In[∘]:= **? P3**

Out[∘]=

Symbol

Global`P3

Definitions

```
P3[ψ_LieSeries] := Module[{pd}, pd = τ[y̅, ψ];
 pd + LieMorphism[{x̅ → y̅, y̅ → 0}][pd] - LieMorphism[{x̅ → x̅ + y̅, y̅ → 0}][pd] - 2 R_{x,y}[ψ]]
```

Full Name Global`P3

In[∘]:= **P3[ψ]**

Out[∘]=

```
AS[0, 0, 0, 0]
```

In[∘]:= **FreeLieFormatting[False]**

In[∘]:= **P3[ψ]**

Out[∘]=

```
ASeries[ASeries$43]
```

In[∘]:= **ψs[x, y, y]**

Out[∘]=

```
0
```

In[∘]:= **ASeries$43[2]**

Out[∘]=

```
0
```

In[∘]:= **? ASeries$43**

Out[∘]=

Symbol

Global`ASeries$43

Definitions

```
ASeries$43[0] = AW[] ψs[y]
```

```
ASeries$43[1] = 0

ASeries$43[2] = 2 AW[x, y] ψs[x, y, y] - AW[y, x] ψs[x, y, y]

ASeries$43[3] = AW[x, x, y] ψs[x, x, x, y] - AW[x, y, x] ψs[x, x, x, y] -
 AW[x, y, y] ψs[x, x, x, y] - 3 AW[y, x, x] ψs[x, x, x, y] - AW[y, x, y] ψs[x, x, x, y] -
 AW[y, y, x] ψs[x, x, x, y] + 2 AW[x, x, y] ψs[x, x, y, y] - 2 AW[x, y, x] ψs[x, x, y, y] +
 AW[x, y, y] ψs[x, x, y, y] - AW[y, x, x] ψs[x, x, y, y] - AW[y, y, x] ψs[x, x, y, y] +
 3 AW[x, y, y] ψs[x, y, y, y] - 3 AW[y, x, y] ψs[x, y, y, y] + AW[y, y, x] ψs[x, y, y, y]

ASeries$43[4] = 2 AW[x, x, x, y] ψs[x, x, x, x, y] - 3 AW[x, x, y, x] ψs[x, x, x, x, y] -
 AW[x, x, y, y] ψs[x, x, x, x, y] - 3 AW[x, y, x, x] ψs[x, x, x, x, y] -
 AW[x, y, x, y] ψs[x, x, x, x, y] - AW[x, y, y, x] ψs[x, x, x, x, y] -
 AW[x, y, y, y] ψs[x, x, x, x, y] + 2 AW[y, x, x, x] ψs[x, x, x, x, y] -
 AW[y, x, x, y] ψs[x, x, x, x, y] - AW[y, x, y, x] ψs[x, x, x, x, y] -
 AW[y, x, y, y] ψs[x, x, x, x, y] - AW[y, y, x, x] ψs[x, x, x, x, y] -
 AW[y, y, x, y] ψs[x, x, x, x, y] - AW[y, y, y, x] ψs[x, x, x, x, y] +
 2 AW[x, x, x, y] ψs[x, x, x, y, y] - 3 AW[x, x, y, x] ψs[x, x, x, y, y] +
 2 AW[x, x, y, y] ψs[x, x, x, y, y] - AW[x, y, x, x] ψs[x, x, x, y, y] -
 2 AW[x, y, x, y] ψs[x, x, x, y, y] - 2 AW[x, y, y, x] ψs[x, x, x, y, y] +
 AW[y, x, x, x] ψs[x, x, x, y, y] - 2 AW[y, x, y, x] ψs[x, x, x, y, y] +
 2 AW[y, y, x, x] ψs[x, x, x, y, y] - 4 AW[x, y, x, x] ψs[x, x, y, x, y] -
 2 AW[x, y, x, y] ψs[x, x, y, x, y] - 2 AW[x, y, y, x] ψs[x, x, y, x, y] +
 2 AW[y, x, x, x] ψs[x, x, y, x, y] + 4 AW[y, x, x, y] ψs[x, x, y, x, y] -
 2 AW[y, x, y, x] ψs[x, x, y, x, y] + 3 AW[x, x, y, y] ψs[x, x, y, y, y] -
 3 AW[x, y, x, y] ψs[x, x, y, y, y] - AW[x, y, y, x] ψs[x, x, y, y, y] +
 AW[x, y, y, y] ψs[x, x, y, y, y] + 2 AW[y, y, x, x] ψs[x, x, y, y, y] +
 AW[y, y, y, x] ψs[x, x, y, y, y] - AW[x, y, x, y] ψs[x, y, x, y, y] +
 AW[x, y, y, x] ψs[x, y, x, y, y] - 3 AW[y, x, x, y] ψs[x, y, x, y, y] +
 2 AW[y, x, y, x] ψs[x, y, x, y, y] - AW[y, x, y, y] ψs[x, y, x, y, y] -
 AW[y, y, x, x] ψs[x, y, x, y, y] - AW[y, y, x, y] ψs[x, y, x, y, y] +
 4 AW[x, y, y, y] ψs[x, y, y, y, y] - 6 AW[y, x, y, y] ψs[x, y, y, y, y] +
 4 AW[y, y, x, y] ψs[x, y, y, y, y] - AW[y, y, y, x] ψs[x, y, y, y, y]

ASeries$43[5] = 0

ASeries$43[FreeLie`Private`d$_Integer] :=
 ASeries$43[FreeLie`Private`d$] = Plus @@ (#1[FreeLie`Private`d$] &) /@
  {ASeries[ASeries$14], ASeries[ASeries$24], ASeries[ASeries$39], ASeries[ASeries$42]}
```

Full Name Global`ASeries$43

In[]:= **? ASeries$14**

Out[*]=

Symbol

Global`ASeries$14

Definitions

```
ASeries$14[0] = AW[] ψs[y]

ASeries$14[1] = AW[x] ψs[x, y]

ASeries$14[2] = AW[x, x] ψs[x, x, y] + AW[x, y] ψs[x, y, y] - 2 AW[y, x] ψs[x, y, y]

ASeries$14[3] =
AW[x, x, x] ψs[x, x, x, y] + AW[x, x, y] ψs[x, x, y, y] - 2 AW[x, y, x] ψs[x, x, y, y] +
AW[x, y, y] ψs[x, y, y, y] - 3 AW[y, x, y] ψs[x, y, y, y] + 3 AW[y, y, x] ψs[x, y, y, y]

ASeries$14[4] = AW[x, x, x, x] ψs[x, x, x, x, y] + AW[x, x, x, y] ψs[x, x, x, y, y] -
2 AW[x, x, y, x] ψs[x, x, x, y, y] + AW[x, x, y, x] ψs[x, x, y, x, y] -
3 AW[x, y, x, x] ψs[x, x, y, x, y] + 2 AW[y, x, x, x] ψs[x, x, y, x, y] +
AW[x, x, y, y] ψs[x, x, y, y, y] - 3 AW[x, y, x, y] ψs[x, x, y, y, y] +
3 AW[x, y, y, x] ψs[x, x, y, y, y] + AW[x, y, x, y] ψs[x, y, x, y, y] -
3 AW[x, y, y, x] ψs[x, y, x, y, y] - AW[y, x, x, y] ψs[x, y, x, y, y] +
4 AW[y, x, y, x] ψs[x, y, x, y, y] - AW[y, y, x, x] ψs[x, y, x, y, y] +
AW[x, y, y, y] ψs[x, y, y, y, y] - 4 AW[y, x, y, y] ψs[x, y, y, y, y] +
6 AW[y, y, x, y] ψs[x, y, y, y, y] - 4 AW[y, y, y, x] ψs[x, y, y, y, y]

ASeries$14[5] = 0

ASeries$14[FreeLie`Private`d$_] := ASeries$14[FreeLie`Private`d$] =
τ[LW[LW[y]], LieSeries[LieSeries$13][FreeLie`Private`d$ + 1]]
```

Full Name Global`ASeries$14

In[◦]:= **? ASeries$24**

Out[◦]=

Symbol

Global`ASeries$24

Definitions

```
ASeries$24[0] = 0

ASeries$24[1] = AW[y] ψs[x, y]

ASeries$24[2] = AW[y, y] ψs[x, x, y]

ASeries$24[3] = AW[y, y, y] ψs[x, x, x, y]

ASeries$24[4] = AW[y, y, y, y] ψs[x, x, x, x, y]

ASeries$24[5] = AW[y, y, y, y, y] ψs[x, x, x, x, x, y]

ASeries$24[FreeLie`Private`d$_] :=
 ASeries$24[FreeLie`Private`d$] = Sum[LieMorphism$23[
   ASeries[ASeries$14][FreeLie`Private`k]][FreeLie`Private`d$], {FreeLie`Private`k, 1, FreeLie`Private`d$}]
```

Full Name Global`ASeries$24

In[◦]:= **? LieMorphism$23**

Out[◦]=

Symbol

Global`LieMorphism$23

SubValue Definitions

```
LieMorphism$23[FreeLie`Private`expr_][FreeLie`Private`d_] :=
 Expand[FreeLie`Private`expr /. FreeLie`Private`w_LW | FreeLie`Private`w_AW |
   FreeLie`Private`w_CW :→ LieMorphism$23[FreeLie`Private`w][FreeLie`Private`d]]
```

DownValue Definitions

```
LieMorphism$23[AW[x, x, x, y, x]] = ASeries[ASeries$90]

LieMorphism$23[AW[y, x]] = ASeries[ASeries$29]

LieMorphism$23[AW[x, x, y, y, y]] = ASeries[ASeries$105]

LieMorphism$23[AW[y]] = ASeries[ASeries$27]

LieMorphism$23[AW[y, y, x, x]] = ASeries[ASeries$68]

LieMorphism$23[AW[x, x, x, y, y]] = ASeries[ASeries$94]

LieMorphism$23[AW[x, x, y, x]] = ASeries[ASeries$60]

LieMorphism$23[AW[x, x, y, x, x]] = ASeries[ASeries$92]

LieMorphism$23[AW[x, x, y]] = ASeries[ASeries$31]

LieMorphism$23[AW[x]] = ASeries[ASeries$20]

LieMorphism$23[AW[x, y, x]] = ASeries[ASeries$32]

LieMorphism$23[AW[y, y, y]] = ASeries[ASeries$104]

LieMorphism$23[AW[x, y, x, y, y]] = ASeries[ASeries$106]

LieMorphism$23[AW[y, y]] = ASeries[ASeries$33]

LieMorphism$23[AW[x, y, y, x, x]] = ASeries[ASeries$99]

LieMorphism$23[AW[x, x, x]] = ASeries[ASeries$30]

LieMorphism$23[AW[x, y, x, x]] = ASeries[ASeries$61]

LieMorphism$23[AW[x, y, y, x]] = ASeries[ASeries$65]

LieMorphism$23[AW[y, x, y]] = ASeries[ASeries$35]
```

```
LieMorphism$23[AW[y, x, y, x, y]] = ASeries[ASeries$110]

LieMorphism$23[AW[x, x, x, x, x]] = ASeries[ASeries$88]

LieMorphism$23[AW[y, x, x, y, x]] = ASeries[ASeries$101]

LieMorphism$23[AW[x, y, y, y, x]] = ASeries[ASeries$108]

LieMorphism$23[AW[x, y, y, x, y]] = ASeries[ASeries$107]

LieMorphism$23[AW[y, y, x, x, x]] = ASeries[ASeries$103]

LieMorphism$23[AW[x, y, x, x, y]] = ASeries[ASeries$97]

LieMorphism$23[AW[x, y, x, y]] = ASeries[ASeries$64]

LieMorphism$23[AW[y, y, y, x]] = ASeries[ASeries$72]

LieMorphism$23[AW[y, y, y, x, x]] = ASeries[ASeries$112]

LieMorphism$23[AW[x, y, x, y, x]] = ASeries[ASeries$98]

LieMorphism$23[AW[y, x, y, y]] = ASeries[ASeries$70]

LieMorphism$23[AW[y, y, x, y, y]] = ASeries[ASeries$115]

LieMorphism$23[AW[y, y, y, x, y]] = ASeries[ASeries$116]

LieMorphism$23[AW[y, x, y, y, y]] = ASeries[ASeries$114]

LieMorphism$23[AW[x, x, x, y]] = ASeries[ASeries$59]

LieMorphism$23[AW[y, x, y, x, x]] = ASeries[ASeries$102]

LieMorphism$23[AW[y, x, x, x, y]] = ASeries[ASeries$100]

LieMorphism$23[AW[y, x, x, y]] = ASeries[ASeries$66]

LieMorphism$23[AW[x, x, y, x, y]] = ASeries[ASeries$95]

LieMorphism$23[AW[y, y, x]] = ASeries[ASeries$36]

LieMorphism$23[AW[x, y, y, y, y]] = ASeries[ASeries$113]

LieMorphism$23[AW[y, x, x]] = ASeries[ASeries$91]

LieMorphism$23[ASeries[ASeries$14]] = ASeries[ASeries$24]

LieMorphism$23[AW[x, y, y, y]] = ASeries[ASeries$69]

LieMorphism$23[AW[]] = ASeries[ASeries$16]
```

```
LieMorphism$23[AW[x, y, y]] = ASeries[ASeries$34]

LieMorphism$23[AW[y, x, x, x]] = ASeries[ASeries$62]

LieMorphism$23[AW[y, y, x, y, x]] = ASeries[ASeries$111]

LieMorphism$23[AW[x, y]] = ASeries[ASeries$28]

LieMorphism$23[AW[x, y, x, x, x]] = ASeries[ASeries$93]

LieMorphism$23[AW[y, x, y, x]] = ASeries[ASeries$67]

LieMorphism$23[AW[x, x, y, y]] = ASeries[ASeries$63]

LieMorphism$23[AW[y, y, x, y]] = ASeries[ASeries$71]

LieMorphism$23[AW[x, x, x, x, y]] = ASeries[ASeries$89]

LieMorphism$23[AW[y, y, y, y, x]] = ASeries[ASeries$117]

LieMorphism$23[AW[x, x, x, x]] = ASeries[ASeries$58]

LieMorphism$23[AW[x, x]] = ASeries[ASeries$25]

LieMorphism$23[Support] = {LW[x], LW[y]}

LieMorphism$23[AW[x, x, y, y, x]] = ASeries[ASeries$96]

LieMorphism$23[AW[y, x, x, y, y]] = ASeries[ASeries$109]

LieMorphism$23[FreeLie`Private`w$_LW] /; Deg[FreeLie`Private`w$] == 1 :=
LieMorphism$23[FreeLie`Private`w$] =
FreeLie`Private`MakeLieSeries[FreeLie`Private`w$ /. {LW[x] → LW[y], LW[y] → 0}]

LieMorphism$23[FreeLie`Private`w_LW] := LieMorphism$23[FreeLie`Private`w] =
b @@ LieMorphism$23 /@ LyndonFactorization[FreeLie`Private`w]

LieMorphism$23[AW[FreeLie`Private`w$_]] := LieMorphism$23[AW[FreeLie`Private`w$]] =
ι[FreeLie`Private`MakeLieSeries[LW[FreeLie`Private`w$] /. {LW[x] → LW[y], LW[y] → 0}]]

LieMorphism$23[FreeLie`Private`w_AW] :=
LieMorphism$23[FreeLie`Private`w] = Module[{FreeLie`Private`w1, FreeLie`Private`w2},
 FreeLie`Private`w1 = Take[FreeLie`Private`w, Floor[Length[FreeLie`Private`w]/2]];
 FreeLie`Private`w2 = Drop[FreeLie`Private`w, Floor[Length[FreeLie`Private`w]/2]];
 LieMorphism$23[FreeLie`Private`w1] ** LieMorphism$23[FreeLie`Private`w2]]

LieMorphism$23[FreeLie`Private`w_CW] := tr[LieMorphism$23[AW @@ FreeLie`Private`w]]

LieMorphism$23[FreeLie`Private`s_LieSeries] := LieMorphism$23[FreeLie`Private`s] =
New[LieSeries[FreeLie`Private`ser], FreeLie`Private`ser[FreeLie`Private`d_] :=
```

```
FreeLie`Private`ser[FreeLie`Private`d] = ∑_{FreeLie`Private`k=1}^{FreeLie`Private`d} LieMorphism$23[
 FreeLie`Private`s[FreeLie`Private`k]][FreeLie`Private`d]]

LieMorphism$23[FreeLie`Private`as_ASeries] := LieMorphism$23[FreeLie`Private`as] =
New[ASeries[FreeLie`Private`ser], FreeLie`Private`ser[FreeLie`Private`d_] :=
 FreeLie`Private`ser[FreeLie`Private`d] = ∑_{FreeLie`Private`k=1}^{FreeLie`Private`d} LieMorphism$23[
 FreeLie`Private`as[FreeLie`Private`k]][FreeLie`Private`d]]

LieMorphism$23[FreeLie`Private`cws_CWSeries] := LieMorphism$23[FreeLie`Private`cws] =
New[CWSeries[FreeLie`Private`ser], FreeLie`Private`ser[FreeLie`Private`d_] :=
 FreeLie`Private`ser[FreeLie`Private`d] = ∑_{FreeLie`Private`k=1}^{FreeLie`Private`d} LieMorphism$23[
 FreeLie`Private`cws[FreeLie`Private`k]][FreeLie`Private`d]]
```

Full Name Global`LieMorphism$23

In[ ]:= **? ASeries$27**

Out[∘]=

Symbol

Global`ASeries$27

Definitions

```
ASeries$27[0] = 0

ASeries$27[2] = 0

ASeries$27[1] = 0

ASeries$27[3] = 0

ASeries$27[4] = 0

ASeries$27[5] = 0

ASeries$27[FreeLie`Private`d$_] /; FreeLie`Private`d$ > 0 :=
ASeries$27[FreeLie`Private`d$] = ι[LieSeries[LieSeries$26][FreeLie`Private`d$]]
```

Full Name Global`ASeries$27

In[∘]:=
```
? LieSeries$26
```

Out[∘]=

Symbol

Global`LieSeries$26

Definitions

```
LieSeries$26[2] = 0

LieSeries$26[1] = 0

LieSeries$26[3] = 0

LieSeries$26[4] = 0

LieSeries$26[5] = 0

LieSeries$26[FreeLie`Private`d$_Integer] := LieSeries$26[FreeLie`Private`d$] =
 Expand[0 /. FreeLie`Private`w$_LW /; Deg[FreeLie`Private`w$] ≠ FreeLie`Private`d$ → 0]
```

Full Name Global`LieSeries$26

In[∘]:=
```
ψ
```

Out[∘]=
```
LieSeries[LieSeries$13]
```

In[∘]:= **? LieSeries$13**

Out[∘]=

Symbol

Global`LieSeries$13

Definitions

```
LieSeries$13[FreeLie`Private`setter] = FreeLie`Private`solver$4248

LieSeries$13[1] = 0

LieSeries$13[2] = 0

LieSeries$13[3] = 0

LieSeries$13[4] = 0

LieSeries$13[5] = 0

LieSeries$13[6] = 0

LieSeries$13[FreeLie`Private`d$_Integer, UndeterminedCoefficients] :=
Cases[ψs @@@ AllLyndonWords[FreeLie`Private`d$, {LW[x], LW[y]}], _ψs]

LieSeries$13[FreeLie`Private`d$_Integer] :=
If[LieSeries$13[FreeLie`Private`setter] =!= Null,
 LieSeries$13[FreeLie`Private`setter][FreeLie`Private`d$];
 LieSeries$13[FreeLie`Private`d$],
 Plus @@ (#1 ψs @@ #1 &) /@ AllLyndonWords[FreeLie`Private`d$, {LW[x], LW[y]}]]
```

Full Name Global`LieSeries$13

In[∘]:= **? FreeLie`Private`solver$4248**

Out[∘]=

Symbol

FreeLie`Private`solver$4248

Definitions

```
FreeLie`Private`solver$4248[0] = Null

FreeLie`Private`solver$4248[1] = Null

FreeLie`Private`solver$4248[2] = Null

FreeLie`Private`solver$4248[3] = Null

FreeLie`Private`solver$4248[4] = Null

FreeLie`Private`solver$4248[5] = Null

FreeLie`Private`solver$4248[6] = Null

FreeLie`Private`solver$4248[FreeLie`Private`n$_] :=
(FreeLie`Private`solver$4248[FreeLie`Private`n$ - 1];
((#1[FreeLie`Private`setter] = Null) &) /@ First /@ {LieSeries[LieSeries$13]};
FreeLie`Private`lineqs$4248 = BooleanSequence[BooleanSequence$57][FreeLie`Private`n$];
FreeLie`Private`lineqs$4248 = If[Head[FreeLie`Private`lineqs$4248] === And,
 List @@ FreeLie`Private`lineqs$4248, {FreeLie`Private`lineqs$4248}];
FreeLie`Private`gens$4248 = Union[
 Cases[FreeLie`Private`lineqs$4248, _LW | _CW | _AW, ∞]];
FreeLie`Private`lineqs$4248 = Flatten[Replace[FreeLie`Private`lineqs$4248,
 FreeLie`Private`lhs$_ == FreeLie`Private`rhs$_ :→ (Coefficient[FreeLie`Private`lhs$,
 #1] == Coefficient[FreeLie`Private`rhs$, #1] &) /@ FreeLie`Private`gens$4248, {1}]];
FreeLie`Private`vars$4248 = Union @@ (#1[FreeLie`Private`n$,
 UndeterminedCoefficients] &) /@ {LieSeries[LieSeries$13]};
FreeLie`Private`sol$4248 = Quiet[Solve[FreeLie`Private`lineqs$4248,
 FreeLie`Private`vars$4248], {Solve::svars}];
If[FreeLie`Private`sol$4248 === {}, AppendTo[FreeLie`Private`msgs$4248,
 {NoSolution, FreeLie`Private`n$}];
Message[SeriesSolve::NoSolution, FreeLie`Private`n$];
Abort[], FreeLie`Private`sol$4248 = FreeLie`Private`sol$4248⟦1⟧];
FreeLie`Private`fvars$4248 =
Complement[FreeLie`Private`vars$4248, First /@ FreeLie`Private`sol$4248];
FreeLie`Private`avals$4248 = FreeLie`Private`arbitrator$4248[
 FreeLie`Private`fvars$4248];
AppendTo[FreeLie`Private`msgs$4248, {ArbitrarilySetting, FreeLie`Private`n$,
 Thread[Hold /@ FreeLie`Private`fvars$4248 → FreeLie`Private`avals$4248]}];
If[FreeLie`Private`fvars$4248 =!= {}, Message[SeriesSolve::ArbitrarilySetting,
```

```
 FreeLie`Private`n$, Thread[FreeLie`Private`fvars$4248 → FreeLie`Private`avals$4248]]];
MapThread[(#1 = #2) &, {FreeLie`Private`fvars$4248, FreeLie`Private`avals$4248}];
FreeLie`Private`sol$4248 /. Rule → Set;
((#1[FreeLie`Private`n$] = #1[FreeLie`Private`n$]) &) /@
First /@ {LieSeries[LieSeries$13]};
((#1[FreeLie`Private`setter] = FreeLie`Private`solver$4248) &) /@
First /@ {LieSeries[LieSeries$13]};
FreeLie`Private`solver$4248[FreeLie`Private`n$] = Null])
```

Attributes {Temporary}
Full Name FreeLie`Private`solver$4248

```
In[•]:= ψ1 = LS[{LW@x, LW@y}, ψ1s]
Out[•]=
LS[x ψ1s[x] + y ψ1s[y], xy ψ1s[x, y], x xy ψ1s[x, x, y] + xy y ψ1s[x, y, y], ...]

In[•]:= Timing[P3[ψ1][9]]
Out[•]=
{0., 7 AW[x, x, x, x, x, x, x, x, y] ψ1s[x, x, x, x, x, x, x, x, x, y] -
  28 AW[x, x, x, x, x, x, x, y, x] ψ1s[x, x, x, x, x, x, x, x, x, y] -
  AW[x, x, x, x, x, x, x, y, y] ψ1s[x, x, x, x, x, x, x, x, x, y] + … 13 119 … +
  126 AW[y, y, y, y, x, y, y, y, y] ψ1s[x, y, y, y, y, y, y, y, y, y] -
  84 AW[y, y, y, y, y, x, y, y, y] ψ1s[x, y, y, y, y, y, y, y, y, y] +
  36 AW[y, y, y, y, y, y, x, y, y] ψ1s[x, y, y, y, y, y, y, y, y, y] -
  9 AW[y, y, y, y, y, y, y, x, y] ψ1s[x, y, y, y, y, y, y, y, y, y] +
  AW[y, y, y, y, y, y, y, y, x] ψ1s[x, y, y, y, y, y, y, y, y, y]}
Full expression not available (original memory size: 2.7 MB)

In[•]:= P3[ψ_] := Module[{pd},
   pd = τ[LW[y], ψ];
   pd + LieMorphism[{LW[x] → LW[y], LW[y] → 0}]@pd -
    LieMorphism[{LW[x] → LW[x] + LW[y], LW[y] → 0}]@pd - 2 R_{x,y}[ψ]
  ]

In[•]:= Timing[P3[ψ1[9]]]
Out[•]=
{1.71875, LieMorphism$23[
   AW[x, x, x, x, x, x, x, x] ψ1s[x, x, x, x, x, x, x, x, y] + AW[x, x, x, x, x, x, x, y] ψ1s[x, x, x, x, x, x, x, y, y] -
    2 AW[x, x, x, x, x, x, y, x] ψ1s[x, x, x, x, x, x, x, y, y] + AW[x, x, x, x, x, x, y, x] ψ1s[x, x, x, x, x, x, y, x, y] -
    3 AW[x, x, x, x, x, y, x, x] ψ1s[x, x, x, x, x, x, y, x, y] + 2 AW[x, x, x, x, y, x, x, x] ψ1s[x, x, x, x, x, x, y, x, y] +
    … 1313 … + 70 AW[y, y, y, y, x, y, y, y] ψ1s[x, y, y, y, y, y, y, y, y] - 56 AW[y, y, y, y, y, x, y, y]
     ψ1s[x, y, y, y, y, y, y, y, y] + 28 AW[y, y, y, y, y, y, x, y] ψ1s[x, y, y, y, y, y, y, y, y] -
    8 AW[y, y, y, y, y, y, y, x] ψ1s[x, y, y, y, y, y, y, y, y]] - LieMorphism$37[… 1 …] + … 1329 …}
Full expression not available (original memory size: 1.6 MB)
```