

Pensieve header: Testing and solving the overhand equation.

```
setDirectory["C:\\drorbn\\AcademicPensieve\\2012-05\\beta5.0"];
<< betaCalculus.m
```

```
Clear[ħ];
$PerturbativeDegree = 6;
βSimplify[expr_] := Replace[
  Series[Normal[expr], {ħ, 0, $PerturbativeDegree}],
  sd_SeriesData -> MapAt[Expand, sd, 3]
];
βCollect[B[ω_, μ_]] := B[
  βSimplify[ω],
  βSimplify[μ]
];
{v1, c1, sol} = Get["SolutionToDegree6-120501.m"];
```

v1

$$\left(\begin{array}{l} 1 + \frac{1}{16} c_1 c_2 \hbar^2 + \left(-\frac{1}{256} c_1^3 c_2 - \frac{1}{256} c_1^2 c_2^2 - \frac{1}{256} c_1 c_2^3 \right) \hbar^4 + \left(\frac{139 c_1^5 c_2}{921600} + \frac{49 c_1^4 c_2^2}{368640} + \frac{49 c_1^3 c_2^3}{276480} + \frac{49 c_1^2 c_2^4}{368640} + \frac{139 c_1 c_2^5}{921600} \right) \hbar^6 \\ t[1] \\ t[2] \end{array} \right)$$

ϕ1 = ϕ[v1]

$$\left(\begin{array}{l} 1 \\ t[1] \\ t[2] \\ t[3] \end{array} \right) \left(\begin{array}{l} \left(-\frac{23 c_1 c_2 c_3}{2304} - \frac{11}{576} c_2^2 c_3 - \frac{65 c_2 c_3^2}{4608} \right) \hbar^3 + \left(\frac{179 c_1^3 c_2 c_3}{172800} + \frac{1531 c_1^2 c_2^2 c_3}{460800} \right) \hbar^5 \\ -\frac{c_3 \hbar}{8} + \left(\frac{1}{720} c_1^2 c_3 - \frac{1}{576} c_1 c_2 c_3 - \frac{1}{960} c_2^2 c_3 - \frac{5 c_1 c_3^2}{4608} + \frac{251 c_2 c_3^2}{23040} + \frac{19 c_3^3}{2880} \right) \hbar^3 + \left(\frac{37 c_1^4 c_3}{153600} + \frac{4597 c_1^3 c_2 c_3}{4838400} + \frac{3731 c_1^2 c_2^2 c_3}{1286400} + \frac{137 c_1 c_2^3 c_3}{1286400} + \frac{137 c_1^2 c_2 c_3^2}{1286400} + \frac{137 c_1 c_2^2 c_3^2}{1286400} + \frac{137 c_1^2 c_2^2 c_3^2}{1286400} \right) \hbar^5 \\ \frac{c_2 \hbar}{24} + \left(\frac{13 c_1^2 c_2}{5760} + \frac{1}{192} c_1 c_2^2 - \frac{7 c_2^3}{5760} + \frac{17 c_1 c_2 c_3}{2880} - \frac{11 c_2^2 c_3}{1440} - \frac{7 c_2 c_3^2}{1920} \right) \hbar^3 + \left(\frac{13 c_1^4 c_2}{138240} + \frac{151 c_1^3 c_2^2}{967680} + \frac{11 c_1^2 c_2^3}{368640} + \frac{11 c_1 c_2^4}{471200} + \frac{11 c_1^2 c_2^4}{471200} + \frac{11 c_1^3 c_2^4}{471200} + \frac{11 c_1^4 c_2^4}{471200} \right) \hbar^5 \end{array} \right)$$

The Overhand Equation:

ϕ1 // dΔ[1, 0, 1] // ds[2] // ds[3] // dm[0, 3, 0] // dm[1, 2, 1]

$$\left(\begin{array}{l} 1 - \frac{1}{12} (c_0 c_1) \hbar^2 + \left(\frac{17 c_0^3 c_1}{2880} + \frac{119 c_0^2 c_1^2}{7680} + \frac{9 c_0 c_1^3}{1280} \right) \hbar^4 + \left(-\frac{59 c_0^5 c_1}{96768} - \frac{10457 c_0^4 c_1^2}{3870720} - \frac{709 c_0^3 c_1^3}{161280} - \frac{17 c_0^2 c_1^4}{5120} - \frac{383 c_0 c_1^5}{345600} \right) \hbar^6 + \\ t[0] \\ t[1] \end{array} \right)$$

```
{
  V0 = βCollect[
    B[ω[ħ c1, ħ c2], α[ħ c1, ħ c2] t[1] h[1] +
      β[ħ c1, ħ c2] t[1] h[2] + γ[ħ c1, ħ c2] t[2] h[1] + δ[ħ c1, ħ c2] t[2] h[2]]
  ] /. {
    (ε : (α | β | γ | δ | ω | κ)) [____] => ε0, (ε : (α | β | γ | δ | ω | κ))(k___) [____] => εFromDigits[{k}]
  },
  C0 = βCollect[B[κ[ħ c1], 0]] /. {
    (ε : (α | β | γ | δ | ω | κ)) [____] => ε0, (ε : (α | β | γ | δ | ω | κ))(k___) [____] => εFromDigits[{k}]
  }
}
{
  ω0 + (c2 ω1 + c1 ω10) ħ + (1/2 c22 ω2 + c1 c2 ω11 + 1/2 c12 ω20) ħ2 + (1/6 c23 ω3 + 1/2 c1 c22 ω12 + 1/2 c12 c2 ω21 + 1/6 c13 ω30
}
```

```
{V2, C2} = {V0, C0} /. sol // ColumnForm
```

$$\left(\begin{array}{l} 1 + \frac{1}{16} c_1 c_2 (1 + 16 \delta_{10}) \hbar^2 + \left(\frac{1}{256} c_1^2 c_2^2 (-1 + 40 \gamma_1 + 192 \gamma_1^2 - 8 \delta_{10} - 192 \gamma_1 \delta_{10} + 128 \delta_{10}^2 + 96 \delta_{12} + 32 \delta_{30}) \right. \\ \left. 1 + c_1 \kappa_1 \hbar + \frac{1}{32} c_1^2 (1 + 16 \delta_{10} + 16 \kappa_1^2) \hbar^2 + \frac{1}{96} c_1^3 \kappa_1 (3 + 48 \delta_{10} + 16 \kappa_1^2) \hbar^3 + \frac{c_1^4 (-3 + 160 \gamma_1 + 768 \gamma_1^2 - 768 \gamma_1 \delta_{10} + 768 \delta_{10}^2)}{96} \right) \end{array} \right)$$

```
ϕ2 = ϕ[V2]
```

A very large output was generated. Here is a sample of it:

(<<1>>)

Show Less	Show More	Show Full Output	Set Size Limit...
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```
eqn = ((ϕ2 // dΔ[1, 0, 1] // dS[2] // dS[3] // dm[0, 3, 0] // dm[1, 2, 1]) == B[1, 0])
```

$$1 + \left(-\frac{1}{12} c_0 c_1 + c_0 c_1 \gamma_1 - c_0 c_1 \delta_{10} \right) \hbar^2 + \left(\frac{17 c_0^3 c_1}{2880} + \frac{119 c_0^2 c_1^2}{7680} + \frac{9 c_0 c_1^3}{1280} - \frac{1}{12} c_0^3 c_1 \gamma_1 - \frac{7}{32} c_0^2 c_1^2 \gamma_1 - \frac{1}{16} c_0 c_1^3 \gamma_1 - c_0^3 c_1 \gamma_1^2 - \frac{1}{4} c_0^2 c_1^2 \gamma_1^2 - \frac{1}{2} c_0 c_1^3 \gamma_1^2 - \frac{1}{2} c_0^2 c_1^2 \gamma_{12} - \frac{1}{2} c_0 c_1^3 \gamma_{12} + \frac{1}{6} c_0^3 c_1 \gamma_{30} + \frac{1}{2} c_0^2 c_1^2 \gamma_{30} + \frac{1}{2} c_0 c_1^3 \gamma_{30} + \frac{1}{8} c_0^3 c_1 \delta_{10} + \frac{35}{96} c_0^2 c_1^2 \delta_{10} + \frac{3}{16} c_0 c_1^3 \delta_{10} + c_0^3 c_1 \gamma_1 \delta_{10} + \frac{5}{4} c_0^2 c_1^2 \gamma_1 \delta_{10} + \frac{3}{2} c_0 c_1^3 \gamma_1 \delta_{10} + \frac{1}{2} c_0^2 c_1^2 \delta_{10}^2 + \frac{3}{8} c_0^2 c_1^2 \delta_{12} + \frac{1}{4} c_0 c_1^3 \delta_{12} - \frac{1}{6} c_0^3 c_1 \delta_{30} - \frac{3}{8} c_0^2 c_1^2 \delta_{30} - \frac{1}{4} c_0 c_1^3 \delta_{30} \right) \hbar^4 + \left(-\frac{59 c_0^5 c_1}{96 768} - \frac{10 457 c_0^4 c_1^2}{3 870 720} - \frac{709 c_0^3 c_1^3}{161 280} - \frac{17 c_0^2 c_1^4}{5120} - \frac{383 c_0 c_1^5}{345 600} + \frac{31 c_0^5 c_1 \gamma_1}{2880} + \frac{221 c_0^4 c_1^2 \gamma_1}{4608} + \right)$$

$$\begin{aligned}
& \frac{5269 c_0^3 c_1^2 \gamma_1}{69120} + \frac{581 c_0^2 c_1^4 \gamma_1}{11520} + \frac{463 c_0 c_1^5 \gamma_1}{28800} + \frac{1}{24} c_0^5 c_1 \gamma_1^2 + \frac{1}{6} c_0^4 c_1^2 \gamma_1^2 + \frac{23}{288} c_0^3 c_1^3 \gamma_1^2 + \\
& \frac{7}{48} c_0^2 c_1^4 \gamma_1^2 + \frac{1}{15} c_0 c_1^5 \gamma_1^2 + c_0^5 c_1 \gamma_1^3 + \frac{1}{4} c_0^4 c_1^2 \gamma_1^3 + \frac{1}{4} c_0^3 c_1^3 \gamma_1^3 - \frac{1}{2} c_0^2 c_1^4 \gamma_1^3 + \frac{1}{24} c_0^4 c_1^2 \gamma_{12} + \\
& \frac{23}{144} c_0^3 c_1^3 \gamma_{12} + \frac{1}{6} c_0^2 c_1^4 \gamma_{12} + \frac{1}{24} c_0 c_1^5 \gamma_{12} + c_0^4 c_1^2 \gamma_1 \gamma_{12} + \frac{4}{3} c_0^3 c_1^3 \gamma_1 \gamma_{12} + c_0^2 c_1^4 \gamma_1 \gamma_{12} + \\
& \frac{3}{5} c_0 c_1^5 \gamma_1 \gamma_{12} + \frac{1}{12} c_0^3 c_1^3 \gamma_{23} + \frac{1}{6} c_0^2 c_1^4 \gamma_{23} + \frac{1}{12} c_0 c_1^5 \gamma_{23} - \frac{1}{72} c_0^5 c_1 \gamma_{30} - \frac{11}{144} c_0^4 c_1^2 \gamma_{30} - \\
& \frac{73}{432} c_0^3 c_1^3 \gamma_{30} - \frac{25}{144} c_0^2 c_1^4 \gamma_{30} - \frac{7}{144} c_0 c_1^5 \gamma_{30} - \frac{1}{3} c_0^5 c_1 \gamma_1 \gamma_{30} - c_0^4 c_1^2 \gamma_1 \gamma_{30} - \frac{11}{9} c_0^3 c_1^3 \gamma_1 \gamma_{30} - \\
& \frac{2}{3} c_0^2 c_1^4 \gamma_1 \gamma_{30} - \frac{7}{15} c_0 c_1^5 \gamma_1 \gamma_{30} - \frac{1}{24} c_0^4 c_1^2 \gamma_{41} - \frac{1}{6} c_0^3 c_1^3 \gamma_{41} - \frac{1}{4} c_0^2 c_1^4 \gamma_{41} - \frac{1}{8} c_0 c_1^5 \gamma_{41} + \\
& \frac{1}{120} c_0^5 c_1 \gamma_{50} + \frac{1}{24} c_0^4 c_1^2 \gamma_{50} + \frac{1}{12} c_0^3 c_1^3 \gamma_{50} + \frac{1}{12} c_0^2 c_1^4 \gamma_{50} + \frac{1}{24} c_0 c_1^5 \gamma_{50} - \frac{41 c_0^5 c_1 \delta_{10}}{2880} - \\
& \frac{87 c_0^4 c_1^2 \delta_{10}}{1280} - \frac{2717 c_0^3 c_1^3 \delta_{10}}{23040} - \frac{1031 c_0^2 c_1^4 \delta_{10}}{11520} - \frac{77 c_0 c_1^5 \delta_{10}}{2880} - \frac{1}{12} c_0^5 c_1 \gamma_1 \delta_{10} - \frac{13}{48} c_0^4 c_1^2 \gamma_1 \delta_{10} - \\
& \frac{53}{144} c_0^3 c_1^3 \gamma_1 \delta_{10} - \frac{1}{2} c_0^2 c_1^4 \gamma_1 \delta_{10} - \frac{1}{4} c_0 c_1^5 \gamma_1 \delta_{10} - c_0^5 c_1 \gamma_1^2 \delta_{10} - \frac{5}{4} c_0^4 c_1^2 \gamma_1^2 \delta_{10} - \frac{5}{3} c_0^3 c_1^3 \gamma_1^2 \delta_{10} - \\
& c_0^2 c_1^4 \gamma_1^2 \delta_{10} - \frac{6}{5} c_0 c_1^5 \gamma_1^2 \delta_{10} - \frac{1}{2} c_0^4 c_1^2 \gamma_{12} \delta_{10} - \frac{7}{6} c_0^3 c_1^3 \gamma_{12} \delta_{10} - \frac{3}{2} c_0^2 c_1^4 \gamma_{12} \delta_{10} - \frac{4}{5} c_0 c_1^5 \gamma_{12} \delta_{10} + \\
& \frac{1}{6} c_0^5 c_1 \gamma_{30} \delta_{10} + \frac{2}{3} c_0^4 c_1^2 \gamma_{30} \delta_{10} + \frac{23}{18} c_0^3 c_1^3 \gamma_{30} \delta_{10} + \frac{4}{3} c_0^2 c_1^4 \gamma_{30} \delta_{10} + \frac{11}{15} c_0 c_1^5 \gamma_{30} \delta_{10} - \\
& \frac{1}{16} c_0^4 c_1^2 \delta_{10}^2 - \frac{11}{96} c_0^3 c_1^3 \delta_{10}^2 + \frac{1}{16} c_0^2 c_1^4 \delta_{10}^2 + \frac{1}{10} c_0 c_1^5 \delta_{10}^2 - \frac{1}{2} c_0^4 c_1^2 \gamma_1 \delta_{10}^2 - \frac{1}{12} c_0^3 c_1^3 \gamma_1 \delta_{10}^2 + \\
& \frac{1}{2} c_0^2 c_1^4 \gamma_1 \delta_{10}^2 + \frac{4}{5} c_0 c_1^5 \gamma_1 \delta_{10}^2 - \frac{1}{6} c_0^3 c_1^3 \delta_{10}^3 - \frac{3}{64} c_0^4 c_1^2 \delta_{12} - \frac{23}{144} c_0^3 c_1^3 \delta_{12} - \frac{1}{6} c_0^2 c_1^4 \delta_{12} - \\
& \frac{7}{120} c_0 c_1^5 \delta_{12} - \frac{3}{8} c_0^4 c_1^2 \gamma_1 \delta_{12} - \frac{13}{24} c_0^3 c_1^3 \gamma_1 \delta_{12} - \frac{3}{4} c_0^2 c_1^4 \gamma_1 \delta_{12} - \frac{2}{5} c_0 c_1^5 \gamma_1 \delta_{12} - \\
& \frac{1}{24} c_0^3 c_1^3 \delta_{10} \delta_{12} + \frac{1}{4} c_0^2 c_1^4 \delta_{10} \delta_{12} + \frac{1}{5} c_0 c_1^5 \delta_{10} \delta_{12} - \frac{1}{18} c_0^3 c_1^3 \delta_{23} - \frac{1}{12} c_0^2 c_1^4 \delta_{23} - \frac{1}{30} c_0 c_1^5 \delta_{23} + \\
& \frac{1}{48} c_0^5 c_1 \delta_{30} + \frac{17}{192} c_0^4 c_1^2 \delta_{30} + \frac{61}{432} c_0^3 c_1^3 \delta_{30} + \frac{1}{9} c_0^2 c_1^4 \delta_{30} + \frac{13}{360} c_0 c_1^5 \delta_{30} + \frac{1}{6} c_0^5 c_1 \gamma_1 \delta_{30} + \\
& \frac{3}{8} c_0^4 c_1^2 \gamma_1 \delta_{30} + \frac{23}{72} c_0^3 c_1^3 \gamma_1 \delta_{30} + \frac{1}{4} c_0^2 c_1^4 \gamma_1 \delta_{30} + \frac{1}{5} c_0 c_1^5 \gamma_1 \delta_{30} - \frac{13}{72} c_0^3 c_1^3 \delta_{10} \delta_{30} - \\
& \frac{5}{12} c_0^2 c_1^4 \delta_{10} \delta_{30} - \frac{4}{15} c_0 c_1^5 \delta_{10} \delta_{30} + \frac{1}{24} c_0^4 c_1^2 \delta_{41} + \frac{5}{36} c_0^3 c_1^3 \delta_{41} + \frac{1}{6} c_0^2 c_1^4 \delta_{41} + \frac{1}{15} c_0 c_1^5 \delta_{41} - \\
& \frac{1}{120} c_0^5 c_1 \delta_{50} - \frac{1}{24} c_0^4 c_1^2 \delta_{50} - \frac{1}{12} c_0^3 c_1^3 \delta_{50} - \frac{1}{12} c_0^2 c_1^4 \delta_{50} - \frac{1}{30} c_0 c_1^5 \delta_{50} \Big) \hbar^6 + O[\hbar]^7 = 1 \&\& \\
\hbar^3 \left(\frac{23 c_0 c_1^2}{2304} + \frac{7 c_1^3}{4608} - \frac{7}{48} c_0 c_1^2 \gamma_1 + \frac{1}{96} c_1^3 \gamma_1 - \frac{1}{2} c_0 c_1^2 \gamma_1^2 - \frac{3}{4} c_1^3 \gamma_1^2 + \frac{3}{16} c_0 c_1^2 \delta_{10} + \frac{1}{96} c_1^3 \delta_{10} + \right. \\
& \left. \frac{3}{2} c_0 c_1^2 \gamma_1 \delta_{10} + \frac{7}{4} c_1^3 \gamma_1 \delta_{10} - \frac{1}{2} c_1^3 \delta_{10}^2 + \frac{1}{4} c_0 c_1^2 \delta_{12} + \frac{1}{8} c_1^3 \delta_{12} - \frac{1}{4} c_0 c_1^2 \delta_{30} - \frac{1}{8} c_1^3 \delta_{30} \right) + \\
\hbar^5 \left(-\frac{179 c_0^3 c_1^2}{172800} - \frac{1}{800} c_0^2 c_1^3 - \frac{671 c_0 c_1^4}{691200} - \frac{661 c_1^5}{2764800} + \frac{29 c_0^3 c_1^2 \gamma_1}{2400} + \frac{13 c_0^2 c_1^3 \gamma_1}{3200} - \frac{19 c_0 c_1^4 \gamma_1}{345600} + \right.
\end{aligned}$$

$$\begin{aligned}
& \frac{649 c_1^5 \gamma_1}{345\,600} + \frac{1}{15} c_0^3 c_1^2 \gamma_1^2 + \frac{7}{120} c_0^2 c_1^3 \gamma_1^2 + \frac{211 c_0 c_1^4 \gamma_1^2}{1440} - \frac{1}{90} c_1^5 \gamma_1^2 + 2 c_0^2 c_1^3 \gamma_1^3 + \frac{13}{4} c_0 c_1^4 \gamma_1^3 + \\
& \frac{7}{4} c_1^5 \gamma_1^3 + \frac{1}{12} c_0^3 c_1^2 \gamma_{12} + \frac{5}{24} c_0^2 c_1^3 \gamma_{12} + \frac{5}{36} c_0 c_1^4 \gamma_{12} + \frac{1}{144} c_1^5 \gamma_{12} + \frac{3}{5} c_0^3 c_1^2 \gamma_1 \gamma_{12} - \\
& \frac{1}{10} c_0^2 c_1^3 \gamma_1 \gamma_{12} - \frac{17}{30} c_0 c_1^4 \gamma_1 \gamma_{12} + \frac{1}{15} c_1^5 \gamma_1 \gamma_{12} - \frac{5}{72} c_0^3 c_1^2 \gamma_{30} - \frac{7}{48} c_0^2 c_1^3 \gamma_{30} - \frac{49}{432} c_0 c_1^4 \gamma_{30} - \\
& \frac{1}{216} c_1^5 \gamma_{30} - \frac{7}{15} c_0^3 c_1^2 \gamma_1 \gamma_{30} - \frac{1}{5} c_0^2 c_1^3 \gamma_1 \gamma_{30} - \frac{1}{45} c_0 c_1^4 \gamma_1 \gamma_{30} - \frac{14}{45} c_1^5 \gamma_1 \gamma_{30} - \frac{77 c_0^3 c_1^2 \delta_{10}}{2880} - \\
& \frac{7}{192} c_0^2 c_1^3 \delta_{10} - \frac{199 c_0 c_1^4 \delta_{10}}{7680} - \frac{13 c_1^5 \delta_{10}}{3840} - \frac{1}{4} c_0^3 c_1^2 \gamma_1 \delta_{10} - \frac{1}{2} c_0^2 c_1^3 \gamma_1 \delta_{10} - \frac{65}{144} c_0 c_1^4 \gamma_1 \delta_{10} - \\
& \frac{7}{144} c_1^5 \gamma_1 \delta_{10} - \frac{6}{5} c_0^3 c_1^2 \gamma_1^2 \delta_{10} - \frac{19}{5} c_0^2 c_1^3 \gamma_1^2 \delta_{10} - \frac{88}{15} c_0 c_1^4 \gamma_1^2 \delta_{10} - \frac{233}{60} c_1^5 \gamma_1^2 \delta_{10} - \\
& \frac{4}{5} c_0^3 c_1^2 \gamma_{12} \delta_{10} - \frac{1}{5} c_0^2 c_1^3 \gamma_{12} \delta_{10} + \frac{8}{15} c_0 c_1^4 \gamma_{12} \delta_{10} - \frac{1}{30} c_1^5 \gamma_{12} \delta_{10} + \frac{11}{15} c_0^3 c_1^2 \gamma_{30} \delta_{10} + \\
& \frac{3}{5} c_0^2 c_1^3 \gamma_{30} \delta_{10} + \frac{8}{45} c_0 c_1^4 \gamma_{30} \delta_{10} + \frac{29}{90} c_1^5 \gamma_{30} \delta_{10} + \frac{1}{10} c_0^3 c_1^2 \delta_{10}^2 + \frac{3}{20} c_0^2 c_1^3 \delta_{10}^2 + \\
& \frac{53}{480} c_0 c_1^4 \delta_{10}^2 + \frac{11}{240} c_1^5 \delta_{10}^2 + \frac{4}{5} c_0^3 c_1^2 \gamma_1 \delta_{10}^2 + \frac{6}{5} c_0^2 c_1^3 \gamma_1 \delta_{10}^2 + \frac{103}{60} c_0 c_1^4 \gamma_1 \delta_{10}^2 + \frac{61}{30} c_1^5 \gamma_1 \delta_{10}^2 - \\
& \frac{1}{6} c_0 c_1^4 \delta_{10}^3 - \frac{1}{3} c_1^5 \delta_{10}^3 - \frac{7}{120} c_0^3 c_1^2 \delta_{12} - \frac{31}{240} c_0^2 c_1^3 \delta_{12} - \frac{13}{180} c_0 c_1^4 \delta_{12} - \frac{17 c_1^5 \delta_{12}}{2880} - \\
& \frac{2}{5} c_0^3 c_1^2 \gamma_1 \delta_{12} - \frac{1}{10} c_0^2 c_1^3 \gamma_1 \delta_{12} + \frac{7}{120} c_0 c_1^4 \gamma_1 \delta_{12} - \frac{7}{120} c_1^5 \gamma_1 \delta_{12} + \frac{1}{5} c_0^3 c_1^2 \delta_{10} \delta_{12} - \\
& \frac{1}{5} c_0^2 c_1^3 \delta_{10} \delta_{12} - \frac{41}{120} c_0 c_1^4 \delta_{10} \delta_{12} - \frac{1}{30} c_1^5 \delta_{10} \delta_{12} - \frac{1}{30} c_0^3 c_1^2 \delta_{23} - \frac{1}{20} c_0^2 c_1^3 \delta_{23} - \\
& \frac{1}{180} c_0 c_1^4 \delta_{23} + \frac{1}{180} c_1^5 \delta_{23} + \frac{13}{360} c_0^3 c_1^2 \delta_{30} + \frac{13}{240} c_0^2 c_1^3 \delta_{30} + \frac{49 c_0 c_1^4 \delta_{30}}{1080} + \frac{43 c_1^5 \delta_{30}}{8640} + \\
& \frac{1}{5} c_0^3 c_1^2 \gamma_1 \delta_{30} + \frac{3}{10} c_0^2 c_1^3 \gamma_1 \delta_{30} + \frac{187}{360} c_0 c_1^4 \gamma_1 \delta_{30} + \frac{113}{360} c_1^5 \gamma_1 \delta_{30} - \frac{4}{15} c_0^3 c_1^2 \delta_{10} \delta_{30} - \\
& \frac{2}{5} c_0^2 c_1^3 \delta_{10} \delta_{30} - \frac{101}{360} c_0 c_1^4 \delta_{10} \delta_{30} - \frac{8}{45} c_1^5 \delta_{10} \delta_{30} + \frac{1}{15} c_0^3 c_1^2 \delta_{41} + \frac{1}{10} c_0^2 c_1^3 \delta_{41} + \\
& \left. \frac{7}{180} c_0 c_1^4 \delta_{41} + \frac{1}{360} c_1^5 \delta_{41} - \frac{1}{30} c_0^3 c_1^2 \delta_{50} - \frac{1}{20} c_0^2 c_1^3 \delta_{50} - \frac{1}{30} c_0 c_1^4 \delta_{50} - \frac{1}{120} c_1^5 \delta_{50} \right) = 0 \ \&\& \\
& \hbar \left(\frac{c_1}{12} - c_1 \gamma_1 + c_1 \delta_{10} \right) + \hbar^3 \left(-\frac{7 c_0^2 c_1}{1920} + \frac{37 c_0 c_1^2}{7680} + \frac{59 c_1^3}{23\,040} + \frac{1}{8} c_0^2 c_1 \gamma_1 - \frac{1}{32} c_0 c_1^2 \gamma_1 - \right. \\
& \frac{7}{96} c_1^3 \gamma_1 + 2 c_0^2 c_1 \gamma_1^2 + \frac{9}{4} c_0 c_1^2 \gamma_1^2 + \frac{5}{4} c_1^3 \gamma_1^2 - c_0^2 c_1 \gamma_{12} - c_0 c_1^2 \gamma_{12} + \frac{1}{2} c_0^2 c_1 \gamma_{30} + \\
& \frac{1}{2} c_0 c_1^2 \gamma_{30} - \frac{1}{6} c_1^3 \gamma_{30} + \frac{17}{96} c_0 c_1^2 \delta_{10} + \frac{5}{96} c_1^3 \delta_{10} - \frac{1}{4} c_0 c_1^2 \gamma_1 \delta_{10} - \frac{5}{4} c_1^3 \gamma_1 \delta_{10} + \\
& \left. \frac{1}{2} c_0 c_1^2 \delta_{10}^2 + \frac{1}{2} c_1^3 \delta_{10}^2 + \frac{1}{2} c_0^2 c_1 \delta_{12} + \frac{5}{8} c_0 c_1^2 \delta_{12} + \frac{1}{8} c_1^3 \delta_{12} - \frac{1}{8} c_0 c_1^2 \delta_{30} + \frac{1}{24} c_1^3 \delta_{30} \right) + \\
& \hbar^5 \left(-\frac{463 c_0^4 c_1}{1\,382\,400} - \frac{1031 c_0^3 c_1^2}{691\,200} - \frac{499 c_0^2 c_1^3}{403\,200} - \frac{429 c_0 c_1^4}{716\,800} + \frac{1783 c_1^5}{19\,353\,600} + \frac{83 c_0^4 c_1 \gamma_1}{19\,200} + \frac{23}{800} c_0^3 c_1^2 \gamma_1 + \right. \\
& \left. \frac{7969 c_0^2 c_1^3 \gamma_1}{345\,600} + \frac{1631 c_0 c_1^4 \gamma_1}{345\,600} - \frac{101 c_1^5 \gamma_1}{21\,600} + \frac{7}{120} c_0^4 c_1 \gamma_1^2 + \frac{23}{120} c_0^3 c_1^2 \gamma_1^2 + \frac{479 c_0^2 c_1^3 \gamma_1^2}{1440} + \right.
\end{aligned}$$

$$\begin{aligned}
& \frac{263}{720} c_0 c_1^4 \gamma_1^2 + \frac{179 c_1^5 \gamma_1^2}{1440} - \frac{5}{2} c_0^4 c_1 \gamma_1^3 - 7 c_0^3 c_1^2 \gamma_1^3 - \frac{39}{4} c_0^2 c_1^3 \gamma_1^3 - \frac{23}{4} c_0 c_1^4 \gamma_1^3 - \frac{3}{2} c_1^5 \gamma_1^3 - \\
& \frac{1}{24} c_0^3 c_1^2 \gamma_{12} - \frac{11}{144} c_0^2 c_1^3 \gamma_{12} - \frac{1}{36} c_0 c_1^4 \gamma_{12} + \frac{1}{144} c_1^5 \gamma_{12} + \frac{7}{5} c_0^4 c_1 \gamma_1 \gamma_{12} + \frac{41}{10} c_0^3 c_1^2 \gamma_1 \gamma_{12} + \\
& \frac{76}{15} c_0^2 c_1^3 \gamma_1 \gamma_{12} + \frac{73}{30} c_0 c_1^4 \gamma_1 \gamma_{12} + \frac{1}{15} c_1^5 \gamma_1 \gamma_{12} + \frac{1}{12} c_0^2 c_1^3 \gamma_{23} + \frac{1}{12} c_0 c_1^4 \gamma_{23} + \frac{1}{72} c_0^4 c_1 \gamma_{30} + \\
& \frac{5}{144} c_0^3 c_1^2 \gamma_{30} + \frac{1}{27} c_0^2 c_1^3 \gamma_{30} - \frac{7}{432} c_0 c_1^4 \gamma_{30} - \frac{1}{54} c_1^5 \gamma_{30} - \frac{1}{5} c_0^4 c_1 \gamma_1 \gamma_{30} - \frac{17}{15} c_0^3 c_1^2 \gamma_1 \gamma_{30} - \\
& \frac{59}{45} c_0^2 c_1^3 \gamma_1 \gamma_{30} - \frac{16}{45} c_0 c_1^4 \gamma_1 \gamma_{30} + \frac{16}{45} c_1^5 \gamma_1 \gamma_{30} - \frac{1}{12} c_0^4 c_1 \gamma_{41} - \frac{1}{6} c_0^3 c_1^2 \gamma_{41} - \frac{1}{4} c_0^2 c_1^3 \gamma_{41} - \\
& \frac{1}{6} c_0 c_1^4 \gamma_{41} + \frac{1}{24} c_0^4 c_1 \gamma_{50} + \frac{1}{12} c_0^3 c_1^2 \gamma_{50} + \frac{1}{12} c_0^2 c_1^3 \gamma_{50} + \frac{1}{24} c_0 c_1^4 \gamma_{50} - \frac{1}{120} c_1^5 \gamma_{50} - \\
& \frac{31 c_0^3 c_1 \delta_{10}}{5760} - \frac{1}{36} c_0^2 c_1^2 \delta_{10} - \frac{377 c_0^2 c_1^3 \delta_{10}}{23040} - \frac{13 c_0 c_1^4 \delta_{10}}{1920} + \frac{11 c_1^5 \delta_{10}}{7680} - \frac{1}{8} c_0^4 c_1 \gamma_1 \delta_{10} - \\
& \frac{1}{4} c_0^3 c_1^2 \gamma_1 \delta_{10} - \frac{55}{144} c_0^2 c_1^3 \gamma_1 \delta_{10} - \frac{59}{144} c_0 c_1^4 \gamma_1 \delta_{10} - \frac{5}{72} c_1^5 \gamma_1 \delta_{10} - \frac{3}{10} c_0^4 c_1 \gamma_1^2 \delta_{10} + \\
& \frac{4}{5} c_0^3 c_1^2 \gamma_1^2 \delta_{10} + \frac{43}{15} c_0^2 c_1^3 \gamma_1^2 \delta_{10} + \frac{143}{60} c_0 c_1^4 \gamma_1^2 \delta_{10} + \frac{97}{60} c_1^5 \gamma_1^2 \delta_{10} - \frac{1}{5} c_0^4 c_1 \gamma_{12} \delta_{10} - \\
& \frac{9}{5} c_0^3 c_1^2 \gamma_{12} \delta_{10} - \frac{53}{15} c_0^2 c_1^3 \gamma_{12} \delta_{10} - \frac{59}{30} c_0 c_1^4 \gamma_{12} \delta_{10} - \frac{1}{30} c_1^5 \gamma_{12} \delta_{10} + \frac{1}{10} c_0^4 c_1 \gamma_{30} \delta_{10} + \\
& \frac{16}{15} c_0^3 c_1^2 \gamma_{30} \delta_{10} + \frac{179}{90} c_0^2 c_1^3 \gamma_{30} \delta_{10} + \frac{91}{90} c_0 c_1^4 \gamma_{30} \delta_{10} - \frac{8}{45} c_1^5 \gamma_{30} \delta_{10} + \frac{1}{40} c_0^4 c_1 \delta_{10}^2 + \\
& \frac{1}{10} c_0^3 c_1^2 \delta_{10}^2 + \frac{157}{480} c_0^2 c_1^3 \delta_{10}^2 + \frac{4}{15} c_0 c_1^4 \delta_{10}^2 + \frac{7}{480} c_1^5 \delta_{10}^2 + \frac{1}{5} c_0^4 c_1 \gamma_1 \delta_{10}^2 + \frac{4}{5} c_0^3 c_1^2 \gamma_1 \delta_{10}^2 + \\
& \frac{107}{60} c_0^2 c_1^3 \gamma_1 \delta_{10}^2 + \frac{7}{15} c_0 c_1^4 \gamma_1 \delta_{10}^2 - \frac{43}{60} c_1^5 \gamma_1 \delta_{10}^2 + \frac{1}{6} c_0^2 c_1^3 \delta_{10}^3 + \frac{1}{3} c_0 c_1^4 \delta_{10}^3 + \frac{1}{6} c_1^5 \delta_{10}^3 - \\
& \frac{17}{480} c_0^4 c_1 \delta_{12} - \frac{7}{120} c_0^3 c_1^2 \delta_{12} - \frac{19}{360} c_0^2 c_1^3 \delta_{12} - \frac{73 c_0 c_1^4 \delta_{12}}{2880} + \frac{13 c_1^5 \delta_{12}}{2880} - \frac{7}{20} c_0^4 c_1 \gamma_1 \delta_{12} - \\
& \frac{7}{5} c_0^3 c_1^2 \gamma_1 \delta_{12} - \frac{277}{120} c_0^2 c_1^3 \gamma_1 \delta_{12} - \frac{173}{120} c_0 c_1^4 \gamma_1 \delta_{12} - \frac{11}{60} c_1^5 \gamma_1 \delta_{12} - \frac{1}{5} c_0^4 c_1 \delta_{10} \delta_{12} + \\
& \frac{1}{5} c_0^3 c_1^2 \delta_{10} \delta_{12} + \frac{131}{120} c_0^2 c_1^3 \delta_{10} \delta_{12} + \frac{47}{60} c_0 c_1^4 \delta_{10} \delta_{12} + \frac{11}{120} c_1^5 \delta_{10} \delta_{12} + \frac{1}{30} c_0^4 c_1 \delta_{23} + \\
& \frac{1}{20} c_0^3 c_1^2 \delta_{23} + \frac{1}{180} c_0^2 c_1^3 \delta_{23} - \frac{1}{180} c_0 c_1^4 \delta_{23} + \frac{1}{180} c_1^5 \delta_{23} + \frac{13 c_0^4 c_1 \delta_{30}}{1440} + \frac{13}{360} c_0^3 c_1^2 \delta_{30} + \\
& \frac{13}{540} c_0^2 c_1^3 \delta_{30} + \frac{167 c_0 c_1^4 \delta_{30}}{8640} + \frac{13 c_1^5 \delta_{30}}{8640} + \frac{1}{20} c_0^4 c_1 \gamma_1 \delta_{30} + \frac{1}{5} c_0^3 c_1^2 \gamma_1 \delta_{30} + \frac{83}{360} c_0^2 c_1^3 \gamma_1 \delta_{30} + \\
& \frac{67}{360} c_0 c_1^4 \gamma_1 \delta_{30} - \frac{11}{180} c_1^5 \gamma_1 \delta_{30} - \frac{1}{15} c_0^4 c_1 \delta_{10} \delta_{30} - \frac{4}{15} c_0^3 c_1^2 \delta_{10} \delta_{30} - \frac{229}{360} c_0^2 c_1^3 \delta_{10} \delta_{30} - \\
& \frac{73}{180} c_0 c_1^4 \delta_{10} \delta_{30} + \frac{11}{360} c_1^5 \delta_{10} \delta_{30} + \frac{1}{60} c_0^4 c_1 \delta_{41} + \frac{1}{15} c_0^3 c_1^2 \delta_{41} + \frac{23}{180} c_0^2 c_1^3 \delta_{41} + \\
& \frac{29}{360} c_0 c_1^4 \delta_{41} + \frac{1}{360} c_1^5 \delta_{41} - \frac{1}{120} c_0^4 c_1 \delta_{50} - \frac{1}{30} c_0^3 c_1^2 \delta_{50} - \frac{1}{20} c_0^2 c_1^3 \delta_{50} - \frac{1}{30} c_0 c_1^4 \delta_{50} \Big) = 0 \ \&\& \\
& \hbar \left(\frac{c_1}{12} - c_1 \gamma_1 + c_1 \delta_{10} \right) + \hbar^3 \left(-\frac{7 c_0^2 c_1}{1920} + \frac{37 c_0 c_1^2}{7680} + \frac{59 c_1^3}{23040} + \frac{1}{8} c_0^2 c_1 \gamma_1 - \frac{1}{32} c_0 c_1^2 \gamma_1 - \right.
\end{aligned}$$

$$\begin{aligned}
& \left. \begin{aligned}
& \frac{7}{96} c_1^3 \gamma_1 + 2 c_0^2 c_1 \gamma_1^2 + \frac{9}{4} c_0 c_1^2 \gamma_1^2 + \frac{5}{4} c_1^3 \gamma_1^2 - c_0^2 c_1 \gamma_{12} - c_0 c_1^2 \gamma_{12} + \frac{1}{2} c_0^2 c_1 \gamma_{30} + \\
& \frac{1}{2} c_0 c_1^2 \gamma_{30} - \frac{1}{6} c_1^3 \gamma_{30} + \frac{17}{96} c_0 c_1^2 \delta_{10} + \frac{5}{96} c_1^3 \delta_{10} - \frac{1}{4} c_0 c_1^2 \gamma_1 \delta_{10} - \frac{5}{4} c_1^3 \gamma_1 \delta_{10} + \\
& \frac{1}{2} c_0 c_1^2 \delta_{10}^2 + \frac{1}{2} c_1^3 \delta_{10}^2 + \frac{1}{2} c_0^2 c_1 \delta_{12} + \frac{5}{8} c_0 c_1^2 \delta_{12} + \frac{1}{8} c_1^3 \delta_{12} - \frac{1}{8} c_0 c_1^2 \delta_{30} + \frac{1}{24} c_1^3 \delta_{30} \right) + \\
\hbar^5 & \left(-\frac{463 c_0^4 c_1}{1382400} - \frac{1031 c_0^3 c_1^2}{691200} - \frac{499 c_0^2 c_1^3}{403200} - \frac{429 c_0 c_1^4}{716800} + \frac{1783 c_1^5}{19353600} + \frac{83 c_0^4 c_1 \gamma_1}{19200} + \frac{23}{800} c_0^3 c_1^2 \gamma_1 + \right. \\
& \frac{7969 c_0^2 c_1^3 \gamma_1}{345600} + \frac{1631 c_0 c_1^4 \gamma_1}{345600} - \frac{101 c_1^5 \gamma_1}{21600} + \frac{7}{120} c_0^4 c_1 \gamma_1^2 + \frac{23}{120} c_0^3 c_1^2 \gamma_1^2 + \frac{479 c_0^2 c_1^3 \gamma_1^2}{1440} + \\
& \frac{263}{720} c_0 c_1^4 \gamma_1^2 + \frac{179 c_1^5 \gamma_1^2}{1440} - \frac{5}{2} c_0^4 c_1 \gamma_1^3 - 7 c_0^3 c_1^2 \gamma_1^3 - \frac{39}{4} c_0^2 c_1^3 \gamma_1^3 - \frac{23}{4} c_0 c_1^4 \gamma_1^3 - \frac{3}{2} c_1^5 \gamma_1^3 - \\
& \frac{1}{24} c_0^3 c_1^2 \gamma_{12} - \frac{11}{144} c_0^2 c_1^3 \gamma_{12} - \frac{1}{36} c_0 c_1^4 \gamma_{12} + \frac{1}{144} c_1^5 \gamma_{12} + \frac{7}{5} c_0^4 c_1 \gamma_1 \gamma_{12} + \frac{41}{10} c_0^3 c_1^2 \gamma_1 \gamma_{12} + \\
& \frac{76}{15} c_0^2 c_1^3 \gamma_1 \gamma_{12} + \frac{73}{30} c_0 c_1^4 \gamma_1 \gamma_{12} + \frac{1}{15} c_1^5 \gamma_1 \gamma_{12} + \frac{1}{12} c_0^2 c_1^3 \gamma_{23} + \frac{1}{12} c_0 c_1^4 \gamma_{23} + \frac{1}{72} c_0^4 c_1 \gamma_{30} + \\
& \frac{5}{144} c_0^3 c_1^2 \gamma_{30} + \frac{1}{27} c_0^2 c_1^3 \gamma_{30} - \frac{7}{432} c_0 c_1^4 \gamma_{30} - \frac{1}{54} c_1^5 \gamma_{30} - \frac{1}{5} c_0^4 c_1 \gamma_1 \gamma_{30} - \frac{17}{15} c_0^3 c_1^2 \gamma_1 \gamma_{30} - \\
& \frac{59}{45} c_0^2 c_1^3 \gamma_1 \gamma_{30} - \frac{16}{45} c_0 c_1^4 \gamma_1 \gamma_{30} + \frac{16}{45} c_1^5 \gamma_1 \gamma_{30} - \frac{1}{12} c_0^4 c_1 \gamma_{41} - \frac{1}{6} c_0^3 c_1^2 \gamma_{41} - \frac{1}{4} c_0^2 c_1^3 \gamma_{41} - \\
& \frac{1}{6} c_0 c_1^4 \gamma_{41} + \frac{1}{24} c_0^4 c_1 \gamma_{50} + \frac{1}{12} c_0^3 c_1^2 \gamma_{50} + \frac{1}{12} c_0^2 c_1^3 \gamma_{50} + \frac{1}{24} c_0 c_1^4 \gamma_{50} - \frac{1}{120} c_1^5 \gamma_{50} - \\
& \frac{31 c_0^3 c_1 \delta_{10}}{5760} - \frac{1}{36} c_0^2 c_1^2 \delta_{10} - \frac{377 c_0 c_1^3 \delta_{10}}{23040} - \frac{13 c_0 c_1^4 \delta_{10}}{1920} + \frac{11 c_1^5 \delta_{10}}{7680} - \frac{1}{8} c_0^4 c_1 \gamma_1 \delta_{10} - \\
& \frac{1}{4} c_0^3 c_1^2 \gamma_1 \delta_{10} - \frac{55}{144} c_0^2 c_1^3 \gamma_1 \delta_{10} - \frac{59}{144} c_0 c_1^4 \gamma_1 \delta_{10} - \frac{5}{72} c_1^5 \gamma_1 \delta_{10} - \frac{3}{10} c_0^4 c_1 \gamma_1^2 \delta_{10} + \\
& \frac{4}{5} c_0^3 c_1^2 \gamma_1^2 \delta_{10} + \frac{43}{15} c_0^2 c_1^3 \gamma_1^2 \delta_{10} + \frac{143}{60} c_0 c_1^4 \gamma_1^2 \delta_{10} + \frac{97}{60} c_1^5 \gamma_1^2 \delta_{10} - \frac{1}{5} c_0^4 c_1 \gamma_{12} \delta_{10} - \\
& \frac{9}{5} c_0^3 c_1^2 \gamma_{12} \delta_{10} - \frac{53}{15} c_0^2 c_1^3 \gamma_{12} \delta_{10} - \frac{59}{30} c_0 c_1^4 \gamma_{12} \delta_{10} - \frac{1}{30} c_1^5 \gamma_{12} \delta_{10} + \frac{1}{10} c_0^4 c_1 \gamma_{30} \delta_{10} + \\
& \frac{16}{15} c_0^3 c_1^2 \gamma_{30} \delta_{10} + \frac{179}{90} c_0^2 c_1^3 \gamma_{30} \delta_{10} + \frac{91}{90} c_0 c_1^4 \gamma_{30} \delta_{10} - \frac{8}{45} c_1^5 \gamma_{30} \delta_{10} + \frac{1}{40} c_0^4 c_1 \delta_{10}^2 + \\
& \frac{1}{10} c_0^3 c_1^2 \delta_{10}^2 + \frac{157}{480} c_0^2 c_1^3 \delta_{10}^2 + \frac{4}{15} c_0 c_1^4 \delta_{10}^2 + \frac{7}{480} c_1^5 \delta_{10}^2 + \frac{1}{5} c_0^4 c_1 \gamma_1 \delta_{10}^2 + \frac{4}{5} c_0^3 c_1^2 \gamma_1 \delta_{10}^2 + \\
& \frac{107}{60} c_0^2 c_1^3 \gamma_1 \delta_{10}^2 + \frac{7}{15} c_0 c_1^4 \gamma_1 \delta_{10}^2 - \frac{43}{60} c_1^5 \gamma_1 \delta_{10}^2 + \frac{1}{6} c_0^2 c_1^3 \delta_{10}^3 + \frac{1}{3} c_0 c_1^4 \delta_{10}^3 + \frac{1}{6} c_1^5 \delta_{10}^3 - \\
& \frac{17}{480} c_0^4 c_1 \delta_{12} - \frac{7}{120} c_0^3 c_1^2 \delta_{12} - \frac{19}{360} c_0^2 c_1^3 \delta_{12} - \frac{73 c_0 c_1^4 \delta_{12}}{2880} + \frac{13 c_1^5 \delta_{12}}{2880} - \frac{7}{20} c_0^4 c_1 \gamma_1 \delta_{12} - \\
& \frac{7}{5} c_0^3 c_1^2 \gamma_1 \delta_{12} - \frac{277}{120} c_0^2 c_1^3 \gamma_1 \delta_{12} - \frac{173}{120} c_0 c_1^4 \gamma_1 \delta_{12} - \frac{11}{60} c_1^5 \gamma_1 \delta_{12} - \frac{1}{5} c_0^4 c_1 \delta_{10} \delta_{12} + \\
& \frac{1}{5} c_0^3 c_1^2 \delta_{10} \delta_{12} + \frac{131}{120} c_0^2 c_1^3 \delta_{10} \delta_{12} + \frac{47}{60} c_0 c_1^4 \delta_{10} \delta_{12} + \frac{11}{120} c_1^5 \delta_{10} \delta_{12} + \frac{1}{30} c_0^4 c_1 \delta_{23} + \\
& \frac{1}{20} c_0^3 c_1^2 \delta_{23} + \frac{1}{180} c_0^2 c_1^3 \delta_{23} - \frac{1}{180} c_0 c_1^4 \delta_{23} + \frac{1}{180} c_1^5 \delta_{23} + \frac{13 c_0^4 c_1 \delta_{30}}{1440} + \frac{13}{360} c_0^3 c_1^2 \delta_{30} +
\end{aligned}
\right.
\end{aligned}$$

$$\begin{aligned}
& \frac{13}{540} c_0^2 c_1^3 \delta_{30} + \frac{167 c_0 c_1^4 \delta_{30}}{8640} + \frac{13 c_1^5 \delta_{30}}{8640} + \frac{1}{20} c_0^4 c_1 \gamma_1 \delta_{30} + \frac{1}{5} c_0^3 c_1^2 \gamma_1 \delta_{30} + \frac{83}{360} c_0^2 c_1^3 \gamma_1 \delta_{30} + \\
& \frac{67}{360} c_0 c_1^4 \gamma_1 \delta_{30} - \frac{11}{180} c_1^5 \gamma_1 \delta_{30} - \frac{1}{15} c_0^4 c_1 \delta_{10} \delta_{30} - \frac{4}{15} c_0^3 c_1^2 \delta_{10} \delta_{30} - \frac{229}{360} c_0^2 c_1^3 \delta_{10} \delta_{30} - \\
& \frac{73}{180} c_0 c_1^4 \delta_{10} \delta_{30} + \frac{11}{360} c_1^5 \delta_{10} \delta_{30} + \frac{1}{60} c_0^4 c_1 \delta_{41} + \frac{1}{15} c_0^3 c_1^2 \delta_{41} + \frac{23}{180} c_0^2 c_1^3 \delta_{41} + \\
& \frac{29}{360} c_0 c_1^4 \delta_{41} + \frac{1}{360} c_1^5 \delta_{41} - \frac{1}{120} c_0^4 c_1 \delta_{50} - \frac{1}{30} c_0^3 c_1^2 \delta_{50} - \frac{1}{20} c_0^2 c_1^3 \delta_{50} - \frac{1}{30} c_0 c_1^4 \delta_{50} \Big) = 0 \ \&\& \\
& \hbar \left(-\frac{c_0}{6} + 2 c_0 \gamma_1 - 2 c_0 \delta_{10} \right) + \hbar^3 \left(\frac{17 c_0^3}{1440} + \frac{9}{640} c_0^2 c_1 + \frac{43 c_0 c_1^2}{7680} - \frac{1}{6} c_0^3 \gamma_1 - \frac{1}{8} c_0^2 c_1 \gamma_1 + \right. \\
& \frac{1}{32} c_0 c_1^2 \gamma_1 - 2 c_0^3 \gamma_1^2 - c_0^2 c_1 \gamma_1^2 - \frac{5}{4} c_0 c_1^2 \gamma_1^2 - c_0^2 c_1 \gamma_{12} - c_0 c_1^2 \gamma_{12} + \frac{1}{3} c_0^3 \gamma_{30} + c_0^2 c_1 \gamma_{30} + \\
& c_0 c_1^2 \gamma_{30} + \frac{1}{4} c_0^3 \delta_{10} + \frac{3}{8} c_0^2 c_1 \delta_{10} + \frac{19}{96} c_0 c_1^2 \delta_{10} + 2 c_0^3 \gamma_1 \delta_{10} + 3 c_0^2 c_1 \gamma_1 \delta_{10} + \frac{13}{4} c_0 c_1^2 \gamma_1 \delta_{10} - \\
& \left. \frac{1}{2} c_0 c_1^2 \delta_{10}^2 + \frac{1}{2} c_0^2 c_1 \delta_{12} + \frac{3}{8} c_0 c_1^2 \delta_{12} - \frac{1}{3} c_0^3 \delta_{30} - \frac{1}{2} c_0^2 c_1 \delta_{30} - \frac{3}{8} c_0 c_1^2 \delta_{30} \right) + \\
& \hbar^5 \left(-\frac{59 c_0^5}{48384} - \frac{12127 c_0^4 c_1}{3225600} - \frac{2551 c_0^3 c_1^2}{403200} - \frac{6613 c_0^2 c_1^3}{1382400} - \frac{4697 c_0 c_1^4}{2764800} + \frac{31 c_0^5 \gamma_1}{1440} + \right. \\
& \frac{3209 c_0^4 c_1 \gamma_1}{57600} + \frac{15923 c_0^3 c_1^2 \gamma_1}{172800} + \frac{2963 c_0^2 c_1^3 \gamma_1}{43200} + \frac{563 c_0 c_1^4 \gamma_1}{21600} + \frac{1}{12} c_0^5 \gamma_1^2 + \frac{11}{60} c_0^4 c_1 \gamma_1^2 - \\
& \frac{47}{720} c_0^3 c_1^2 \gamma_1^2 - \frac{83}{720} c_0^2 c_1^3 \gamma_1^2 - \frac{47 c_0 c_1^4 \gamma_1^2}{1440} + 2 c_0^5 \gamma_1^3 + \frac{9}{2} c_0^4 c_1 \gamma_1^3 + \frac{13}{2} c_0^3 c_1^2 \gamma_1^3 + 2 c_0^2 c_1^3 \gamma_1^3 + \\
& \frac{1}{2} c_0 c_1^4 \gamma_1^3 + \frac{1}{6} c_0^4 c_1 \gamma_{12} + \frac{4}{9} c_0^3 c_1^2 \gamma_{12} + \frac{13}{36} c_0^2 c_1^3 \gamma_{12} + \frac{11}{144} c_0 c_1^4 \gamma_{12} - \frac{3}{5} c_0^4 c_1 \gamma_1 \gamma_{12} - \\
& \frac{37}{30} c_0^3 c_1^2 \gamma_1 \gamma_{12} + \frac{17}{30} c_0^2 c_1^3 \gamma_1 \gamma_{12} + \frac{17}{15} c_0 c_1^4 \gamma_1 \gamma_{12} + \frac{1}{6} c_0^3 c_1^2 \gamma_{23} + \frac{1}{3} c_0^2 c_1^3 \gamma_{23} + \frac{1}{6} c_0 c_1^4 \gamma_{23} - \\
& \frac{1}{36} c_0^5 \gamma_{30} - \frac{1}{6} c_0^4 c_1 \gamma_{30} - \frac{155}{432} c_0^3 c_1^2 \gamma_{30} - \frac{125}{432} c_0^2 c_1^3 \gamma_{30} - \frac{7}{108} c_0 c_1^4 \gamma_{30} - \frac{2}{3} c_0^5 \gamma_1 \gamma_{30} - \\
& \frac{8}{15} c_0^4 c_1 \gamma_1 \gamma_{30} - \frac{11}{45} c_0^3 c_1^2 \gamma_1 \gamma_{30} - \frac{29}{45} c_0^2 c_1^3 \gamma_1 \gamma_{30} - \frac{43}{45} c_0 c_1^4 \gamma_1 \gamma_{30} - \frac{1}{12} c_0^4 c_1 \gamma_{41} - \\
& \frac{1}{3} c_0^3 c_1^2 \gamma_{41} - \frac{1}{2} c_0^2 c_1^3 \gamma_{41} - \frac{1}{4} c_0 c_1^4 \gamma_{41} + \frac{1}{60} c_0^5 \gamma_{50} + \frac{1}{12} c_0^4 c_1 \gamma_{50} + \frac{1}{6} c_0^3 c_1^2 \gamma_{50} + \frac{1}{6} c_0^2 c_1^3 \gamma_{50} + \\
& \frac{1}{12} c_0 c_1^4 \gamma_{50} - \frac{41 c_0^5 \delta_{10}}{1440} - \frac{587 c_0^4 c_1 \delta_{10}}{5760} - \frac{2129 c_0^3 c_1^2 \delta_{10}}{11520} - \frac{1571 c_0^2 c_1^3 \delta_{10}}{11520} - \frac{937 c_0 c_1^4 \delta_{10}}{23040} - \\
& \frac{1}{6} c_0^5 \gamma_1 \delta_{10} - \frac{13}{24} c_0^4 c_1 \gamma_1 \delta_{10} - \frac{53}{72} c_0^3 c_1^2 \gamma_1 \delta_{10} - \frac{25}{36} c_0^2 c_1^3 \gamma_1 \delta_{10} - \frac{25}{72} c_0 c_1^4 \gamma_1 \delta_{10} - \\
& 2 c_0^5 \gamma_1^2 \delta_{10} - \frac{53}{10} c_0^4 c_1 \gamma_1^2 \delta_{10} - \frac{113}{15} c_0^3 c_1^2 \gamma_1^2 \delta_{10} - \frac{139}{30} c_0^2 c_1^3 \gamma_1^2 \delta_{10} - \frac{181}{60} c_0 c_1^4 \gamma_1^2 \delta_{10} + \\
& \frac{9}{5} c_0^4 c_1 \gamma_{12} \delta_{10} + \frac{28}{15} c_0^3 c_1^2 \gamma_{12} \delta_{10} - \frac{23}{15} c_0^2 c_1^3 \gamma_{12} \delta_{10} - \frac{47}{30} c_0 c_1^4 \gamma_{12} \delta_{10} + \frac{1}{3} c_0^5 \gamma_{30} \delta_{10} - \\
& \frac{2}{5} c_0^4 c_1 \gamma_{30} \delta_{10} - \frac{2}{45} c_0^3 c_1^2 \gamma_{30} \delta_{10} + \frac{82}{45} c_0^2 c_1^3 \gamma_{30} \delta_{10} + \frac{133}{90} c_0 c_1^4 \gamma_{30} \delta_{10} - \frac{9}{40} c_0^4 c_1 \delta_{10}^2 - \\
& \frac{91}{240} c_0^3 c_1^2 \delta_{10}^2 + \frac{11}{240} c_0^2 c_1^3 \delta_{10}^2 + \frac{89}{480} c_0 c_1^4 \delta_{10}^2 - \frac{9}{5} c_0^4 c_1 \gamma_1 \delta_{10}^2 - \frac{41}{30} c_0^3 c_1^2 \gamma_1 \delta_{10}^2 +
\end{aligned}$$

$$\begin{aligned} & \frac{61}{30} c_0^2 c_1^3 \gamma_1 \delta_{10}^2 + \frac{139}{60} c_0 c_1^4 \gamma_1 \delta_{10}^2 - \frac{1}{3} c_0^3 c_1^2 \delta_{10}^3 - \frac{1}{3} c_0^2 c_1^3 \delta_{10}^3 - \frac{1}{6} c_0 c_1^4 \delta_{10}^3 - \frac{19}{160} c_0^4 c_1 \delta_{12} - \\ & \frac{257}{720} c_0^3 c_1^2 \delta_{12} - \frac{511 c_0^2 c_1^3 \delta_{12}}{1440} - \frac{349 c_0 c_1^4 \delta_{12}}{2880} + \frac{13}{20} c_0^4 c_1 \gamma_1 \delta_{12} + \frac{61}{60} c_0^3 c_1^2 \gamma_1 \delta_{12} - \\ & \frac{13}{30} c_0^2 c_1^3 \gamma_1 \delta_{12} - \frac{37}{60} c_0 c_1^4 \gamma_1 \delta_{12} - \frac{6}{5} c_0^4 c_1 \delta_{10} \delta_{12} - \frac{113}{60} c_0^3 c_1^2 \delta_{10} \delta_{12} - \frac{17}{60} c_0^2 c_1^3 \delta_{10} \delta_{12} + \\ & \frac{37}{120} c_0 c_1^4 \delta_{10} \delta_{12} + \frac{1}{30} c_0^4 c_1 \delta_{23} - \frac{11}{180} c_0^3 c_1^2 \delta_{23} - \frac{29}{180} c_0^2 c_1^3 \delta_{23} - \frac{13}{180} c_0 c_1^4 \delta_{23} + \frac{1}{24} c_0^5 \delta_{30} + \\ & \frac{203 c_0^4 c_1 \delta_{30}}{1440} + \frac{493 c_0^3 c_1^2 \delta_{30}}{2160} + \frac{689 c_0^2 c_1^3 \delta_{30}}{4320} + \frac{431 c_0 c_1^4 \delta_{30}}{8640} + \frac{1}{3} c_0^5 \gamma_1 \delta_{30} + \frac{11}{20} c_0^4 c_1 \gamma_1 \delta_{30} + \\ & \frac{61}{180} c_0^3 c_1^2 \gamma_1 \delta_{30} + \frac{17}{90} c_0^2 c_1^3 \gamma_1 \delta_{30} + \frac{53}{180} c_0 c_1^4 \gamma_1 \delta_{30} + \frac{4}{15} c_0^4 c_1 \delta_{10} \delta_{30} + \frac{7}{180} c_0^3 c_1^2 \delta_{10} \delta_{30} - \\ & \frac{137}{180} c_0^2 c_1^3 \delta_{10} \delta_{30} - \frac{203}{360} c_0 c_1^4 \delta_{10} \delta_{30} + \frac{1}{60} c_0^4 c_1 \delta_{41} + \frac{8}{45} c_0^3 c_1^2 \delta_{41} + \frac{53}{180} c_0^2 c_1^3 \delta_{41} + \\ & \left. \frac{47}{360} c_0 c_1^4 \delta_{41} - \frac{1}{60} c_0^5 \delta_{50} - \frac{1}{20} c_0^4 c_1 \delta_{50} - \frac{7}{60} c_0^3 c_1^2 \delta_{50} - \frac{2}{15} c_0^2 c_1^3 \delta_{50} - \frac{7}{120} c_0 c_1^4 \delta_{50} \right) = 0 \end{aligned}$$

soll = PerturbativeSolveAlways[eqn, ħ, \$PerturbativeDegree, {c1, c2}]

Warning: multiple solutions in degree 3

$$\begin{aligned} & \left\{ \gamma_1 \rightarrow \frac{1}{12} + \delta_{10}, c_0 \rightarrow 0, \gamma_{30} \rightarrow \frac{1}{480} (23 + 120 \delta_{10} + 480 \delta_{30}), \right. \\ & \delta_{12} \rightarrow \frac{1}{576} (13 - 192 \delta_{10} - 2304 \delta_{10}^2 + 576 \delta_{30}), \\ & \gamma_{50} \rightarrow \frac{1}{120960} (-187 + 181440 \gamma_{12} + 65016 \delta_{10} + 483840 \gamma_{12} \delta_{10} + \\ & \quad 322560 \delta_{10}^2 - 967680 \delta_{10}^3 + 80640 \delta_{23} - 47040 \delta_{30} + 806400 \delta_{10} \delta_{30} + 40320 \delta_{41}), \\ & \delta_{50} \rightarrow \frac{1}{17280} (-1771 + 25920 \gamma_{12} - 7272 \delta_{10} + 69120 \gamma_{12} \delta_{10} + 46080 \delta_{10}^2 - \\ & \quad \left. 138240 \delta_{10}^3 + 11520 \delta_{23} - 21120 \delta_{30} + 115200 \delta_{10} \delta_{30} + 5760 \delta_{41}) \right\} \end{aligned}$$

indvars = Union[Cases[Last /@ #, ε_{-k} → ε_k, Infinity]] & /@ {soll}

{ {γ₁₂, δ₁₀, δ₂₃, δ₃₀, δ₄₁ } }

{V3, C3} = {V2, C2} /. soll /. Thread[{γ₁₂, δ₁₀, δ₂₃, δ₃₀, δ₄₁} → 0] // ColumnForm

$$\begin{pmatrix} 1 + \frac{1}{16} c_1 c_2 \hbar^2 + \left(\frac{1}{72} c_1^3 c_2 + \frac{35 c_1^2 c_2^2}{1536} + \frac{1}{72} c_1 c_2^3 \right) \hbar^4 + \left(-\frac{661 c_1^5 c_2}{691200} - \frac{421 c_1^4 c_2^2}{276480} - \frac{6121 c_1^3 c_2^3}{3317760} - \frac{421 c_1^2 c_2^4}{276480} - \frac{661 c_1 c_2^5}{691200} \right) \hbar^6 - \\ t[1] \\ t[2] \\ 1 + c_1 \kappa_1 \hbar + \frac{1}{32} c_1^2 (1 + 16 \kappa_1^2) \hbar^2 + \frac{1}{96} c_1^3 \kappa_1 (3 + 16 \kappa_1^2) \hbar^3 + \frac{c_1^4 \left(\frac{73}{3} + 96 \kappa_1^2 + 256 \kappa_1^4 \right) \hbar^4}{6144} + \frac{c_1^5 \kappa_1 \left(\frac{365}{3} + 160 \kappa_1^2 + 256 \kappa_1^4 \right) \hbar^5}{30720} + \dots \\ t[1] \end{pmatrix}$$

False && Put[{V3, C3, soll}, "SolutionToDegree6-120518.m"]