big)H(0;\alpha_0)- \tfrac{2\,d_1}{y_0-1}+\tfrac{d_1'}{y_0-1}+\tfrac{61}{12(y_0-1)}+\tfrac{1}{2\,(y_0-1)^2}+\tfrac{103}{12}\Big)H(0;y_0)+\Big(-\tfrac{1}{6}d_1y_0^3\,\alpha_0^4+\tfrac{1}{2}d_1y_0^2\alpha_0^4-\tfrac{1}{2}d_1y_0\,\alpha_0^4+$$

$$
\begin{aligned}
&\tfrac{8}{9}d_1y_0^3\alpha_0^3-3d_1y_0^2\alpha_0^3+\tfrac{10}{3}d_1\,y_0\alpha_0^3-2d_1y_0^3\alpha_0^2+\tfrac{15}{2}d_1y_0^2\alpha_0^2-10d_1y_0\,\alpha_0^2+\tfrac{8}{3}d_1y_0^3\alpha_0-11d_1y_0^2\alpha_0+\\
&18d_1y_0\,\alpha_0-\tfrac{25d_1y_0^3}{18}+6d_1y_0^2-\tfrac{65d_1y_0}{6}\Big)\,H(1;\alpha_0)+\Big(-\tfrac{1}{12}y_0^3\alpha_0^4+\tfrac{y_0^2\,\alpha_0^4}{4}-\tfrac{y_0\alpha_0^4}{4}+\tfrac{\alpha_0^4}{12}+\tfrac{4y_0^3\,\alpha_0^3}{9}-\\
&\tfrac{3y_0^2\alpha_0^3}{2}+\tfrac{5y_0\alpha_0^3}{3}-\tfrac{11\,\alpha_0^3}{18}-y_0^3\alpha_0^2+\tfrac{15y_0^2\alpha_0^2}{4}-5y_0\alpha_0^2+\tfrac{11\,\alpha_0^2}{4}+\tfrac{4y_0^3\alpha_0}{3}-\tfrac{11y_0^2\alpha_0}{2}-2d_1\alpha_0+d_1'\,\alpha_0+9y_0\alpha_0-\\
&\tfrac{25y_0^3}{36}+\tfrac{8y_0^2}{3}+2\,d_1-d_1'-\tfrac{49y_0}{12}+\Big(-2\alpha_0+\tfrac{2}{y_0-1}+2\Big)\,H(0;\alpha_0)+\Big(-2\alpha_0d_1+\tfrac{2d_1}{y_0-1}+2d_1\Big)\,H(1;\alpha_0)+\\
&\tfrac{2d_1}{y_0-1}-\tfrac{d_1'}{y_0-1}-\tfrac{61}{12\,(y_0-1)}-\tfrac{1}{2(y_0-1)^2}-\tfrac{55}{12}\Big)\,H(c_1(\alpha_0);y_0)+\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6\,y_0+\tfrac{2}{y_0-1}+\\
&2\Big)H(0,0;\alpha_0)+\Big(-\tfrac{10y_0^3}{3}+15\,y_0^2-30y_0-\tfrac{6}{y_0-1}-14\Big)H(0,0;y_0)+\Big(-\tfrac{2d_1\,y_0^3}{3}+3d_1y_0^2-6d_1y_0+\\
&2d_1+\tfrac{2d_1}{y_0-1}\Big)H(0,1;\,\alpha_0)+H(1;y_0)\Big(-\tfrac{1}{12}d_1'y_0^3\alpha_0^4+\tfrac{1}{4}d_1'\,y_0^2\alpha_0^4+\tfrac{d_1'\alpha_0^4}{12}-\tfrac{1}{4}d_1'y_0\,\alpha_0^4+\tfrac{4}{9}d_1'y_0^3\alpha_0^3-\\
&\tfrac{3}{2}d_1'y_0^2\,\alpha_0^3-\tfrac{11d_1'\alpha_0^3}{18}+\tfrac{5}{3}d_1'y_0\alpha_0^3-d_1'y_0^3\,\alpha_0^2+\tfrac{15}{4}d_1'y_0^2\alpha_0^2+\tfrac{9d_1'\alpha_0^2}{4}-5d_1'y_0\,\alpha_0^2+\tfrac{4}{3}d_1'y_0^3\alpha_0-\tfrac{11}{2}d_1'y_0^2\alpha_0-\\
&\tfrac{23\,d_1'\alpha_0}{6}+9d_1'y_0\alpha_0-\tfrac{d_1'^2y_0^3}{9}+\tfrac{4d_1'\,y_0^3}{3}+\tfrac{49d_1'^2}{36}+\tfrac{7d_1'^2y_0^2}{12}-\tfrac{25\,d_1'y_0^2}{4}-\tfrac{133d_1'}{12}-\tfrac{11d_1'^2y_0}{6}+16d_1'\,y_0+\Big(-\tfrac{d_1'y_0^3}{3}+\\
&\tfrac{y_0^3}{3}+\tfrac{3d_1'\,y_0^2}{2}-\tfrac{3y_0^2}{2}-3d_1'y_0+3y_0+\tfrac{11\,d_1'}{6}-\tfrac{2\,d_1}{y_0-1}+\tfrac{d_1'}{y_0-1}+\tfrac{1}{y_0-1}+5\Big)H(0;\alpha_0)-2\,H(0,0;\alpha_0)-\\
&2d_1H(0,1;\alpha_0)+\tfrac{\pi^2}{6}\Big)+\Big(-d_1'\,y_0^3+\tfrac{9d_1'y_0^2}{2}-9d_1'y_0-3d_1'+(2d_1-2)\,H(0;\alpha_0)-\tfrac{d_1'}{y_0-1}\Big)\,H(0,1;y_0)+\\
&\Big(\tfrac{y_0^3}{3}-\tfrac{3y_0^2}{2}+3y_0-2H(0;\alpha_0)-2\,d_1H(1;\alpha_0)+\tfrac{3}{y_0-1}+5\Big)H(0,c_1(\alpha_0);y_0)+\Big(-d_1'\,y_0^3-\tfrac{y_0^3}{3}+\\
&\tfrac{9d_1'y_0^2}{2}+\tfrac{3y_0^2}{2}-9d_1'\,y_0-3y_0+\tfrac{11d_1'}{2}-2H(0;\alpha_0)+\tfrac{2\,d_1}{y_0-1}-\tfrac{d_1'}{y_0-1}-\tfrac{1}{y_0-1}-5\Big)\,H(1,0;y_0)+\Big(-\tfrac{1}{3}d_1'^2y_0^3+\\
&\tfrac{3d_1'^2y_0^2}{2}-3\,d_1'^2y_0+\tfrac{11d_1'^2}{6}+(2d_1-d_1'-1)H(0;\alpha_0)\Big)\,H(1,1;y_0)+\Big(\tfrac{y_0^3}{3}-\tfrac{3y_0^2}{2}+3y_0-2H(0;\alpha_0)-\\
&2\,d_1H(1;\alpha_0)-\tfrac{2d_1}{y_0-1}+\tfrac{d_1'}{y_0-1}+\tfrac{1}{y_0-1}+5\,\Big)H(1,c_1(\alpha_0);y_0)+\Big(-2\alpha_0+\tfrac{2}{y_0-1}+2\Big)\,H(c_1(\alpha_0),0;y_0)+\\
&\Big(-\alpha_0d_1'+\tfrac{d_1'}{y_0-1}+d_1'\Big)\,H(c_1(\alpha_0),1;y_0)+\Big(-\alpha_0+\tfrac{1}{y_0-1}+1\Big)\,H(c_1(\alpha_0),c_1(\alpha_0);y_0)+\\
&16H(0,0,0;y_0)+4d_1'H(0,0,1;y_0)-4\,H(0,0,c_1(\alpha_0);y_0)+(-2d_1+4d_1'+2)H(0,1,0;y_0)+\\
&d_1'^2\,H(0,1,1;y_0)+(2d_1-d_1'-2)H(0,1,c_1(\alpha_0);y_0)-2\,H(0,c_1(\alpha_0),0;y_0)-\\
&d_1'\,H(0,c_1(\alpha_0),1;y_0)-H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+6H(1,0,0;y_0)+d_1'\,H(1,0,1;y_0)-\\
&3H(1,0,c_1(\alpha_0);y_0)+(-2d_1+d_1'+1)H(1,1,0;y_0)+(2\,d_1-d_1'-1)H(1,1,c_1(\alpha_0);y_0)-\\
&2H(1,c_1(\alpha_0),0;y_0)-d_1'\,H(1,c_1(\alpha_0),1;y_0)-H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)-\tfrac{\pi^2}{6\,(y_0-1)}+\tfrac{3\zeta_3}{2}-\tfrac{\pi^2}{6}-2.
\end{aligned}
$$

### G.3 The $\mathcal{K}{*}\mathcal{I}$ integral for $k=2$

The $\varepsilon$ expansion for this integral reads

$$
\mathcal{K}{*}\mathcal{I}(\epsilon;y_0,d_0',\alpha_0,d_0;1)=\frac{1}{\varepsilon^3}(k*i)_{-3}^{(2)}+\frac{1}{\varepsilon^2}(k*i)_{-2}^{(2)}+\frac{1}{\varepsilon}(k*i)_{-1}^{(2)}+(k*i)_0^{(2)}+\mathcal{O}(\varepsilon)\,, \quad \text{(G.3)}
$$

where

$$
(k*i)_{-3}^{(2)}=-\tfrac{1}{6},
$$

$$
(k*i)_{-2}^{(2)}=-\tfrac{2y_0^3}{9}+y_0^2-2y_0+\tfrac{2}{3}H(0;y_0)-\tfrac{4}{9},
$$

$$
\begin{aligned}
&(k*i)_{-1}^{(2)}=\tfrac{y_0^3\alpha_0^4}{18}-\tfrac{y_0^2\alpha_0^4}{12}+\tfrac{y_0\,\alpha_0^4}{3}-\tfrac{\alpha_0^4}{6(y_0-2)}-\tfrac{\alpha_0^4}{12}-\tfrac{8y_0^3\,\alpha_0^3}{27}+\tfrac{2y_0^2\alpha_0^3}{3}-\tfrac{8y_0\,\alpha_0^3}{9}-\tfrac{\alpha_0^3}{y_0-2}-\\
&\tfrac{4\alpha_0^3}{9(y_0-2)^2}-\tfrac{7\,\alpha_0^3}{18}+\tfrac{2y_0^3\alpha_0^2}{3}-2y_0^2\alpha_0^2+\tfrac{5y_0\,\alpha_0^2}{3}-\tfrac{8\alpha_0^2}{3(y_0-2)}-\tfrac{11\alpha_0^2}{3\,(y_0-2)^2}-\tfrac{4\alpha_0^2}{3(y_0-2)^3}-\tfrac{7\alpha_0^2}{12}-\tfrac{8\,y_0^3\alpha_0}{9}+\\
&\tfrac{10y_0^2\alpha_0}{3}-4y_0\alpha_0-\tfrac{13\alpha_0}{3\,(y_0-2)}-\tfrac{18\alpha_0}{(y_0-2)^2}-\tfrac{52\alpha_0}{3(y_0-2)^3}-\tfrac{16\,\alpha_0}{3(y_0-2)^4}+\tfrac{\alpha_0}{2}+\tfrac{2d_1'y_0^3}{27}-\tfrac{25\,y_0^3}{27}-\tfrac{7d_1'y_0^2}{18}+\\
&\tfrac{13y_0^2}{3}+\tfrac{11d_1'\,y_0}{9}-11y_0+\Big(\tfrac{2y_0^3}{9}-y_0^2+2y_0-\tfrac{2}{3\,(y_0-1)}-\tfrac{80}{3(y_0-2)^2}-\tfrac{160}{3\,(y_0-2)^3}-\tfrac{40}{(y_0-2)^4}-
\end{aligned}
$$

$$\frac{32}{3\ (y_0-2)^5}+\frac{3}{2}\Big)H(0;\alpha_0)+\Big(\frac{2y_0^3}{3}-3y_0^2+6\ y_0+\frac{2}{3(y_0-1)}+\frac{80}{3(y_0-2)^2}+\frac{160}{3\ (y_0-2)^3}+\frac{40}{(y_0-2)^4}+$$
$$\frac{32}{3\ (y_0-2)^5}+\frac{5}{18}\Big)H(0;y_0)+\Big(\frac{2d_1'\ y_0^3}{9}-d_1'y_0^2+2d_1'y_0-\frac{11d_1'}{9}+\frac{2}{3}\ H(0;\alpha_0)\Big)H(1;y_0)+\Big(\frac{2\alpha_0}{3}-$$
$$\frac{2}{3\ (y_0-1)}-\frac{2}{3}\Big)\ H(c_1(\alpha_0);y_0)+\Big(\frac{\alpha_0^4}{2}+\frac{2\alpha_0^3}{3}-\alpha_0^2-2\ \alpha_0-\frac{80}{3(y_0-2)^2}-\frac{160}{3\ (y_0-2)^3}-\frac{40}{(y_0-2)^4}-$$
$$\frac{32}{3\ (y_0-2)^5}+\frac{11}{6}\Big)H(c_2(\alpha_0);y_0)-\frac{8}{3}\ H(0,0;y_0)-\frac{2}{3}d_1'H(0,1;y_0)+\frac{2}{3}H(0,c_1(\alpha_0);y_0)-$$
$$\frac{2}{3}H(1,0;y_0)+\frac{2}{3}H(1,c_1(\alpha_0);y_0)-\frac{80\ln 2}{3(y_0-2)^2}-\frac{160\ln 2}{3(y_0-2)^3}-\frac{40\ln 2}{(y_0-2)^4}-\frac{32\ln 2}{3(y_0-2)^5}+\frac{13\ln 2}{6}-\frac{26}{27},$$

$$(k*i)_0^{(2)}=-\frac{1}{36}d_1y_0^3\alpha_0^4-\frac{1}{54}d_1'y_0^3\alpha_0^4+\frac{7\ y_0^3\alpha_0^4}{27}+\frac{1}{24}d_1y_0^2\alpha_0^4+\frac{1}{72}d_1'y_0^2\ \alpha_0^4-\frac{5y_0^2\alpha_0^4}{18}+\frac{d_1\alpha_0^4}{24}-$$
$$\frac{1}{6}d_1\ y_0\alpha_0^4-\frac{11}{36}d_1'y_0\alpha_0^4+\frac{41y_0\ \alpha_0^4}{18}+\frac{d_1\alpha_0^4}{12(y_0-2)}-\frac{31\alpha_0^4}{36\ (y_0-2)}-\frac{31\alpha_0^4}{72}+\frac{13}{81}d_1y_0^3\ \alpha_0^3+\frac{8}{81}d_1'y_0^3\alpha_0^3-\frac{229y_0^3\ \alpha_0^3}{162}-$$
$$\frac{7}{18}d_1y_0^2\alpha_0^3-\frac{5}{27}d_1'y_0^2\ \alpha_0^3+\frac{305y_0^2\alpha_0^3}{108}+\frac{43d_1\alpha_0^3}{108}-\frac{d_1'\ \alpha_0^3}{18}+\frac{10}{27}d_1y_0\alpha_0^3+\frac{14}{27}d_1'y_0\ \alpha_0^3-\frac{541y_0\alpha_0^3}{108}+\frac{17d_1\alpha_0^3}{18\ (y_0-2)}-$$
$$\frac{d_1'\alpha_0^3}{9(y_0-2)}-\frac{29\alpha_0^3}{6\ (y_0-2)}+\frac{8d_1\alpha_0^3}{27(y_0-2)^2}-\frac{64\alpha_0^3}{27\ (y_0-2)^2}-\frac{197\alpha_0^3}{108}-\frac{23}{54}d_1y_0^3\ \alpha_0^2-\frac{2}{9}d_1'y_0^3\alpha_0^2+\frac{359y_0^3\ \alpha_0^2}{108}+\frac{17}{12}d_1y_0^2\alpha_0^2+$$
$$\frac{2}{3}d_1'y_0^2\ \alpha_0^2-\frac{2099y_0^2\alpha_0^2}{216}+\frac{113d_1\alpha_0^2}{72}-\frac{13\ d_1'\alpha_0^2}{36}-\frac{10}{9}d_1y_0\alpha_0^2-\frac{1}{3}d_1'y_0\ \alpha_0^2+\frac{215y_0\alpha_0^2}{27}+\frac{46d_1\alpha_0^2}{9(y_0-2)}-\frac{8\ d_1'\alpha_0^2}{9(y_0-2)}-$$
$$\frac{25\alpha_0^2}{2(y_0-2)}+\frac{83d_1\ \alpha_0^2}{18(y_0-2)^2}-\frac{d_1'\alpha_0^2}{3(y_0-2)^2}-\frac{349\ \alpha_0^2}{18(y_0-2)^2}+\frac{4d_1\alpha_0^2}{3(y_0-2)^3}-\frac{68\ \alpha_0^2}{9(y_0-2)^3}-\frac{169\alpha_0^2}{72}+\frac{25}{27}d_1y_0^3\alpha_0+\frac{8}{27}d_1'y_0^3\alpha_0-$$
$$\frac{91y_0^3\alpha_0}{18}-\frac{23}{6}d_1\ y_0^2\alpha_0-\frac{11}{9}d_1'y_0^2\alpha_0+\frac{2099y_0^2\ \alpha_0}{108}+\frac{83d_1\alpha_0}{36}-\frac{19d_1'\alpha_0}{18}+\frac{52d_1\ y_0\alpha_0}{9}+\frac{14d_1'y_0\alpha_0}{9}-\frac{949y_0\ \alpha_0}{36}+$$
$$\frac{383d_1\alpha_0}{18(y_0-2)}-\frac{35d_1'\alpha_0}{9\ (y_0-2)}-\frac{385\alpha_0}{18(y_0-2)}-\frac{\alpha_0}{3(y_0-1)}+\frac{151\ d_1\alpha_0}{3(y_0-2)^2}-\frac{38d_1'\alpha_0}{9(y_0-2)^2}-\frac{983\ \alpha_0}{9(y_0-2)^2}+\frac{118d_1\alpha_0}{3(y_0-2)^3}-\frac{4d_1'\alpha_0}{3\ (y_0-2)^3}-$$
$$\frac{998\alpha_0}{9(y_0-2)^3}+\frac{32d_1\alpha_0}{3\ (y_0-2)^4}-\frac{320\alpha_0}{9(y_0-2)^4}+\frac{167\alpha_0}{36}-\frac{2\ d_1'^2y_0^3}{81}+\frac{31d_1'y_0^3}{81}+\frac{\pi^2\ y_0^3}{27}-\frac{230y_0^3}{81}+\frac{17d_1'^2y_0^2}{108}-\frac{247\ d_1'y_0^2}{108}-$$
$$\frac{\pi^2y_0^2}{6}+\frac{247y_0^2}{18}-\frac{49\ d_1'^2y_0}{54}+\frac{304d_1'y_0}{27}+\frac{\pi^2\ y_0}{3}-\frac{134y_0}{3}+\Big(-\frac{1}{9}y_0^3\alpha_0^4+\frac{y_0^2\ \alpha_0^4}{6}-\frac{2y_0\alpha_0^4}{3}+\frac{\alpha_0^4}{3\ (y_0-2)}+\frac{\alpha_0^4}{6}+$$
$$\frac{16y_0^3\alpha_0^3}{27}-\frac{4y_0^2\ \alpha_0^3}{3}+\frac{16y_0\alpha_0^3}{9}+\frac{2\alpha_0^3}{y_0-2}+\frac{8\ \alpha_0^3}{9(y_0-2)^2}+\frac{7\alpha_0^3}{9}-\frac{4y_0^3\alpha_0^2}{3}+4y_0^2\ \alpha_0^2-\frac{10y_0\alpha_0^2}{3}+\frac{16\alpha_0^2}{3(y_0-2)}+\frac{22\ \alpha_0^2}{3(y_0-2)^2}+$$
$$\frac{8\alpha_0^2}{3(y_0-2)^3}+\frac{7\ \alpha_0^2}{6}+\frac{16y_0^3\alpha_0}{9}-\frac{20y_0^2\alpha_0}{3}+8y_0\ \alpha_0+\frac{26\alpha_0}{3(y_0-2)}+\frac{36\alpha_0}{(y_0-2)^2}+\frac{104\ \alpha_0}{3(y_0-2)^3}+\frac{32\alpha_0}{3(y_0-2)^4}-\alpha_0-\frac{2d_1'\ y_0^3}{27}+$$
$$\frac{25y_0^3}{54}+\frac{7d_1'y_0^2}{18}-\frac{95\ y_0^2}{36}-\frac{41d_1}{36}-\frac{d_1'}{18}-\frac{11d_1'y_0}{9}+9\ y_0-\frac{8d_1'}{3(y_0-2)}+\frac{20}{3(y_0-2)}+\frac{4d_1}{3\ (y_0-1)}-\frac{2d_1'}{3(y_0-1)}-\frac{7}{2(y_0-1)}+$$
$$\frac{16d_1}{(\ y_0-2)^2}-\frac{12d_1'}{(y_0-2)^2}-\frac{344}{3\ (y_0-2)^2}-\frac{1}{3(y_0-1)^2}+\frac{128d_1}{9(y_0-2)^3}-\frac{88\ d_1'}{9(y_0-2)^3}-\frac{2152}{9(y_0-2)^3}+\frac{4\ d_1}{(y_0-2)^4}-\frac{8d_1'}{3(y_0-2)^4}-$$
$$\frac{548}{3\ (y_0-2)^4}-\frac{448}{9(y_0-2)^5}+\frac{317}{36}\Big)\ H(0;\alpha_0)+\Big(-\frac{1}{9}d_1y_0^3\alpha_0^4+\frac{1}{6}d_1y_0^2\ \alpha_0^4+\frac{d_1\alpha_0^4}{6}-\frac{2}{3}d_1y_0\alpha_0^4+\frac{d_1\ \alpha_0^4}{3(y_0-2)}+$$
$$\frac{16}{27}d_1y_0^3\alpha_0^3-\frac{4}{3}d_1y_0^2\ \alpha_0^3+\frac{7d_1\alpha_0^3}{9}+\frac{16}{9}d_1y_0\alpha_0^3+\frac{2d_1\ \alpha_0^3}{y_0-2}+\frac{8d_1\alpha_0^3}{9(y_0-2)^2}-\frac{4}{3}d_1y_0^3\ \alpha_0^2+4d_1y_0^2\alpha_0^2+\frac{7d_1\alpha_0^2}{6}-$$
$$\frac{10}{3}d_1y_0\ \alpha_0^2+\frac{16d_1\alpha_0^2}{3(y_0-2)}+\frac{22d_1\alpha_0^2}{3\ (y_0-2)^2}+\frac{8d_1\alpha_0^2}{3(y_0-2)^3}+\frac{16}{9}d_1y_0^3\ \alpha_0-\frac{20}{3}d_1y_0^2\alpha_0-d_1\alpha_0+8d_1y_0\alpha_0+\frac{26d_1\ \alpha_0}{3(y_0-2)}+$$
$$\frac{36d_1\alpha_0}{(y_0-2)^2}+\frac{104d_1\alpha_0}{3\ (y_0-2)^3}+\frac{32d_1\alpha_0}{3(y_0-2)^4}-\frac{25d_1\ y_0^3}{27}+\frac{23d_1y_0^2}{6}-\frac{10d_1}{9}-\frac{52d_1\ y_0}{9}-\frac{49d_1}{3(y_0-2)}-\frac{398d_1}{9\ (y_0-2)^2}-\frac{112d_1}{3(y_0-2)^3}-$$
$$\frac{32d_1}{3\ (y_0-2)^4}\Big)H(1;\alpha_0)+\Big(-\frac{1}{18}y_0^3\alpha_0^4+\frac{y_0^2\ \alpha_0^4}{12}-\frac{y_0\alpha_0^4}{3}+\frac{\alpha_0^4}{6(y_0-2)}+\frac{17\ \alpha_0^4}{36}+\frac{8y_0^3\alpha_0^3}{27}-\frac{2y_0^2\alpha_0^3}{3}+\frac{8\ y_0\alpha_0^3}{9}+\frac{\alpha_0^3}{y_0-2}+$$
$$\frac{4\alpha_0^3}{9\ (y_0-2)^2}+\frac{29\alpha_0^3}{54}-\frac{2y_0^3\alpha_0^2}{3}+2y_0^2\alpha_0^2-\frac{5y_0\alpha_0^2}{3}+\frac{8\alpha_0^2}{3(y_0-2)}+\frac{11\alpha_0^2}{3\ (y_0-2)^2}+\frac{4\alpha_0^2}{3(y_0-2)^3}+\frac{17\alpha_0^2}{12}+\frac{8\ y_0^3\alpha_0}{9}-\frac{10y_0^2\alpha_0}{3}-$$
$$\frac{4d_1\alpha_0}{3}+\frac{2d_1'\ \alpha_0}{3}+4y_0\alpha_0+\frac{13\alpha_0}{3(y_0-2)}+\frac{18\ \alpha_0}{(y_0-2)^2}+\frac{52\alpha_0}{3(y_0-2)^3}+\frac{16\alpha_0}{3\ (y_0-2)^4}-\frac{19\alpha_0}{18}-\frac{25y_0^3}{54}+\frac{61y_0^2}{36}+\frac{4d_1}{3}-\frac{2d_1'}{3}-$$
$$2y_0+\Big(-\frac{4\ \alpha_0}{3}+\frac{4}{3(y_0-1)}+\frac{4}{3}\Big)H(0;\alpha_0)+\Big(-\frac{4\ \alpha_0d_1}{3}+\frac{4d_1}{3(y_0-1)}+\frac{4d_1}{3}\Big)\ H(1;\alpha_0)-\frac{32}{3(y_0-2)}+\frac{4d_1}{3(y_0-1)}-$$
$$\frac{2d_1'}{3\ (y_0-1)}-\frac{7}{2(y_0-1)}-\frac{332}{9(y_0-2)^2}-\frac{1}{3\ (y_0-1)^2}-\frac{104}{3(y_0-2)^3}-\frac{32}{3\ (y_0-2)^4}-\frac{53}{18}\Big)H(c_1(\alpha_0);y_0)+\Big(-\frac{d_1\ \alpha_0^4}{4}+$$
$$\frac{d_1'\alpha_0^4}{6}+\frac{25\alpha_0^4}{12}-\frac{7d_1\ \alpha_0^3}{9}+\frac{5d_1'\alpha_0^3}{9}+\frac{11\alpha_0^3}{9}-\frac{d_1\ \alpha_0^2}{6}+\frac{d_1'\alpha_0^2}{3}-\frac{13\alpha_0^2}{2}+\frac{11d_1\ \alpha_0}{3}-\frac{5d_1'\alpha_0}{3}-\frac{23\alpha_0}{3}-\frac{89\ d_1}{36}+\frac{11d_1'}{18}+$$
$$\Big(-\alpha_0^4-\frac{4\alpha_0^3}{3}+2\alpha_0^2+4\ \alpha_0+\frac{160}{3(y_0-2)^2}+\frac{320}{3\ (y_0-2)^3}+\frac{80}{(y_0-2)^4}+\frac{64}{3\ (y_0-2)^5}-\frac{11}{3}\Big)H(0;\alpha_0)+\Big(-d_1\alpha_0^4-$$
$$\frac{4d_1\ \alpha_0^3}{3}+2d_1\alpha_0^2+4d_1\alpha_0-\frac{11d_1}{3}+\frac{160d_1}{3\ (y_0-2)^2}+\frac{320d_1}{3(y_0-2)^3}+\frac{80\ d_1}{(y_0-2)^4}+\frac{64d_1}{3(y_0-2)^5}\Big)H(1;\alpha_0)-\frac{8\ d_1'}{3(y_0-2)}+$$
$$\frac{52}{3(y_0-2)}+\frac{16\ d_1}{(y_0-2)^2}-\frac{12d_1'}{(y_0-2)^2}-\frac{700}{9\ (y_0-2)^2}+\frac{128d_1}{9(y_0-2)^3}-\frac{88d_1'}{9\ (y_0-2)^3}-\frac{1840}{9(y_0-2)^3}+\frac{4d_1}{(y_0-2)^4}-\frac{8\ d_1'}{3(y_0-2)^4}-$$



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$$\frac{172}{(y_0-2)^4} - \frac{448}{9(y_0-2)^5} + \frac{391}{36}\Big) H(c_2(\alpha_0);y_0) + \Big(-\frac{4y_0^3}{9} + 2y_0^2 - 4y_0 + \frac{4}{3(y_0-1)} + \frac{160}{3(y_0-2)^2} + \frac{320}{3(y_0-2)^3} +$$

$$\frac{80}{(y_0-2)^4} + \frac{64}{3(y_0-2)^5} - 3\Big) H(0,0;\alpha_0) + \Big(-\frac{20y_0^3}{9} + 10y_0^2 - 20y_0 - \frac{4}{y_0-1} - \frac{160}{(y_0-2)^2} - \frac{320}{(y_0-2)^3} -$$

$$\underline{240}(y_0-2)^4 - \frac{64}{(y_0-2)^5} + \frac{17}{9}\Big) H(0,0;y_0) + \Big(-\frac{4d_1y_0^3}{9} + 2d_1y_0^2 - 4d_1y_0 - 3d_1 + \frac{4d_1}{3(y_0-1)} + \frac{160d_1}{3(y_0-2)^2} +$$

$$\frac{320d_1}{3(y_0-2)^3} + \frac{80d_1}{(y_0-2)^4} + \frac{64d_1}{3(y_0-2)^5}\Big) H(0,1;\alpha_0) + \Big(-\frac{2d_1'y_0^3}{3} + 3d_1'y_0^2 - 6d_1'y_0 - \frac{5d_1'}{18} + \Big(\frac{4d_1}{3} - \frac{4}{3}\Big) H(0;\alpha_0) -$$

$$\frac{2d_1'}{3(y_0-1)} - \frac{80d_1'}{3(y_0-2)^2} - \frac{160d_1'}{3(y_0-2)^3} - \frac{40d_1'}{(y_0-2)^4} - \frac{32d_1'}{3(y_0-2)^5}\Big) H(0,1;y_0) + \Big(\frac{2y_0^3}{9} - y_0^2 + 2y_0 - \frac{4}{3}H(0;\alpha_0) -$$

$$\frac{4}{3}d_1 H(1;\alpha_0) + \frac{2}{y_0-1} - \frac{80}{3(y_0-2)^2} - \frac{160}{3(y_0-2)^3} - \frac{40}{(y_0-2)^4} - \frac{32}{3(y_0-2)^5} + \frac{107}{18}\Big) H(0,c_1(\alpha_0);y_0) + \Big(-$$

$$\frac{26}{3} + \frac{320}{3(y_0-2)^2} + \frac{640}{3(y_0-2)^3} + \frac{160}{(y_0-2)^4} + \frac{128}{3(y_0-2)^5}\Big) H(0,c_2(\alpha_0);y_0) + \Big(-\frac{2d_1'y_0^3}{3} - \frac{2y_0^3}{9} + 3d_1'y_0^2 +$$

$$y_0^2 - 6d_1'y_0 - 2y_0 + \frac{19d_1'}{3} - \frac{4}{3}H(0;\alpha_0) + \frac{4d_1}{3(y_0-1)} - \frac{2d_1'}{3(y_0-1)} - \frac{2}{3(y_0-1)} - \frac{80d_1'}{3(y_0-2)^2} + \frac{80}{3(y_0-2)^2} -$$

$$\frac{160d_1'}{3(y_0-2)^3} + \frac{160}{3(y_0-2)^3} - \frac{40d_1'}{(y_0-2)^4} + \frac{40}{(y_0-2)^4} - \frac{32d_1'}{3(y_0-2)^5} + \frac{32}{3(y_0-2)^5} - \frac{107}{18}\Big) H(1,0;y_0) + \Big(-\frac{2}{9}d_1'^2y_0^3 +$$

$$d_1'^2y_0^2 - 2d_1'^2y_0 + \frac{11d_1'^2}{9} + \Big(\frac{4d_1}{3} - \frac{2d_1'}{3} - \frac{2}{3}\Big)H(0;\alpha_0)\Big) H(1,1;y_0) + \Big(\frac{2y_0^3}{9} - y_0^2 + 2y_0 - \frac{4}{3}H(0;\alpha_0) -$$

$$\frac{4}{3}d_1 H(1;\alpha_0) - \frac{4d_1}{3(y_0-1)} + \frac{2d_1'}{3(y_0-1)} + \frac{2}{3(y_0-1)} - \frac{80}{3(y_0-2)^2} - \frac{160}{3(y_0-2)^3} - \frac{40}{(y_0-2)^4} - \frac{32}{3(y_0-2)^5} +$$

$$\frac{107}{18}\Big) H(1,c_1(\alpha_0);y_0) + \Big(\frac{80d_1'}{3(y_0-2)^2} + \frac{160d_1'}{3(y_0-2)^3} + \frac{40d_1'}{(y_0-2)^4} + \frac{32d_1'}{3(y_0-2)^5} - \frac{8d_1'}{3}\Big) H(1,c_2(\alpha_0);y_0) +$$

$$\Big(-\frac{160d_1}{3(y_0-2)^2} - \frac{320d_1}{3(y_0-2)^3} - \frac{80d_1}{(y_0-2)^4} - \frac{64d_1}{3(y_0-2)^5} + \frac{8d_1'}{3} + \frac{160}{3(y_0-2)^2} + \frac{320}{3(y_0-2)^3} + \frac{80}{(y_0-2)^4} + \frac{64}{3(y_0-2)^5} -$$

$$\frac{26}{3}\Big) H(2,0;y_0) + \Big(\frac{160d_1}{3(y_0-2)^2} + \frac{320d_1}{3(y_0-2)^3} + \frac{80d_1}{(y_0-2)^4} + \frac{64d_1}{3(y_0-2)^5} - \frac{8d_1'}{3} - \frac{160}{3(y_0-2)^2} - \frac{320}{3(y_0-2)^3} - \frac{80}{(y_0-2)^4} -$$

$$\frac{64}{3(y_0-2)^5} + \frac{26}{3}\Big) H(2,c_2(\alpha_0);y_0) + \Big(-\frac{4\alpha_0}{3} + \frac{4}{3(y_0-1)} + \frac{4}{3}\Big) H(c_1(\alpha_0),0;y_0) + \Big(-\frac{2\alpha_0d_1'}{3} + \frac{2d_1'}{3(y_0-1)} +$$

$$\frac{2d_1'}{3}\Big) H(c_1(\alpha_0),1;y_0) + \Big(-\frac{2\alpha_0}{3} + \frac{2}{3(y_0-1)} + \frac{2}{3}\Big) H(c_1(\alpha_0),c_1(\alpha_0);y_0) + \Big(-\alpha_0^4 - \frac{4\alpha_0^3}{3} + 2\alpha_0^2 +$$

$$4\alpha_0 + \frac{160}{3(y_0-2)^2} + \frac{320}{3(y_0-2)^3} + \frac{80}{(y_0-2)^4} + \frac{64}{3(y_0-2)^5} - \frac{11}{3}\Big) H(c_2(\alpha_0),0;y_0) + \Big(-\frac{d_1'\alpha_0^4}{2} - \frac{2d_1'\alpha_0^3}{3} + d_1'\alpha_0^2 +$$

$$2d_1'\alpha_0 - \frac{11d_1'}{6} + \frac{80d_1'}{3(y_0-2)^2} + \frac{160d_1'}{3(y_0-2)^3} + \frac{40d_1'}{(y_0-2)^4} + \frac{32d_1'}{3(y_0-2)^5}\Big) H(c_2(\alpha_0),1;y_0) + \Big(-\frac{\alpha_0^4}{2} - \frac{2\alpha_0^3}{3} + \alpha_0^2 +$$

$$2\alpha_0 + \frac{80}{3(y_0-2)^2} + \frac{160}{3(y_0-2)^3} + \frac{40}{(y_0-2)^4} + \frac{32}{3(y_0-2)^5} - \frac{11}{6}\Big) H(c_2(\alpha_0),c_1(\alpha_0);y_0) + \frac{32}{3}H(0,0,0;y_0) +$$

$$\frac{8}{3}d_1'H(0,0,1;y_0) - \frac{8}{3}H(0,0,c_1(\alpha_0);y_0) + \Big(-\frac{4d_1}{3} + \frac{8d_1'}{3} + \frac{4}{3}\Big) H(0,1,0;y_0) + \frac{2}{3}d_1'^2 H(0,1,1;y_0) +$$

$$\Big(\frac{4d_1}{3} - \frac{2d_1'}{3} - \frac{4}{3}\Big) H(0,1,c_1(\alpha_0);y_0) - \frac{4}{3}H(0,c_1(\alpha_0),0;y_0) - \frac{2}{3}d_1' H(0,c_1(\alpha_0),1;y_0) -$$

$$\frac{2}{3}H(0,c_1(\alpha_0),c_1(\alpha_0);y_0) + 4H(1,0,0;y_0) + \frac{2}{3}d_1'H(1,0,1;y_0) - 2H(1,0,c_1(\alpha_0);y_0) + \Big(-$$

$$\frac{4d_1}{3} + \frac{2d_1'}{3} + \frac{2}{3}\Big) H(1,1,0;y_0) + \Big(\frac{4d_1}{3} - \frac{2d_1'}{3} - \frac{2}{3}\Big) H(1,1,c_1(\alpha_0);y_0) - \frac{4}{3}H(1,c_1(\alpha_0),0;y_0) -$$

$$\frac{2}{3}d_1'H(1,c_1(\alpha_0),1;y_0) - \frac{2}{3}H(1,c_1(\alpha_0),c_1(\alpha_0);y_0) + H(0;y_0)\Big(-\frac{1}{9}y_0^3\alpha_0^4 + \frac{y_0^2\alpha_0^4}{6} - \frac{2y_0\alpha_0^4}{3} +$$

$$\frac{\alpha_0^4}{3(y_0-2)} + \frac{\alpha_0^4}{6} + \frac{16y_0^3\alpha_0^3}{27} - \frac{4y_0^2\alpha_0^3}{3} + \frac{16y_0\alpha_0^3}{9} + \frac{2\alpha_0^3}{y_0-2} + \frac{8\alpha_0^3}{9(y_0-2)^2} + \frac{7\alpha_0^3}{9} - \frac{4y_0^3\alpha_0^2}{3} + 4y_0^2\alpha_0^2 - \frac{10y_0\alpha_0^2}{3} +$$

$$\frac{16\alpha_0^2}{3(y_0-2)} + \frac{22\alpha_0^2}{3(y_0-2)^2} + \frac{8\alpha_0^2}{3(y_0-2)^3} + \frac{7\alpha_0^2}{6} + \frac{16y_0^3\alpha_0}{9} - \frac{20y_0^2\alpha_0}{3} + 8y_0\alpha_0 + \frac{26\alpha_0}{3(y_0-2)} + \frac{36\alpha_0}{(y_0-2)^2} + \frac{104\alpha_0}{3(y_0-2)^3} +$$

$$\frac{32\alpha_0}{3(y_0-2)^4} - \alpha_0 - \frac{2d_1'y_0^3}{9} + \frac{175y_0^3}{54} + \frac{7d_1'y_0^2}{6} - \frac{529y_0^2}{36} + \frac{41d_1}{36} + \frac{d_1'}{18} - \frac{11d_1'y_0}{3} + 35y_0 + \Big(-\frac{4y_0^3}{9} + 2y_0^2 - 4y_0 +$$

$$\frac{4}{3(y_0-1)} + \frac{160}{3(y_0-2)^2} + \frac{320}{3(y_0-2)^3} + \frac{80}{(y_0-2)^4} + \frac{64}{3(y_0-2)^5} - 3\Big) H(0;\alpha_0) + \frac{8d_1'}{3(y_0-2)} - \frac{20}{3(y_0-2)} - \frac{4d_1}{3(y_0-1)} +$$

$$\frac{2d_1'}{3(y_0-1)} + \frac{7}{2(y_0-1)} - \frac{16d_1}{(y_0-2)^2} + \frac{12d_1'}{(y_0-2)^2} + \frac{344}{3(y_0-2)^2} + \frac{1}{3(y_0-1)^2} - \frac{128d_1}{9(y_0-2)^3} + \frac{88d_1'}{9(y_0-2)^3} + \frac{2152}{9(y_0-2)^3} -$$

$$\frac{4d_1}{(y_0-2)^4} + \frac{8d_1'}{3(y_0-2)^4} + \frac{548}{3(y_0-2)^4} + \frac{448}{9(y_0-2)^5} + \frac{320\ln 2}{3(y_0-2)^2} + \frac{640\ln 2}{3(y_0-2)^3} + \frac{160\ln 2}{(y_0-2)^4} + \frac{128\ln 2}{3(y_0-2)^5} - \frac{26\ln 2}{3} -$$

$$\frac{535}{108}\Big) + H(2;y_0)\Big(\frac{160\ln 2\, d_1}{3(y_0-2)^2} + \frac{320\ln 2\, d_1}{3(y_0-2)^3} + \frac{80\ln 2\, d_1}{(y_0-2)^4} + \frac{64\ln 2\, d_1}{3(y_0-2)^5} + \Big(\frac{160d_1}{3(y_0-2)^2} + \frac{320d_1}{3(y_0-2)^3} + \frac{80d_1}{(y_0-2)^4} +$$

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$$\frac{64d_1}{3(y_0-2)^5}-\frac{8\ d'_1}{3}-\frac{160}{3(y_0-2)^2}-\frac{320}{3\ (y_0-2)^3}-\frac{80}{(y_0-2)^4}-\frac{64}{3\ (y_0-2)^5}+\frac{26}{3}\Big)H(0;\alpha_0)-\frac{8}{3}d'_1\ln 2\ -\frac{160\ln 2}{3(y_0-2)^2}-\frac{320\ln 2}{3\ (y_0-2)^3}-\frac{80\ln 2}{(y_0-2)^4}-\frac{64\ln 2}{3\ (y_0-2)^5}+\frac{26\ln 2}{3}\Big)+H(1;y_0)\Big(-\frac{1}{18}\ d'_1y_0^3\alpha_0^4+\frac{1}{12}d'_1y_0^2\alpha_0^4+\frac{17d'_1\ \alpha_0^4}{36}-\frac{1}{3}d'_1y_0\alpha_0^4+\frac{d'_1\alpha_0^4}{6\ (y_0-2)}+\frac{8}{27}d'_1y_0^3\alpha_0^3-\frac{2}{3}d'_1y_0^2\ \alpha_0^3+\frac{d'_1\alpha_0^3}{27}+\frac{8}{9}d'_1y_0\alpha_0^3+\frac{d'_1\ \alpha_0^3}{y_0-2}+\frac{4d'_1\alpha_0^3}{9(y_0-2)^2}-\frac{2}{3}d'_1y_0^3\ \alpha_0^2+2d'_1y_0^2\alpha_0^2+\frac{2d'_1\alpha_0^2}{3}-\frac{5}{3}d'_1y_0\ \alpha_0^2+\frac{8d'_1\alpha_0^2}{3(y_0-2)}+\frac{11d'_1\alpha_0^2}{3\ (y_0-2)^2}+\frac{4d'_1\alpha_0^2}{3(y_0-2)^3}+\frac{8}{9}d'_1y_0^3\ \alpha_0-\frac{10}{3}d'_1y_0^2\alpha_0-\frac{23d'_1\alpha_0}{9}+4d'_1y_0\alpha_0+\frac{13d'_1\alpha_0}{3(y_0-2)}+\frac{18d'_1\alpha_0}{(y_0-2)^2}+\frac{52\ d'_1\alpha_0}{3(y_0-2)^3}+\frac{16d'_1\alpha_0}{3(y_0-2)^4}-\frac{2d'^2_1\ y_0^3}{27}+\frac{25d'_1y_0^3}{27}+\frac{49d'^2_1}{54}+\frac{7\ d'^2_1y_0^2}{18}-\frac{13d'_1y_0^2}{3}-\frac{205\ d'_1}{27}-\frac{11d'^2_1y_0}{9}+11d'_1y_0+\Big(-\frac{2d'_1\ y_0^3}{9}+\frac{2y_0^3}{9}+d'_1y_0^2-y_0^2-2d'_1y_0+2\ y_0-\frac{13d'_1}{9}-\frac{4d_1}{3(y_0-1)}+\frac{2d'_1}{3\ (y_0-1)}+\frac{2}{3(y_0-1)}+\frac{80d'_1}{3(y_0-2)^2}-\frac{80}{3\ (y_0-2)^2}+\frac{160d'_1}{3(y_0-2)^3}-\frac{160}{3\ (y_0-2)^3}+\frac{40d'_1}{(y_0-2)^4}-\frac{40}{(y_0-2)^4}+\frac{32\ d'_1}{3(y_0-2)^5}-\frac{32}{3(y_0-2)^5}+\frac{107}{18}\Big)\ H(0;\alpha_0)-\frac{4}{3}H(0,0;\alpha_0)-\frac{4}{3}d_1\ H(0,1;\alpha_0)-\frac{8}{3}d'_1\ln 2+\frac{80d'_1\ln 2}{3\ (y_0-2)^2}+\frac{160d'_1\ln 2}{3(y_0-2)^3}+\frac{40d'_1\ln\ 2}{(y_0-2)^4}+\frac{32d'_1\ln 2}{3(y_0-2)^5}+\frac{\pi\ ^2}{9}\Big)-\frac{\pi^2}{9(y_0-1)}-\frac{20\pi^2}{9\ (y_0-2)^2}-\frac{40\pi^2}{9(y_0-2)^3}-\frac{10\pi^2}{3\ (y_0-2)^4}-\frac{8\pi^2}{9(y_0-2)^5}+\zeta_3-\frac{80\ln^2 2}{3(y_0-2)^2}-\frac{160\ln^2 2}{3(y_0-2)^3}-\frac{40\ln^2 2}{(y_0-2)^4}-\frac{32\ln^2 2}{3(y_0-2)^5}+\frac{13\ln^2 2}{6}-\frac{89}{36}d_1\ln 2+\frac{11}{18}d'_1\ln 2-\frac{8\ d'_1\ln 2}{3(y_0-2)}+\frac{52\ln 2}{3(y_0-2)}+\frac{16d_1\ \ln 2}{(y_0-2)^2}-\frac{12d'_1\ln 2}{(y_0-2)^2}-\frac{700\ln\ 2}{9(y_0-2)^2}+\frac{128d_1\ln 2}{9(y_0-2)^3}-\frac{88d'_1\ \ln 2}{9(y_0-2)^3}-\frac{1840\ln 2}{9(y_0-2)^3}+\frac{4d_1\ \ln 2}{(y_0-2)^4}-\frac{8d'_1\ln 2}{3(y_0-2)^4}-\frac{172\ \ln 2}{(y_0-2)^4}-\frac{448\ln 2}{9(y_0-2)^5}+\frac{47\ln\ 2}{4}+\frac{5\pi^2}{72}-\frac{160}{81}.$$

### G.4 The $\mathcal{K}{*}\mathcal{I}$ integral for $k=-1$

The $\varepsilon$ expansion for this integral reads

$$\mathcal{K}{*}\mathcal{I}(\epsilon;y_0,d'_0,\alpha_0,d_0;1)=\frac{1}{\varepsilon^4}(k{*}i)^{(-1)}_{-4}+\frac{1}{\varepsilon^3}(k{*}i)^{(-1)}_{-3}+\frac{1}{\varepsilon^2}(k{*}i)^{(-1)}_{-2}+\frac{1}{\varepsilon}(k{*}i)^{(-1)}_{-1}+(k{*}i)^{(-1)}_{0}+\mathcal{O}(\varepsilon)\,, \tag{G.4}$$

where

$$(k*i)^{(-1)}_{-4}=\tfrac{1}{4},$$

$$(k*i)^{(-1)}_{-3}=\tfrac{y_0^3}{3}-\tfrac{3y_0^2}{2}+3y_0-H(0;y_0),$$

$$(k*i)^{(-1)}_{-2}=-\tfrac{d'_1y_0^3}{9}+\tfrac{7y_0^3}{9}+\tfrac{7d'_1y_0^2}{12}-4\ y_0^2-\tfrac{11d'_1y_0}{6}+13y_0+\Big(-\tfrac{4y_0^3}{3}+6y_0^2-12\ y_0\Big)H(0;y_0)+\Big(-\tfrac{d'_1y_0^3}{3}+\tfrac{3d'_1y_0^2}{2}-3\ d'_1y_0+\tfrac{11d'_1}{6}\Big)H(1;y_0)+4H(0,0;y_0)+d'_1H(0,1;y_0),$$

$$(k*i)^{(-1)}_{-1}=-\tfrac{1}{18}y_0^3\alpha_0^4+\tfrac{5y_0^2\alpha_0^4}{12}-\tfrac{5y_0\ \alpha_0^4}{3}+\tfrac{13y_0^3\alpha_0^3}{54}-\tfrac{17y_0^2\alpha_0^3}{9}+\tfrac{80\ y_0\alpha_0^3}{9}-\tfrac{11y_0^3\alpha_0^2}{36}+\tfrac{109y_0^2\ \alpha_0^2}{36}-\tfrac{158y_0\alpha_0^2}{9}-\tfrac{7y_0^3\alpha_0}{18}-\tfrac{7\ y_0^2\alpha_0}{18}+\tfrac{43y_0\alpha_0}{3}+\tfrac{d'^2_1y_0^3}{27}-\tfrac{11\ d'_1y_0^3}{27}-\tfrac{\pi^2y_0^3}{9}+\tfrac{44y_0^3}{27}-\tfrac{17\ d'^2_1y_0^2}{72}+\tfrac{25d'_1y_0^2}{9}+\tfrac{\pi^2\ y_0^2}{2}-\tfrac{37y_0^2}{4}+\tfrac{49d'^2_1y_0}{36}-\tfrac{154d'_1\ y_0}{9}-\pi^2y_0+48y_0+\Big(\tfrac{7y_0^3}{6}-\tfrac{13\ y_0^2}{3}+\tfrac{11y_0}{2}-\tfrac{13}{6(y_0-1)}-\tfrac{13}{6}\Big)\ H(0;\alpha_0)+\Big(\tfrac{4d'_1y_0^3}{9}-\tfrac{77y_0^3}{18}-\tfrac{7d'_1\ y_0^2}{3}+\tfrac{61y_0^2}{3}+\tfrac{22d'_1y_0}{3}-\tfrac{115y_0}{2}+\tfrac{13}{6(y_0-1)}+\tfrac{13}{6}\Big)H(0;y_0)+\Big(\tfrac{d'^2_1\ y_0^3}{9}-\tfrac{7d'_1y_0^3}{9}-\tfrac{7d'^2_1y_0^2}{12}+4d'_1\ y_0^2+\tfrac{11d'^2_1y_0}{6}-13d'_1y_0-\tfrac{49\ d'^2_1}{36}+\tfrac{88d'_1}{9}+\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6\ y_0-\tfrac{2}{y_0-1}+\tfrac{19}{3}\Big)H(0;\alpha_0)-\tfrac{\pi^2}{3}\Big)\ H(1;y_0)+\Big(\tfrac{y_0^3\alpha_0^4}{6}-y_0^2\alpha_0^4+\tfrac{5y_0\ \alpha_0^4}{2}-\tfrac{5\alpha_0^4}{3}-\tfrac{8y_0^3\alpha_0^3}{9}+5y_0^2\ \alpha_0^3-\tfrac{38y_0\alpha_0^3}{3}+\tfrac{68\alpha_0^3}{9}+2y_0^3\ \alpha_0^2-\tfrac{21y_0^2\alpha_0^2}{2}+26y_0\alpha_0^2-\tfrac{38\ \alpha_0^2}{3}-\tfrac{8y_0^3\alpha_0}{3}+13y_0^2\alpha_0-30y_0\alpha_0+\tfrac{41\ \alpha_0}{3}+\tfrac{25y_0^3}{18}-\tfrac{35y_0^2}{6}+\tfrac{23\ y_0}{2}-\tfrac{13}{6(y_0-1)}-\tfrac{13}{6}\Big)\ H(c_1(\alpha_0);y_0)+\Big(\tfrac{16y_0^3}{3}-24y_0^2+48y_0\Big)\ H(0,0;y_0)+\Big(\tfrac{4d'_1y_0^3}{3}-6d'_1y_0^2+12d'_1y_0+4\ H(0;\alpha_0)\Big)H(0,1;y_0)+\Big(-\alpha_0^4+\tfrac{16\alpha_0^3}{3}-12\alpha_0^2+16\ \alpha_0-\tfrac{2y_0^3}{3}+3y_0^2-6y_0-\tfrac{2}{y_0-1}-2\Big)\ H(0,c_1(\alpha_0);y_0)+\Big(\tfrac{4d'_1y_0^3}{3}+\tfrac{2y_0^3}{3}-6\ d'_1y_0^2-3y_0^2+12d'_1y_0+6y_0-\tfrac{22\ d'_1}{3}+\tfrac{2}{y_0-1}-\tfrac{19}{3}\Big)\ H(1,0;y_0)+\Big(\tfrac{d'^2_1y_0^3}{3}-\tfrac{3d'^2_1y_0^2}{2}+3\ d'^2_1y_0-\tfrac{11d'^2_1}{6}+2H(0;\alpha_0)\Big)\ H(1,1;y_0)+$$

$$\Big(-\frac{2y_0^3}{3}+3y_0^2-6\,y_0-\frac{2}{y_0-1}+\frac{19}{3}\Big)H(1,c_1(\alpha_0);y_0)+\Big(-2\,\alpha_0+\frac{2}{y_0-1}+2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)-$$
$$16H(0,0,0;y_0)-4\,d_1'H(0,0,1;y_0)+4H(0,0,c_1(\alpha_0);y_0)+(-4d_1'-4)\,H(0,1,0;y_0)-$$
$$d_1'^2H(0,1,1;y_0)+4H(0,1,c_1(\alpha_0);y_0)-2\,H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+2H(1,0,c_1(\alpha_0);y_0)-$$
$$2H(1,1,0;y_0)+2\,H(1,1,c_1(\alpha_0);y_0)-2H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\frac{\pi^2}{3\,(y_0-1)}-\frac{3\zeta_3}{2}+\frac{\pi^2}{3},$$

$$(k*i)_0^{(-1)}=\frac{1}{36}d_1y_0^3\alpha_0^4+\frac{1}{27}d_1'y_0^3\alpha_0^4-\frac{19\,y_0^3\alpha_0^4}{108}-\frac{5}{24}d_1y_0^2\alpha_0^4-\frac{13}{36}d_1'\,y_0^2\alpha_0^4+\frac{35y_0^2\alpha_0^4}{24}+\frac{5}{6}d_1y_0\,\alpha_0^4+$$
$$\frac{47}{18}d_1'y_0\alpha_0^4-\frac{17y_0\,\alpha_0^4}{2}-\frac{31}{324}d_1y_0^3\alpha_0^3-\frac{29}{162}d_1'y_0^3\,\alpha_0^3+\frac{263y_0^3\alpha_0^3}{324}+\frac{91}{108}d_1y_0^2\,\alpha_0^3+\frac{187}{108}d_1'y_0^2\alpha_0^3-\frac{193y_0^2\,\alpha_0^3}{27}-$$
$$\frac{245}{54}d_1y_0\alpha_0^3-\frac{1549}{108}d_1'y_0\,\alpha_0^3+\frac{1354y_0\alpha_0^3}{27}-\frac{17}{216}d_1y_0^3\,\alpha_0^2+\frac{35}{108}d_1'y_0^3\alpha_0^2-\frac{245y_0^3\,\alpha_0^2}{216}-\frac{17}{27}d_1y_0^2\alpha_0^2-$$
$$\frac{707}{216}d_1'y_0^2\,\alpha_0^2+\frac{2803y_0^2\alpha_0^2}{216}+\frac{895}{108}d_1y_0\,\alpha_0^2+\frac{809}{27}d_1'y_0\alpha_0^2-\frac{3013y_0\,\alpha_0^2}{27}+\frac{205}{108}d_1y_0^3\alpha_0-\frac{1}{6}d_1'y_0^3\,\alpha_0-\frac{58y_0^3\alpha_0}{27}-$$
$$\frac{659}{108}d_1y_0^2\,\alpha_0+\frac{74}{27}d_1'y_0^2\alpha_0-\frac{55y_0^2\alpha_0}{27}-\frac{d_1\,y_0\alpha_0}{36}-\frac{278d_1'y_0\alpha_0}{9}+\frac{1379y_0\,\alpha_0}{12}-\frac{7\alpha_0}{12(y_0-1)}-\frac{7\alpha_0}{12}-\frac{d_1'^3\,y_0^3}{81}+$$
$$\frac{5d_1'^2y_0^3}{27}-\frac{28d_1'\,y_0^3}{27}+\frac{1}{27}d_1'\pi^2y_0^3-\frac{49\pi^2\,y_0^3}{108}+\frac{268y_0^3}{81}+\frac{43d_1'^3\,y_0^2}{432}-\frac{179d_1'^2y_0^2}{108}+\frac{1891d_1'y_0^2}{216}-\frac{7}{36}d_1'\pi^2y_0^2+\frac{37\pi^2y_0^2}{18}-$$
$$\frac{161\,y_0^2}{8}-\frac{251d_1'^3y_0}{216}+\frac{545d_1'^2\,y_0}{27}-\frac{10847d_1'y_0}{108}+\frac{11}{18}d_1'\pi^2\,y_0-\frac{21\pi^2y_0}{4}+164y_0+\Big(\frac{y_0^3\,\alpha_0^4}{9}-\frac{5y_0^2\alpha_0^4}{6}+\frac{10y_0\alpha_0^4}{3}-$$
$$\frac{13\,y_0^3\alpha_0^3}{27}+\frac{34y_0^2\alpha_0^3}{9}-\frac{160y_0\,\alpha_0^3}{9}+\frac{11y_0^3\alpha_0^2}{18}-\frac{109y_0^2\,\alpha_0^2}{18}+\frac{316y_0\alpha_0^2}{9}+\frac{7y_0^3\alpha_0}{9}+\frac{7\,y_0^2\alpha_0}{9}-\frac{86y_0\alpha_0}{3}-\frac{205d_1y_0^3}{108}-$$
$$\frac{17\,d_1'y_0^3}{54}+\frac{91y_0^3}{18}+\frac{22d_1y_0^2}{3}+\frac{10\,d_1'y_0^2}{9}-\frac{187y_0^2}{9}+\frac{217d_1}{36}-\frac{d_1'}{6}-\frac{469d_1y_0}{36}+\frac{7d_1'y_0}{18}+\frac{314\,y_0}{9}+\frac{217d_1}{36(y_0-1)}-$$
$$\frac{d_1'}{6(y_0-1)}-\frac{88}{9\,(y_0-1)}-\frac{19}{12(y_0-1)^2}-\frac{295}{36}\Big)\,H(0;\alpha_0)+\Big(\frac{1}{9}d_1y_0^3\alpha_0^4-\frac{5}{6}d_1y_0^2\,\alpha_0^4+\frac{10}{3}d_1y_0\alpha_0^4-\frac{13}{27}d_1y_0^3\,\alpha_0^3+$$
$$\frac{34}{9}d_1y_0^2\alpha_0^3-\frac{160}{9}d_1y_0\,\alpha_0^3+\frac{11}{18}d_1y_0^3\alpha_0^2-\frac{109}{18}d_1y_0^2\,\alpha_0^2+\frac{316}{9}d_1y_0\alpha_0^2+\frac{7}{9}d_1y_0^3\,\alpha_0+\frac{7}{9}d_1y_0^2\alpha_0-\frac{86d_1y_0\alpha_0}{3}-$$
$$\frac{55d_1\,y_0^3}{54}+\frac{7d_1y_0^2}{3}+8d_1y_0\Big)\,H(1;\alpha_0)+\Big(-\frac{1}{12}d_1y_0^3\alpha_0^4-\frac{1}{18}d_1'y_0^3\,\alpha_0^4+\frac{5y_0^3\alpha_0^4}{12}+\frac{1}{2}d_1y_0^2\,\alpha_0^4+\frac{5}{12}d_1'y_0^2\alpha_0^4-$$
$$\frac{5y_0^2\alpha_0^4}{2}+\frac{5\,d_1\alpha_0^4}{6}+\frac{47d_1'\alpha_0^4}{36}-\frac{5}{4}d_1y_0\,\alpha_0^4-\frac{5}{3}d_1'y_0\alpha_0^4+\frac{29y_0\alpha_0^4}{4}-\frac{31\,\alpha_0^4}{6}+\frac{13}{27}d_1y_0^3\alpha_0^3+\frac{8}{27}d_1'y_0^3\,\alpha_0^3-$$
$$\frac{125y_0^3\alpha_0^3}{54}-\frac{8}{3}d_1y_0^2\,\alpha_0^3-\frac{37}{18}d_1'y_0^2\alpha_0^3+\frac{40y_0^2\,\alpha_0^3}{3}-\frac{221d_1\alpha_0^3}{54}-\frac{313d_1'\,\alpha_0^3}{54}+\frac{61}{9}d_1y_0\alpha_0^3+\frac{77}{9}d_1'y_0\,\alpha_0^3-\frac{379y_0\alpha_0^3}{9}+$$
$$\frac{745\alpha_0^3}{27}-\frac{23}{18}d_1\,y_0^3\alpha_0^2-\frac{2}{3}d_1'y_0^3\alpha_0^2+\frac{203y_0^3\,\alpha_0^2}{36}+\frac{13}{2}d_1y_0^2\alpha_0^2+\frac{17}{4}d_1'y_0^2\,\alpha_0^2-\frac{373y_0^2\alpha_0^2}{12}+\frac{287d_1\alpha_0^2}{36}+\frac{28\,d_1'\alpha_0^2}{3}-$$
$$\frac{95}{6}d_1y_0\alpha_0^2-\frac{35}{2}d_1'y_0\,\alpha_0^2+\frac{599y_0\alpha_0^2}{6}-\frac{161\alpha_0^2}{3}+\frac{25}{9}d_1\,y_0^3\alpha_0+\frac{8}{9}d_1'y_0^3\alpha_0-\frac{169y_0^3\alpha_0}{18}-13d_1\,y_0^2\alpha_0-$$
$$\frac{31}{6}d_1'y_0^2\alpha_0+\frac{295y_0^2\,\alpha_0}{6}-\frac{343d_1\alpha_0}{18}-\frac{47d_1'\alpha_0}{6}+\frac{85d_1y_0\,\alpha_0}{3}+\frac{59d_1'y_0\alpha_0}{3}-\frac{440y_0\,\alpha_0}{3}+\frac{\alpha_0}{y_0-1}+\frac{149\alpha_0}{2}-\frac{205d_1\,y_0^3}{108}-$$
$$\frac{25d_1'y_0^3}{54}+\frac{305y_0^3}{54}+\frac{22\,d_1y_0^2}{3}+\frac{7d_1'y_0^2}{3}-\frac{919y_0^2}{36}+\frac{217\,d_1}{36}-\frac{d_1'}{6}-\frac{469d_1y_0}{36}-8d_1'y_0+\frac{602\,y_0}{9}+\Big(-\frac{1}{3}y_0^3\alpha_0^4+2y_0^2\alpha_0^4-$$
$$5y_0\,\alpha_0^4+\frac{10\alpha_0^4}{3}+\frac{16y_0^3\alpha_0^3}{9}-10y_0^2\,\alpha_0^3+\frac{76y_0\alpha_0^3}{3}-\frac{136\alpha_0^3}{9}-4y_0^3\alpha_0^2+21\,y_0^2\alpha_0^2-52y_0\alpha_0^2+\frac{76\alpha_0^2}{3}+\frac{16y_0^3\alpha_0}{3}-$$
$$26\,y_0^2\alpha_0+60y_0\alpha_0-\frac{82\alpha_0}{3}-\frac{25y_0^3}{9}+\frac{35\,y_0^2}{3}-23y_0+\frac{13}{3(y_0-1)}+\frac{13}{3}\Big)\,H(0;\alpha_0)+\Big(-\frac{1}{3}d_1y_0^3\alpha_0^4+2d_1y_0^2\alpha_0^4+$$
$$\frac{10\,d_1\alpha_0^4}{3}-5d_1y_0\alpha_0^4+\frac{16}{9}d_1y_0^3\alpha_0^3-10d_1\,y_0^2\alpha_0^3-\frac{136d_1\alpha_0^3}{9}+\frac{76}{3}d_1y_0\alpha_0^3-4d_1\,y_0^3\alpha_0^2+21d_1y_0^2\alpha_0^2+$$
$$\frac{76d_1\alpha_0^2}{3}-52d_1y_0\,\alpha_0^2+\frac{16}{3}d_1y_0^3\alpha_0-26d_1y_0^2\alpha_0-\frac{82d_1\,\alpha_0}{3}+60d_1y_0\alpha_0-\frac{25d_1y_0^3}{9}+\frac{35d_1y_0^2}{3}+\frac{13d_1}{3}-$$
$$23d_1y_0+\frac{13d_1}{3(y_0-1)}\Big)\,H(1;\alpha_0)+\frac{217d_1}{36(y_0-1)}-\frac{d_1'}{6\,(y_0-1)}-\frac{88}{9(y_0-1)}-\frac{19}{12\,(y_0-1)^2}-\frac{295}{36}\Big)H(c_1(\alpha_0);y_0)+$$
$$\Big(-\frac{7\,y_0^3}{3}+\frac{26y_0^2}{3}-11y_0+\frac{13}{3(y_0-1)}+\frac{13}{3}\,\Big)H(0,0;\alpha_0)+\Big(-\frac{16d_1'y_0^3}{9}+\frac{175\,y_0^3}{9}+\frac{28d_1'y_0^2}{3}-90y_0^2-\frac{88d_1'y_0}{3}+$$
$$241\,y_0-\frac{13}{y_0-1}-13\Big)H(0,0;y_0)+\Big(-\frac{7d_1\,y_0^3}{3}+\frac{26d_1y_0^2}{3}-11d_1y_0+\frac{13d_1}{3}+\frac{13\,d_1}{3(y_0-1)}\Big)H(0,1;\alpha_0)+\Big(-$$
$$\frac{4}{9}d_1'^2\,y_0^3+\frac{77d_1'y_0^3}{18}+\frac{7d_1'^2y_0^2}{3}-\frac{61d_1'\,y_0^2}{3}-\frac{22d_1'^2y_0}{3}+\frac{115d_1'y_0}{2}-\frac{13\,d_1'}{6}+\Big(-\frac{4d_1y_0^3}{3}+\frac{4y_0^3}{3}+6d_1y_0^2-6\,y_0^2-$$
$$12d_1y_0+12y_0+\frac{38d_1}{3}-\frac{4\,d_1}{y_0-1}+\frac{4}{y_0-1}+\frac{62}{3}\Big)H(0;\alpha_0)-8H(0,0;\alpha_0)-8\,d_1H(0,1;\alpha_0)-\frac{13d_1'}{6(y_0-1)}-$$
$$\frac{2d_1\pi^2}{3}\Big)\,H(0,1;y_0)+\Big(\frac{d_1\alpha_0^4}{2}-\frac{\alpha_0^4}{2}-\frac{26d_1\,\alpha_0^3}{9}+\frac{38\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{3}-\frac{49\,\alpha_0^2}{3}-\frac{50d_1\alpha_0}{3}+\frac{142\alpha_0}{3}+\frac{2d_1'\,y_0^3}{9}-$$
$$\frac{49y_0^3}{18}-\frac{7d_1'y_0^2}{6}+\frac{37\,y_0^2}{3}+4d_1-2d_1'+\frac{11d_1'y_0}{3}-\frac{63y_0}{2}+\Big(2\,\alpha_0^4-\frac{32\alpha_0^3}{3}+24\alpha_0^2-32\alpha_0+\frac{4y_0^3}{3}-6y_0^2+12\,y_0+$$
$$\frac{4}{y_0-1}+4\Big)H(0;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{32d_1\,\alpha_0^3}{3}+24d_1\alpha_0^2-32d_1\alpha_0+\frac{4d_1y_0^3}{3}-6d_1y_0^2+4\,d_1+12d_1y_0+$$



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$$\frac{4d_1}{y_0-1}\Big)H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{11}{6\,(y_0-1)}-\frac{1}{(y_0-1)^2}-\frac{5}{6}\Big)\,H(0,c_1(\alpha_0);y_0)+\Big(-\frac{4}{9}d_1'^2y_0^3+\frac{73d_1'\,y_0^3}{18}+$$

$$\frac{49y_0^3}{18}+\frac{7d_1'^2y_0^2}{3}-\frac{4d_1\,y_0^2}{3}-\frac{115d_1'y_0^2}{6}-\frac{41y_0^2}{3}-\frac{22d_1'^2\,y_0}{3}+\frac{16d_1y_0}{3}+\frac{323d_1'y_0}{6}+\frac{221\,y_0}{6}+\frac{49d_1'^2}{9}-\frac{37d_1}{18}-$$

$$\frac{697\,d_1'}{18}+\Big(\frac{4y_0^3}{3}-6y_0^2+12\,y_0+\frac{4}{y_0-1}-\frac{38}{3}\Big)H(0;\alpha_0)+\frac{d_1}{3(y_0-1)}-\frac{d_1'}{6(y_0-1)}+\frac{37}{6\,(y_0-1)}+\frac{1}{(y_0-1)^2}+\frac{4\pi^2}{3}-$$

$$\frac{130}{3}\Big)\,H(1,0;y_0)+\Big(-\frac{1}{9}y_0^3d_1'^3+\frac{7y_0^2\,d_1'^3}{12}-\frac{11y_0d_1'^3}{6}+\frac{49d_1'^3}{36}+\frac{7\,y_0^3d_1'^2}{9}-4y_0^2d_1'^2+13y_0d_1'^2-\frac{88\,d_1'^2}{9}+$$

$$\frac{\pi^2d_1'}{3}+\Big(-\frac{4d_1y_0^3}{3}+\frac{4\,d_1'y_0^3}{3}-\frac{2y_0^3}{3}+6d_1y_0^2-6d_1'y_0^2+3y_0^2-12\,d_1y_0+12d_1'y_0-6y_0+\frac{38d_1}{3}-10d_1'-$$

$$\frac{8\,d_1}{y_0-1}+\frac{4d_1'}{y_0-1}+\frac{2}{y_0-1}+\frac{43}{3}\Big)\,H(0;\alpha_0)-4H(0,0;\alpha_0)-4d_1H(0,1;\alpha_0)-\frac{2d_1\pi^2}{3}+\frac{\pi^2}{3}\Big)H(1,1;y_0)+$$

$$\Big(-\frac{1}{6}d_1'y_0^3\,\alpha_0^4+d_1'y_0^2\alpha_0^4+\frac{5d_1'\alpha_0^4}{3}-\frac{5}{2}d_1'y_0\,\alpha_0^4+\frac{8}{9}d_1'y_0^3\alpha_0^3-5d_1'y_0^2\alpha_0^3-\frac{77d_1'\,\alpha_0^3}{9}+\frac{38}{3}d_1'y_0\alpha_0^3-$$

$$2d_1'y_0^3\alpha_0^2+\frac{21}{2}\,d_1'y_0^2\alpha_0^2+\frac{35d_1'\alpha_0^2}{2}-26d_1'y_0\,\alpha_0^2+\frac{8}{3}d_1'y_0^3\alpha_0-13d_1'y_0^2\alpha_0-\frac{65d_1'\,\alpha_0}{3}+30d_1'y_0\alpha_0-\frac{7d_1'y_0^3}{6}-$$

$$\frac{49\,y_0^3}{18}+\frac{4d_1y_0^2}{3}+\frac{14d_1'y_0^2}{3}+\frac{41\,y_0^2}{3}+\frac{37d_1}{18}+\frac{13d_1'}{3}-\frac{16d_1\,y_0}{3}-\frac{47d_1'y_0}{6}-\frac{221y_0}{6}+\Big(\frac{4\,y_0^3}{3}-6y_0^2+12y_0+\frac{4}{y_0-1}-$$

$$\frac{38}{3}\Big)\,H(0;\alpha_0)+\Big(\frac{4d_1y_0^3}{3}-6d_1y_0^2+12d_1y_0-\frac{38\,d_1}{3}+\frac{4d_1}{y_0-1}\Big)H(1;\alpha_0)-\frac{d_1}{3\,(y_0-1)}+\frac{d_1'}{6(y_0-1)}-\frac{37}{6\,(y_0-1)}-$$

$$\frac{1}{(y_0-1)^2}+\frac{130}{3}\Big)\,H(1,c_1(\alpha_0);y_0)+\Big(-\frac{1}{3}y_0^3\alpha_0^4+2y_0^2\alpha_0^4-5y_0\,\alpha_0^4+\frac{10\alpha_0^4}{3}+\frac{16y_0^3\alpha_0^3}{9}-10y_0^2\,\alpha_0^3+\frac{76y_0\alpha_0^3}{3}-$$

$$\frac{136\alpha_0^3}{9}-4y_0^3\alpha_0^2+21\,y_0^2\alpha_0^2-52y_0\alpha_0^2+\frac{76\alpha_0^2}{3}+\frac{16y_0^3\alpha_0}{3}-26\,y_0^2\alpha_0+60y_0\alpha_0-\frac{82\alpha_0}{3}-\frac{25y_0^3}{9}+\frac{35\,y_0^2}{3}-$$

$$23y_0+\frac{13}{3(y_0-1)}+\frac{13}{3}\Big)H(c_1(\alpha_0),0;\;y_0)+\Big(-\frac{1}{6}d_1'y_0^3\alpha_0^4+d_1'y_0^2\alpha_0^4+\frac{5d_1'\,\alpha_0^4}{3}-\frac{5}{2}d_1'y_0\alpha_0^4+\frac{8}{9}d_1'y_0^3\alpha_0^3-$$

$$5\,d_1'y_0^2\alpha_0^3-\frac{68d_1'\alpha_0^3}{9}+\frac{38}{3}d_1'y_0\,\alpha_0^3-2d_1'y_0^3\alpha_0^2+\frac{21}{2}d_1'y_0^2\alpha_0^2+\frac{38d_1'\,\alpha_0^2}{3}-26d_1'y_0\alpha_0^2+\frac{8}{3}d_1'y_0^3\alpha_0-$$

$$13d_1'y_0^2\,\alpha_0-\frac{41d_1'\alpha_0}{3}+30d_1'y_0\alpha_0-\frac{25d_1'\,y_0^3}{18}+\frac{35d_1'y_0^2}{6}+\frac{13d_1'}{6}-\frac{23d_1'\,y_0}{2}+\frac{13d_1'}{6(y_0-1)}\Big)\,H(c_1(\alpha_0),1;y_0)+$$

$$\Big(-\frac{1}{2}y_0^3\alpha_0^4+3y_0^2\,\alpha_0^4-\frac{15y_0\alpha_0^4}{2}+5\alpha_0^4+\frac{8y_0^3\alpha_0^3}{3}-15y_0^2\,\alpha_0^3+38y_0\alpha_0^3-\frac{68\alpha_0^3}{3}-6y_0^3\alpha_0^2+\frac{63y_0^2\,\alpha_0^2}{2}-78y_0\alpha_0^2+$$

$$37\alpha_0^2+8y_0^3\alpha_0-39y_0^2\alpha_0+4d_1\alpha_0-2\,d_1'\alpha_0+90y_0\alpha_0-43\alpha_0-\frac{25y_0^3}{6}+\frac{35y_0^2}{2}-4\,d_1+2d_1'-\frac{69y_0}{2}+$$

$$\Big(4\alpha_0-\frac{4}{y_0-1}-4\Big)\,H(0;\alpha_0)+\Big(4\alpha_0d_1-\frac{4d_1}{y_0-1}-4d_1\Big)\,H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+\frac{21}{2\,(y_0-1)}+\frac{1}{(y_0-1)^2}+$$

$$\frac{19}{2}\Big)\,H(c_1(\alpha_0),c_1(\alpha_0);y_0)+\Big(-\frac{64y_0^3}{3}+96y_0^2-192\,y_0\Big)H(0,0,0;y_0)+\Big(-\frac{16d_1'y_0^3}{3}+24d_1'y_0^2-$$

$$48\,d_1'y_0+(8d_1-8)H(0;\alpha_0)\Big)H(0,0,1;y_0)+\Big(\frac{8\,y_0^3}{3}-12y_0^2+24y_0-8H(0;\alpha_0)-8d_1H(1;\alpha_0)+$$

$$\frac{8}{y_0-1}+8\,\Big)H(0,0,c_1(\alpha_0);y_0)+\Big(\frac{4d_1y_0^3}{3}-\frac{16d_1'\,y_0^3}{3}-\frac{4y_0^3}{3}-6d_1y_0^2+24d_1'y_0^2+6y_0^2+12d_1\,y_0-48d_1'y_0-$$

$$12y_0-\frac{38d_1}{3}-8H(0;\alpha_0)+\frac{4\,d_1}{y_0-1}-\frac{4}{y_0-1}-\frac{62}{3}\Big)\,H(0,1,0;y_0)+\Big(-\frac{4}{3}d_1'^2y_0^3+6d_1'^2y_0^2-12d_1'^2\,y_0+$$

$$(12d_1-8d_1')H(0;\alpha_0)\Big)H(0,1,1;y_0)+\Big(d_1'\,\alpha_0^4-\frac{16d_1'\alpha_0^3}{3}+12d_1'\alpha_0^2-16d_1'\alpha_0-\frac{4d_1\,y_0^3}{3}+\frac{2d_1'y_0^3}{3}+$$

$$\frac{4y_0^3}{3}+6d_1y_0^2-3d_1'\,y_0^2-6y_0^2+\frac{38d_1}{3}+2d_1'-12d_1y_0+6d_1'y_0+12y_0-8\,H(0;\alpha_0)-8d_1H(1;\alpha_0)-$$

$$\frac{4d_1}{y_0-1}+\frac{2\,d_1'}{y_0-1}+\frac{4}{y_0-1}+\frac{62}{3}\Big)\,H(0,1,c_1(\alpha_0);y_0)+\Big(2\alpha_0^4-\frac{32\alpha_0^3}{3}+24\alpha_0^2-32\,\alpha_0+\frac{4y_0^3}{3}-6y_0^2+12y_0+$$

$$\frac{4}{y_0-1}+4\Big)\,H(0,c_1(\alpha_0),0;y_0)+\Big(d_1'\alpha_0^4-\frac{16d_1'\alpha_0^3}{3}+12d_1'\,\alpha_0^2-16d_1'\alpha_0+\frac{2d_1'y_0^3}{3}-3d_1'y_0^2+2d_1'+$$

$$6d_1'\,y_0+\frac{2d_1'}{y_0-1}\Big)H(0,c_1(\alpha_0),1;y_0)+\Big(3\alpha_0^4-16\,\alpha_0^3+36\alpha_0^2-48\alpha_0+2y_0^3-9y_0^2+18y_0+4H(0;\alpha_0)+$$

$$4d_1\,H(1;\alpha_0)-\frac{2}{y_0-1}-2\Big)\,H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+\Big(-\frac{16d_1'y_0^3}{3}-4y_0^3+24\,d_1'y_0^2+18y_0^2-48d_1'y_0-$$

$$36y_0+\frac{88\,d_1'}{3}-\frac{12}{y_0-1}+38\Big)H(1,0,0;y_0)+\Big(-\frac{4}{3}\,d_1'^2y_0^3-\frac{2d_1'y_0^3}{3}+6d_1'^2y_0^2+3d_1'y_0^2-12\,d_1'^2y_0-6d_1'y_0+$$

$$\frac{22d_1'^2}{3}+\frac{19d_1'}{3}+(4d_1-4)\,H(0;\alpha_0)-\frac{2d_1'}{y_0-1}\Big)H(1,0,1;y_0)+\Big(\frac{2d_1'\,y_0^3}{3}+\frac{2y_0^3}{3}-3d_1'y_0^2-3y_0^2+6d_1'y_0+$$

$$6\,y_0-\frac{11d_1'}{3}-4H(0;\alpha_0)-4d_1H(1;\alpha_0)-\frac{4\,d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+\frac{6}{y_0-1}+\frac{5}{3}\Big)\,H(1,0,c_1(\alpha_0);y_0)+\Big(-$$

$$\frac{4}{3}d_1'^2y_0^3+\frac{4d_1\,y_0^3}{3}-\frac{4d_1'y_0^3}{3}+\frac{2y_0^3}{3}+6d_1'^2y_0^2-6\,d_1y_0^2+6d_1'y_0^2-3y_0^2-12d_1'^2y_0+12d_1y_0-12d_1'y_0+6\,y_0+$$

$$
\frac{22d_1'^2}{3}-\frac{38d_1}{3}+10d_1'-4H(0;\alpha_0)+\frac{8\ d_1}{y_0-1}-\frac{4d_1'}{y_0-1}-\frac{2}{y_0-1}-\frac{43}{3}\Big)\ H(1,1,0;y_0)+\Big(-\frac{1}{3}y_0^3d_1'^3+\frac{3y_0^2\ d_1'^3}{2}-
$$
$$
3y_0d_1'^3+\frac{11d_1'^3}{6}+(8d_1-4d_1'-2)H(0;\alpha_0)\ \Big)H(1,1,1;y_0)+\Big(-\frac{4d_1y_0^3}{3}+\frac{4d_1'\ y_0^3}{3}-\frac{2y_0^3}{3}+6d_1y_0^2-6d_1'y_0^2+
$$
$$
3y_0^2-12d_1\ y_0+12d_1'y_0-6y_0+\frac{38d_1}{3}-10d_1'-4H(0;\alpha_0)-4d_1\ H(1;\alpha_0)-\frac{8d_1}{y_0-1}+\frac{4\ d_1'}{y_0-1}+\frac{2}{y_0-1}+
$$
$$
\frac{43}{3}\Big)\ H(1,1,c_1(\alpha_0);y_0)+\Big(\frac{4y_0^3}{3}-6y_0^2+12\ y_0+\frac{4}{y_0-1}-\frac{38}{3}\Big)\ H(1,c_1(\alpha_0),0;y_0)+\Big(\frac{2d_1'y_0^3}{3}-3d_1'y_0^2+
$$
$$
6d_1'\ y_0-\frac{19d_1'}{3}+\frac{2d_1'}{y_0-1}\Big)\ H(1,c_1(\alpha_0),1;y_0)+\Big(2y_0^3-9y_0^2+18y_0+4H(0;\alpha_0)+4d_1H(1;\ \alpha_0)+\frac{4d_1}{y_0-1}-
$$
$$
\frac{2d_1'}{y_0-1}+\frac{2}{y_0-1}-27\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\Big(2\alpha_0d_1'-\frac{2d_1'}{y_0-1}-2\ d_1'\Big)H(c_1(\alpha_0),1,c_1(\alpha_0);y_0)+
$$
$$
\Big(4\ \alpha_0-\frac{4}{y_0-1}-4\Big)H(c_1(\alpha_0),c_1(\alpha_0),0;y_0)+\Big(2\alpha_0\ d_1'-\frac{2d_1'}{y_0-1}-2d_1'\Big)\ H(c_1(\alpha_0),c_1(\alpha_0),1;y_0)+
$$
$$
\Big(6\alpha_0-\frac{6}{y_0-1}-6\Big)\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)+64H(0,0,0,0;y_0)+16d_1'\ H(0,0,0,1;y_0)-
$$
$$
16H(0,0,0,c_1(\alpha_0);y_0)+(-8d_1+16d_1'+8)H(0,0,1,0;\ y_0)+4d_1'^2H(0,0,1,1;y_0)+(8d_1-
$$
$$
4d_1'-8)H(0,0,1,c_1(\alpha_0);y_0)-8\ H(0,0,c_1(\alpha_0),0;y_0)-4d_1'H(0,0,c_1(\alpha_0),1;y_0)-
$$
$$
4\ H(0,0,c_1(\alpha_0),c_1(\alpha_0);y_0)+(16d_1'+24)H(0,1,0,0;y_0)+\Big(4\ d_1'^2+4d_1'\Big)H(0,1,0,1;y_0)+
$$
$$
(4d_1-4d_1'-8)\ H(0,1,0,c_1(\alpha_0);y_0)+\Big(4d_1'^2+8d_1'-12d_1\Big)\ H(0,1,1,0;y_0)+
$$
$$
d_1'^3H(0,1,1,1;y_0)+(12d_1-8d_1')\ H(0,1,1,c_1(\alpha_0);y_0)-8H(0,1,c_1(\alpha_0),0;y_0)-
$$
$$
4d_1'\ H(0,1,c_1(\alpha_0),1;y_0)+(-4d_1+2d_1'-8)\ H(0,1,c_1(\alpha_0),c_1(\alpha_0);y_0)+
$$
$$
2d_1'H(0,c_1(\alpha_0),1,c_1(\alpha_0);y_0)+4\ H(0,c_1(\alpha_0),c_1(\alpha_0),0;y_0)+2d_1'H(0,c_1(\alpha_0),c_1(\alpha_0),1;y_0)+
$$
$$
6\ H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)-8H(1,0,0,c_1(\alpha_0);y_0)+(4-4d_1)\ H(1,0,1,0;y_0)+
$$
$$
(4d_1-2d_1'-4)H(1,0,1,c_1(\alpha_0);y_0)-4\ H(1,0,c_1(\alpha_0),0;y_0)-2d_1'H(1,0,c_1(\alpha_0),1;y_0)+
$$
$$
2\ H(1,0,c_1(\alpha_0),c_1(\alpha_0);y_0)+12H(1,1,0,0;y_0)+2d_1'\ H(1,1,0,1;y_0)+(4d_1-2d_1'-
$$
$$
6)H(1,1,0,c_1(\alpha_0);y_0)+(-8d_1+4\ d_1'+2)H(1,1,1,0;y_0)+(8d_1-4d_1'-
$$
$$
2)H(1,1,1,c_1(\alpha_0);y_0)-4\ H(1,1,c_1(\alpha_0),0;y_0)-2d_1'H(1,1,c_1(\alpha_0),1;y_0)+(-4d_1+2d_1'-
$$
$$
2)\ H(1,1,c_1(\alpha_0),c_1(\alpha_0);y_0)+2d_1'H(1,c_1(\alpha_0),1,c_1(\alpha_0);y_0)+4\ H(1,c_1(\alpha_0),c_1(\alpha_0),0;y_0)+
$$
$$
2d_1'H(1,c_1(\alpha_0),c_1(\alpha_0),1;y_0)+6\ H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)+H(1;y_0)\Big(\frac{1}{18}d_1'\ y_0^3\alpha_0^4-
$$
$$
\frac{5}{12}d_1'y_0^2\alpha_0^4-\frac{47d_1'\ \alpha_0^4}{36}+\frac{5}{3}d_1'y_0\alpha_0^4-\frac{13}{54}d_1'y_0^3\alpha_0^3+\ \frac{17}{9}d_1'y_0^2\alpha_0^3+\frac{391d_1'\alpha_0^3}{54}-\frac{80}{9}\ d_1'y_0\alpha_0^3+\frac{11}{36}d_1'y_0^3\alpha_0^2-
$$
$$
\frac{109}{36}d_1'\ y_0^2\alpha_0^2-\frac{89d_1'\alpha_0^2}{6}+\frac{158}{9}d_1'y_0\ \alpha_0^2+\frac{7}{18}d_1'y_0^3\alpha_0+\frac{7}{18}d_1'y_0^2\ \alpha_0+\frac{247d_1'\alpha_0}{18}-\frac{43d_1'y_0\alpha_0}{3}+\frac{251\ d_1'^3}{216}-
$$
$$
\frac{d_1'^3y_0^3}{27}+\frac{11d_1'^2\ y_0^3}{27}-\frac{44d_1'y_0^3}{27}+\frac{1}{9}d_1'\pi^2\ y_0^3+\frac{\pi^2y_0^3}{9}-\frac{398d_1'^2}{27}+\frac{17d_1'^3\ y_0^2}{72}-\frac{25d_1'^2y_0^2}{9}+\frac{37d_1'\ y_0^2}{4}-\frac{1}{2}d_1'\pi^2y_0^2-
$$
$$
\frac{\pi^2\ y_0^2}{2}+\frac{4361d_1'}{108}-\frac{49d_1'^3y_0}{36}+\frac{154\ d_1'^2y_0}{9}-48d_1'y_0+d_1'\pi^2y_0+\pi^2y_0+\Big(-\frac{17\ d_1'y_0^3}{18}-\frac{49y_0^3}{18}+\frac{4d_1y_0^2}{3}+
$$
$$
\frac{19\ d_1'y_0^2}{6}+\frac{41y_0^2}{3}-\frac{16d_1y_0}{3}-\frac{11d_1'\ y_0}{6}-\frac{221y_0}{6}+\frac{37d_1}{18}-\frac{7\ d_1'}{18}-\frac{d_1}{3(y_0-1)}+\frac{d_1'}{6(y_0-1)}-\frac{37}{6\ (y_0-1)}-\frac{1}{(y_0-1)^2}+
$$
$$
\frac{130}{3}\Big)H(0;\alpha_0)+\Big(\frac{4\ y_0^3}{3}-6y_0^2+12y_0+\frac{4}{y_0-1}-\frac{38}{3}\Big)\ H(0,0;\alpha_0)+\Big(\frac{4d_1y_0^3}{3}-6d_1y_0^2+12d_1y_0-\frac{38\ d_1}{3}+
$$
$$
\frac{4d_1}{y_0-1}\Big)H(0,1;\alpha_0)+\frac{2d_1\pi^2}{3\ (y_0-1)}-\frac{d_1'\pi^2}{3(y_0-1)}-\frac{\pi^2}{3(y_0-1)}-6\ \zeta_3-\frac{11d_1'\pi^2}{18}-\frac{43\pi^2}{18}\Big)+H(0;y_0)\ \Big(\frac{y_0^3\alpha_0^4}{9}-
$$
$$
\frac{5y_0^2\alpha_0^4}{6}+\frac{10y_0\ \alpha_0^4}{3}-\frac{13y_0^3\alpha_0^3}{27}+\frac{34y_0^2\ \alpha_0^3}{9}-\frac{160y_0\alpha_0^3}{9}+\frac{11y_0^3\alpha_0^2}{18}-\frac{109\ y_0^2\alpha_0^2}{18}+\frac{316y_0\alpha_0^2}{9}+\frac{7y_0^3\ \alpha_0}{9}+\frac{7y_0^2\alpha_0}{9}-
$$
$$
\frac{86y_0\alpha_0}{3}-\frac{4d_1'^2\ y_0^3}{27}+\frac{205d_1y_0^3}{108}+\frac{35d_1'y_0^3}{18}+\frac{4\ \pi^2y_0^3}{9}-\frac{625y_0^3}{54}+\frac{17d_1'^2\ y_0^2}{18}-\frac{22d_1y_0^2}{3}-\frac{110d_1'y_0^2}{9}-2\pi^2\ y_0^2+\frac{520y_0^2}{9}-
$$
$$
\frac{217d_1}{36}+\frac{d_1'}{6}-\frac{49\ d_1'^2y_0}{9}+\frac{469d_1y_0}{36}+\frac{1225d_1'y_0}{18}+4\pi^{\ 2}y_0-\frac{2042y_0}{9}+\Big(-\frac{7y_0^3}{3}+\frac{26\ y_0^2}{3}-11y_0+\frac{13}{3(y_0-1)}+
$$
$$
\frac{13}{3}\Big)\ H(0;\alpha_0)-\frac{217d_1}{36(y_0-1)}+\frac{d_1'}{6(y_0-1)}-\frac{4\ \pi^2}{3(y_0-1)}+\frac{88}{9(y_0-1)}+\frac{19}{12(y_0-1)^2}+6\ \zeta_3-\frac{4\pi^2}{3}+\frac{295}{36}\Big)-\frac{2d_1\pi^2}{3\ (y_0-1)}+
$$
$$
\frac{d_1'\pi^2}{3(y_0-1)}+\frac{37\pi^2}{36\ (y_0-1)}+\frac{\pi^2}{6(y_0-1)^2}-4y_0^3\zeta_3+18y_0^2\ \zeta_3-36y_0\zeta_3+\frac{6\zeta_3}{y_0-1}+6\zeta_3-\frac{\pi^{\ 4}}{120}-\frac{2d_1\pi^2}{3}+\frac{d_1'\pi^2}{3}+\frac{31\pi^{\ 2}}{36}.
$$

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