In[•]:=
```
{K = Knot[3, 1], d = 2}
```
Out[•]=
```
{Knot[3, 1], 2}
```

In[•]:=
```
{Cs, φ} = Rot[K]
```
KnotTheory: Loading precomputed data in PD4Knots`.

Out[•]=
```
{{{-1, 4, 1}, {-1, 6, 3}, {-1, 2, 5}}, {0, 0, 0, -1, 0, 0}}
```

In[•]:=
```
n = Length[Cs]
```
Out[•]=
```
3
```

In[•]:=
```
A = IdentityMatrix[2 n + 1]
```
Out[•]=
```
{{1, 0, 0, 0, 0, 0, 0}, {0, 1, 0, 0, 0, 0, 0}, {0, 0, 1, 0, 0, 0, 0},
 {0, 0, 0, 1, 0, 0, 0}, {0, 0, 0, 0, 1, 0, 0}, {0, 0, 0, 0, 0, 1, 0}, {0, 0, 0, 0, 0, 0, 1}}
```

In[•]:=
```
Cases[Cs, {s_, i_, j_} :> (A[[{i, j}, {i + 1, j + 1}]] += ({{-T^s, T^s - 1}, {0, -1}}))]
```
Out[•]=
$$\left\{\left\{\left\{-\frac{1}{T}, -1+\frac{1}{T}\right\}, \{0,-1\}\right\}, \left\{\left\{-\frac{1}{T}, -1+\frac{1}{T}\right\}, \{0,-1\}\right\}, \left\{\left\{-\frac{1}{T}, -1+\frac{1}{T}\right\}, \{0,-1\}\right\}\right\}$$

In[•]:=
```
G = Inverse[A]
```
Out[•]=
$$\left\{\left\{1, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1\right\},\right.$$
$$\left\{0, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1\right\},$$
$$\left\{0, \frac{1-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{\frac{1}{T^3}-\frac{2}{T^2}+\frac{2}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1}{\left(\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}\right)T}, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1\right\},$$
$$\left\{0, \frac{1-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{-\frac{1}{T^2}+\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1}{\left(\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}\right)T}, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1\right\},$$
$$\left\{0, \frac{1+\frac{1}{T^2}-\frac{2}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{\frac{1}{T^3}-\frac{2}{T^2}+\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{\frac{1}{T^3}-\frac{2}{T^2}+\frac{2}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1\right\},$$
$$\left.\left\{0, \frac{1+\frac{1}{T^2}-\frac{2}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{\frac{1}{T^3}-\frac{2}{T^2}+\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{-\frac{1}{T^2}+\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, \frac{1+\frac{1}{T^2}-\frac{1}{T}}{\frac{1}{T^3}-\frac{1}{T^2}+\frac{1}{T}}, 1\right\}, \{0,0,0,0,0,0,1\}\right\}$$

In[ ]:=
```
ρd1 = PP_Mold@Exp[Total[Cases[Cs, {s_, i_, j_} :> Sum[ϵ^d1 r_{d1,s}[i, j], {d1, d}]]] +
      Sum[ϵ^d1 γ_{d1,φ[[k]]}[k], {k, 2 n}, {d1, d}]]
```

Out[ ]=
```
ℯ^(ϵ r_{1,-1}[2,5] + ϵ r_{1,-1}[4,1] + ϵ r_{1,-1}[6,3] + ϵ^2 r_{2,-1}[2,5] + ϵ^2 r_{2,-1}[4,1] + ϵ^2 r_{2,-1}[6,3] + ϵ γ_{1,-1}[4] + ϵ γ_{1,0}[1] + ϵ γ_{1,0}[2] + ϵ γ_{1,0}[3] + ϵ γ_{1,0}[5] + ϵ γ_{1,0}[6
```

In[•]:=
```
ρd2 = PP_ExpandedMold[
  Expand[F[{}, {}] × Normal@Series[ρd1, {ϵ, 0, d}]] //.
   F[fs_, {es___}] × (f : (r | γ)_ps__[is__])^p_. :>
    F[Join[fs, Table[f, p]], DeleteDuplicates@{es, is}]
 ]
```

Out[•]=

$$
\begin{aligned}
&F[\{\},\{\}] + \epsilon F[\{r_{1,-1}[2,5]\},\{2,5\}] + \epsilon F[\{r_{1,-1}[4,1]\},\{4,1\}] +\\
&\epsilon F[\{r_{1,-1}[6,3]\},\{6,3\}] + \epsilon^2 F[\{r_{2,-1}[2,5]\},\{2,5\}] + \epsilon^2 F[\{r_{2,-1}[4,1]\},\{4,1\}] +\\
&\epsilon^2 F[\{r_{2,-1}[6,3]\},\{6,3\}] + \epsilon F[\{\gamma_{1,-1}[4]\},\{4\}] + \epsilon F[\{\gamma_{1,0}[1]\},\{1\}] +\\
&\epsilon F[\{\gamma_{1,0}[2]\},\{2\}] + \epsilon F[\{\gamma_{1,0}[3]\},\{3\}] + \epsilon F[\{\gamma_{1,0}[5]\},\{5\}] + \epsilon F[\{\gamma_{1,0}[6]\},\{6\}] +\\
&\epsilon^2 F[\{\gamma_{2,-1}[4]\},\{4\}] + \epsilon^2 F[\{\gamma_{2,0}[1]\},\{1\}] + \epsilon^2 F[\{\gamma_{2,0}[2]\},\{2\}] + \epsilon^2 F[\{\gamma_{2,0}[3]\},\{3\}] +\\
&\epsilon^2 F[\{\gamma_{2,0}[5]\},\{5\}] + \epsilon^2 F[\{\gamma_{2,0}[6]\},\{6\}] + \frac{1}{2}\epsilon^2 F[\{r_{1,-1}[2,5], r_{1,-1}[2,5]\},\{2,5\}] +\\
&\epsilon^2 F[\{r_{1,-1}[2,5], r_{1,-1}[4,1]\},\{2,5,4,1\}] + \epsilon^2 F[\{r_{1,-1}[2,5], r_{1,-1}[6,3]\},\{2,5,6,3\}] +\\
&\epsilon^2 F[\{r_{1,-1}[2,5], \gamma_{1,-1}[4]\},\{2,5,4\}] + \epsilon^2 F[\{r_{1,-1}[2,5], \gamma_{1,0}[1]\},\{2,5,1\}] +\\
&\epsilon^2 F[\{r_{1,-1}[2,5], \gamma_{1,0}[2]\},\{2,5\}] + \epsilon^2 F[\{r_{1,-1}[2,5], \gamma_{1,0}[3]\},\{2,5,3\}] +\\
&\epsilon^2 F[\{r_{1,-1}[2,5], \gamma_{1,0}[5]\},\{2,5\}] + \epsilon^2 F[\{r_{1,-1}[2,5], \gamma_{1,0}[6]\},\{2,5,6\}] +\\
&\frac{1}{2}\epsilon^2 F[\{r_{1,-1}[4,1], r_{1,-1}[4,1]\},\{4,1\}] + \epsilon^2 F[\{r_{1,-1}[4,1], r_{1,-1}[6,3]\},\{4,1,6,3\}] +\\
&\epsilon^2 F[\{r_{1,-1}[4,1], \gamma_{1,-1}[4]\},\{4,1\}] + \epsilon^2 F[\{r_{1,-1}[4,1], \gamma_{1,0}[1]\},\{4,1\}] +\\
&\epsilon^2 F[\{r_{1,-1}[4,1], \gamma_{1,0}[2]\},\{4,1,2\}] + \epsilon^2 F[\{r_{1,-1}[4,1], \gamma_{1,0}[3]\},\{4,1,3\}] +\\
&\epsilon^2 F[\{r_{1,-1}[4,1], \gamma_{1,0}[5]\},\{4,1,5\}] + \epsilon^2 F[\{r_{1,-1}[4,1], \gamma_{1,0}[6]\},\{4,1,6\}] +\\
&\frac{1}{2}\epsilon^2 F[\{r_{1,-1}[6,3], r_{1,-1}[6,3]\},\{6,3\}] + \epsilon^2 F[\{r_{1,-1}[6,3], \gamma_{1,-1}[4]\},\{6,3,4\}] +\\
&\epsilon^2 F[\{r_{1,-1}[6,3], \gamma_{1,0}[1]\},\{6,3,1\}] + \epsilon^2 F[\{r_{1,-1}[6,3], \gamma_{1,0}[2]\},\{6,3,2\}] +\\
&\epsilon^2 F[\{r_{1,-1}[6,3], \gamma_{1,0}[3]\},\{6,3\}] + \epsilon^2 F[\{r_{1,-1}[6,3], \gamma_{1,0}[5]\},\{6,3,5\}] +\\
&\epsilon^2 F[\{r_{1,-1}[6,3], \gamma_{1,0}[6]\},\{6,3\}] + \frac{1}{2}\epsilon^2 F[\{\gamma_{1,-1}[4], \gamma_{1,-1}[4]\},\{4\}] +\\
&\epsilon^2 F[\{\gamma_{1,-1}[4], \gamma_{1,0}[1]\},\{4,1\}] + \epsilon^2 F[\{\gamma_{1,-1}[4], \gamma_{1,0}[2]\},\{4,2\}] +\\
&\epsilon^2 F[\{\gamma_{1,-1}[4], \gamma_{1,0}[3]\},\{4,3\}] + \epsilon^2 F[\{\gamma_{1,-1}[4], \gamma_{1,0}[5]\},\{4,5\}] +\\
&\epsilon^2 F[\{\gamma_{1,-1}[4], \gamma_{1,0}[6]\},\{4,6\}] + \frac{1}{2}\epsilon^2 F[\{\gamma_{1,0}[1], \gamma_{1,0}[1]\},\{1\}] +\\
&\epsilon^2 F[\{\gamma_{1,0}[1], \gamma_{1,0}[2]\},\{1,2\}] + \epsilon^2 F[\{\gamma_{1,0}[1], \gamma_{1,0}[3]\},\{1,3\}] +\\
&\epsilon^2 F[\{\gamma_{1,0}[1], \gamma_{1,0}[5]\},\{1,5\}] + \epsilon^2 F[\{\gamma_{1,0}[1], \gamma_{1,0}[6]\},\{1,6\}] +\\
&\frac{1}{2}\epsilon^2 F[\{\gamma_{1,0}[2], \gamma_{1,0}[2]\},\{2\}] + \epsilon^2 F[\{\gamma_{1,0}[2], \gamma_{1,0}[3]\},\{2,3\}] +\\
&\epsilon^2 F[\{\gamma_{1,0}[2], \gamma_{1,0}[5]\},\{2,5\}] + \epsilon^2 F[\{\gamma_{1,0}[2], \gamma_{1,0}[6]\},\{2,6\}] +\\
&\frac{1}{2}\epsilon^2 F[\{\gamma_{1,0}[3], \gamma_{1,0}[3]\},\{3\}] + \epsilon^2 F[\{\gamma_{1,0}[3], \gamma_{1,0}[5]\},\{3,5\}] +\\
&\epsilon^2 F[\{\gamma_{1,0}[3], \gamma_{1,0}[6]\},\{3,6\}] + \frac{1}{2}\epsilon^2 F[\{\gamma_{1,0}[5], \gamma_{1,0}[5]\},\{5\}] +\\
&\epsilon^2 F[\{\gamma_{1,0}[5], \gamma_{1,0}[6]\},\{5,6\}] + \frac{1}{2}\epsilon^2 F[\{\gamma_{1,0}[6], \gamma_{1,0}[6]\},\{6\}]
\end{aligned}
$$

In[ ]:=
```
gPair[fs_, w_] := gPair[fs, w] = (
   Print["Running gPair on", {fs, w}];
   Zip_{Join@@Table[{p_α, p̄_α, x_α, x̄_α}, {α, w}]}[
    (Times @@ (V /@ fs)) Exp[Sum[g_{α,β} (π_α + π̄_α) (ξ_β + ξ̄_β), {α, w}, {β, w}] - Sum[ξ̄_α π_α, {α, w}]]]
  )
```

In[ ]:=
```
ρd3 = PP_Pairing[
  ρd2 /. F[fs_, es_] :> (gPair[
       Replace[fs, Thread[es → Range@Length@es], {2}],
       Length@es
      ] /. g_{α_,β_} :> g_{es[[α]],es[[β]]})
 ]
```

```
Running gPair on{{}, 0}
Running gPair on{{r1,-1[1, 2]}, 2}
Running gPair on{{r2,-1[1, 2]}, 2}
Running gPair on{{γ1,-1[1]}, 1}
Running gPair on{{γ1,0[1]}, 1}
Running gPair on{{γ2,-1[1]}, 1}
Running gPair on{{γ2,0[1]}, 1}
Running gPair on{{r1,-1[1, 2], r1,-1[1, 2]}, 2}
Running gPair on{{r1,-1[1, 2], r1,-1[3, 4]}, 4}
Running gPair on{{r1,-1[1, 2], γ1,-1[3]}, 3}
Running gPair on{{r1,-1[1, 2], γ1,0[3]}, 3}
Running gPair on{{r1,-1[1, 2], γ1,0[1]}, 2}
Running gPair on{{r1,-1[1, 2], γ1,0[2]}, 2}
Running gPair on{{r1,-1[1, 2], γ1,-1[1]}, 2}
Running gPair on{{γ1,-1[1], γ1,-1[1]}, 1}
Running gPair on{{γ1,-1[1], γ1,0[2]}, 2}
Running gPair on{{γ1,0[1], γ1,0[1]}, 1}
Running gPair on{{γ1,0[1], γ1,0[2]}, 2}
```

Out[∘]=

$$1 + \cdots 17 \cdots + \epsilon^2 \left(\cdots 1 \cdots \right) +$$
$$\frac{1}{2}\epsilon^2 \left(\frac{1}{4} + g_{3,6} - 2\, g_{3,3}\, g_{3,6} + 2\, g_{3,6}^2 - \left(1 - \frac{1}{T}\right) g_{3,6}^2 - 12\, g_{3,3}\, g_{3,6}^2 + 24\, g_{3,3}^2\, g_{3,6}^2 - \right.$$
$$6 \left(1 - \frac{1}{T}\right) g_{3,6}^3 + 24 \left(1 - \frac{1}{T}\right) g_{3,3}\, g_{3,6}^3 + 6 \left(1 - \frac{1}{T}\right)^2 g_{3,6}^4 + g_{3,6}\, g_{6,3} + 8\, g_{3,6}^2\, g_{6,3} -$$
$$24\, g_{3,3}\, g_{3,6}^2\, g_{6,3} + 12 \left(-1 + \frac{1}{T}\right) g_{3,6}^3\, g_{6,3} + \cdots 10 \cdots + 6 \left(1 - \frac{1}{T}\right) g_{3,6}^2\, g_{6,6} -$$
$$6 \left(-1 + \frac{1}{T}\right) g_{3,6}^2\, g_{6,6} + 36 \left(-1 + \frac{1}{T}\right) g_{3,3}\, g_{3,6}^2\, g_{6,6} + 12 \left(1 - \frac{1}{T}\right) \left(-1 + \frac{1}{T}\right) g_{3,6}^3\, g_{6,6} -$$
$$8\, g_{3,6}\, g_{6,3}\, g_{6,6} + 16\, g_{3,3}\, g_{3,6}\, g_{6,3}\, g_{6,6} + 12 \left(1 - \frac{1}{T}\right) g_{3,6}^2\, g_{6,3}\, g_{6,6} + 2\, g_{6,6}^2 - 4\, g_{3,3}\, g_{6,6}^2 +$$
$$\left. 4\, g_{3,3}^2\, g_{6,6}^2 + 6 \left(-1 + \frac{1}{T}\right) g_{3,6}\, g_{6,6}^2 + 12 \left(1 - \frac{1}{T}\right) g_{3,3}\, g_{3,6}\, g_{6,6}^2 + 6 \left(-1 + \frac{1}{T}\right)^2 g_{3,6}^2\, g_{6,6}^2 \right)$$

Full expression not available (original memory size: 0.4 MB)

In[•]:=
```
? gPair
```

Out[•]=

Symbol

Global`gPair

Definitions

$$\text{gPair}[\{\},0]=1$$

$$\text{gPair}[\{r_{1,-1}[1,2]\},2]=\frac{1}{2}-g_{1,1}+g_{2,1}+\left(1-\frac{1}{T}\right)g_{1,1}g_{2,1}+g_{1,2}g_{2,1}-\left(1-\frac{1}{T}\right)g_{2,1}^2+g_{1,1}g_{2,2}-2g_{2,1}g_{2,2}$$

$$\text{gPair}[\{\gamma_{1,-1}[1]\},1]=-\frac{1}{2}+g_{1,1}$$

$$\text{gPair}[\{\gamma_{1,0}[1]\},1]=0$$

$$\text{gPair}[fs\_,w\_]:=\text{gPair}[fs,w]=\left(\text{Print}[\text{Running gPair on, }\{fs,w\}];\ \text{Zip}_{\text{Join@@Table}[\{p_\alpha,\overline{p}_\alpha,x_\alpha,\overline{x}_\alpha\},\{\alpha,w\}]}\left[\text{Times}@@V/@fs\ \text{Exp}\left[\sum_\alpha^w\sum_\beta^w g_{\alpha,\beta}\ (\pi_\alpha+\overline{\pi}_\alpha)\ \left(\xi_\beta+\overline{\xi}_\beta\right)-\sum_\alpha^w\overline{\xi}_\alpha\,\pi_\alpha\right]\right]\right)$$

Full Name Global`gPair

In[•]:=
```
{K = Knot[3, 1], d = 1}
```

Out[•]=
```
{Knot[3, 1], 1}
```

In[•]:=
```
PP"Green"[
 {Cs, φ} = Rot[K]; n = Length[Cs];
 A = IdentityMatrix[2 n + 1];
 Cases[Cs, {s_, i_, j_} :> (A[[{i, j}, {i + 1, j + 1}]] += ({{-T^s, T^s - 1}, {0, -1}}))];
 G = Inverse[A];
]
```

In[•]:=
```
ρd1 = PP_Mold@Exp[Total[Cases[Cs, {s_, i_, j_} :> Sum[ϵ^d1 r_{d1,s}[i, j], {d1, d}]]] +
    Sum[ϵ^d1 γ_{d1,φ[[k]]}[k], {k, 2 n}, {d1, d}]]
```

Out[•]=
$$e^{\epsilon\, r_{1,-1}[2,5]+\epsilon\, r_{1,-1}[4,1]+\epsilon\, r_{1,-1}[6,3]+\epsilon\,\gamma_{1,-1}[4]+\epsilon\,\gamma_{1,0}[1]+\epsilon\,\gamma_{1,0}[2]+\epsilon\,\gamma_{1,0}[3]+\epsilon\,\gamma_{1,0}[5]+\epsilon\,\gamma_{1,0}[6]}$$

```
In[•]:= ρd2 = PP_ExpandedMold[
          Expand[F[{}, {}] × Normal@Series[ρd1, {ϵ, 0, d}]] //.
           F[fs_, {es___}] × (f : (r | γ)_ps__[is__])^p_. :>
            F[Join[fs, Table[f, p]], DeleteDuplicates@{es, is}]
          ]
```

```
Out[•]=
F[{}, {}] + ϵ F[{r_{1,-1}[2, 5]}, {2, 5}] + ϵ F[{r_{1,-1}[4, 1]}, {4, 1}] +
 ϵ F[{r_{1,-1}[6, 3]}, {6, 3}] + ϵ F[{γ_{1,-1}[4]}, {4}] + ϵ F[{γ_{1,0}[1]}, {1}] +
 ϵ F[{γ_{1,0}[2]}, {2}] + ϵ F[{γ_{1,0}[3]}, {3}] + ϵ F[{γ_{1,0}[5]}, {5}] + ϵ F[{γ_{1,0}[6]}, {6}]
```

```
In[•]:= ρd3 = Echo@PP_Pairing[
          ρd2 /. F[fs_, es_] :> (gPair[
                Replace[fs, Thread[es → Range@Length@es], {2}],
                Length@es
               ] /. g_{α_,β_} :> g_{es[[α]],es[[β]]})
          ]
```

```
» 1 + ϵ (-1/2 + g_{4,4}) + ϵ (1/2 + g_{1,4} - 2 g_{1,1} g_{1,4} - (1 - 1/T) g_{1,4}^2 + g_{1,4} g_{4,1} - g_{4,4} + g_{1,1} g_{4,4} + (1 - 1/T) g_{1,4} g_{4,4}) +
 ϵ (1/2 - g_{2,2} + g_{5,2} + (1 - 1/T) g_{2,2} g_{5,2} + g_{2,5} g_{5,2} - (1 - 1/T) g_{5,2}^2 + g_{2,2} g_{5,5} - 2 g_{5,2} g_{5,5}) +
 ϵ (1/2 + g_{3,6} - 2 g_{3,3} g_{3,6} - (1 - 1/T) g_{3,6}^2 + g_{3,6} g_{6,3} - g_{6,6} + g_{3,3} g_{6,6} + (1 - 1/T) g_{3,6} g_{6,6})
```

```
Out[•]=
1 + ϵ (-1/2 + g_{4,4}) + ϵ (1/2 + g_{1,4} - 2 g_{1,1} g_{1,4} - (1 - 1/T) g_{1,4}^2 + g_{1,4} g_{4,1} - g_{4,4} + g_{1,1} g_{4,4} + (1 - 1/T) g_{1,4} g_{4,4}) +
 ϵ (1/2 - g_{2,2} + g_{5,2} + (1 - 1/T) g_{2,2} g_{5,2} + g_{2,5} g_{5,2} - (1 - 1/T) g_{5,2}^2 + g_{2,2} g_{5,5} - 2 g_{5,2} g_{5,5}) +
 ϵ (1/2 + g_{3,6} - 2 g_{3,3} g_{3,6} - (1 - 1/T) g_{3,6}^2 + g_{3,6} g_{6,3} - g_{6,6} + g_{3,3} g_{6,6} + (1 - 1/T) g_{3,6} g_{6,6})
```

```
In[•]:= {Δ, ρd3 /. ϵ → ϵ Δ^2}
```

```
Out[•]=
{Δ, 1 + Δ^2 ϵ (-1/2 + g_{4,4}) +
  Δ^2 ϵ (1/2 + g_{1,4} - 2 g_{1,1} g_{1,4} - (1 - 1/T) g_{1,4}^2 + g_{1,4} g_{4,1} - g_{4,4} + g_{1,1} g_{4,4} + (1 - 1/T) g_{1,4} g_{4,4}) +
  Δ^2 ϵ (1/2 - g_{2,2} + g_{5,2} + (1 - 1/T) g_{2,2} g_{5,2} + g_{2,5} g_{5,2} - (1 - 1/T) g_{5,2}^2 + g_{2,2} g_{5,5} - 2 g_{5,2} g_{5,5}) +
  Δ^2 ϵ (1/2 + g_{3,6} - 2 g_{3,3} g_{3,6} - (1 - 1/T) g_{3,6}^2 + g_{3,6} g_{6,3} - g_{6,6} + g_{3,3} g_{6,6} + (1 - 1/T) g_{3,6} g_{6,6})}
```