

Pensieve header: Solving for caps and cups for NOE-1.

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SetDirectory["C:\\drorbn\\AcademicPensieve\\Projects\\OneCo-1606"];
<< NOE-1.m
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Solution to all-but-one equations, as found on 160807:

$$\begin{aligned}
 \text{ECA11ButOne} = \{ & f_2[x_, y_] \Rightarrow y f_9[x, y] + y^2 f_{26}[x, y] - g_6[x], f_3[x_, z_] \Rightarrow x^2 f_{18}[x, z], \\
 & f_4[x_, y_] \Rightarrow y f_{13}[x, y] - g_1[x], f_5[x_, y_] \Rightarrow y^2 f_{26}[x, y], f_8[x_, z_] \Rightarrow 0, \\
 & f_{10}[x_, z_] \Rightarrow 2 x f_{18}[x, z], f_{11}[x_, y_] \Rightarrow 2 x f_{18}[x, y] - 2 e^x x f_{18}[x, y] - g_4[x], \\
 & f_{12}[x_, z_] \Rightarrow 0, f_{13}[x_, z_] \Rightarrow x f_{22}[x, z] - g_3[z], f_{14}[x_, y_] \Rightarrow y f_{22}[x, y] - g_2[x], \\
 & f_{15}[x_, y_] \Rightarrow \frac{1}{(-1 + e^y) x} \left(-x y f_{23}[x, y] + e^y x y f_{23}[x, y] + x g_2[x] - e^x x g_2[x] - e^y x g_2[x] + \right. \\
 & \quad e^{x+y} x g_2[x] - e^y y g_2[y] + e^{x+y} y g_2[y] - y g_3[y] + e^x y g_3[y] - y g_4[y] + e^x y g_4[y] + \\
 & \quad 8 y^2 g_5[y] - 8 e^x y^2 g_5[y] - 16 e^y y^2 g_5[y] + 8 e^{2y} y^2 g_5[y] + 16 e^{x+y} y^2 g_5[y] - \\
 & \quad \left. 8 e^{x+2y} y^2 g_5[y] + 4 y g_7[y] - 4 e^x y g_7[y] - 4 e^y y g_7[y] + 4 e^{x+y} y g_7[y] \right), \\
 & f_{16}[x_, z_] \Rightarrow 0, f_{17}[x_, y_] \Rightarrow 2 y f_{26}[x, y], f_{18}[x_, y_] \Rightarrow \\
 & \quad - \left((f_{19}[x, y] + 4 g_5[x] - 8 e^x g_5[x] + 4 e^{2x} g_5[x]) / (2 (-1 + e^x)) \right), \\
 & f_{19}[x_, y_] \Rightarrow \frac{1}{(-1 + e^x) (-1 + e^y) x^2 y} \left(-1 + 2 e^x - e^{2x} + e^y - 2 e^{x+y} + e^{2x+y} + \right. \\
 & \quad 2 x^2 y f_{20}[x, y] - 2 e^y x^2 y f_{20}[x, y] + x y g_4[x] - e^x x y g_4[x] - e^y x y g_4[x] + \\
 & \quad e^{x+y} x y g_4[x] + y^2 g_4[y] - 2 e^x y^2 g_4[y] + e^{2x} y^2 g_4[y] - 4 y^3 g_5[y] + 8 e^x y^3 g_5[y] - \\
 & \quad 4 e^{2x} y^3 g_5[y] + 8 e^y y^3 g_5[y] - 4 e^{2y} y^3 g_5[y] - 16 e^{x+y} y^3 g_5[y] + 8 e^{2x+y} y^3 g_5[y] + \\
 & \quad \left. 8 e^{x+2y} y^3 g_5[y] - 4 e^{2x+2y} y^3 g_5[y] - e^y y h_1[] + 2 e^{x+y} y h_1[] - e^{2x+y} y h_1[] \right), \\
 & f_{21}[x_, z_] \Rightarrow 0, f_{22}[x_, z_] \Rightarrow \frac{-x f_{23}[x, z] - 4 g_7[z] + 4 e^x g_7[z]}{(-1 + e^x) x}, \\
 & f_{24}[x_, z_] \Rightarrow 0, f_{25}[x_, z_] \Rightarrow 0, g_1[y_] \Rightarrow y g_2[y] + h_1[], \\
 & g_2[y_] \Rightarrow \frac{1}{2 y^2} e^{-y} \left(-2 + 2 e^y - 2 y^2 g_3[y] + 8 y^3 g_5[y] - 16 e^y y^3 g_5[y] + \right. \\
 & \quad \left. 8 e^{2y} y^3 g_5[y] + 8 y^2 g_7[y] - 8 e^y y^2 g_7[y] - y h_1[] - e^y y h_1[] \right), \\
 & f_1[x_, z_] \Rightarrow \frac{1}{2} \left(-\frac{1}{(-1 + e^x)^2} x \left(-2 (-1 + e^x)^2 f_6[x, z] - 2 x f_{20}[x, z] + \right. \right. \\
 & \quad \left. \left. (-1 + e^x) \left(g_4[x] + 4 (-1 + e^x)^2 x g_5[x] \right) \right) + g_8[z] \right);
 \end{aligned}$$

Solution to all equations, as found on 160809:

$$\begin{aligned}
 \text{ECA11} = \text{ECA11ButOne} \cup \{ & f_6[x_, z_] \rightarrow \frac{-x f_7[x, z] + g_9[x] + g_{10}[z]}{x}, g_{10}[y_] \rightarrow \frac{1}{2 (-1 + e^y)^2 y} \\
 & \left(-1 + e^y - y^2 g_4[y] + 2 e^y y^2 g_4[y] - 4 y^3 g_5[y] + 8 e^y y^3 g_5[y] - 4 e^{2y} y^3 g_5[y] + 2 e^y y g_6[y] - \right. \\
 & \quad \left. 2 e^{2y} y g_6[y] - y g_8[y] + e^y y g_8[y] - 2 y g_9[y] + 4 e^y y g_9[y] - 2 e^{2y} y g_9[y] - e^y y h_1[] \right);
 \end{aligned}$$

Length[ECA11]

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$$\text{Rp}[i_ , j_] := \mathbb{E} \left[b_i c_j + \frac{e^{b_i} - 1}{b_i} u_i w_j \right] \left(1 + \epsilon c_i f_1[b_i, b_j] + \epsilon c_j f_2[b_i, b_j] + \epsilon c_i^2 f_3[b_i, b_j] + \epsilon c_i c_j f_4[b_i, b_j] + \epsilon c_j^2 f_5[b_i, b_j] + \epsilon u_i w_i f_6[b_i, b_j] + \epsilon u_i w_j f_7[b_i, b_j] + \epsilon u_j w_i f_8[b_i, b_j] + \epsilon u_j w_j f_9[b_i, b_j] + \epsilon c_i u_i w_i f_{10}[b_i, b_j] + \epsilon c_i u_i w_j f_{11}[b_i, b_j] + \epsilon c_i u_j w_i f_{12}[b_i, b_j] + \epsilon c_i u_j w_j f_{13}[b_i, b_j] + \epsilon c_j u_i w_i f_{14}[b_i, b_j] + \epsilon c_j u_i w_j f_{15}[b_i, b_j] + \epsilon c_j u_j w_i f_{16}[b_i, b_j] + \epsilon c_j u_j w_j f_{17}[b_i, b_j] + \epsilon u_i^2 w_i^2 f_{18}[b_i, b_j] + \epsilon u_i^2 w_i w_j f_{19}[b_i, b_j] + \epsilon u_i^2 w_j^2 f_{20}[b_i, b_j] + \epsilon u_i u_j w_i^2 f_{21}[b_i, b_j] + \epsilon u_i u_j w_i w_j f_{22}[b_i, b_j] + \epsilon u_i u_j w_j^2 f_{23}[b_i, b_j] + \epsilon u_j^2 w_i^2 f_{24}[b_i, b_j] + \epsilon u_j^2 w_i w_j f_{25}[b_i, b_j] + \epsilon u_j^2 w_j^2 f_{26}[b_i, b_j] \right)$$

Rp[1, 2]

$$\mathbb{E} \left[b_1 c_2 + \frac{(-1 + e^{b_1}) u_1 w_2}{b_1} \right] \left(1 + \epsilon c_1 f_1[b_1, b_2] + \epsilon c_2 f_2[b_1, b_2] + \epsilon c_1^2 f_3[b_1, b_2] + \epsilon c_1 c_2 f_4[b_1, b_2] + \epsilon c_2^2 f_5[b_1, b_2] + \epsilon u_1 w_1 f_6[b_1, b_2] + \epsilon u_1 w_2 f_7[b_1, b_2] + \epsilon u_2 w_1 f_8[b_1, b_2] + \epsilon u_2 w_2 f_9[b_1, b_2] + \epsilon c_1 u_1 w_1 f_{10}[b_1, b_2] + \epsilon c_1 u_1 w_2 f_{11}[b_1, b_2] + \epsilon c_1 u_2 w_1 f_{12}[b_1, b_2] + \epsilon c_1 u_2 w_2 f_{13}[b_1, b_2] + \epsilon c_2 u_1 w_1 f_{14}[b_1, b_2] + \epsilon c_2 u_1 w_2 f_{15}[b_1, b_2] + \epsilon c_2 u_2 w_1 f_{16}[b_1, b_2] + \epsilon c_2 u_2 w_2 f_{17}[b_1, b_2] + \epsilon u_1^2 w_1^2 f_{18}[b_1, b_2] + \epsilon u_1^2 w_1 w_2 f_{19}[b_1, b_2] + \epsilon u_1^2 w_2^2 f_{20}[b_1, b_2] + \epsilon u_1 u_2 w_1^2 f_{21}[b_1, b_2] + \epsilon u_1 u_2 w_1 w_2 f_{22}[b_1, b_2] + \epsilon u_1 u_2 w_2^2 f_{23}[b_1, b_2] + \epsilon u_2^2 w_1^2 f_{24}[b_1, b_2] + \epsilon u_2^2 w_1 w_2 f_{25}[b_1, b_2] + \epsilon u_2^2 w_2^2 f_{26}[b_1, b_2] \right)$$

Short[t1 = Rp[1, 2] (Rp[3, 4] Rp[5, 6] // m[3, 5, x]) // m[1, 6, y] // m[2, 4, z]]

$$\frac{1}{b_x^2 b_y^2} \mathbb{E} \left[\frac{b_x^2 b_y c_y + \ll 10 \gg + \ll 1 \gg}{b_x b_y} \right] (b_x^2 \ll 1 \gg + \ll 397 \gg + \ll 1 \gg)$$

t2 = (Rp[1, 2] Rp[3, 4] // m[1, 3, x]) Rp[5, 6] // m[2, 5, y] // m[4, 6, z]

$$\frac{1}{2 b_x^2 b_y^2} e^{-2 b_y} \mathbb{E} \left[\frac{b_x^2 b_y c_y + \dots 10 \dots + e^{b_y} b_x u_y w_z}{b_x b_y} \right] \left(2 e^{2 b_y} b_x^2 b_y^2 + \dots 662 \dots + 2 e^{2 b_y} \epsilon b_x^2 b_y^2 u_2^2 w_2^2 f_{26}[b_y, b_z] \right)$$

large output show less show more show all set size limit...

t3 = (t1 ≡ t2) // . ECall

$$\frac{1}{2 b_x^2 b_y^2} e^{-2 b_y} \left(-4 e^{2 b_y} \epsilon b_x b_y c_y u_x w_z + 4 e^{3 b_y} \epsilon b_x b_y c_y u_x w_z + \dots 494 \dots + e^{b_x+3 b_y} \epsilon b_x b_y^2 u_x w_z \left(g_8[b_z] - \frac{b_y (\dots 1 \dots)}{(\dots 1 \dots)^2} \right) \right) == 0$$

large output show less show more show all set size limit...

Together[t3]

True

```

ur[i_] :=
  e^{b_i/4} E[0] (1 + e c_i ur_1[b_i] + e c_i^2 ur_2[b_i] + e u_i w_i ur_3[b_i] + e c_i u_i w_i ur_4[b_i] + e u_i^2 w_i^2 ur_5[b_i]);
nr[i_] := e^{-b_i/4} E[0] (1 - e c_i ur_1[b_i] - e c_i^2 ur_2[b_i] -
  e u_i w_i ur_3[b_i] - e c_i u_i w_i ur_4[b_i] - e u_i^2 w_i^2 ur_5[b_i]);
ul[i_] := e^{-b_i/4} E[0] (1 + e c_i ul_1[b_i] + e c_i^2 ul_2[b_i] + e u_i w_i ul_3[b_i] +
  e c_i u_i w_i ul_4[b_i] + e u_i^2 w_i^2 ul_5[b_i]);
nl[i_] := e^{b_i/4} E[0] (1 - e c_i ul_1[b_i] - e c_i^2 ul_2[b_i] - e u_i w_i ul_3[b_i] -
  e c_i u_i w_i ul_4[b_i] - e u_i^2 w_i^2 ul_5[b_i]);

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ur[1] nr[2] // m[1, 2, 1]
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E[0]
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ul[1] nl[2] // m[1, 2, 1]
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E[0]
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(* kpr for "kink positive right", etc. *)

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kpr[i_] := Rp[i, 4] nr[3] ul[4] // m[i, 2, i] // m[i, 3, i] // m[i, 4, i];
kpl[i_] := Rp[4, i] nl[3] ur[4] // m[i, 2, i] // m[i, 3, i] // m[i, 4, i];
kmr[i_] := Rm[4, i] nr[3] ul[4] // m[i, 2, i] // m[i, 3, i] // m[i, 4, i];
kml[i_] := Rm[i, 4] nl[3] ur[4] // m[i, 2, i] // m[i, 3, i] // m[i, 4, i];

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```
t0 = ((Rp[x, y] kpr[3] // m[x, 3, x]) ≡ (Rp[x, y] kpr[3] // m[3, x, x])) [[1]] // ECAll
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$$\frac{1}{2 b_x^3} e^{-\frac{5 b_x}{2}} (4 e^{b_x} \in b_x u_x w_y - 8 e^{2 b_x} \in b_x u_x w_y + \dots 216 \dots + 2 \in b_x^3 u_x^2 w_y^2 ur_5[b_x] - 4 e^{b_x} \in b_x^3 u_x^2 w_y^2 ur_5[b_x] + 2 e^{2 b_x} \in b_x^3 u_x^2 w_y^2 ur_5[b_x])$$

large output | show less | show more | show all | set size limit...

```
Short[E0 = CoefficientRules[Expand[t0], {Cx, ux, wx, Cy, uy, wy}] /. {(_ -> c_) -> c} /. {bx -> x, by -> y}]
```

$$\left\{ -\frac{e^{-3x/2} \in}{x^2} + \ll 117 \gg + e^{-3x/2} \in ur_4[x] - e^{-x/2} \in ur_4[x], \right.$$

$$\left. \ll 2 \gg, -\frac{e^{\ll 1 \gg} \in}{2 (\ll 1 \gg \ll 1 \gg^4 x^2)} + \ll 238 \gg + 4 e^{\ll 1 \gg} x \in ur_5[x] \right\}$$

E0 = DeleteCases[Simplify[E0 //. ECall], 0] // SortBy[LeafCount]

$$\left\{ \frac{1}{2 x^2} e^{-5 x/2} \in \left(-4 e^x x^3 f_{20}[x, x] + (-1 + e^x) (2 - 6 e^x + 4 e^{2x} + 2 e^x x^3 f_{23}[x, x] - 2 (-1 + e^x) x^2 g_3[x] + 4 e^x x^2 g_4[x] - 8 x^3 g_5[x] + 24 e^x x^3 g_5[x] - 24 e^{2x} x^3 g_5[x] + 8 e^{3x} x^3 g_5[x] - 8 x^2 g_7[x] + 24 e^x x^2 g_7[x] - 16 e^{2x} x^2 g_7[x] + x h_1[] - 3 e^{2x} x h_1[] - 4 e^{2x} x u_{12}[x] + 2 e^{2x} x^2 u_{14}[x] + 4 e^x x u_{r2}[x] - 2 e^x x^2 u_{r4}[x]) \right), \right.$$

$$-\frac{1}{2 x^3} e^{-7 x/2} (-1 + e^x) \in \left(2 e^x (-3 + e^x) x^3 f_{20}[x, x] + (-1 + e^x) (2 - 9 e^x + 10 e^{2x} - 3 e^{3x} + 2 e^x x^3 f_{23}[x, x] + 2 (-1 + e^x)^2 x^2 g_3[x] + 6 e^x x^2 g_4[x] - 2 e^{2x} x^2 g_4[x] - 8 x^3 g_5[x] + 24 e^x x^3 g_5[x] - 24 e^{2x} x^3 g_5[x] + 8 e^{3x} x^3 g_5[x] - 8 x^2 g_7[x] + 32 e^x x^2 g_7[x] - 32 e^{2x} x^2 g_7[x] + 8 e^{3x} x^2 g_7[x] + x h_1[] - e^x x h_1[] - 4 e^{2x} x h_1[] + 2 e^{3x} x h_1[] - 4 e^{2x} x u_{12}[x] + 2 e^{3x} x u_{12}[x] + 2 e^{2x} x^2 u_{14}[x] - 2 e^{3x} x^2 u_{14}[x] + 2 e^{3x} x^3 u_{15}[x] + 2 e^x x u_{r2}[x] - 2 e^x x^3 u_{r5}[x]) \right), \left.$$

$$\frac{1}{2 x^3} e^{-7 x/2} \in \left(4 e^x (-2 + e^x) x^3 f_{20}[x, x] + (-1 + e^x) (2 - 12 e^x + 16 e^{2x} - 6 e^{3x} + 2 e^x x^3 f_{23}[x, x] + 2 (1 - 3 e^x + 2 e^{2x}) x^2 g_3[x] + 8 e^x x^2 g_4[x] - 4 e^{2x} x^2 g_4[x] - 8 x^3 g_5[x] + 24 e^x x^3 g_5[x] - 24 e^{2x} x^3 g_5[x] + 8 e^{3x} x^3 g_5[x] - 8 x^2 g_7[x] + 40 e^x x^2 g_7[x] - 48 e^{2x} x^2 g_7[x] + 16 e^{3x} x^2 g_7[x] + x h_1[] - 2 e^x x h_1[] - 5 e^{2x} x h_1[] + 4 e^{3x} x h_1[] - 4 e^{2x} x u_{12}[x] + 4 e^{3x} x u_{12}[x] + 2 e^{2x} x^2 u_{14}[x] - 4 e^{3x} x^2 u_{14}[x] + 4 e^{3x} x^3 u_{15}[x] + 2 e^x x^2 u_{r4}[x] - 4 e^x x^3 u_{r5}[x]) \right), \left.$$

$$\frac{1}{2 x^2} e^{-5 x/2} \in \left(2 - 11 e^x + 17 e^{2x} - 8 e^{3x} + 2 e^x (-1 + e^x) x^2 f_7[x, x] + 8 e^x x^3 f_{20}[x, x] + 2 e^x x^3 f_{23}[x, x] - 2 e^{2x} x^3 f_{23}[x, x] + 2 x^2 g_3[x] - 6 e^x x^2 g_3[x] + 4 e^{2x} x^2 g_3[x] + 9 e^x x^2 g_4[x] - 10 e^{2x} x^2 g_4[x] - 8 x^3 g_5[x] + 28 e^x x^3 g_5[x] - 32 e^{2x} x^3 g_5[x] + 12 e^{3x} x^3 g_5[x] - 2 e^{2x} x g_6[x] + 2 e^{3x} x g_6[x] - 8 x^2 g_7[x] + 40 e^x x^2 g_7[x] - 56 e^{2x} x^2 g_7[x] + 24 e^{3x} x^2 g_7[x] + e^x x g_8[x] - e^{2x} x g_8[x] + x h_1[] - 2 e^x x h_1[] - 6 e^{2x} x h_1[] + 8 e^{3x} x h_1[] + 2 e^{2x} x u_{11}[x] - 2 e^{3x} x u_{11}[x] - 2 e^{2x} x u_{12}[x] + 2 e^{3x} x u_{12}[x] - 2 e^{2x} x^2 u_{13}[x] + 2 e^{3x} x^2 u_{13}[x] - 2 e^x x u_{r1}[x] + 2 e^{2x} x u_{r1}[x] + 2 e^x x u_{r2}[x] - 2 e^{2x} x u_{r2}[x] + 2 e^x x^2 u_{r3}[x] - 2 e^{2x} x^2 u_{r3}[x] + 4 e^x x^2 u_{r4}[x] - 4 e^{2x} x^2 u_{r4}[x] - 8 e^x x^3 u_{r5}[x] + 8 e^{2x} x^3 u_{r5}[x] \right) \}$$

Solve[(# == 0) & /@ E0, {ul5[x], ur2[x], ur5[x]}]

$$\left\{ \left\{ \begin{aligned} & \text{ul}_5[x] \rightarrow -\frac{1}{16(-1+e^x)x^3} e^{-3x} \left(-6 + 42 e^x - 88 e^{2x} + 76 e^{3x} - 24 e^{4x} - 4 e^x x^2 f_7[x, x] + 4 e^{2x} x^2 f_7[x, x] - \right. \\ & 20 e^x x^3 f_{20}[x, x] + 16 e^{2x} x^3 f_{20}[x, x] - 6 e^x x^3 f_{23}[x, x] + 6 e^{2x} x^3 f_{23}[x, x] - 6 x^2 g_3[x] + \\ & 24 e^x x^2 g_3[x] - 34 e^{2x} x^2 g_3[x] + 16 e^{3x} x^2 g_3[x] - 18 e^x x^2 g_4[x] + 32 e^{2x} x^2 g_4[x] - \\ & 16 e^{3x} x^2 g_4[x] + 24 x^3 g_5[x] - 104 e^x x^3 g_5[x] + 176 e^{2x} x^3 g_5[x] - 136 e^{3x} x^3 g_5[x] + \\ & 40 e^{4x} x^3 g_5[x] - 4 e^{2x} x g_6[x] + 4 e^{3x} x g_6[x] + 24 x^2 g_7[x] - 144 e^x x^2 g_7[x] + \\ & 280 e^{2x} x^2 g_7[x] - 224 e^{3x} x^2 g_7[x] + 64 e^{4x} x^2 g_7[x] + 2 e^x x g_8[x] - 2 e^{2x} x g_8[x] - \\ & 3 x h_1[] + 9 e^x x h_1[] + 3 e^{2x} x h_1[] - 23 e^{3x} x h_1[] + 16 e^{4x} x h_1[] + 4 e^{2x} x \text{ul}_1[x] - \\ & 4 e^{3x} x \text{ul}_1[x] + 16 e^{2x} x \text{ul}_2[x] - 32 e^{3x} x \text{ul}_2[x] + 16 e^{4x} x \text{ul}_2[x] - 4 e^{2x} x^2 \text{ul}_3[x] + \\ & 4 e^{3x} x^2 \text{ul}_3[x] - 10 e^{2x} x^2 \text{ul}_4[x] + 26 e^{3x} x^2 \text{ul}_4[x] - 16 e^{4x} x^2 \text{ul}_4[x] - 4 e^x x \text{ur}_1[x] + \\ & \left. 4 e^{2x} x \text{ur}_1[x] + 4 e^x x^2 \text{ur}_3[x] - 4 e^{2x} x^2 \text{ur}_3[x] + 2 e^x x^2 \text{ur}_4[x] - 2 e^{2x} x^2 \text{ur}_4[x] \right), \\ & \text{ur}_2[x] \rightarrow -\frac{1}{4(-1+e^x)x} e^{-x} \left(-2 + 8 e^x - 10 e^{2x} + 4 e^{3x} - 4 e^x x^3 f_{20}[x, x] - 2 e^x x^3 f_{23}[x, x] + \right. \\ & 2 e^{2x} x^3 f_{23}[x, x] - 2 x^2 g_3[x] + 4 e^x x^2 g_3[x] - 2 e^{2x} x^2 g_3[x] - 4 e^x x^2 g_4[x] + \\ & 4 e^{2x} x^2 g_4[x] + 8 x^3 g_5[x] - 32 e^x x^3 g_5[x] + 48 e^{2x} x^3 g_5[x] - 32 e^{3x} x^3 g_5[x] + \\ & 8 e^{4x} x^3 g_5[x] + 8 x^2 g_7[x] - 32 e^x x^2 g_7[x] + 40 e^{2x} x^2 g_7[x] - 16 e^{3x} x^2 g_7[x] - \\ & x h_1[] + e^x x h_1[] + 3 e^{2x} x h_1[] - 3 e^{3x} x h_1[] + 4 e^{2x} x \text{ul}_2[x] - 4 e^{3x} x \text{ul}_2[x] - \\ & \left. 2 e^{2x} x^2 \text{ul}_4[x] + 2 e^{3x} x^2 \text{ul}_4[x] + 2 e^x x^2 \text{ur}_4[x] - 2 e^{2x} x^2 \text{ur}_4[x] \right), \\ & \text{ur}_5[x] \rightarrow -\frac{1}{16(-1+e^x)x^3} e^{-x} \left(2 - 14 e^x + 24 e^{2x} - 12 e^{3x} - 4 e^x x^2 f_7[x, x] + 4 e^{2x} x^2 f_7[x, x] + \right. \\ & 12 e^x x^3 f_{20}[x, x] + 2 e^x x^3 f_{23}[x, x] - 2 e^{2x} x^3 f_{23}[x, x] + 2 x^2 g_3[x] - 8 e^x x^2 g_3[x] + \\ & 6 e^{2x} x^2 g_3[x] + 14 e^x x^2 g_4[x] - 16 e^{2x} x^2 g_4[x] - 8 x^3 g_5[x] + 24 e^x x^3 g_5[x] - \\ & 16 e^{2x} x^3 g_5[x] - 8 e^{3x} x^3 g_5[x] + 8 e^{4x} x^3 g_5[x] - 4 e^{2x} x g_6[x] + 4 e^{3x} x g_6[x] - \\ & 8 x^2 g_7[x] + 48 e^x x^2 g_7[x] - 72 e^{2x} x^2 g_7[x] + 32 e^{3x} x^2 g_7[x] + 2 e^x x g_8[x] - 2 e^{2x} x g_8[x] + \\ & x h_1[] - 3 e^x x h_1[] - 9 e^{2x} x h_1[] + 13 e^{3x} x h_1[] + 4 e^{2x} x \text{ul}_1[x] - 4 e^{3x} x \text{ul}_1[x] - \\ & 4 e^{2x} x^2 \text{ul}_3[x] + 4 e^{3x} x^2 \text{ul}_3[x] - 2 e^{2x} x^2 \text{ul}_4[x] + 2 e^{3x} x^2 \text{ul}_4[x] - 4 e^x x \text{ur}_1[x] + \\ & \left. 4 e^{2x} x \text{ur}_1[x] + 4 e^x x^2 \text{ur}_3[x] - 4 e^{2x} x^2 \text{ur}_3[x] + 10 e^x x^2 \text{ur}_4[x] - 10 e^{2x} x^2 \text{ur}_4[x] \right) \} \} \end{aligned}$$

EC0 =

$$\text{ECA11} \cup \{ul_5[x_-] \Rightarrow -\frac{1}{16(-1+e^x)x^3} e^{-3x} (-6+42e^x-88e^{2x}+76e^{3x}-24e^{4x}-4e^x x^2 f_7[x, x] +$$

$$4e^{2x} x^2 f_7[x, x] - 20e^x x^3 f_{20}[x, x] + 16e^{2x} x^3 f_{20}[x, x] - 6e^x x^3 f_{23}[x, x] + 6e^{2x} x^3 f_{23}[x, x] - 6x^2 g_3[x] + 24e^x x^2 g_3[x] - 34e^{2x} x^2 g_3[x] + 16e^{3x} x^2 g_3[x] - 18e^x x^2 g_4[x] + 32e^{2x} x^2 g_4[x] - 16e^{3x} x^2 g_4[x] + 24x^3 g_5[x] - 104e^x x^3 g_5[x] + 176e^{2x} x^3 g_5[x] - 136e^{3x} x^3 g_5[x] + 40e^{4x} x^3 g_5[x] - 4e^{2x} x g_6[x] + 4e^{3x} x g_6[x] + 24x^2 g_7[x] - 144e^x x^2 g_7[x] + 280e^{2x} x^2 g_7[x] - 224e^{3x} x^2 g_7[x] + 64e^{4x} x^2 g_7[x] + 2e^x x g_8[x] - 2e^{2x} x g_8[x] - 3x h_1[] + 9e^x x h_1[] + 3e^{2x} x h_1[] - 23e^{3x} x h_1[] + 16e^{4x} x h_1[] + 4e^{2x} x ul_1[x] - 4e^{3x} x ul_1[x] + 16e^{2x} x ul_2[x] - 32e^{3x} x ul_2[x] + 16e^{4x} x ul_2[x] - 4e^{2x} x^2 ul_3[x] + 4e^{3x} x^2 ul_3[x] - 10e^{2x} x^2 ul_4[x] + 26e^{3x} x^2 ul_4[x] - 16e^{4x} x^2 ul_4[x] - 4e^x x ur_1[x] + 4e^{2x} x ur_1[x] + 4e^x x^2 ur_3[x] - 4e^{2x} x^2 ur_3[x] + 2e^x x^2 ur_4[x] - 2e^{2x} x^2 ur_4[x]),$$

$$ur_2[x_-] \Rightarrow -\frac{1}{4(-1+e^x)x} e^{-x} (-2+8e^x-10e^{2x}+4e^{3x}-4e^x x^3 f_{20}[x, x] -$$

$$2e^x x^3 f_{23}[x, x] + 2e^{2x} x^3 f_{23}[x, x] - 2x^2 g_3[x] + 4e^x x^2 g_3[x] - 2e^{2x} x^2 g_3[x] - 4e^x x^2 g_4[x] + 4e^{2x} x^2 g_4[x] + 8x^3 g_5[x] - 32e^x x^3 g_5[x] + 48e^{2x} x^3 g_5[x] - 32e^{3x} x^3 g_5[x] + 8e^{4x} x^3 g_5[x] + 8x^2 g_7[x] - 32e^x x^2 g_7[x] + 40e^{2x} x^2 g_7[x] - 16e^{3x} x^2 g_7[x] - x h_1[] + e^x x h_1[] + 3e^{2x} x h_1[] - 3e^{3x} x h_1[] + 4e^{2x} x ul_2[x] - 4e^{3x} x ul_2[x] - 2e^{2x} x^2 ul_4[x] + 2e^{3x} x^2 ul_4[x] + 2e^x x^2 ur_4[x] - 2e^{2x} x^2 ur_4[x]),$$

$$ur_5[x_-] \Rightarrow -\frac{1}{16(-1+e^x)x^3} e^{-x} (2-14e^x+24e^{2x}-12e^{3x}-4e^x x^2 f_7[x, x] +$$

$$4e^{2x} x^2 f_7[x, x] + 12e^x x^3 f_{20}[x, x] + 2e^x x^3 f_{23}[x, x] - 2e^{2x} x^3 f_{23}[x, x] + 2x^2 g_3[x] - 8e^x x^2 g_3[x] + 6e^{2x} x^2 g_3[x] + 14e^x x^2 g_4[x] - 16e^{2x} x^2 g_4[x] - 8x^3 g_5[x] + 24e^x x^3 g_5[x] - 16e^{2x} x^3 g_5[x] - 8e^{3x} x^3 g_5[x] + 8e^{4x} x^3 g_5[x] - 4e^{2x} x g_6[x] + 4e^{3x} x g_6[x] - 8x^2 g_7[x] + 48e^x x^2 g_7[x] - 72e^{2x} x^2 g_7[x] + 32e^{3x} x^2 g_7[x] + 2e^x x g_8[x] - 2e^{2x} x g_8[x] + x h_1[] - 3e^x x h_1[] - 9e^{2x} x h_1[] + 13e^{3x} x h_1[] + 4e^{2x} x ul_1[x] - 4e^{3x} x ul_1[x] - 4e^{2x} x^2 ul_3[x] + 4e^{3x} x^2 ul_3[x] - 2e^{2x} x^2 ul_4[x] + 2e^{3x} x^2 ul_4[x] - 4e^x x ur_1[x] + 4e^{2x} x ur_1[x] + 4e^x x^2 ur_3[x] - 4e^{2x} x^2 ur_3[x] + 10e^x x^2 ur_4[x] - 10e^{2x} x^2 ur_4[x])$$

$$\{f_6[x_-, z_-] \Rightarrow \frac{-\frac{x f_7[x, z]}{-1+e^x} + g_9[x] + g_{10}[z]}{x},$$

$$g_{10}[y_-] \Rightarrow \frac{1}{2(-1+e^y)^2 y} (-1+e^y-y^2 g_4[y] + 2e^y y^2 g_4[y] - 4y^3 g_5[y] +$$

$$8e^y y^3 g_5[y] - 4e^{2y} y^3 g_5[y] + 2e^y y g_6[y] - 2e^{2y} y g_6[y] - y g_8[y] + e^y y g_8[y] -$$

$$2y g_9[y] + 4e^y y g_9[y] - 2e^{2y} y g_9[y] - e^y y h_1[]), f_1[x_-, z_-] \Rightarrow \frac{1}{2} \left(-\frac{1}{(-1+e^x)^2} \right.$$

$$\left. x \left(-2(-1+e^x)^2 f_6[x, z] - 2x f_{20}[x, z] + (-1+e^x) \left(g_4[x] + 4(-1+e^x)^2 x g_5[x] \right) \right) + g_8[z] \right),$$

$$f_2[x_-, y_-] \Rightarrow y f_9[x, y] + y^2 f_{26}[x, y] - g_6[x], f_3[x_-, z_-] \Rightarrow x^2 f_{18}[x, z],$$

$$f_4[x_-, y_-] \Rightarrow y f_{13}[x, y] - g_1[x],$$

$$f_5[x_-, y_-] \Rightarrow y^2 f_{26}[x, y],$$

$$f_8[x_-, z_-] \Rightarrow 0,$$

$$f_{10}[x_-, z_-] \Rightarrow 2x f_{18}[x, z],$$

$$f_{11}[x_-, y_-] \Rightarrow 2x f_{18}[x, y] - 2e^x x f_{18}[x, y] - g_4[x],$$

$$f_{12}[x_-, z_-] \Rightarrow 0, f_{13}[x_-, z_-] \Rightarrow x f_{22}[x, z] - g_3[z],$$

$$f_{14}[x_-, y_-] \Rightarrow y f_{22}[x, y] - g_2[x],$$

$$\begin{aligned}
 f_{15}[x_-, y_-] & \Rightarrow \frac{1}{(-1 + e^y) x} \left(-x y f_{23}[x, y] + e^y x y f_{23}[x, y] + x g_2[x] - e^x x g_2[x] - \right. \\
 & e^y x g_2[x] + e^{x+y} x g_2[x] - e^y y g_2[y] + e^{x+y} y g_2[y] - y g_3[y] + e^x y g_3[y] - y g_4[y] + \\
 & e^x y g_4[y] + 8 y^2 g_5[y] - 8 e^x y^2 g_5[y] - 16 e^y y^2 g_5[y] + 8 e^{2y} y^2 g_5[y] + 16 e^{x+y} y^2 g_5[y] - \\
 & \left. 8 e^{x+2y} y^2 g_5[y] + 4 y g_7[y] - 4 e^x y g_7[y] - 4 e^y y g_7[y] + 4 e^{x+y} y g_7[y] \right), f_{16}[x_-, z_-] \Rightarrow 0, \\
 f_{17}[x_-, y_-] & \Rightarrow 2 y f_{26}[x, y], f_{18}[x_-, y_-] \Rightarrow -\frac{f_{19}[x, y] + 4 g_5[x] - 8 e^x g_5[x] + 4 e^{2x} g_5[x]}{2(-1 + e^x)}, \\
 f_{19}[x_-, y_-] & \Rightarrow \frac{1}{(-1 + e^x)(-1 + e^y) x^2 y} \left(-1 + 2 e^x - e^{2x} + e^y - 2 e^{x+y} + e^{2x+y} + 2 x^2 y f_{20}[x, y] - 2 e^y x^2 y f_{20}[x, y] + \right. \\
 & x y g_4[x] - e^x x y g_4[x] - e^y x y g_4[x] + e^{x+y} x y g_4[x] + y^2 g_4[y] - 2 e^x y^2 g_4[y] + e^{2x} y^2 g_4[y] - \\
 & 4 y^3 g_5[y] + 8 e^x y^3 g_5[y] - 4 e^{2x} y^3 g_5[y] + 8 e^y y^3 g_5[y] - 4 e^{2y} y^3 g_5[y] - 16 e^{x+y} y^3 g_5[y] + \\
 & \left. 8 e^{x+2y} y^3 g_5[y] + 8 e^{x+2y} y^3 g_5[y] - 4 e^{2x+2y} y^3 g_5[y] - e^y y h_1[] + 2 e^{x+y} y h_1[] - e^{2x+y} y h_1[] \right), \\
 f_{21}[x_-, z_-] & \Rightarrow 0, f_{22}[x_-, z_-] \Rightarrow \frac{-x f_{23}[x, z] - 4 g_7[z] + 4 e^x g_7[z]}{(-1 + e^x) x}, \\
 f_{24}[x_-, z_-] & \Rightarrow 0, \\
 f_{25}[x_-, z_-] & \Rightarrow 0, \\
 g_1[y_-] & \Rightarrow y g_2[y] + h_1[], \\
 g_2[y_-] & \Rightarrow \frac{1}{2 y^2} e^{-y} \left(-2 + 2 e^y - 2 y^2 g_3[y] + 8 y^3 g_5[y] - 16 e^y y^3 g_5[y] + \right. \\
 & \left. 8 e^{2y} y^3 g_5[y] + 8 y^2 g_7[y] - 8 e^y y^2 g_7[y] - y h_1[] - e^y y h_1[] \right), ul_5[x_-] \Rightarrow \\
 & -\frac{1}{16(-1 + e^x) x^3} e^{-3x} \left(-6 + 42 e^x - 88 e^{2x} + 76 e^{3x} - 24 e^{4x} - 4 e^x x^2 f_7[x, x] + 4 e^{2x} x^2 f_7[x, x] - \right. \\
 & 20 e^x x^3 f_{20}[x, x] + 16 e^{2x} x^3 f_{20}[x, x] - 6 e^x x^3 f_{23}[x, x] + 6 e^{2x} x^3 f_{23}[x, x] - 6 x^2 g_3[x] + \\
 & 24 e^x x^2 g_3[x] - 34 e^{2x} x^2 g_3[x] + 16 e^{3x} x^2 g_3[x] - 18 e^x x^2 g_4[x] + 32 e^{2x} x^2 g_4[x] - \\
 & 16 e^{3x} x^2 g_4[x] + 24 x^3 g_5[x] - 104 e^x x^3 g_5[x] + 176 e^{2x} x^3 g_5[x] - 136 e^{3x} x^3 g_5[x] + \\
 & 40 e^{4x} x^3 g_5[x] - 4 e^{2x} x g_6[x] + 4 e^{3x} x g_6[x] + 24 x^2 g_7[x] - 144 e^x x^2 g_7[x] + \\
 & 280 e^{2x} x^2 g_7[x] - 224 e^{3x} x^2 g_7[x] + 64 e^{4x} x^2 g_7[x] + 2 e^x x g_8[x] - 2 e^{2x} x g_8[x] - \\
 & 3 x h_1[] + 9 e^x x h_1[] + 3 e^{2x} x h_1[] - 23 e^{3x} x h_1[] + 16 e^{4x} x h_1[] + 4 e^{2x} x ul_1[x] - \\
 & 4 e^{3x} x ul_1[x] + 16 e^{2x} x ul_2[x] - 32 e^{3x} x ul_2[x] + 16 e^{4x} x ul_2[x] - 4 e^{2x} x^2 ul_3[x] + \\
 & 4 e^{3x} x^2 ul_3[x] - 10 e^{2x} x^2 ul_4[x] + 26 e^{3x} x^2 ul_4[x] - 16 e^{4x} x^2 ul_4[x] - 4 e^x x ur_1[x] + \\
 & \left. 4 e^{2x} x ur_1[x] + 4 e^x x^2 ur_3[x] - 4 e^{2x} x^2 ur_3[x] + 2 e^x x^2 ur_4[x] - 2 e^{2x} x^2 ur_4[x] \right), \\
 ur_2[x_-] & \Rightarrow -\frac{1}{4(-1 + e^x) x} e^{-x} \left(-2 + 8 e^x - 10 e^{2x} + 4 e^{3x} - 4 e^x x^3 f_{20}[x, x] - 2 e^x x^3 f_{23}[x, x] + \right. \\
 & 2 e^{2x} x^3 f_{23}[x, x] - 2 x^2 g_3[x] + 4 e^x x^2 g_3[x] - 2 e^{2x} x^2 g_3[x] - 4 e^x x^2 g_4[x] + \\
 & 4 e^{2x} x^2 g_4[x] + 8 x^3 g_5[x] - 32 e^x x^3 g_5[x] + 48 e^{2x} x^3 g_5[x] - 32 e^{3x} x^3 g_5[x] + \\
 & 8 e^{4x} x^3 g_5[x] + 8 x^2 g_7[x] - 32 e^x x^2 g_7[x] + 40 e^{2x} x^2 g_7[x] - 16 e^{3x} x^2 g_7[x] - \\
 & x h_1[] + e^x x h_1[] + 3 e^{2x} x h_1[] - 3 e^{3x} x h_1[] + 4 e^{2x} x ul_2[x] - 4 e^{3x} x ul_2[x] - \\
 & \left. 2 e^{2x} x^2 ul_4[x] + 2 e^{3x} x^2 ul_4[x] + 2 e^x x^2 ur_4[x] - 2 e^{2x} x^2 ur_4[x] \right), \\
 ur_5[x_-] & \Rightarrow -\frac{1}{16(-1 + e^x) x^3} e^{-x} \left(2 - 14 e^x + 24 e^{2x} - 12 e^{3x} - 4 e^x x^2 f_7[x, x] + 4 e^{2x} x^2 f_7[x, x] + \right. \\
 & 12 e^x x^3 f_{20}[x, x] + 2 e^x x^3 f_{23}[x, x] - 2 e^{2x} x^3 f_{23}[x, x] + 2 x^2 g_3[x] - 8 e^x x^2 g_3[x] + \\
 & 6 e^{2x} x^2 g_3[x] + 14 e^x x^2 g_4[x] - 16 e^{2x} x^2 g_4[x] - 8 x^3 g_5[x] + 24 e^x x^3 g_5[x] - \\
 & 16 e^{2x} x^3 g_5[x] - 8 e^{3x} x^3 g_5[x] + 8 e^{4x} x^3 g_5[x] - 4 e^{2x} x g_6[x] + 4 e^{3x} x g_6[x] - \\
 & 8 x^2 g_7[x] + 48 e^x x^2 g_7[x] - 72 e^{2x} x^2 g_7[x] + 32 e^{3x} x^2 g_7[x] + 2 e^x x g_8[x] - 2 e^{2x} x g_8[x] + \\
 & x h_1[] - 3 e^x x h_1[] - 9 e^{2x} x h_1[] + 13 e^{3x} x h_1[] + 4 e^{2x} x ul_1[x] - 4 e^{3x} x ul_1[x] - \\
 & \left. 4 e^{2x} x^2 ul_3[x] + 4 e^{3x} x^2 ul_3[x] - 2 e^{2x} x^2 ul_4[x] + 2 e^{3x} x^2 ul_4[x] - 4 e^x x ur_1[x] + \right. \\
 & \left. \dots \right)
 \end{aligned}$$

`t1 = ((Rp[x, y] kpr[3] // m[y, 3, y]) == (Rp[x, y] kpr[3] // m[3, y, y])) [[1]] // . EC0`

$$\frac{1}{2 b_x^2 b_y^2} e^{-\frac{3by}{2}} \left(\dots 240 \dots + \frac{\dots 1 \dots}{4 \dots 1 \dots} - \frac{e^{-by} \in b_x u_x u_y w_y^2 (-6 + \dots 77 \dots)}{4 (-1 + e^{by})} \right)$$

large output | show less | show more | show all | set size limit...

`Short[E1 = CoefficientRules[Expand[t1], {c_x, u_x, w_x, c_y, u_y, w_y}] /. {(_ -> c_) => c} /. {b_x -> x, b_y -> y}]`

$$\{ \ll 295 \gg + \frac{e^{y/2} y \in ur_4[y]}{(1 - e^y) x^2}, -\frac{e^{\ll 1 \gg} \in}{x y} + \ll 148 \gg, \ll 1 \gg, -\frac{e^{x - \ll 1 \gg} \in}{x y} + \ll 406 \gg \}$$

`E1 = DeleteCases[Simplify[E1 // . EC0], 0] // SortBy[LeafCount]`
`{}`