Pensieve header: An isolated attempt to compute the multiplication tensor of QU.

The implementation of QU is modified from pensieve://Projects/SL2Portfolio/SL2PortfolioProgram.nb.

Initialization / Utilities

```
In[∘]:=
$k = 1; $U = QU; $E := {$k};
$trim := {ϵ^(k_.) /; k > $k → 0};
SetAttributes[{SS, SST}, HoldAll];
q_ℏ_ := 𝕖^(γ ϵ ℏ);
(* Upper to lower and lower to Upper: *)
U2l = {B_i_^(p_.) → 𝕖^(-p ℏ γ b_i), B^(p_.) → 𝕖^(-p ℏ γ b), T_i_^(p_.) → 𝕖^(p ℏ t_i), T^(p_.) → 𝕖^(p ℏ t), 𝒜_i_^(p_.) → 𝕖^(p γ α_i), 𝒜^(p_.) → 𝕖^(p γ α)};
l2U = {𝕖^(c_. b_i_ + d_.) :→ B_i^(-c/(ℏ γ)) 𝕖^d, 𝕖^(c_. b + d_.) :→ B^(-c/(ℏ γ)) 𝕖^d,
    𝕖^(c_. t_i_ + d_.) :→ T_i^(c/ℏ) 𝕖^d, 𝕖^(c_. t + d_.) :→ T^(c/ℏ) 𝕖^d,
    𝕖^(c_. α_i_ + d_.) :→ 𝒜_i^(c/γ) 𝕖^d, 𝕖^(c_. α + d_.) :→ 𝒜^(c/γ) 𝕖^d,
    𝕖^ℰ_ :→ 𝕖^(Expand@ℰ)};
SS[ℰ_, op_] := Collect[Normal@Series[ℰ, {ϵ, 0, $k}], ϵ, op];
SS[ℰ_] := SS[ℰ, Together];
SST[ℰ_, op___] := SS[ℰ /. U2l, op];
Simp[ℰ_, op_] := Collect[ℰ, _CU | _QU, op];
Simp[ℰ_] := Simp[ℰ, SS[#, Expand] &];
SimpT[ℰ_] := Collect[ℰ, _CU | _QU, SST[#, Expand] &];
Kδ /: Kδ_{i_,j_} := If[i === j, 1, 0];
c_Integer_{k_Integer} := c + O[ϵ]^(k+1);
```

```
In[∘]:=
CF[ℰ_] := ExpandDenominator@
    ExpandNumerator@Together[Expand[ℰ] //. 𝕖^x_ 𝕖^y_ :→ 𝕖^(x+y) /. 𝕖^x_ :→ 𝕖^(CF[x])];
```

```
In[∘]:=
Unprotect[SeriesData];
SeriesData /: CF[sd_SeriesData] := MapAt[CF, sd, 3];
SeriesData /: Expand[sd_SeriesData] := MapAt[Expand, sd, 3];
SeriesData /: Simplify[sd_SeriesData] := MapAt[Simplify, sd, 3];
SeriesData /: Together[sd_SeriesData] := MapAt[Together, sd, 3];
SeriesData /: Collect[sd_SeriesData, specs__] := MapAt[Collect[#, specs] &, sd, 3];
Protect[SeriesData];
```

Self-Pair (SP):

```
In[∘]:=
SP_{}[P_] := P; SP_{ℰ_→x_,ps___}[P_] := Expand[P // SP_{ps}] /. f_. ℰ^(d_.) :→ ∂_{x,d} f
```

DeclareAlgebra

In[∘]:=
```
Unprotect[NonCommutativeMultiply]; Attributes[NonCommutativeMultiply] = {};
(NCM = NonCommutativeMultiply) [x_] := x;
NCM[x_, y_, z__] := (x ⊠ y) ⊠ z;
0 ⊠ _ = _ ⊠ 0 = 0;
(x_Plus) ⊠ y_ := (# ⊠ y) & /@ x; x_ ⊠ (y_Plus) := (x ⊠ #) & /@ y;
B[x_, x_] = 0; B[x_, y_] := x ⊠ y - y ⊠ x;
B[x_, y_, e_] := B[x, y, e] = B[x, y];
```

In[∘]:=
```
DeclareAlgebra[U_Symbol, opts__Rule] := Module[
  {gp, sr, g, cp, M, pow, k = 0,
   gs = Generators /. {opts},
   cs = Centrals /. {opts} /. Centrals → {}
  },
  U[Generators] = gs;
  (#_U = U@#) & /@ gs;
  gp = Alternatives @@ gs; gp = gp | gp_; (* gens *)
  sr = Flatten@Table[{g → ++k, g_i_ → {i, k}}, {g, gs}]; (* sorting → *)
  cp = Alternatives @@ cs; (* cents *)
  SetAttributes[M, HoldRest]; M[0, _] = 0; M[a_, x_] := a x;
  CE[ℰ_] := Collect[ℰ, _U, Expand] /. ⅇ^x_ :> ⅇ^Expand[x] /. $trim;
  U_i_ [ℰ_] := ℰ /. {t : cp :> t_i, u_U :> (#_i &) /@ u};
  U_i_ [NCM[]] = pow[ℰ_, 0] = U@{} = 1_U = U[];
  B[U@(x_)_i_, U@(y_)_i_] := U_i@B[U@x, U@y];
  B[U@(x_)_i_, U@(y_)_j_] /; i =!= j := 0;
  B[U@y_, U@x_] := CE[-B[U@x, U@y]];
  x_ ⊠ (c_. 1_U) := CE[c x]; (c_. 1_U) ⊠ x_ := CE[c x];
  (a_. U[xx___, x_]) ⊠ (b_. U[y_, yy___]) := If[OrderedQ[{x, y} /. sr],
    CE@M[a b /. $trim, U[xx, x, y, yy]],
    U@xx ⊠ CE@M[a b /. $trim, U@y ⊠ U@x + B[U@x, U@y, $E]] ⊠ U@yy ];
  U@{c_. * (l : gp)^n_, r___} /; FreeQ[c, gp] := CE[c U@Table[l, {n}] ⊠ U@{r}];
  U@{c_. * l : gp, r___} := CE[c U[l] ⊠ U@{r}];
  U@{c_, r___} /; FreeQ[c, gp] := CE[c U@{r}];
  U@{l_Plus, r___} := CE[U@{#, r} & /@ l];
  U@{l_, r___} := U@{Expand[l], r};
  U[ℰ_NonCommutativeMultiply] := U /@ ℰ;
  𝕆_U[specs___, poly_] := Module[{sp, null, vs, us},
    sp = Replace[{specs}, l_List :> l_null, {1}];
    vs = Join @@ (First /@ sp);
    us = Join @@ (sp /. l_s_ :> (l /. x_i_ :> x_s));
    CE[Total[
       CoefficientRules[poly, vs] /. (p_ → c_) :> c U@(us^p)
      ]] /. x_null :> x];
```

```
𝕆U[specs___, 𝔼[L_, Q_, P_]] := 𝕆U[specs, SS@Normal[P ⅇ^(L+Q)]];
pow[ℰ_, n_] := pow[ℰ, n - 1] ⊠ ℰ;
𝕊U[ℰ_, ss___Rule] := CE@Total[
    CoefficientRules[ℰ, First /@ {ss}] /.
     (p_ → c_) :→ c NCM @@ MapThread[pow, {Last /@ {ss}, p}]];
σrs___[c_. * u_U] := (c /. (t : cp)j_ :→ t_{j/.{rs}}) U[List @@ (u /. v_j_ :→ v_{j/.{rs}})];
m_{j_→k_}[c_. * u_U] := CE[((c /. (t : cp)j → tk) DeleteCases[u, _{j|k}]) ⊠
    U @@ Cases[u, w_j :→ wk] ⊠ U @@ Cases[u, _k]];
U /: c_. * u_U * v_U := CE[c u ⊠ v];
S_i_[c_. * u_U] := CE[((c /. Si[U, Centrals]) DeleteCases[u, _i]) ⊠
    Ui[NCM @@ Reverse@Cases[u, x_i :→ S@U@x]]];
Δ_{i_→j_,k_}[c_. * u_U] := CE[((c /. Δ_{i→j,k}[U, Centrals]) DeleteCases[u, _i]) ⊠
    (NCM @@ Cases[u, x_i :→ σ_{1→j,2→k}@Δ@U@x] /. NCM[] → U[])]; ]
```

In[∘]:=
```
𝕊QU[(a^2 + a) b, a → QU[y, x], b → 7 QU[]]
```

Out[∘]=

$(14 - 7\,T)\,\mathrm{QU}[y, x] + 14\,T\,\epsilon\,\mathrm{QU}[y, a, x] + (7 + 7\,\epsilon)\,\mathrm{QU}[y, y, x, x]$

Meta-Operations

In[∘]:=
```
σrs___[ℰ_Plus] := σrs /@ ℰ;
m_{j_→j_} = Identity; m_{j_→k_}[0] = 0;
m_{j_→k_}[ℰ_Plus] := Simp[m_{j→k} /@ ℰ];
m_{is___,i_,j_→k_}[ℰ_] := m_{j→k}@m_{is,i→j}@ℰ;
S_i_[ℰ_Plus] := Simp[Si /@ ℰ];
Δis___[ℰ_Plus] := Simp[Δis /@ ℰ];
```

Implementing CU = $\mathcal{U}(sl_2^{\gamma\epsilon})$

Verify σ and Δ! Also Generalize Δ to $\Delta_{i,j_1,j_2,\ldots}$.

In[∘]:=
```
DeclareAlgebra[CU, Generators → {y, a, x}, Centrals → {t}];
B[aCU, yCU] = -γ yCU; B[xCU, aCU] = -γ xCU;
B[xCU, yCU] = 2 ϵ aCU - t 1CU;
(S@yCU = -yCU; S@aCU = -aCU; S@xCU = -xCU;)
S_i_[CU, Centrals] = {ti → -ti};
Δ@yCU = CU@y1 + CU@y2; Δ@aCU = CU@a1 + CU@a2; Δ@xCU = CU@x1 + CU@x2;
Δ_{i_→j_,k_}[CU, Centrals] = {ti → tj + tk};
```

Implementing QU = $\mathcal{U}_q(\mathrm{sl}_3^{\gamma\epsilon})$

In[∘]:=
```
ℏ = γ = 1;
DeclareAlgebra[QU, Generators → {X, Y, Z, b, a, z, y, x}, Centrals → {s, t}];
B[a_QU, x_QU] = -2 QU@x; B[b_QU, x_QU] = QU@x;
B[b_QU, y_QU] = -2 QU@y; B[a_QU, y_QU] = QU@y;
B[a_QU, z_QU] = -QU@z; B[b_QU, z_QU] = -QU@z;
B[y_QU, x_QU] = -z_QU + ∈ ℏ QU[y, x];
B[z_QU, x_QU] = -∈ ℏ QU[z, x];
B[b_QU, a_QU] = 0;
B[z_QU, y_QU] = ∈ ℏ QU[z, y];
B[a_QU, X_QU] = 2 X_QU; B[b_QU, X_QU] = -X_QU;
B[a_QU, Y_QU] = -Y_QU; B[b_QU, Y_QU] = 2 Y_QU;
B[a_QU, Z_QU] = Z_QU; B[b_QU, Z_QU] = Z_QU;
B[x_QU, X_QU] = -2 ∈ ℏ QU@{X, x} + (1 - s) QU[]/ℏ + 2 s ∈ QU[a];
B[y_QU, Y_QU] = -2 ∈ ℏ QU@{Y, y} + (1 - t) QU[]/ℏ + 2 t ∈ QU[b];
B[z_QU, Z_QU] = -2 ∈ ℏ QU@{Z, z} + (1 - s t) QU[]/ℏ + 2 s t ∈ QU[a] + 2 s t ∈ QU[b];
B[y_QU, Z_QU] = X_QU - ∈ ℏ QU@{Z, y};
B[x_QU, Z_QU] = -∈ ℏ QU@{Z, x} - (s + s ∈ ℏ) QU[Y] + 2 s ∈ ℏ QU[Y, a];
B[z_QU, X_QU] = 2 ∈ y_QU - ∈ ℏ QU@{X, z};
B[z_QU, Y_QU] = -2 t ∈ QU[x] - ∈ ℏ QU[Y, z]; B[y_QU, X_QU] = ∈ ℏ QU[X, y];
B[x_QU, Y_QU] = ∈ ℏ QU[Y, x];
B[X_QU, Y_QU] = 2 ∈ Z_QU - ∈ ℏ QU[X, Y];
B[X_QU, Z_QU] = ∈ ℏ QU[X, Z];
B[Z_QU, Y_QU] = ∈ ℏ QU[Y, Z];
```

In[∘]:=
```
B[x_QU, y_QU]
```

Out[∘]=

QU[z] - ∈ QU[y, x]

In[∘]:=
```
QU[x] ⊠ QU[y, Z]
```

Out[∘]=

(1 - s t) QU[] + (-s + s t) QU[] + 2 s t ∈ QU[a] + (2 s ∈ - 2 s t ∈) QU[a] + (1 - 2 ∈) QU[X, x] - 2 s ∈ QU[Y, y] + (-s + 2 s ∈) QU[Y, y] + (1 - 2 ∈) QU[Z, z] + 2 s ∈ QU[Y, a, y] + (1 - 3 ∈) QU[Z, y, x]

tSW

Logoi from Pensieve://Talks/Toulouse-1705/DogmaDemo.nb and from Pensieve://Talks/Sydney-1708/ExtraDetails@@.nb.

Goal. In either U, compute $F = e^{-\eta y}\, e^{\xi x}\, e^{\eta y}\, e^{-\xi x}$. First compute $\mathrm{G} = e^{\xi x}\, y\, e^{-\xi x}$, a finite sum. Now F satisfies the ODE $\partial_\eta F = \partial_\eta\left(e^{-\eta y}\, e^{\eta \mathrm{G}}\right) = -\mathrm{yF} + \mathrm{FG}$ with initial conditions $F(\eta = 0) = 1$. So we set it up and solve:

In[∘]:=
```
SW_xy[U_, kk_] :=
  SW_xy[U, kk] = Block[{$U = U, $k = kk, $p = kk}, Module[{G, F, fs, f, bs, e, b, es},
     G = Simp[Table[ξ^k / k!, {k, 0, $k + 1}].NestList[Simp[B[x_U, #]] &, y_U, $k + 1]];
     fs = Flatten@Table[f_{l,i,j,k}[η], {l, 0, $k}, {i, 0, 1}, {j, 0, 1}, {k, 0, 1}];
     F = fs.(bs = fs /. f_{l_,i_,j_,k_}[η] :> ϵ^l U@{y^i, a^j, x^k});
     es = Flatten[
       Table[Coefficient[e, b] == 0, {e, {F - 1_U /. η → 0, F ⊠ G - y_U ⊠ F - ∂_η F}}, {b, bs}]];
     F = F /. DSolve[es, fs, η][[1]];
     𝔼[0,
       ξ x + η y + (U /. {CU → -t η ξ, QU → η ξ (1 - T) / ℏ}),
       F + 0_$k /. {e- → 1, U → Times}
      ] /. (v : η | ξ | t | T | y | a | x) → v_1
    ]];
tSW_{xy_,i_,j_→k_} := SW_xy[$U, $k] /. {ξ_1 → ξ_i, η_1 → η_j, (v : t | T | y | a | x)_1 → v_k};
tSW_{xa,i_,j_→k_} := 𝔼[α_j a_k, e^{-γ α_j} ξ_i x_k, 1];
tSW_{ay,i_,j_→k_} := 𝔼[α_i a_k, e^{-γ α_i} η_j y_k, 1];
```

Exponentials as needed.

Task. Define $\text{Exp}_{U_i,k}[\xi, P]$ which computes $e^{\xi\,\mathbb{O}(P)}$ to ϵ^k in the algebra U_i, where ξ is a scalar, X is x_i or y_i, and P is an ϵ-dependent near-docile element, giving the answer in $\mathbb{E}$-form. Should satisfy $U@\text{Exp}_{U_i,k}[\xi, P] == \mathbb{S}_U[e^{\xi X},\ x \to \mathbb{O}(P)]$.

Methodology. If $P_0 := P_{\epsilon=0}$ and $e^{\xi\,\mathbb{O}(P)} = \mathbb{O}\left(e^{\xi P_0} F(\xi)\right)$, then $F(\xi = 0) = 1$ and we have:
$\mathbb{O}\left(e^{\xi P_0}(P_0 F(\xi) + \partial_\xi F)\right) = \mathbb{O}\left(\partial_\xi e^{\xi P_0} F(\xi)\right) = \partial_\xi \mathbb{O}\left(e^{\xi P_0} F(\xi)\right) = \partial_\xi e^{\xi\,\mathbb{O}(P)} = e^{\xi\,\mathbb{O}(P)}\,\mathbb{O}(P) = \mathbb{O}\left(e^{\xi P_0} F(\xi)\right)\mathbb{O}(P)$.
This is an ODE for F. Setting inductively $F_k = F_{k-1} + \epsilon^k \varphi$ we find that $F_0 = 1$ and solve for φ.

In[∘]:=
```
(* Bug: The first line is valid only if 𝕆(e^P0) == e^𝕆(P0). *)
(* Bug: ξ must be a symbol. *)
Exp_{U_i_,0}[ξ_, P_] := Module[{LQ = Normal@P /. ϵ → 0},
   𝔼[ξ LQ /. (x | y)_i → 0, ξ LQ /. (t | a)_i → 0, 1] ];
Exp_{U_i_,k_}[ξ_, P_] := Block[{$U = U, $k = k},
  Module[{P0, φ, φs, F, j, rhs, at0, atξ},
   P0 = Normal@P /. ϵ → 0;
   φs =
    Flatten@Table[φ_{j1,j2,j3}[ξ], {j2, 0, k}, {j1, 0, 2 k + 1 - j2}, {j3, 0, 2 k + 1 - j2 - j1}];
   F = Normal@Last@Exp_{U_i,k-1}[ξ, P] + ϵ^k φs.(φs /. φ_js__[ξ] :> Times @@ {y_i, a_i, x_i}^{js});
   rhs = Normal@
     Last@m_{i,j→i}[𝔼[ξ P0 /. (x | y)_i → 0, ξ P0 /. (t | a)_i → 0, F + 0_k] m_{i→j}@𝔼[0, 0, P + 0_k]];
   at0 = (# == 0) & /@ Flatten@CoefficientList[F - 1 /. ξ → 0, {y_i, a_i, x_i}];
   atξ = (# == 0) & /@ Flatten@CoefficientList[(∂_ξ F) + P0 F - rhs, {y_i, a_i, x_i}];
   𝔼[ξ P0 /. (x | y)_i → 0, ξ P0 /. (t | a)_i → 0, F + 0_k] /.
    DSolve[And @@ (at0 ⋃ atξ), φs, ξ][[1]] ]]
```

In[∘]:=
```
$k = 1
```
Out[∘]=
```
1
```

In[∘]:=
```
$Basis = {a_QU, x_QU, y_QU};
Module[{a, b}, Table[{a, b} → CE[B[a, b]], {a, $Basis}, {b, $Basis}]] // MatrixForm
```
Out[∘]//MatrixForm=

$$\begin{pmatrix} \{QU[a], QU[a]\} \to 0 & \{QU[a], QU[x]\} \to \gamma\, QU[x] & \\ \{QU[x], QU[a]\} \to -\gamma\, QU[x] & \{QU[x], QU[x]\} \to 0 & \{QU[x], \\ \{QU[y], QU[a]\} \to \gamma\, QU[y] & \{QU[y], QU[x]\} \to \left(-\frac{1}{\hbar} + \frac{T}{\hbar}\right) QU[] - 2\, T \in QU[a] - \gamma \in \hbar\, QU[y, x] & \end{pmatrix}$$

In[∘]:=
```
$Basis = {a_QU, x_QU, y_QU};
Module[{a, b},
 DeleteCases[
  Flatten[Table[{a, b, c} → CE[B[a, b] + B[b, a]], {a, $Basis}, {b, $Basis}]], _ → 0]
]
Module[{a, b, c},
 DeleteCases[Flatten[Table[{a, b, c} → CE[B[a, B[b, c]] + B[b, B[c, a]] + B[c, B[a, b]]],
    {a, $Basis}, {b, $Basis}, {c, $Basis}]], _ → 0]
]
$ABasis = {a_QU, x_QU, y_QU, QU[y, y], QU[y, a], QU[y, x], QU[a, a], QU[a, x], QU[x, x]};
Module[{a, b, c},
 DeleteCases[Flatten[Table[{a, b, c} → CE[a ⊠ CE[b ⊠ c] - CE[a ⊠ b] ⊠ c],
    {a, $ABasis}, {b, $ABasis}, {c, $ABasis}]], _ → 0]
]
```
Out[∘]=
```
{}
```
Out[∘]=
```
{}
```
Out[∘]=
```
{}
```

In[∘]:=
```
Module[{a, b, c},
  Table[{a, b, c} → CE[a ⊠ CE[b ⊠ c]], {a, $ABasis}, {b, $ABasis}, {c, $ABasis}]
 ];
```

In[∘]:=
```
B[x_QU, y_QU] // CE
```
Out[∘]=

$$\left(\frac{1}{\hbar} - \frac{T}{\hbar}\right) QU[] + 2\, T \in QU[a] + \gamma \in \hbar\, QU[y, x]$$

In[∘]:=
```
B[x_QU, B[x_QU, y_QU]] // CE
```
Out[∘]=

$$(\gamma \in - 3\, T\, \gamma \in)\, QU[x]$$

In[∘]:=
```
B[x_QU, B[x_QU, B[x_QU, y_QU]]] // CE
```
Out[∘]=
```
0
```

In[∘]:=
```
B[x_QU, B[x_QU, B[x_QU, B[x_QU, y_QU]]]] // CE
```
Out[∘]=
```
0
```

In[∘]:=
```
B[x_QU, B[x_QU, B[x_QU, B[x_QU, B[x_QU, y_QU]]]]] // Expand
```
Out[∘]=
```
0
```

In[∘]:=
```
B[x_QU, B[x_QU, B[x_QU, B[x_QU, B[x_QU, B[x_QU, y_QU]]]]]] // Expand
```
Out[∘]=
```
0
```

In[∘]:=
```
adPower[x_, k_, Env_][c_ * y_QU] := CE[c adPower[x, k, Env][y]];
adPower[x_, k_, Env_][y_Plus] := adPower[x, k, Env] /@ y;
adPower[_, 0, Env_][y_] := y;
adPower[x_, k_, Env_][0] = 0;
adPower[x_, k_, Env_][y_QU] :=
  adPower[x, k, Env][y] = CE@B[adPower[x, k - 1, Env][y], x];
adPower[x_, k_][y_] := adPower[x, k, $E][y];
```

In[∘]:=
```
adPower[x_QU, 1][y_QU]
```
Out[∘]=
```
-QU[z] + ∈ QU[y, x]
```

In[∘]:=
```
adPower[x_QU, 2][y_QU]
```
Out[∘]=
```
0
```

In[∘]:=
```
adPower[x_QU, 3][y_QU]
```
Out[∘]=
```
0
```

In[∘]:=
```
adPower[x_QU, 4][y_QU]
```
Out[∘]=
```
0
```

In[∘]:=
```
adPower[x_QU, 5][y_QU]
```
Out[∘]=
```
0
```

In[∘]:=
```
NilQ[z_QU] = NilQ[Z_QU] = NilQ[X_QU] = NilQ[Y_QU] = NilQ[x_QU] = NilQ[y_QU] = True; NilQ[a_QU] = False;
NilQ[b_QU] = False;
PotQ[c_. * x_QU] := ¬ NilQ[x]; (* Potent Q *)
NilQ[c_ * x_QU] := NilQ[x];
PotQ[x_Plus] := And @@ (PotQ /@ (List @@ x));
NilQ[x_Plus] := And @@ (NilQ /@ (List @@ x));
```

In[∘]:=
```
Ad[0] = Identity;
Ad[c_. a_QU][z_] := z /. w_QU :→ e^(c γ (Sum[B[g_QU, a_QU]/g_QU Count[w,g], {g,QU@Generators}])) w;
Ad[c_. b_QU][z_] := z /. w_QU :→ e^(c γ (Sum[B[g_QU, b_QU]/g_QU Count[w,g], {g,QU@Generators}])) w;
Ad[c_. QU[]][z_] := z;
```

In[∘]:=
```
Sum[B[g_QU, a_QU]/g_QU Cnt[w, g], {g, QU@Generators}]
```

Out[∘]=
```
2 Cnt[w, x] - 2 Cnt[w, X] - Cnt[w, y] + Cnt[w, Y] + Cnt[w, z] - Cnt[w, Z]
```

In[∘]:=
```
Table[SeriesCoefficient[Ad[c a_QU][g_QU], {c, 0, 1}] -
  B[g_QU, a_QU], {g, Generators // QU}]
Table[SeriesCoefficient[Ad[c b_QU][g_QU], {c, 0, 1}] -
  B[g_QU, b_QU], {g, Generators // QU}]
```

Out[∘]=
```
{0, 0, 0, 0, 0, 0, 0, 0}
```

Out[∘]=
```
{0, 0, 0, 0, 0, 0, 0, 0}
```

In[∘]:=
```
B[X_QU, a_QU]
B[Y_QU, a_QU]
B[Z_QU, a_QU]
```

Out[∘]=
```
-2 QU[X]
```

Out[∘]=
```
QU[Y]
```

Out[∘]=
```
-QU[Z]
```

In[∘]:=
```
Ad[x_][y_] /; NilQ[x] := Expand@Module[{k = 0, s = 0},
   While[adPower[x, k][y] =!= 0,
    s += adPower[x, k][y] / k!;
    ++k
   ];
   s
  ]
```

In[∘]:=
```
Ad[x_QU][y_QU]
```

Out[∘]=
```
QU[y] - QU[z] + ∈ QU[y, x]
```

In[∘]:=
```
$k
```

Out[∘]=
```
1
```

In[∘]:=
```
Ad[c a_QU] /@ {QU[], x_QU, y_QU, QU[x, y]}
```
Out[∘]=

$$\{QU[],\ e^{-c\,\gamma}\,QU[x],\ e^{c\,\gamma}\,QU[y],\ QU[x,y]\}$$

In[∘]:=
```
Ad[(α1 + α2 + ϵ fa[λ]) a_QU] /@ {QU[], x_QU, y_QU, QU[x, y]}
```
Out[∘]=

$$\left\{QU[],\ e^{-\gamma\,(\alpha 1+\alpha 2+\epsilon\,fa[\lambda])}\,QU[x],\ e^{\gamma\,(\alpha 1+\alpha 2+\epsilon\,fa[\lambda])}\,QU[y],\ QU[x,y]\right\}$$

In[∘]:=
```
Normal@Series[e^(-γ (α1+α2+ϵ fa[λ])), {ϵ, 0, $k}]
```
Out[∘]=

$$e^{-((\alpha 1+\alpha 2)\,\gamma)} - e^{-((\alpha 1+\alpha 2)\,\gamma)}\,\gamma\,\epsilon\,fa[\lambda]$$

In[∘]:=
```
CE[
 Ad[(α1 + α2 + ϵ fa[λ]) a_QU] /@ {QU[], x_QU, y_QU, QU[x, y]} /. e^δ_ :> Normal@Series[e^δ, {ϵ, 0, $k}]]
```
Out[∘]=

$$\left\{QU[],\ \left(e^{-\alpha 1\,\gamma-\alpha 2\,\gamma} - e^{-\alpha 1\,\gamma-\alpha 2\,\gamma}\,\gamma\,\epsilon\,fa[\lambda]\right)QU[x],\ \left(e^{\alpha 1\,\gamma+\alpha 2\,\gamma} + e^{\alpha 1\,\gamma+\alpha 2\,\gamma}\,\gamma\,\epsilon\,fa[\lambda]\right)QU[y],\ QU[x,y]\right\}$$

In[∘]:=
```
Ad[a_QU][Ad[x_QU][y_QU]]
```
Out[∘]=

$$e\,QU[y] - QU[z] + \epsilon\,QU[y,x]$$

In[∘]:=
```
TT_λ_[] = 0; (* Translated Tangent *)
TT_λ_[xs___, x_] := CE[Ad[x][TT_λ[xs]] + ∂_λ x];
TT_λ_[xs_List] := TT_λ @@ xs
```

In[∘]:=
```
TT_λ[λ y_QU, λ a_QU, λ x_QU]
```
Out[∘]=

$$\left(-e^{\lambda}\,\lambda + e^{\lambda}\,T\,\lambda\right)QU[] + \left(1 - 2\,e^{\lambda}\,T\,\epsilon\,\lambda\right)QU[a] +$$
$$\left(1 + \lambda + \frac{1}{2}\,e^{\lambda}\,\epsilon\,\lambda^2 - \frac{3}{2}\,e^{\lambda}\,T\,\epsilon\,\lambda^2\right)QU[x] + e^{\lambda}\,QU[y] - e^{\lambda}\,\epsilon\,\lambda\,QU[y,x]$$

In[∘]:=
```
Seepage_U_[{}, c_] = c;
Seepage_U_[ξs_List, P_] := Module[{gs = U[Generators], lx},
  lx = gs⟦Length@ξs⟧;
  Collect[P, lx, (Ad[Last[ξs] lx_U][O_U[gs, Seepage_U[Most@ξs, #]]] /. U → Times) &]
 ]
```

In[∘]:=
```
B[y_QU, α a_QU]
```
Out[∘]=

$$\alpha\,QU[y]$$

In[∘]:=
```
Seepage_QU[{η, α, ξ}, y]
```
Out[∘]=

$$e^{\alpha}\,y - e^{\alpha}\,\xi + e^{\alpha}\,T\,\xi - 2\,a\,e^{\alpha}\,T\,\epsilon\,\xi - e^{\alpha}\,x\,y\,\epsilon\,\xi + \frac{1}{2}\,e^{\alpha}\,x\,\epsilon\,\xi^2 - \frac{3}{2}\,e^{\alpha}\,T\,x\,\epsilon\,\xi^2$$

$$L_\lambda = \mathbb{OE}(\lambda \xi_{i,1} x)\,\mathbb{OE}(\lambda \xi_{i,2} x) \qquad \text{Seepage is defined by: } \underbrace{\mathbb{OE}(f_i x_i)}_{\text{OFI}}\,\mathbb{O}(\text{Seepage}(\{f_i\}, A)) = \mathbb{O}(e^{f_i x_i} A)$$

$$TT(L_\lambda) = L^{-1}\partial_\lambda L_\lambda \qquad S(B) = \text{Seepage}(\{f_i\}, B).$$

$$R_\lambda = \mathbb{OE}(f+g), \quad f = f_i x_i \quad g = \sum_{\substack{w \\ |w|>1}} g_w w \qquad e^f = F \quad e^g = G \qquad R_\lambda = \mathbb{O}(FG) \qquad \partial_\lambda F = F\partial_\lambda f$$

$$TT(R_\lambda) = R_\lambda^{-1}(\partial_\lambda R_\lambda) = \mathbb{O}(FG)^{-1}\mathbb{O}(\partial_\lambda FG) = S(G)^{-1}\mathbb{O}(F)^{-1}\mathbb{O}(F(\partial_\lambda f G + \partial_\lambda G)) = S(G)^{-1}S(\partial_\lambda f G + \partial_\lambda G)$$

In[∘]:=
```
TTL = TTλ[λ Ξ1 X_QU, λ ϒ1 Y_QU, λ Ω1 Z_QU, β1 b_QU, α1 a_QU, λ ζ1 z_QU, λ η1 y_QU,
  λ ξ1 x_QU, λ Ξ2 X_QU, λ ϒ2 Y_QU, λ Ω2 Z_QU, β2 b_QU, α2 a_QU, λ ζ2 z_QU, λ η2 y_QU, λ ξ2 x_QU]
```

Out[∘]=

In[∘]:=
```
Total[
 f1_#[λ] # & /@ (Times @@ # & /@ {QU[X, x], QU[X, X], QU[X, y], QU[X, Y], QU[X, z], QU[X, Z],
     QU[y, x], QU[Y, a], QU[Y, x], QU[Y, y], QU[Y, Y], QU[Y, z], QU[Y, Z],
     QU[z, x], QU[z, y], QU[z, z], QU[Z, x], QU[Z, y], QU[Z, z]})]
```

Out[∘]=

$$x X f1_{xX}[\lambda] + X^2 f1_{X^2}[\lambda] + x y f1_{xy}[\lambda] + X y f1_{Xy}[\lambda] + a Y f1_{aY}[\lambda] + x Y f1_{xY}[\lambda] + X Y f1_{XY}[\lambda] + y Y f1_{yY}[\lambda] + Y^2 f1_{Y^2}[\lambda] + x z f1_{xz}[\lambda] + X z f1_{Xz}[\lambda] + y z f1_{yz}[\lambda] + Y z f1_{Yz}[\lambda] + z^2 f1_{z^2}[\lambda] + x Z f1_{xZ}[\lambda] + X Z f1_{XZ}[\lambda] + y Z f1_{yZ}[\lambda] + Y Z f1_{YZ}[\lambda] + z Z f1_{zZ}[\lambda]$$

In[∘]:=
```
f = {fX0[λ] + ∊ fX1[λ], fY0[λ] + ∊ fY1[λ], fZ0[λ] + ∊ fZ1[λ], β1 + β2 + ∊ fb1[λ],
  α1 + α2 + ∊ fa1[λ], fz0[λ] + ∊ fz1[λ], fy0[λ] + ∊ fy1[λ], fx0[λ] + ∊ fx1[λ]}
g = (ft0[λ] + ∊ ft1[λ]) +
  ∊ Total[f1_#[λ] # & /@ (Times @@ # & /@ {QU[X, x], QU[X, X], QU[X, y], QU[X, Y], QU[X, z],
        QU[X, Z], QU[y, x], QU[Y, a], QU[Y, x], QU[Y, y], QU[Y, Y], QU[Y, z],
        QU[Y, Z], QU[z, x], QU[z, y], QU[z, z], QU[Z, x], QU[Z, y], QU[Z, z]})]
G = SS[ⅇ^g]
```

Out[∘]=

$$\{fX0[\lambda] + \epsilon\, fX1[\lambda],\ fY0[\lambda] + \epsilon\, fY1[\lambda],\ fZ0[\lambda] + \epsilon\, fZ1[\lambda],\ \beta1 + \beta2 + \epsilon\, fb1[\lambda],\ \alpha1 + \alpha2 + \epsilon\, fa1[\lambda],\ fz0[\lambda] + \epsilon\, fz1[\lambda],\ fy0[\lambda] + \epsilon\, fy1[\lambda],\ fx0[\lambda] + \epsilon\, fx1[\lambda]\}$$

Out[∘]=

$$ft0[\lambda] + \epsilon\, ft1[\lambda] + \epsilon\, \big(x X f1_{xX}[\lambda] + X^2 f1_{X^2}[\lambda] + x y f1_{xy}[\lambda] + X y f1_{Xy}[\lambda] + a Y f1_{aY}[\lambda] + x Y f1_{xY}[\lambda] + X Y f1_{XY}[\lambda] + y Y f1_{yY}[\lambda] + Y^2 f1_{Y^2}[\lambda] + x z f1_{xz}[\lambda] + X z f1_{Xz}[\lambda] + y z f1_{yz}[\lambda] + Y z f1_{Yz}[\lambda] + z^2 f1_{z^2}[\lambda] + x Z f1_{xZ}[\lambda] + X Z f1_{XZ}[\lambda] + y Z f1_{yZ}[\lambda] + Y Z f1_{YZ}[\lambda] + z Z f1_{zZ}[\lambda]\big)$$

Out[∘]=

$$e^{ft0[\lambda]} + e^{ft0[\lambda]}\, \epsilon\, \big(ft1[\lambda] + x X f1_{xX}[\lambda] + X^2 f1_{X^2}[\lambda] + x y f1_{xy}[\lambda] + X y f1_{Xy}[\lambda] + a Y f1_{aY}[\lambda] + x Y f1_{xY}[\lambda] + X Y f1_{XY}[\lambda] + y Y f1_{yY}[\lambda] + Y^2 f1_{Y^2}[\lambda] + x z f1_{xz}[\lambda] + X z f1_{Xz}[\lambda] + y z f1_{yz}[\lambda] + Y z f1_{Yz}[\lambda] + z^2 f1_{z^2}[\lambda] + x Z f1_{xZ}[\lambda] + X Z f1_{XZ}[\lambda] + y Z f1_{yZ}[\lambda] + Y Z f1_{YZ}[\lambda] + z Z f1_{zZ}[\lambda]\big)$$

In[∘]:=
```
𝓈[B_] := CE[SS@𝕆_QU[{X, Y, Z, b, a, z, y, x}, Seepage_QU[f, SS@B]]];
𝓈[G]
```

Out[∘]=

$$e^{ft0[\lambda]}\, \epsilon\, QU[y, x]\, f1_{xy}[\lambda] + e^{\alpha1+\alpha2-2\beta1-2\beta2+ft0[\lambda]}\, \epsilon\, QU[Y, a]\, f1_{aY}[\lambda] + QU[a]\, \big(-e^{\alpha1+\alpha2-2\beta1-2\beta2+ft0[\lambda]}\, \epsilon\, fy0[\lambda]\, f1_{aY}[\lambda] + e^{\alpha1+\alpha2-2\beta1-2\beta2+ft0[\lambda]}\, t\, \epsilon\, fy0[\lambda]\, f1_{aY}[\lambda]\big) +$$

$$
\begin{aligned}
&\mathrm{QU}[z, x]\left(-e^{\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{x y}[\lambda]+e^{\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{x z}[\lambda]\right)+\\
&e^{\mathrm{ft0}[\lambda]} \in \mathrm{QU}[z, y]\, \mathrm{f1}_{y z}[\lambda]+\mathrm{QU}[z, z]\left(-e^{\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{y z}[\lambda]+e^{\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{z^2}[\lambda]\right)+\\
&e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{QU}[Z, x]\, \mathrm{f1}_{x Z}[\lambda]+\mathrm{QU}[Y, x]\left(-2\, e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{a Y}[\lambda]+\right.\\
&\quad\left.e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{x Y}[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{x Z}[\lambda]\right)+\\
&\mathrm{QU}[X, x]\left(e^{-2 \alpha 1-2 \alpha 2+\beta 1+\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{x X}[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{x Z}[\lambda]\right)+\\
&\mathrm{QU}[x]\left(-e^{-2 \alpha 1-2 \alpha 2+\beta 1+\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{x X}[\lambda]+\right.\\
&\quad e^{-2 \alpha 1-2 \alpha 2+\beta 1+\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{x X}[\lambda]+2\, e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{a Y}[\lambda]-\\
&\quad 2\, e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{a Y}[\lambda]-e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{x Y}[\lambda]+\\
&\quad e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{x Y}[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{x Z}[\lambda]-\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{x Z}[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{x Z}[\lambda]+\\
&\quad\left.e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s\, t \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{x Z}[\lambda]\right)+e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]} \in \mathrm{QU}[X, Z]\, \mathrm{f1}_{X Z}[\lambda]+\\
&\mathrm{QU}[X, X]\left(e^{-4 \alpha 1-4 \alpha 2+2 \beta 1+2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{X^2}[\lambda]-e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]\right)+\\
&e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{QU}[Z, y]\, \mathrm{f1}_{y Z}[\lambda]+\\
&\mathrm{QU}[Y, y]\left(e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{a Y}[\lambda]+\right.\\
&\quad\left.e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{y Y}[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{y Z}[\lambda]\right)+\\
&\mathrm{QU}[X, y]\left(e^{-2 \alpha 1-2 \alpha 2+\beta 1+\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{X y}[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{y Z}[\lambda]\right)+\\
&\mathrm{QU}[y]\left(-e^{-2 \alpha 1-2 \alpha 2+\beta 1+\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X y}[\lambda]+e^{-2 \alpha 1-2 \alpha 2+\beta 1+\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X y}[\lambda]-\right.\\
&\quad e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]^2\, \mathrm{f1}_{a Y}[\lambda]+e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]^2\, \mathrm{f1}_{a Y}[\lambda]-\\
&\quad e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{y Y}[\lambda]+e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{y Y}[\lambda]+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{y Z}[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{y Z}[\lambda]-\\
&\quad\left.e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{y Z}[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s\, t \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{y Z}[\lambda]\right)+\\
&e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{QU}[Y, Z]\, \mathrm{f1}_{Y Z}[\lambda]+\mathrm{QU}[Y, Y]\\
&\quad\left(e^{2 \alpha 1+2 \alpha 2-4 \beta 1-4 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{Y^2}[\lambda]+e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]\right)+\\
&\mathrm{QU}[X, Y]\left(e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{f1}_{X Y}[\lambda]+e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]-\right.\\
&\quad\left.e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]\right)+\\
&\mathrm{QU}[Z]\left(-e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]+e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]-\right.\\
&\quad\left.e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]+e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]\right)+\\
&\mathrm{QU}[X]\left(-2\, e^{-4 \alpha 1-4 \alpha 2+2 \beta 1+2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X^2}[\lambda]+2\, e^{-4 \alpha 1-4 \alpha 2+2 \beta 1+2 \beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X^2}[\lambda]-\right.\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]+\\
&\quad 2\, e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]-2\, e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]-\\
&\quad e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]} \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]+e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]}\, s\, t \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{X Z}[\lambda]+\\
&\quad\left.e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]^2\, \mathrm{f1}_{Y Z}[\lambda]-e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]^2\, \mathrm{f1}_{Y Z}[\lambda]\right)+\\
&\mathrm{QU}[Y]\left(-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]-\right.\\
&\quad 2\, e^{2 \alpha 1+2 \alpha 2-4 \beta 1-4 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y^2}[\lambda]+2\, e^{2 \alpha 1+2 \alpha 2-4 \beta 1-4 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y^2}[\lambda]-\\
&\quad e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]^2\, \mathrm{f1}_{X Z}[\lambda]+e^{-3 \alpha 1-3 \alpha 2+\mathrm{ft0}[\lambda]}\, s^2 \in \mathrm{fx0}[\lambda]^2\, \mathrm{f1}_{X Z}[\lambda]+\\
&\quad e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]-2\, e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]+\\
&\quad e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]}\, s\, t \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]-\\
&\quad\left.e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]+e^{-3 \beta 1-3 \beta 2+\mathrm{ft0}[\lambda]}\, s\, t \in \mathrm{fz0}[\lambda]\, \mathrm{f1}_{Y Z}[\lambda]\right)+\\
&\mathrm{QU}[\,]\left(e^{\mathrm{ft0}[\lambda]}+e^{\mathrm{ft0}[\lambda]} \in \mathrm{ft1}[\lambda]+e^{-4 \alpha 1-4 \alpha 2+2 \beta 1+2 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]^2\, \mathrm{f1}_{X^2}[\lambda]-\right.\\
&\quad 2\, e^{-4 \alpha 1-4 \alpha 2+2 \beta 1+2 \beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]^2\, \mathrm{f1}_{X^2}[\lambda]+e^{-4 \alpha 1-4 \alpha 2+2 \beta 1+2 \beta 2+\mathrm{ft0}[\lambda]}\, s^2 \in \mathrm{fx0}[\lambda]^2\, \mathrm{f1}_{X^2}[\lambda]+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]-\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2+\mathrm{ft0}[\lambda]}\, s\, t \in \mathrm{fx0}[\lambda]\, \mathrm{fy0}[\lambda]\, \mathrm{f1}_{X Y}[\lambda]+\\
&\quad e^{2 \alpha 1+2 \alpha 2-4 \beta 1-4 \beta 2+\mathrm{ft0}[\lambda]} \in \mathrm{fy0}[\lambda]^2\, \mathrm{f1}_{Y^2}[\lambda]-2\, e^{2 \alpha 1+2 \alpha 2-4 \beta 1-4 \beta 2+\mathrm{ft0}[\lambda]}\, t \in \mathrm{fy0}[\lambda]^2\, \mathrm{f1}_{Y^2}[\lambda]+
\end{aligned}
$$

$$
\begin{aligned}
&e^{2\alpha1+2\alpha2-4\beta1-4\beta2+\text{ft0}[\lambda]}\,t^2 \in \text{fy0}[\lambda]^2\,\text{f1}_{Y^2}[\lambda] - e^{-3\alpha1-3\alpha2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]^2\,\text{fy0}[\lambda]\,\text{f1}_{XZ}[\lambda] + \\
&2\,e^{-3\alpha1-3\alpha2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]^2\,\text{fy0}[\lambda]\,\text{f1}_{XZ}[\lambda] - e^{-3\alpha1-3\alpha2+\text{ft0}[\lambda]}\,s^2 \in \text{fx0}[\lambda]^2\,\text{fy0}[\lambda]\,\text{f1}_{XZ}[\lambda] + \\
&e^{-3\alpha1-3\alpha2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{XZ}[\lambda] - e^{-3\alpha1-3\alpha2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{XZ}[\lambda] - \\
&e^{-3\alpha1-3\alpha2+\text{ft0}[\lambda]}\,s\,t \in \text{fx0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{XZ}[\lambda] + e^{-3\alpha1-3\alpha2+\text{ft0}[\lambda]}\,s^2\,t \in \text{fx0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{XZ}[\lambda] - \\
&e^{-3\beta1-3\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]^2\,\text{f1}_{YZ}[\lambda] + e^{-3\beta1-3\beta2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]^2\,\text{f1}_{YZ}[\lambda] + \\
&e^{-3\beta1-3\beta2+\text{ft0}[\lambda]}\,t \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]^2\,\text{f1}_{YZ}[\lambda] - e^{-3\beta1-3\beta2+\text{ft0}[\lambda]}\,s\,t \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]^2\,\text{f1}_{YZ}[\lambda] + \\
&e^{-3\beta1-3\beta2+\text{ft0}[\lambda]} \in \text{fy0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{YZ}[\lambda] - e^{-3\beta1-3\beta2+\text{ft0}[\lambda]}\,t \in \text{fy0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{YZ}[\lambda] - \\
&e^{-3\beta1-3\beta2+\text{ft0}[\lambda]}\,s\,t \in \text{fy0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{YZ}[\lambda] + e^{-3\beta1-3\beta2+\text{ft0}[\lambda]}\,s\,t^2 \in \text{fy0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{YZ}[\lambda]\Big) + \\
&\text{QU}[Z, z]\,\Big(-e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{f1}_{yZ}[\lambda] + e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{f1}_{zZ}[\lambda]\Big) + \\
&\text{QU}[Y, z]\,\Big(-e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]\,\text{f1}_{aY}[\lambda] - e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{fz0}[\lambda]\,\text{f1}_{aY}[\lambda] - \\
&e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{f1}_{yY}[\lambda] + e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{f1}_{Yz}[\lambda] - \\
&e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]^2\,\text{f1}_{yz}[\lambda] + e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]\,\text{f1}_{zz}[\lambda]\Big) + \\
&\text{QU}[X, z]\,\Big(-e^{-2\alpha1-2\alpha2+\beta1+\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{f1}_{Xy}[\lambda] + e^{-2\alpha1-2\alpha2+\beta1+\beta2+\text{ft0}[\lambda]} \in \text{f1}_{Xz}[\lambda] + \\
&e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]\,\text{f1}_{yz}[\lambda] - e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{fy0}[\lambda]\,\text{f1}_{zz}[\lambda]\Big) + \\
&\text{QU}[z]\,\Big(e^{-2\alpha1-2\alpha2+\beta1+\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]^2\,\text{f1}_{Xy}[\lambda] - e^{-2\alpha1-2\alpha2+\beta1+\beta2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]^2\,\text{f1}_{Xy}[\lambda] + \\
&e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]^2\,\text{f1}_{aY}[\lambda] - e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]}\,t \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]^2\,\text{f1}_{aY}[\lambda] + \\
&e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{fy0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{aY}[\lambda] - e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]}\,t \in \text{fy0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{aY}[\lambda] + \\
&e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]\,\text{f1}_{yY}[\lambda] - e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]}\,t \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]\,\text{f1}_{yY}[\lambda] - \\
&e^{-2\alpha1-2\alpha2+\beta1+\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{f1}_{Xz}[\lambda] + e^{-2\alpha1-2\alpha2+\beta1+\beta2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]\,\text{f1}_{Xz}[\lambda] - \\
&e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]} \in \text{fy0}[\lambda]\,\text{f1}_{Yz}[\lambda] + e^{\alpha1+\alpha2-2\beta1-2\beta2+\text{ft0}[\lambda]}\,t \in \text{fy0}[\lambda]\,\text{f1}_{Yz}[\lambda] - \\
&e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]^2\,\text{fy0}[\lambda]\,\text{f1}_{yz}[\lambda] + e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]^2\,\text{fy0}[\lambda]\,\text{f1}_{yz}[\lambda] + \\
&e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{yz}[\lambda] - e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]}\,s\,t \in \text{fx0}[\lambda]\,\text{fz0}[\lambda]\,\text{f1}_{yz}[\lambda] + \\
&e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]\,\text{f1}_{zz}[\lambda] - e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]}\,s \in \text{fx0}[\lambda]\,\text{fy0}[\lambda]\,\text{f1}_{zz}[\lambda] - \\
&e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]} \in \text{fz0}[\lambda]\,\text{f1}_{zz}[\lambda] + e^{-\alpha1-\alpha2-\beta1-\beta2+\text{ft0}[\lambda]}\,s\,t \in \text{fz0}[\lambda]\,\text{f1}_{zz}[\lambda]\Big)
\end{aligned}
$$

In[∘]:=
```
InvertU_ [ℰ_] := Module[{A, B, β}, (* ℰ=A U[]+ϵ B *)
  A = Coefficient[ℰ, 1U] /. ϵ → 0;
  B = CE[ϵ^-1 (ℰ - A 1U)];
  𝕊U[SS[(A + ϵ β)^-1], β → B]
 ]
```

In[∘]:= `InvertQU[𝒮[G]]`

Out[∘]=

$$\left(e^{-\text{ft0}[\lambda]} - e^{-\text{ft0}[\lambda]} \in \text{ft1}[\lambda]\right)\text{QU}[\,] - e^{-\text{ft0}[\lambda]} \in \text{fyx1}[\lambda]\,\text{QU}[y, x] + e^{-\text{ft0}[\lambda]} \in \text{fx0}[\lambda]\,\text{fyx1}[\lambda]\,\text{QU}[z, x]$$

In[∘]:= `CE[InvertQU[𝒮[G]] ⊠ 𝒮[G]]`

Out[∘]=

QU[]

$L_\lambda = \mathbb{OE}(\lambda\xi_{i,1}x)\,\mathbb{OE}(\lambda\xi_{i,2}x)$ Seepage is defined by: $\underbrace{\mathbb{OE}(f_ix_i)}_{\mathbb{O}F}\mathbb{O}(\text{Seepage}(\{f_i\},A)) = \mathbb{O}(e^{f_ix_i}A)$

$TT(L_\lambda) = L^{-1}\partial_\lambda L_\lambda$ $S(B) = \text{Seepage}(\{f_i\}, B)$.

$R_\lambda = \mathbb{OE}(f+g)$, $f = f_ix_i$ $g = \sum_{\substack{w\\|w|\neq 1}} g_w w$ $e^f = F$ $e^g = G$ $R_\lambda = \mathbb{O}(FG)$ $\partial_\lambda F = F\partial_\lambda f$

$TT(R_\lambda) = R_\lambda^{-1}(\partial_\lambda R_\lambda) = \mathbb{O}(FG)^{-1}\mathbb{O}(\partial_\lambda FG) = S(G)^{-1}\mathbb{O}(F)^{-1}\mathbb{O}(F(\partial_\lambda f G + \partial_\lambda G)) = S(G)^{-1}S(\partial_\lambda f G + \partial_\lambda G)$.

In[∘]:= G

Out[∘]=

$e^{ft0[\lambda]} + e^{ft0[\lambda]}\,\epsilon\,(ft1[\lambda] + x\,y\,fyx1[\lambda])$

In[∘]:= (∂_λ (f.QU@Generators) G + ∂_λ G)

Out[∘]=

$e^{ft0[\lambda]}\,ft0'[\lambda] + e^{ft0[\lambda]}\,\epsilon\,(ft1[\lambda] + x\,y\,fyx1[\lambda])\,ft0'[\lambda] + \left(e^{ft0[\lambda]} + e^{ft0[\lambda]}\,\epsilon\,(ft1[\lambda] + x\,y\,fyx1[\lambda])\right)$
$(a\,\epsilon\,fa1'[\lambda] + x\,(fx0'[\lambda] + \epsilon\,fx1'[\lambda]) + y\,(fy0'[\lambda] + \epsilon\,fy1'[\lambda])) +$
$e^{ft0[\lambda]}\,\epsilon\,(ft1'[\lambda] + x\,y\,fyx1'[\lambda])$

In[∘]:= TTR = CE[Invert_QU[𝒮[G]] ⊠ 𝒮[(∂_λ (f.QU@Generators) G + ∂_λ G)]]

Out[∘]=

In[∘]:= Cases[TTR, x_QU, Infinity] // Sort
Cases[TTL, x_QU, Infinity] // Sort

Out[∘]=

{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z], QU[Z], QU[X, x], QU[X, X], QU[X, y], QU[X, Y], QU[X, z], QU[X, Z], QU[y, x], QU[Y, a], QU[Y, x], QU[Y, y], QU[Y, Y], QU[Y, z], QU[Y, Z], QU[z, x], QU[z, y], QU[z, z], QU[Z, x], QU[Z, y], QU[Z, z]}

Out[∘]=

{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z], QU[Z], QU[X, x], QU[X, X], QU[X, y], QU[X, Y], QU[X, z], QU[X, Z], QU[y, x], QU[Y, a], QU[Y, x], QU[Y, y], QU[Y, Y], QU[Y, z], QU[Y, Z], QU[z, x], QU[z, y], QU[z, z], QU[Z, x], QU[Z, y], QU[Z, z]}

In[∘]:= diff = CE[TTL - TTR]

Out[∘]=

In[∘]:= **diff /. ϵ → 0**

Out[∘]=

$$
\begin{aligned}
&\mathrm{QU}[x]\left(e^{2\alpha 2-\beta 2}\,\xi 1+\xi 2-\mathrm{fx0}'[\lambda]\right)+\mathrm{QU}[y]\left(e^{-\alpha 2+2\beta 2}\,\eta 1+\eta 2-\mathrm{fy0}'[\lambda]\right)+\\
&\quad\mathrm{QU}[z]\left(e^{\alpha 2+\beta 2}\,\zeta 1+\zeta 2-e^{\alpha 2+\beta 2}\,\eta 1\,\lambda\,\xi 1+e^{2\alpha 2-\beta 2}\,\eta 2\,\lambda\,\xi 1-e^{-\alpha 2+2\beta 2}\,\eta 1\,\lambda\,\xi 2-\eta 2\,\lambda\,\xi 2+\right.\\
&\qquad\left.\mathrm{fx0}[\lambda]\,\mathrm{fy0}'[\lambda]-\mathrm{fz0}'[\lambda]\right)+\mathrm{QU}[Z]\left(e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\Omega 1+e^{-\alpha 2-\beta 2}\,\Omega 2-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fZ0}'[\lambda]\right)+\\
&\quad\mathrm{QU}[Y]\left(e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\Upsilon 1+e^{\alpha 2-2\beta 2}\,\Upsilon 2+e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\lambda\,\xi 1\,\Omega 1+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 1-\right.\\
&\qquad\left.e^{\alpha 2-2\beta 2}\,s\,\lambda\,\xi 1\,\Omega 2+e^{-\alpha 2-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 2-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\mathrm{fY0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\mathrm{fx0}[\lambda]\,\mathrm{fZ0}'[\lambda]\right)+\\
&\quad\mathrm{QU}[X]\left(e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\Xi 1+e^{-2\alpha 2+\beta 2}\,\Xi 2-e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda\,\Omega 1+\right.\\
&\qquad\left.e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda\,\Omega 2-e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda\,\Omega 2-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\mathrm{fX0}'[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]\right)+\\
&\quad\mathrm{QU}[\,]\left(-e^{-2\alpha 1+\beta 1}\,\lambda\,\xi 1\,\Xi 1+e^{-2\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\Xi 1-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\lambda\,\Xi 1\,\xi 2+e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\Xi 1\,\xi 2+\right.\\
&\qquad\lambda\,\xi 1\,\Xi 2-s\,\lambda\,\xi 1\,\Xi 2-e^{-2\alpha 2+\beta 2}\,\lambda\,\xi 2\,\Xi 2+e^{-2\alpha 2+\beta 2}\,s\,\lambda\,\xi 2\,\Xi 2-e^{\alpha 1-2\beta 1}\,\eta 1\,\lambda\,\Upsilon 1+\\
&\qquad e^{\alpha 1-2\beta 1}\,t\,\eta 1\,\lambda\,\Upsilon 1-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 1+e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 1+\eta 1\,\lambda\,\Upsilon 2-\\
&\qquad t\,\eta 1\,\lambda\,\Upsilon 2-e^{\alpha 2-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 2+e^{\alpha 2-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 2-e^{-\alpha 1-\beta 1}\,\zeta 1\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,s\,t\,\zeta 1\,\lambda\,\Omega 1-\\
&\qquad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\zeta 2\,\lambda\,\Omega 1+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-e^{-\alpha 1-\beta 1}\,s\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-\\
&\qquad e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1-\\
&\qquad e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1+\\
&\qquad \zeta 1\,\lambda\,\Omega 2-s\,t\,\zeta 1\,\lambda\,\Omega 2-e^{-\alpha 2-\beta 2}\,\zeta 2\,\lambda\,\Omega 2+e^{-\alpha 2-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 2-\eta 1\,\lambda^2\,\xi 1\,\Omega 2+s\,t\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2+\\
&\qquad e^{\alpha 2-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-e^{\alpha 2-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+e^{-2\alpha 2+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+\\
&\qquad e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-e^{-\alpha 2-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-\mathrm{ft0}'[\lambda]+e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\mathrm{fx0}[\lambda]\,\mathrm{fX0}'[\lambda]-\\
&\qquad e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\mathrm{fx0}[\lambda]\,\mathrm{fX0}'[\lambda]+e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\mathrm{fy0}[\lambda]\,\mathrm{fY0}'[\lambda]-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\mathrm{fy0}[\lambda]\,\mathrm{fY0}'[\lambda]-\\
&\qquad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fx0}[\lambda]\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\mathrm{fx0}[\lambda]\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]+\\
&\qquad\left.e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fz0}[\lambda]\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\mathrm{fz0}[\lambda]\,\mathrm{fZ0}'[\lambda]\right)
\end{aligned}
$$

In[∘]:= **Generators // QU**

Out[∘]=

{X, Y, Z, b, a, z, y, x}

In[∘]:= **{sol1} = DSolve[Coefficient[diff /. ϵ → 0, x_{QU}] == 0 ∧ fx0[0] == 0, fx0, λ]**

Out[∘]=

$$\left\{\left\{\mathrm{fx0}\to\mathrm{Function}\left[\{\lambda\},\ e^{-\beta 2}\,\lambda\left(e^{2\alpha 2}\,\xi 1+e^{\beta 2}\,\xi 2\right)\right]\right\}\right\}$$

In[∘]:= **CE[diff /. sol1 /. ϵ → 0]**

Out[∘]=

$$
\begin{aligned}
&\mathrm{QU}[y]\left(e^{-\alpha 2+2\beta 2}\,\eta 1+\eta 2-\mathrm{fy0}'[\lambda]\right)+\\
&\mathrm{QU}[z]\Big(e^{\alpha 2+\beta 2}\,\zeta 1+\zeta 2-e^{\alpha 2+\beta 2}\,\eta 1\,\lambda\,\xi 1+e^{2\alpha 2-\beta 2}\,\eta 2\,\lambda\,\xi 1-e^{-\alpha 2+2\beta 2}\,\eta 1\,\lambda\,\xi 2-\\
&\quad \eta 2\,\lambda\,\xi 2+e^{2\alpha 2-\beta 2}\,\lambda\,\xi 1\,\mathrm{fy0}'[\lambda]+\lambda\,\xi 2\,\mathrm{fy0}'[\lambda]-\mathrm{fz0}'[\lambda]\Big)+\\
&\mathrm{QU}[Z]\left(e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\Omega 1+e^{-\alpha 2-\beta 2}\,\Omega 2-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fZ0}'[\lambda]\right)+\\
&\mathrm{QU}[Y]\Big(e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\Upsilon 1+e^{\alpha 2-2\beta 2}\,\Upsilon 2+e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\lambda\,\xi 1\,\Omega 1+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 1-e^{\alpha 2-2\beta 2}\,s\,\lambda\,\xi 1\,\Omega 2+e^{-\alpha 2-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 2-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\mathrm{fY0}'[\lambda]-\\
&\quad e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\lambda\,\xi 1\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\mathrm{fZ0}'[\lambda]\Big)+\\
&\mathrm{QU}[X]\Big(e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\Xi 1+e^{-2\alpha 2+\beta 2}\,\Xi 2-e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda\,\Omega 1+\\
&\quad e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda\,\Omega 2-e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda\,\Omega 2-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\mathrm{fX0}'[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]\Big)+\\
&\mathrm{QU}[\,]\Big(-e^{-2\alpha 1+\beta 1}\,\lambda\,\xi 1\,\Xi 1+e^{-2\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\Xi 1-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\lambda\,\Xi 1\,\xi 2+e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\Xi 1\,\xi 2+\\
&\quad \lambda\,\xi 1\,\Xi 2-s\,\lambda\,\xi 1\,\Xi 2-e^{-2\alpha 2+\beta 2}\,\lambda\,\xi 2\,\Xi 2+e^{-2\alpha 2+\beta 2}\,s\,\lambda\,\xi 2\,\Xi 2-e^{\alpha 1-2\beta 1}\,\eta 1\,\lambda\,\Upsilon 1+e^{\alpha 1-2\beta 1}\,t\,\eta 1\,\lambda\,\Upsilon 1-\\
&\quad e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 1+e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 1+\eta 1\,\lambda\,\Upsilon 2-t\,\eta 1\,\lambda\,\Upsilon 2-e^{\alpha 2-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 2+\\
&\quad e^{\alpha 2-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 2-e^{-\alpha 1-\beta 1}\,\zeta 1\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,s\,t\,\zeta 1\,\lambda\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\zeta 2\,\lambda\,\Omega 1+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-e^{-\alpha 1-\beta 1}\,s\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+\\
&\quad e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1-e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1+\zeta 1\,\lambda\,\Omega 2-s\,t\,\zeta 1\,\lambda\,\Omega 2-\\
&\quad e^{-\alpha 2-\beta 2}\,\zeta 2\,\lambda\,\Omega 2+e^{-\alpha 2-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 2-\eta 1\,\lambda^2\,\xi 1\,\Omega 2+s\,t\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2+e^{\alpha 2-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-\\
&\quad e^{\alpha 2-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+e^{-2\alpha 2+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-\\
&\quad e^{-\alpha 2-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-\mathrm{ft0}'[\lambda]+e^{-2\alpha 1+\beta 1}\,\lambda\,\xi 1\,\mathrm{fX0}'[\lambda]-e^{-2\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\mathrm{fX0}'[\lambda]+\\
&\quad e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\lambda\,\xi 2\,\mathrm{fX0}'[\lambda]-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\xi 2\,\mathrm{fX0}'[\lambda]+e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\mathrm{fy0}[\lambda]\,\mathrm{fY0}'[\lambda]-\\
&\quad e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\mathrm{fy0}[\lambda]\,\mathrm{fY0}'[\lambda]-e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,\lambda\,\xi 1\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]+\\
&\quad e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\lambda\,\xi 1\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\lambda\,\xi 2\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\mathrm{fy0}[\lambda]\,\mathrm{fZ0}'[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fz0}[\lambda]\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\mathrm{fz0}[\lambda]\,\mathrm{fZ0}'[\lambda]\Big)
\end{aligned}
$$

In[∘]:= **{sol2} = DSolve[Coefficient[CE[diff /. sol1 /. ϵ → 0], y_{QU}] == 0 ∧ fy0[0] == 0, fy0, λ]**

Out[∘]=

$$\left\{\left\{\mathrm{fy0}\to\mathrm{Function}\left[\{\lambda\},\ e^{-\alpha 2}\left(e^{2\beta 2}\,\eta 1+e^{\alpha 2}\,\eta 2\right)\lambda\right]\right\}\right\}$$

In[ ]:=
```
CE[diff /. sol1 /. sol2 /. ϵ → 0]
```

Out[ ]=

$$
\begin{aligned}
&\mathrm{QU}[z]\left(e^{\alpha 2+\beta 2}\,\zeta 1+\zeta 2+2\,e^{2\,\alpha 2-\beta 2}\,\eta 2\,\lambda\,\xi 1-\mathrm{fz0}'[\lambda]\right)+\\
&\ \mathrm{QU}[Z]\left(e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\Omega 1+e^{-\alpha 2-\beta 2}\,\Omega 2-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fZ0}'[\lambda]\right)+\\
&\ \mathrm{QU}[X]\left(e^{-2\,\alpha 1-2\,\alpha 2+\beta 1+\beta 2}\,\Xi 1+e^{-2\,\alpha 2+\beta 2}\,\Xi 2-e^{-\alpha 1-2\,\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda\,\Omega 1+e^{-2\,\alpha 2+\beta 2}\,\eta 1\,\lambda\,\Omega 2-\right.\\
&\qquad \left.e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda\,\Omega 2-e^{-2\,\alpha 1-2\,\alpha 2+\beta 1+\beta 2}\,\mathrm{fX0}'[\lambda]+e^{-\alpha 1-2\,\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda\,\mathrm{fZ0}'[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda\,\mathrm{fZ0}'[\lambda]\right)+\\
&\ \mathrm{QU}[Y]\left(e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,\Upsilon 1+e^{\alpha 2-2\,\beta 2}\,\Upsilon 2+e^{-\alpha 1+\alpha 2-\beta 1-2\,\beta 2}\,s\,\lambda\,\xi 1\,\Omega 1+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 1-\right.\\
&\qquad e^{\alpha 2-2\,\beta 2}\,s\,\lambda\,\xi 1\,\Omega 2+e^{-\alpha 2-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 2-e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,\mathrm{fY0}'[\lambda]-\\
&\qquad \left.e^{-\alpha 1+\alpha 2-\beta 1-2\,\beta 2}\,s\,\lambda\,\xi 1\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\mathrm{fZ0}'[\lambda]\right)+\\
&\ \mathrm{QU}[\,]\left(-e^{-2\,\alpha 1+\beta 1}\,\lambda\,\xi 1\,\Xi 1+e^{-2\,\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\Xi 1-e^{-2\,\alpha 1-2\,\alpha 2+\beta 1+\beta 2}\,\lambda\,\Xi 1\,\xi 2+e^{-2\,\alpha 1-2\,\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\Xi 1\,\xi 2+\right.\\
&\qquad \lambda\,\xi 1\,\Xi 2-s\,\lambda\,\xi 1\,\Xi 2-e^{-2\,\alpha 2+\beta 2}\,\lambda\,\xi 2\,\Xi 2+e^{-2\,\alpha 2+\beta 2}\,s\,\lambda\,\xi 2\,\Xi 2-e^{\alpha 1-2\,\beta 1}\,\eta 1\,\lambda\,\Upsilon 1+e^{\alpha 1-2\,\beta 1}\,t\,\eta 1\,\lambda\,\Upsilon 1-\\
&\qquad e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,\eta 2\,\lambda\,\Upsilon 1+e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 1+\eta 1\,\lambda\,\Upsilon 2-t\,\eta 1\,\lambda\,\Upsilon 2-e^{\alpha 2-2\,\beta 2}\,\eta 2\,\lambda\,\Upsilon 2+\\
&\qquad e^{\alpha 2-2\,\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 2-e^{-\alpha 1-\beta 1}\,\zeta 1\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,s\,t\,\zeta 1\,\lambda\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\zeta 2\,\lambda\,\Omega 1+\\
&\qquad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-e^{-\alpha 1-\beta 1}\,s\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-e^{-\alpha 1+\alpha 2-\beta 1-2\,\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+\\
&\qquad e^{-\alpha 1+\alpha 2-\beta 1-2\,\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+e^{-\alpha 1-2\,\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1-e^{-\alpha 1-2\,\alpha 2-\beta 1+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1+\\
&\qquad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1+\zeta 1\,\lambda\,\Omega 2-s\,t\,\zeta 1\,\lambda\,\Omega 2-e^{-\alpha 2-\beta 2}\,\zeta 2\,\lambda\,\Omega 2+\\
&\qquad e^{-\alpha 2-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 2-\eta 1\,\lambda^2\,\xi 1\,\Omega 2+s\,t\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2+e^{\alpha 2-2\,\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-e^{\alpha 2-2\,\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-\\
&\qquad e^{-2\,\alpha 2+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+e^{-2\,\alpha 2+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-e^{-\alpha 2-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-\\
&\qquad \mathrm{ft0}'[\lambda]+e^{-2\,\alpha 1+\beta 1}\,\lambda\,\xi 1\,\mathrm{fX0}'[\lambda]-e^{-2\,\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\mathrm{fX0}'[\lambda]+e^{-2\,\alpha 1-2\,\alpha 2+\beta 1+\beta 2}\,\lambda\,\xi 2\,\mathrm{fX0}'[\lambda]-\\
&\qquad e^{-2\,\alpha 1-2\,\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\xi 2\,\mathrm{fX0}'[\lambda]+e^{\alpha 1-2\,\beta 1}\,\eta 1\,\lambda\,\mathrm{fY0}'[\lambda]-e^{\alpha 1-2\,\beta 1}\,t\,\eta 1\,\lambda\,\mathrm{fY0}'[\lambda]+\\
&\qquad e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,\eta 2\,\lambda\,\mathrm{fY0}'[\lambda]-e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,t\,\eta 2\,\lambda\,\mathrm{fY0}'[\lambda]-e^{-\alpha 1-\beta 1}\,\eta 1\,\lambda^2\,\xi 1\,\mathrm{fZ0}'[\lambda]+\\
&\qquad e^{-\alpha 1-\beta 1}\,s\,\eta 1\,\lambda^2\,\xi 1\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1+\alpha 2-\beta 1-2\,\beta 2}\,\eta 2\,\lambda^2\,\xi 1\,\mathrm{fZ0}'[\lambda]+e^{-\alpha 1+\alpha 2-\beta 1-2\,\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\mathrm{fZ0}'[\lambda]-\\
&\qquad e^{-\alpha 1-2\,\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\mathrm{fZ0}'[\lambda]+e^{-\alpha 1-2\,\alpha 2-\beta 1+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\mathrm{fZ0}'[\lambda]+\\
&\qquad \left.e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\mathrm{fZ0}'[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\mathrm{fz0}[\lambda]\,\mathrm{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\mathrm{fz0}[\lambda]\,\mathrm{fZ0}'[\lambda]\right)
\end{aligned}
$$

In[ ]:=
```
{sol3} = DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. ϵ → 0], QU[z]] == 0 ∧ fz0[0] == 0, fz0, λ]
```

Out[ ]=

$$
\left\{\left\{\mathrm{fz0}\to\mathrm{Function}\left[\{\lambda\},\ e^{-\beta 2}\,\lambda\left(e^{\alpha 2+2\,\beta 2}\,\zeta 1+e^{\beta 2}\,\zeta 2+e^{2\,\alpha 2}\,\eta 2\,\lambda\,\xi 1\right)\right]\right\}\right\}
$$

In[]:=
```
CE[diff /. sol1 /. sol2 /. sol3] /. ϵ → 0
```

Out[]=

$$
\begin{aligned}
&\text{QU}[Z]\,\left(e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\Omega 1+e^{-\alpha 2-\beta 2}\,\Omega 2-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\text{fZ0}'[\lambda]\right)+\\
&\text{QU}[X]\,\left(e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\Xi 1+e^{-2\alpha 2+\beta 2}\,\Xi 2-e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda\,\Omega 1+e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda\,\Omega 2-\right.\\
&\quad e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda\,\Omega 2-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\text{fX0}'[\lambda]+e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda\,\text{fZ0}'[\lambda]+\left.e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda\,\text{fZ0}'[\lambda]\right)+\\
&\text{QU}[Y]\,\left(e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\Upsilon 1+e^{\alpha 2-2\beta 2}\,\Upsilon 2+e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\lambda\,\xi 1\,\Omega 1+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 1-\right.\\
&\quad e^{\alpha 2-2\beta 2}\,s\,\lambda\,\xi 1\,\Omega 2+e^{-\alpha 2-\beta 2}\,s\,\lambda\,\xi 2\,\Omega 2-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\text{fY0}'[\lambda]-\\
&\quad e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\lambda\,\xi 1\,\text{fZ0}'[\lambda]-\left.e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\lambda\,\xi 2\,\text{fZ0}'[\lambda]\right)+\\
&\text{QU}[\,]\,\left(-e^{-2\alpha 1+\beta 1}\,\lambda\,\xi 1\,\Xi 1+e^{-2\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\Xi 1-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\lambda\,\Xi 1\,\xi 2+e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\Xi 1\,\xi 2+\right.\\
&\quad \lambda\,\xi 1\,\Xi 2-s\,\lambda\,\xi 1\,\Xi 2-e^{-2\alpha 2+\beta 2}\,\lambda\,\xi 2\,\Xi 2+e^{-2\alpha 2+\beta 2}\,s\,\lambda\,\xi 2\,\Xi 2-e^{\alpha 1-2\beta 1}\,\eta 1\,\lambda\,\Upsilon 1+e^{\alpha 1-2\beta 1}\,t\,\eta 1\,\lambda\,\Upsilon 1-\\
&\quad e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 1+e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 1+\eta 1\,\lambda\,\Upsilon 2-t\,\eta 1\,\lambda\,\Upsilon 2-e^{\alpha 2-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 2+\\
&\quad e^{\alpha 2-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 2-e^{-\alpha 1-\beta 1}\,\zeta 1\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,s\,t\,\zeta 1\,\lambda\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\zeta 2\,\lambda\,\Omega 1+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 1+e^{-\alpha 1-\beta 1}\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-e^{-\alpha 1-\beta 1}\,s\,\eta 1\,\lambda^2\,\xi 1\,\Omega 1-e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+\\
&\quad e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 1+e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1-e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 1+\\
&\quad e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 1+\zeta 1\,\lambda\,\Omega 2-s\,t\,\zeta 1\,\lambda\,\Omega 2-e^{-\alpha 2-\beta 2}\,\zeta 2\,\lambda\,\Omega 2+\\
&\quad e^{-\alpha 2-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\Omega 2-\eta 1\,\lambda^2\,\xi 1\,\Omega 2+s\,t\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2+e^{\alpha 2-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-e^{\alpha 2-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-\\
&\quad e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+e^{-2\alpha 2+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+e^{-\alpha 2-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-e^{-\alpha 2-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\Omega 2-\\
&\quad \text{ft0}'[\lambda]+e^{-2\alpha 1+\beta 1}\,\lambda\,\xi 1\,\text{fX0}'[\lambda]-e^{-2\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\text{fX0}'[\lambda]+e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\lambda\,\xi 2\,\text{fX0}'[\lambda]-\\
&\quad e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\xi 2\,\text{fX0}'[\lambda]+e^{\alpha 1-2\beta 1}\,\eta 1\,\lambda\,\text{fY0}'[\lambda]-e^{\alpha 1-2\beta 1}\,t\,\eta 1\,\lambda\,\text{fY0}'[\lambda]+\\
&\quad e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\eta 2\,\lambda\,\text{fY0}'[\lambda]-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\eta 2\,\lambda\,\text{fY0}'[\lambda]+e^{-\alpha 1-\beta 1}\,\zeta 1\,\lambda\,\text{fZ0}'[\lambda]-\\
&\quad e^{-\alpha 1-\beta 1}\,s\,t\,\zeta 1\,\lambda\,\text{fZ0}'[\lambda]+e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\zeta 2\,\lambda\,\text{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,t\,\zeta 2\,\lambda\,\text{fZ0}'[\lambda]-\\
&\quad e^{-\alpha 1-\beta 1}\,\eta 1\,\lambda^2\,\xi 1\,\text{fZ0}'[\lambda]+e^{-\alpha 1-\beta 1}\,s\,\eta 1\,\lambda^2\,\xi 1\,\text{fZ0}'[\lambda]+e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\text{fZ0}'[\lambda]-\\
&\quad e^{-\alpha 1+\alpha 2-\beta 1-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\text{fZ0}'[\lambda]-e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\text{fZ0}'[\lambda]+\\
&\quad e^{-\alpha 1-2\alpha 2-\beta 1+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\text{fZ0}'[\lambda]-e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,\eta 2\,\lambda^2\,\xi 2\,\text{fZ0}'[\lambda]+\left.e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 2\,\text{fZ0}'[\lambda]\right)
\end{aligned}
$$

In[]:=
```
{sol4} =
  DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. ϵ → 0], QU[Z]] == 0 ∧ fZ0[0] == 0, fZ0, λ]
```

Out[]=

$$\left\{\left\{\text{fZ0}\to\text{Function}\left[\{\lambda\},\ \lambda\,\left(\Omega 1+e^{\alpha 1+\beta 1}\,\Omega 2\right)\right]\right\}\right\}$$

In[]:=
```
CE[diff /. sol1 /. sol2 /. sol3 /. sol4] /. ϵ → 0
```

Out[]=

$$
\begin{aligned}
&\text{QU}[X]\,\left(e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\Xi 1+e^{-2\alpha 2+\beta 2}\,\Xi 2+2\,e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda\,\Omega 2-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\text{fX0}'[\lambda]\right)+\\
&\text{QU}[Y]\,\left(e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\Upsilon 1+e^{\alpha 2-2\beta 2}\,\Upsilon 2-2\,e^{\alpha 2-2\beta 2}\,s\,\lambda\,\xi 1\,\Omega 2-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\text{fY0}'[\lambda]\right)+\\
&\text{QU}[\,]\,\left(-e^{-2\alpha 1+\beta 1}\,\lambda\,\xi 1\,\Xi 1+e^{-2\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\Xi 1-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\lambda\,\Xi 1\,\xi 2+e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\Xi 1\,\xi 2+\right.\\
&\quad \lambda\,\xi 1\,\Xi 2-s\,\lambda\,\xi 1\,\Xi 2-e^{-2\alpha 2+\beta 2}\,\lambda\,\xi 2\,\Xi 2+e^{-2\alpha 2+\beta 2}\,s\,\lambda\,\xi 2\,\Xi 2-e^{\alpha 1-2\beta 1}\,\eta 1\,\lambda\,\Upsilon 1+\\
&\quad e^{\alpha 1-2\beta 1}\,t\,\eta 1\,\lambda\,\Upsilon 1-e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 1+e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 1+\eta 1\,\lambda\,\Upsilon 2-t\,\eta 1\,\lambda\,\Upsilon 2-\\
&\quad e^{\alpha 2-2\beta 2}\,\eta 2\,\lambda\,\Upsilon 2+e^{\alpha 2-2\beta 2}\,t\,\eta 2\,\lambda\,\Upsilon 2+2\,\zeta 1\,\lambda\,\Omega 2-2\,s\,t\,\zeta 1\,\lambda\,\Omega 2-2\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2+s\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2+\\
&\quad s\,t\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2+2\,e^{\alpha 2-2\beta 2}\,s\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-2\,e^{\alpha 2-2\beta 2}\,s\,t\,\eta 2\,\lambda^2\,\xi 1\,\Omega 2-2\,e^{-2\alpha 2+\beta 2}\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2+\\
&\quad 2\,e^{-2\alpha 2+\beta 2}\,s\,\eta 1\,\lambda^2\,\xi 2\,\Omega 2-\text{ft0}'[\lambda]+e^{-2\alpha 1+\beta 1}\,\lambda\,\xi 1\,\text{fX0}'[\lambda]-e^{-2\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\text{fX0}'[\lambda]+\\
&\quad e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,\lambda\,\xi 2\,\text{fX0}'[\lambda]-e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2}\,s\,\lambda\,\xi 2\,\text{fX0}'[\lambda]+e^{\alpha 1-2\beta 1}\,\eta 1\,\lambda\,\text{fY0}'[\lambda]-\\
&\quad e^{\alpha 1-2\beta 1}\,t\,\eta 1\,\lambda\,\text{fY0}'[\lambda]+e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,\eta 2\,\lambda\,\text{fY0}'[\lambda]-\left.e^{\alpha 1+\alpha 2-2\beta 1-2\beta 2}\,t\,\eta 2\,\lambda\,\text{fY0}'[\lambda]\right)
\end{aligned}
$$

In[]:=
```
{sol5} = DSolve[
   Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. ϵ → 0], QU[Y]] == 0 ∧ fY0[0] == 0, fY0, λ]
```

Out[]=

$$\left\{\left\{\text{fY0}\to\text{Function}\left[\{\lambda\},\ e^{-\alpha 1}\,\lambda\,\left(e^{\alpha 1}\,\Upsilon 1+e^{2\beta 1}\,\Upsilon 2-e^{2\beta 1}\,s\,\lambda\,\xi 1\,\Omega 2\right)\right]\right\}\right\}$$

In[∘]:= `CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5] /. ϵ → 0`

Out[∘]=

$$\mathrm{QU}[X]\left(e^{-2\alpha1-2\alpha2+\beta1+\beta2}\,\Xi1+e^{-2\alpha2+\beta2}\,\Xi2+2\,e^{-2\alpha2+\beta2}\,\eta1\,\lambda\,\Omega2-e^{-2\alpha1-2\alpha2+\beta1+\beta2}\,\mathrm{fX0}'[\lambda]\right)+\mathrm{QU}[\,]\left(-e^{-2\alpha1+\beta1}\,\lambda\,\xi1\,\Xi1+e^{-2\alpha1+\beta1}\,s\,\lambda\,\xi1\,\Xi1-e^{-2\alpha1-2\alpha2+\beta1+\beta2}\,\lambda\,\Xi1\,\xi2+e^{-2\alpha1-2\alpha2+\beta1+\beta2}\,s\,\lambda\,\Xi1\,\xi2+\lambda\,\xi1\,\Xi2-s\,\lambda\,\xi1\,\Xi2-e^{-2\alpha2+\beta2}\,\lambda\,\xi2\,\Xi2+e^{-2\alpha2+\beta2}\,s\,\lambda\,\xi2\,\Xi2+2\,\eta1\,\lambda\,\Upsilon2-2\,t\,\eta1\,\lambda\,\Upsilon2+2\,\zeta1\,\lambda\,\Omega2-2\,s\,t\,\zeta1\,\lambda\,\Omega2-2\,\eta1\,\lambda^2\,\xi1\,\Omega2-s\,\eta1\,\lambda^2\,\xi1\,\Omega2+3\,s\,t\,\eta1\,\lambda^2\,\xi1\,\Omega2-2\,e^{-2\alpha2+\beta2}\,\eta1\,\lambda^2\,\xi2\,\Omega2+2\,e^{-2\alpha2+\beta2}\,s\,\eta1\,\lambda^2\,\xi2\,\Omega2-\mathrm{ft0}'[\lambda]+e^{-2\alpha1+\beta1}\,\lambda\,\xi1\,\mathrm{fX0}'[\lambda]-e^{-2\alpha1+\beta1}\,s\,\lambda\,\xi1\,\mathrm{fX0}'[\lambda]+e^{-2\alpha1-2\alpha2+\beta1+\beta2}\,\lambda\,\xi2\,\mathrm{fX0}'[\lambda]-e^{-2\alpha1-2\alpha2+\beta1+\beta2}\,s\,\lambda\,\xi2\,\mathrm{fX0}'[\lambda]\right)$$

In[∘]:= `{sol6} = DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. ϵ → 0], QU[X]] == 0 ∧ fX0[0] == 0, fX0, λ]`

Out[∘]=

$$\left\{\left\{\mathrm{fX0}\to\mathrm{Function}\left[\{\lambda\},\,e^{-\beta1}\,\lambda\left(e^{\beta1}\,\Xi1+e^{2\alpha1}\,\Xi2+e^{2\alpha1}\,\eta1\,\lambda\,\Omega2\right)\right]\right\}\right\}$$

In[∘]:= `CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6] /. ϵ → 0`

Out[∘]=

$$\mathrm{QU}[\,]\left(2\,\lambda\,\xi1\,\Xi2-2\,s\,\lambda\,\xi1\,\Xi2+2\,\eta1\,\lambda\,\Upsilon2-2\,t\,\eta1\,\lambda\,\Upsilon2+2\,\zeta1\,\lambda\,\Omega2-2\,s\,t\,\zeta1\,\lambda\,\Omega2-3\,s\,\eta1\,\lambda^2\,\xi1\,\Omega2+3\,s\,t\,\eta1\,\lambda^2\,\xi1\,\Omega2-\mathrm{ft0}'[\lambda]\right)$$

In[∘]:= `{sol7} = DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. ϵ → 0], QU[]] == 0 ∧ ft0[0] == 0, ft0, λ]`

Out[∘]=

$$\left\{\left\{\mathrm{ft0}\to\mathrm{Function}\left[\{\lambda\},\,\lambda^2\,\xi1\,\Xi2-s\,\lambda^2\,\xi1\,\Xi2+\eta1\,\lambda^2\,\Upsilon2-t\,\eta1\,\lambda^2\,\Upsilon2+\zeta1\,\lambda^2\,\Omega2-s\,t\,\zeta1\,\lambda^2\,\Omega2-s\,\eta1\,\lambda^3\,\xi1\,\Omega2+s\,t\,\eta1\,\lambda^3\,\xi1\,\Omega2\right]\right\}\right\}$$

In[∘]:= `CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7] /. ϵ → 0`

Out[∘]=

0

In[∘]:= `CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7]`

Out[∘]=

In[∘]:= `Coefficient[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7, QU[y, x]]`

Out[∘]=

$$e^{\alpha2+\beta2}\,\epsilon\,\eta1\,\lambda\,\xi1-e^{2\alpha2-\beta2}\,\epsilon\,\eta2\,\lambda\,\xi1+e^{-\alpha2+2\beta2}\,\epsilon\,\eta1\,\lambda\,\xi2+\epsilon\,\eta2\,\lambda\,\xi2-e^{-\alpha2-\beta2}\,\epsilon\left(e^{2\beta2}\,\eta1+e^{\alpha2}\,\eta2\right)\lambda\left(e^{2\alpha2}\,\xi1+e^{\beta2}\,\xi2\right)-\epsilon\,\mathrm{f1}_{xy}'[\lambda]$$

In[∘]:= `{sol8} = DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7], QU[y, x]] == 0 ∧ f1_{xy}[0] == 0, f1_{xy}, λ]`

Out[∘]=

$$\left\{\left\{\mathrm{f1}_{xy}\to\mathrm{Function}\left[\{\lambda\},\,-e^{2\alpha2-\beta2}\,\eta2\,\lambda^2\,\xi1\right]\right\}\right\}$$

In[∘]:= `CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8]`

Out[∘]=

In[∘]:=
```
Coefficient[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8, QU[z, x]]
```
Out[∘]=

$$-e^{3\alpha 2}\in\zeta 1\,\lambda\,\xi 1+e^{2\alpha 2-\beta 2}\in\zeta 2\,\lambda\,\xi 1-e^{\alpha 2+\beta 2}\in\zeta 1\,\lambda\,\xi 2-\in\zeta 2\,\lambda\,\xi 2-2\,e^{2\alpha 2-2\beta 2}\in\eta 2\,\lambda^2\,\xi 1\left(e^{2\alpha 2}\,\xi 1+e^{\beta 2}\,\xi 2\right)+ e^{-\beta 2}\in\lambda\left(e^{2\alpha 2-\beta 2}\,\eta 2\,\lambda\,\xi 1+e^{-\beta 2}\left(e^{\alpha 2+2\beta 2}\,\zeta 1+e^{\beta 2}\,\zeta 2+e^{2\alpha 2}\,\eta 2\,\lambda\,\xi 1\right)\right)\left(e^{2\alpha 2}\,\xi 1+e^{\beta 2}\,\xi 2\right)-\in f1_{x\,z}{}'[\lambda]$$

In[∘]:=
```
{sol9} =
  DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8],
      QU[z, x]] == 0 ∧ f1_{x z}[0] == 0,  f1_{x z}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{x\,z}\to \text{Function}\left[\{\lambda\},\ e^{2\alpha 2-\beta 2}\,\zeta 2\,\lambda^2\,\xi 1\right]\right\}\right\}$$

In[∘]:=
```
CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9]
```
Out[∘]=

In[∘]:=
```
{sol10} = DSolve[
   Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9],
      QU[z, y]] == 0 ∧ f1_{y z}[0] == 0,  f1_{y z}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{y\,z}\to \text{Function}\left[\{\lambda\},\ -e^{-\alpha 2-\beta 2}\,\lambda^2\left(e^{3\beta 2}\,\zeta 2\,\eta 1+e^{2\alpha 2+2\beta 2}\,\eta 1\,\eta 2\,\lambda\,\xi 1+e^{3\alpha 2}\,\eta 2^2\,\lambda\,\xi 1\right)\right]\right\}\right\}$$

In[∘]:=
```
CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10]
```
Out[∘]=

In[∘]:=
```
Cases[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10],
   _QU, Infinity] // Union
```
Out[∘]=

{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z], QU[Z],
QU[X, x], QU[X, X], QU[X, y], QU[X, Y], QU[X, z], QU[X, Z], QU[Y, a], QU[Y, x],
QU[Y, y], QU[Y, Y], QU[Y, z], QU[Y, Z], QU[z, z], QU[Z, x], QU[Z, y], QU[Z, z]}

In[∘]:=
```
Coefficient[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10,
   QU[z, z]] // Simplify
```
Out[∘]=

$$3\,e^{2\alpha 2-\beta 2}\in\zeta 2\,\eta 2\,\lambda^2\,\xi 1-\in f1_{z^2}{}'[\lambda]$$

In[∘]:=
```
{sol11} = DSolve[
   Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
        sol10], QU[z, z]] == 0 ∧ f1_{z z}[0] == 0,  f1_{z z}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{z^2}\to \text{Function}\left[\{\lambda\},\ e^{2\alpha 2-\beta 2}\,\zeta 2\,\eta 2\,\lambda^3\,\xi 1\right]\right\}\right\}$$

In[∘]:=
```
Cases[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
     sol11], _QU, Infinity] // Union
```
Out[∘]=

{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z], QU[Z],
QU[X, x], QU[X, X], QU[X, y], QU[X, Y], QU[X, z], QU[X, Z], QU[Y, a], QU[Y, x],
QU[Y, y], QU[Y, Y], QU[Y, z], QU[Y, Z], QU[Z, x], QU[Z, y], QU[Z, z]}

In[∘]:=
```
Coefficient[
 CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11],
 QU[Z, x]]
```
Out[∘]=

$$-2\, e^{\alpha 2-2 \beta 2} \epsilon\, \lambda\, \xi 1\, \Omega 2 - e^{-\alpha 1-\alpha 2-\beta 1-\beta 2} \epsilon\, f1_{x Z}'[\lambda]$$

In[∘]:=
```
{sol12} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
      sol10 /. sol11], QU[Z, x]] == 0 ∧ f1Zx[0] == 0,  f1Zx, λ]
```
Out[∘]=

$$\left\{\left\{f1_{x Z} \to \text{Function}\left[\{\lambda\}, -e^{\alpha 1+2 \alpha 2+\beta 1-\beta 2} \lambda^2\, \xi 1\, \Omega 2\right]\right\}\right\}$$

In[∘]:=
```
{sol13} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
       sol10 /. sol11 /. sol12], QU[Z, y]] == 0 ∧ f1Zy[0] == 0,  f1Zy, λ]
```
Out[∘]=

$$\left\{\left\{f1_{y Z} \to \text{Function}\left[\{\lambda\}, -e^{\alpha 1-\alpha 2+\beta 1+2 \beta 2} \eta 1\, \lambda^2\, \Omega 2\right]\right\}\right\}$$

In[∘]:=
```
Cases[CE[
   diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
     sol12 /. sol13], _QU, Infinity] // Union
```
Out[∘]=

```
{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z],
 QU[Z], QU[X, x], QU[X, X], QU[X, y], QU[X, Y], QU[X, z], QU[X, Z],
 QU[Y, a], QU[Y, x], QU[Y, y], QU[Y, Y], QU[Y, z], QU[Y, Z], QU[Z, z]}
```

In[∘]:=
```
Coefficient[CE[
   diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
    sol12 /. sol13], QU[X, x]]
```
Out[∘]=

$$-4\, \epsilon\, \lambda\, \xi 1\, \Xi 2 - 3\, \epsilon\, \eta 1\, \lambda^2\, \xi 1\, \Omega 2 - e^{-2 \alpha 1-2 \alpha 2+\beta 1+\beta 2} \epsilon\, f1_{x X}'[\lambda]$$

In[∘]:=
```
{sol14} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
        sol10 /. sol11 /. sol12 /. sol13], QU[X, x]] == 0 ∧ f1Xx[0] == 0,  f1Xx, λ]
```
Out[∘]=

$$\left\{\left\{f1_{x X} \to \text{Function}\left[\{\lambda\}, -e^{2 \alpha 1+2 \alpha 2-\beta 1-\beta 2} \lambda^2\, \xi 1\, (2\, \Xi 2 + \eta 1\, \lambda\, \Omega 2)\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[CE[
   diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
     sol12 /. sol13 /. sol14], QU[Y, a]]
```
Out[∘]=

$$4\, e^{\alpha 2-2 \beta 2} s\, \epsilon\, \lambda\, \xi 1\, \Omega 2 - e^{\alpha 1+\alpha 2-2 \beta 1-2 \beta 2} \epsilon\, f1_{a Y}'[\lambda]$$

In[∘]:=
```
{sol15} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
         sol10 /. sol11 /. sol12 /. sol13 /. sol14], QU[Y, a]] == 0 ∧ f1Ya[0] == 0,  f1Ya, λ]
```
Out[∘]=

$$\left\{\left\{f1_{a Y} \to \text{Function}\left[\{\lambda\}, 2\, e^{-\alpha 1+2 \beta 1} s\, \lambda^2\, \xi 1\, \Omega 2\right]\right\}\right\}$$

In[∘]:=
```
Cases[CE[
   diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
      sol12 /. sol13 /. sol14 /. sol15], _QU, Infinity] // Union
```
Out[∘]=
```
{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z], QU[Z], QU[X, X], QU[X, y], QU[X, Y],
 QU[X, z], QU[X, Z], QU[Y, x], QU[Y, y], QU[Y, Y], QU[Y, z], QU[Y, Z], QU[Z, z]}
```

In[∘]:=
```
Coefficient[CE[
  diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
     sol12 /. sol13 /. sol14 /. sol15], QU[Z, z]]
```
Out[∘]=

$$-4 \in \zeta 1\, \lambda\, \Omega 2 - 3\, e^{\alpha 2-2\,\beta 2} \in \eta 2\, \lambda^2\, \xi 1\, \Omega 2 - e^{-\alpha 1-\alpha 2-\beta 1-\beta 2} \in f1_{z\,Z}{}'[\lambda]$$

In[∘]:=
```
{sol16} = DSolve[Coefficient[
    CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
        sol11 /. sol12 /. sol13 /. sol14 /. sol15], QU[Z, z]] == 0 ∧ f1_{Z z}[0] == 0,  f1_{Z z}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{z\,Z} \to \text{Function}\left[\{\lambda\},\ -e^{\alpha 1+\alpha 2+\beta 1-\beta 2}\, \lambda^2\, \left(2\, e^{2\,\beta 2}\, \zeta 1 + e^{\alpha 2}\, \eta 2\, \lambda\, \xi 1\right)\, \Omega 2\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[CE[
  diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
     sol12 /. sol13 /. sol14 /. sol15 /. sol16], QU[Y, y]]
```
Out[∘]=

$$-4 \in \eta 1\, \lambda\, \Upsilon 2 - e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2} \in f1_{y\,Y}{}'[\lambda]$$

In[∘]:=
```
{sol17} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
          sol10 /. sol11 /. sol12 /. sol13 /. sol14 /.
       sol15 /. sol16], QU[Y, y]] == 0 ∧ f1_{Y y}[0] == 0,  f1_{Y y}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{y\,Y} \to \text{Function}\left[\{\lambda\},\ -2\, e^{-\alpha 1-\alpha 2+2\,\beta 1+2\,\beta 2}\, \eta 1\, \lambda^2\, \Upsilon 2\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[CE[
  diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
      sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17], QU[Y, x]]
```
Out[∘]=

$$2\, e^{3\,\alpha 2-3\,\beta 2} \in \lambda\, \xi 1\, \Upsilon 2 + 6\, e^{3\,\alpha 2-3\,\beta 2}\, s \in \lambda^2\, \xi 1^2\, \Omega 2 - e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2} \in f1_{x\,Y}{}'[\lambda]$$

In[∘]:=
```
{sol18} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
           sol10 /. sol11 /. sol12 /. sol13 /. sol14 /.
        sol15 /. sol16 /. sol17], QU[Y, x]] == 0 ∧ f1_{Y x}[0] == 0,  f1_{Y x}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{x\,Y} \to \text{Function}\left[\{\lambda\},\ e^{-\alpha 1+2\,\alpha 2+2\,\beta 1-\beta 2}\, \lambda^2\, \xi 1\, (\Upsilon 2 + 2\, s\, \lambda\, \xi 1\, \Omega 2)\right]\right\}\right\}$$

In[∘]:=
```
Cases[CE[
    diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
          sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18], _QU, Infinity] // Union
```
Out[∘]=
```
{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z], QU[Z],
 QU[X, X], QU[X, y], QU[X, Y], QU[X, z], QU[X, Z], QU[Y, Y], QU[Y, z], QU[Y, Z]}
```

In[∘]:=
```
Coefficient[CE[
   diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
          sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18], QU[X, y]]
```
Out[∘]=

$$2\, e^{-3\alpha 2+3\beta 2} \in \eta 1\, \lambda\, \Xi 2 - e^{-2\alpha 1-2\alpha 2+\beta 1+\beta 2} \in f1_{X\,y}{}'[\lambda]$$

In[∘]:=
```
{sol19} =
  DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /.
                sol9 /. sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
          sol16 /. sol17 /. sol18], QU[X, y]] == 0 ∧ f1_{X y}[0] == 0,  f1_{X y}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{X\,y} \to \text{Function}\left[\{\lambda\},\, e^{2\alpha 1-\alpha 2-\beta 1+2\beta 2}\, \eta 1\, \lambda^2\, \Xi 2\right]\right\}\right\}$$

In[∘]:=
```
Cases[CE[
    diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
           sol12 /. sol13 /. sol14 /. sol15 /.
       sol16 /. sol17 /. sol18 /. sol19], _QU, Infinity] // Union
```
Out[∘]=
```
{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z], QU[Z],
 QU[X, X], QU[X, Y], QU[X, z], QU[X, Z], QU[Y, Y], QU[Y, z], QU[Y, Z]}
```

In[∘]:=
```
{sol20} = DSolve[
   Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
                sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
          sol17 /. sol18 /. sol19], QU[X, z]] == 0 ∧ f1_{X z}[0] == 0,  f1_{X z}, λ]
```
Out[∘]=

$$\left\{\left\{f1_{X\,z} \to \text{Function}\left[\{\lambda\},\; -e^{2\alpha 1+\alpha 2-\beta 1-\beta 2}\, \lambda^2 \left(e^{2\beta 2}\, \zeta 1\, \Xi 2 + 2\, e^{\alpha 2}\, \eta 2\, \lambda\, \xi 1\, \Xi 2 + e^{2\beta 2}\, \zeta 1\, \eta 1\, \lambda\, \Omega 2 + e^{\alpha 2}\, \eta 1\, \eta 2\, \lambda^2\, \xi 1\, \Omega 2\right)\right]\right\}\right\}$$

In[∘]:=
```
Cases[CE[
    diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
            sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
       sol17 /. sol18 /. sol19 /. sol20], _QU, Infinity] // Union
```
Out[∘]=
```
{QU[], QU[a], QU[b], QU[x], QU[X], QU[y], QU[Y], QU[z],
 QU[Z], QU[X, X], QU[X, Y], QU[X, Z], QU[Y, Y], QU[Y, z], QU[Y, Z]}
```

In[∘]:=
```
Coefficient[
 CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
       sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
    sol16 /. sol17 /. sol18 /. sol19 /. sol20], QU[Y, Z]]
```

Out[∘]=

$$2\,e^{-\alpha 1-\beta 1-3\,\beta 2}\,\epsilon\,\lambda\,\Upsilon 2\,\Omega 1-3\,e^{-\alpha 1-\beta 1-3\,\beta 2}\,s\,\epsilon\,\lambda^2\,\xi 1\,\Omega 1\,\Omega 2+3\,e^{-3\,\beta 2}\,s\,\epsilon\,\lambda^2\,\xi 1\,\Omega 2^2-e^{-3\,\beta 1-3\,\beta 2}\,\epsilon\,f1_{YZ}{}'[\lambda]$$

In[∘]:=
```
{sol21} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
        sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /.
     sol18 /. sol19 /. sol20], QU[Y, Z]] == 0 ∧ f1YZ[0] == 0, f1YZ, λ]
```

Out[∘]=

$$\left\{\left\{f1_{YZ}\to\text{Function}\left[\{\lambda\},\ e^{-\alpha 1+2\,\beta 1}\,\lambda^2\,\left(\Upsilon 2\,\Omega 1-s\,\lambda\,\xi 1\,\Omega 1\,\Omega 2+e^{\alpha 1+\beta 1}\,s\,\lambda\,\xi 1\,\Omega 2^2\right)\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[
 CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
       sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
    sol16 /. sol17 /. sol18 /. sol19 /. sol20 /. sol21], QU[X, Z]]
```

Out[∘]=

$$-2\,e^{-\alpha 1-3\,\alpha 2-\beta 1}\,\epsilon\,\lambda\,\Xi 2\,\Omega 1-3\,e^{-\alpha 1-3\,\alpha 2-\beta 1}\,\epsilon\,\eta 1\,\lambda^2\,\Omega 1\,\Omega 2-3\,e^{-3\,\alpha 2}\,\epsilon\,\eta 1\,\lambda^2\,\Omega 2^2-e^{-3\,\alpha 1-3\,\alpha 2}\,\epsilon\,f1_{XZ}{}'[\lambda]$$

In[∘]:=
```
{sol22} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
        sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /.
     sol18 /. sol19 /. sol20 /. sol21], QU[X, Z]] == 0 ∧ f1XZ[0] == 0, f1XZ, λ]
```

Out[∘]=

$$\left\{\left\{f1_{XZ}\to\text{Function}\left[\{\lambda\},\ -e^{2\,\alpha 1-\beta 1}\,\lambda^2\,\left(\Xi 2\,\Omega 1+\eta 1\,\lambda\,\Omega 1\,\Omega 2+e^{\alpha 1+\beta 1}\,\eta 1\,\lambda\,\Omega 2^2\right)\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[
 CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
       sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
    sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22], QU[a]]
```

Out[∘]=

$$4\,s\,\epsilon\,\lambda\,\xi 1\,\Xi 2+4\,s\,t\,\epsilon\,\zeta 1\,\lambda\,\Omega 2+6\,s\,\epsilon\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2-6\,s\,t\,\epsilon\,\eta 1\,\lambda^2\,\xi 1\,\Omega 2-\epsilon\,fa1'[\lambda]$$

In[∘]:=
```
{sol23} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
        sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /.
     sol18 /. sol19 /. sol20 /. sol21 /. sol22], QU[a]] == 0 ∧ fa1[0] == 0, fa1, λ]
```

Out[∘]=

$$\left\{\left\{fa1\to\text{Function}\left[\{\lambda\},\ -2\,s\,\lambda^2\,\left(-\xi 1\,\Xi 2-t\,\zeta 1\,\Omega 2-\eta 1\,\lambda\,\xi 1\,\Omega 2+t\,\eta 1\,\lambda\,\xi 1\,\Omega 2\right)\right]\right\}\right\}$$

In[∘]:=
```
{sol24} = DSolve[Coefficient[
    CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
        sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18 /.
     sol19 /. sol20 /. sol21 /. sol22 /. sol23], QU[b]] == 0 ∧ fb1[0] == 0, fb1, λ]
```

Out[∘]=

$$\left\{\left\{fb1\to\text{Function}\left[\{\lambda\},\ -2\,t\,\lambda^2\,\left(-\eta 1\,\Upsilon 2-s\,\zeta 1\,\Omega 2+s\,\eta 1\,\lambda\,\xi 1\,\Omega 2\right)\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[
  CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
          sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18 /.
      sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24], QU[Y, Y]]
```

Out[∘]=

$$-3\, e^{2\alpha 2-4\beta 2}\, s\, \epsilon\, \lambda^2\, \xi 1\, \Upsilon 2\, \Omega 2 - e^{2\alpha 1+2\alpha 2-4\beta 1-4\beta 2}\, \epsilon\, f1_{Y^2}'[\lambda]$$

In[∘]:=
```
{sol25} =
  DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /.
              sol9 /. sol10 /. sol11 /. sol12 /. sol13 /. sol14 /.
          sol15 /. sol16 /. sol17 /. sol18 /. sol19 /. sol20 /. sol21 /.
      sol22 /. sol23 /. sol24], QU[Y, Y]] == 0 ∧ f1Y²[0] == 0, f1Y², λ]
```

Out[∘]=

$$\left\{\left\{f1_{Y^2} \to \text{Function}\left[\{\lambda\},\ -e^{-2\alpha 1+4\beta 1}\, s\, \lambda^3\, \xi 1\, \Upsilon 2\, \Omega 2\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[
  CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
          sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18 /.
      sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24], QU[X, X]]
```

Out[∘]=

$$3\, e^{-4\alpha 2+2\beta 2}\, \epsilon\, \eta 1\, \lambda^2\, \Xi 2\, \Omega 2 - e^{-4\alpha 1-4\alpha 2+2\beta 1+2\beta 2}\, \epsilon\, f1_{X^2}'[\lambda]$$

In[∘]:=
```
{sol26} =
  DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /.
              sol9 /. sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
          sol16 /. sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /.
      sol23 /. sol24 /. sol25], QU[X, X]] == 0 ∧ f1X²[0] == 0, f1X², λ]
```

Out[∘]=

$$\left\{\left\{f1_{X^2} \to \text{Function}\left[\{\lambda\},\ e^{4\alpha 1-2\beta 1}\, \eta 1\, \lambda^3\, \Xi 2\, \Omega 2\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[
  CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
          sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18 /.
      sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24 /. sol25], QU[X, Y]]
```

Out[∘]=

$$2\, e^{\alpha 1-\alpha 2-2\beta 1-\beta 2}\, \epsilon\, \lambda\, \Xi 2\, \Upsilon 1 + 6\, e^{-\alpha 2-\beta 2}\, s\, \epsilon\, \lambda^2\, \xi 1\, \Xi 2\, \Omega 2 + 3\, e^{\alpha 1-\alpha 2-2\beta 1-\beta 2}\, \epsilon\, \eta 1\, \lambda^2\, \Upsilon 1\, \Omega 2 -$$
$$3\, e^{-\alpha 2-\beta 2}\, \epsilon\, \eta 1\, \lambda^2\, \Upsilon 2\, \Omega 2 + 8\, e^{-\alpha 2-\beta 2}\, s\, \epsilon\, \eta 1\, \lambda^3\, \xi 1\, \Omega 2^2 - e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\, \epsilon\, f1_{XY}'[\lambda]$$

In[∘]:=
```
{sol27} =
  DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /.
              sol9 /. sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
          sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /.
      sol24 /. sol25 /. sol26], QU[X, Y]] == 0 ∧ f1XY[0] == 0, f1XY, λ]
```

Out[∘]=

$$\left\{\left\{f1_{XY} \to \text{Function}\left[\{\lambda\},\right.\right.\right.$$
$$\left.\left.\left. e^{\alpha 1-\beta 1}\, \lambda^2 \left(e^{\alpha 1}\, \Xi 2\, \Upsilon 1 + 2\, e^{2\beta 1}\, s\, \lambda\, \xi 1\, \Xi 2\, \Omega 2 + e^{\alpha 1}\, \eta 1\, \lambda\, \Upsilon 1\, \Omega 2 - e^{2\beta 1}\, \eta 1\, \lambda\, \Upsilon 2\, \Omega 2 + 2\, e^{2\beta 1}\, s\, \eta 1\, \lambda^2\, \xi 1\, \Omega 2^2\right)\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[CE[
  diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
      sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18 /. sol19 /.
    sol20 /. sol21 /. sol22 /. sol23 /. sol24 /. sol25 /. sol26 /. sol27], QU[Z]]
```

Out[∘]=

$$-4\, e^{\alpha 1-\alpha 2-2\,\beta 1-\beta 2}\, \epsilon\, \lambda\, \Xi 2\, \Upsilon 1 + 6\, e^{-\alpha 2-\beta 2}\, s\, \epsilon\, \lambda^2\, \xi 1\, \Xi 2\, \Omega 2 - 6\, e^{\alpha 1-\alpha 2-2\,\beta 1-\beta 2}\, \epsilon\, \eta 1\, \lambda^2\, \Upsilon 1\, \Omega 2 - 6\, e^{-\alpha 2-\beta 2}\, \epsilon\, \eta 1\, \lambda^2\, \Upsilon 2\, \Omega 2 + 6\, e^{-\alpha 2-\beta 2}\, t\, \epsilon\, \eta 1\, \lambda^2\, \Upsilon 2\, \Omega 2 - 3\, e^{-\alpha 2-\beta 2}\, \epsilon\, \zeta 1\, \lambda^2\, \Omega 2^2 + 9\, e^{-\alpha 2-\beta 2}\, s\, t\, \epsilon\, \zeta 1\, \lambda^2\, \Omega 2^2 + 12\, e^{-\alpha 2-\beta 2}\, s\, \epsilon\, \eta 1\, \lambda^3\, \xi 1\, \Omega 2^2 - 12\, e^{-\alpha 2-\beta 2}\, s\, t\, \epsilon\, \eta 1\, \lambda^3\, \xi 1\, \Omega 2^2 - e^{-\alpha 1-\alpha 2-\beta 1-\beta 2}\, \epsilon\, fZ1'[\lambda]$$

In[∘]:=
```
{sol28} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
          sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
        sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /.
     sol24 /. sol25 /. sol26 /. sol27], QU[Z]] == 0 ∧ fZ1[0] == 0, fZ1, λ]
```

Out[∘]=

$$\left\{\left\{fZ1 \to \text{Function}\left[\{\lambda\},\ -e^{\alpha 1-\beta 1}\, \lambda^2 \left(2\, e^{\alpha 1}\, \Xi 2\, \Upsilon 1 - 2\, e^{2\,\beta 1}\, s\, \lambda\, \xi 1\, \Xi 2\, \Omega 2 + 2\, e^{\alpha 1}\, \eta 1\, \lambda\, \Upsilon 1\, \Omega 2 + 2\, e^{2\,\beta 1}\, \eta 1\, \lambda\, \Upsilon 2\, \Omega 2 - 2\, e^{2\,\beta 1}\, t\, \eta 1\, \lambda\, \Upsilon 2\, \Omega 2 + e^{2\,\beta 1}\, \zeta 1\, \lambda\, \Omega 2^2 - 3\, e^{2\,\beta 1}\, s\, t\, \zeta 1\, \lambda\, \Omega 2^2 - 3\, e^{2\,\beta 1}\, s\, \eta 1\, \lambda^2\, \xi 1\, \Omega 2^2 + 3\, e^{2\,\beta 1}\, s\, t\, \eta 1\, \lambda^2\, \xi 1\, \Omega 2^2\right)\right]\right\}\right\}$$

In[∘]:=
```
Coefficient[
 CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
        sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
      sol16 /. sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /.
   sol23 /. sol24 /. sol25 /. sol26 /. sol27 /. sol28], QU[y]]
```

Out[∘]=

$$4\, e^{-\alpha 2+2\,\beta 2}\, \epsilon\, \zeta 1\, \lambda\, \Xi 2 - 6\, e^{-\alpha 2+2\,\beta 2}\, s\, \epsilon\, \eta 1\, \lambda^2\, \xi 1\, \Xi 2 - 3\, e^{-\alpha 2+2\,\beta 2}\, \epsilon\, \eta 1^2\, \lambda^2\, \Upsilon 2 + 9\, e^{-\alpha 2+2\,\beta 2}\, t\, \epsilon\, \eta 1^2\, \lambda^2\, \Upsilon 2 + 3\, e^{-\alpha 2+2\,\beta 2}\, \epsilon\, \zeta 1\, \eta 1\, \lambda^2\, \Omega 2 + 3\, e^{-\alpha 2+2\,\beta 2}\, s\, t\, \epsilon\, \zeta 1\, \eta 1\, \lambda^2\, \Omega 2 - 4\, e^{-\alpha 2+2\,\beta 2}\, s\, \epsilon\, \eta 1^2\, \lambda^3\, \xi 1\, \Omega 2 - 4\, e^{-\alpha 2+2\,\beta 2}\, s\, t\, \epsilon\, \eta 1^2\, \lambda^3\, \xi 1\, \Omega 2 - \epsilon\, fy1'[\lambda]$$

In[∘]:=
```
{sol29} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
          sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
        sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24 /.
     sol25 /. sol26 /. sol27 /. sol28], QU[y]] == 0 ∧ fy1[0] == 0, fy1, λ]
```

Out[∘]=

$$\left\{\left\{fy1 \to \text{Function}\left[\{\lambda\},\ -e^{-\alpha 2+2\,\beta 2}\, \lambda^2 \left(-2\, \zeta 1\, \Xi 2 + 2\, s\, \eta 1\, \lambda\, \xi 1\, \Xi 2 + \eta 1^2\, \lambda\, \Upsilon 2 - 3\, t\, \eta 1^2\, \lambda\, \Upsilon 2 - \zeta 1\, \eta 1\, \lambda\, \Omega 2 - s\, t\, \zeta 1\, \eta 1\, \lambda\, \Omega 2 + s\, \eta 1^2\, \lambda^2\, \xi 1\, \Omega 2 + s\, t\, \eta 1^2\, \lambda^2\, \xi 1\, \Omega 2\right)\right]\right\}\right\}$$

In[∘]:=
```
{sol30} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
          sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
        sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24 /.
     sol25 /. sol26 /. sol27 /. sol28 /. sol29], QU[x]] == 0 ∧ fx1[0] == 0, fx1, λ]
```

Out[∘]=

$$\left\{\left\{fx1 \to \text{Function}\left[\{\lambda\},\ -e^{2\,\alpha 2-\beta 2}\, \lambda^2 \left(\lambda\, \xi 1^2\, \Xi 2 - 3\, s\, \lambda\, \xi 1^2\, \Xi 2 + 2\, t\, \zeta 1\, \Upsilon 2 - \eta 1\, \lambda\, \xi 1\, \Upsilon 2 + t\, \eta 1\, \lambda\, \xi 1\, \Upsilon 2 + \zeta 1\, \lambda\, \xi 1\, \Omega 2 - 3\, s\, t\, \zeta 1\, \lambda\, \xi 1\, \Omega 2 - 2\, s\, \eta 1\, \lambda^2\, \xi 1^2\, \Omega 2 + 2\, s\, t\, \eta 1\, \lambda^2\, \xi 1^2\, \Omega 2\right)\right]\right\}\right\}$$

In[∘]:= Coefficient[
 CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
 sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
 sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24 /.
 sol25 /. sol26 /. sol27 /. sol28 /. sol29 /. sol30], QU[Y, z]]

Out[∘]=

$$-2\,e^{2\,\alpha 2-\beta 2}\,\epsilon\,\zeta 1\,\lambda\,\Upsilon 2+3\,e^{3\,\alpha 2-3\,\beta 2}\,\epsilon\,\eta 2\,\lambda^2\,\xi 1\,\Upsilon 2+9\,e^{2\,\alpha 2-\beta 2}\,s\,\epsilon\,\zeta 1\,\lambda^2\,\xi 1\,\Omega 2+8\,e^{3\,\alpha 2-3\,\beta 2}\,s\,\epsilon\,\eta 2\,\lambda^3\,\xi 1^2\,\Omega 2-e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,\epsilon\,f1_{Y\,z}{}'[\lambda]$$

In[∘]:= {sol31} =
 DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /.
 sol9 /. sol10 /. sol11 /. sol12 /. sol13 /. sol14 /.
 sol15 /. sol16 /. sol17 /. sol18 /. sol19 /. sol20 /.
 sol21 /. sol22 /. sol23 /. sol24 /. sol25 /. sol26 /. sol27 /.
 sol28 /. sol29 /. sol30], QU[Y, z]] == 0 ∧ f1_{Y z}[0] == 0, f1_{Y z}, λ]

Out[∘]=

$$\left\{\left\{f1_{Y\,z}\to\text{Function}\left[\{\lambda\},\ e^{-\alpha 1+\alpha 2+2\,\beta 1-\beta 2}\,\lambda^2\,\left(-e^{2\,\beta 2}\,\zeta 1\,\Upsilon 2+e^{\alpha 2}\,\eta 2\,\lambda\,\xi 1\,\Upsilon 2+3\,e^{2\,\beta 2}\,s\,\zeta 1\,\lambda\,\xi 1\,\Omega 2+2\,e^{\alpha 2}\,s\,\eta 2\,\lambda^2\,\xi 1^2\,\Omega 2\right)\right]\right\}\right\}$$

In[∘]:= Coefficient[
 CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /.
 sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /.
 sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24 /.
 sol25 /. sol26 /. sol27 /. sol28 /. sol29 /. sol30 /. sol31], QU[Y]]

Out[∘]=

$$-6\,e^{\alpha 2-2\,\beta 2}\,s\,\epsilon\,\lambda^2\,\xi 1\,\Xi 2\,\Upsilon 2-3\,e^{\alpha 2-2\,\beta 2}\,\epsilon\,\eta 1\,\lambda^2\,\Upsilon 2^2+9\,e^{\alpha 2-2\,\beta 2}\,t\,\epsilon\,\eta 1\,\lambda^2\,\Upsilon 2^2-2\,e^{\alpha 2-2\,\beta 2}\,s\,\epsilon\,\lambda\,\xi 1\,\Omega 2+4\,e^{\alpha 2-2\,\beta 2}\,s\,\epsilon\,\lambda^3\,\xi 1^2\,\Xi 2\,\Omega 2-4\,e^{\alpha 2-2\,\beta 2}\,s^2\,\epsilon\,\lambda^3\,\xi 1^2\,\Xi 2\,\Omega 2-3\,e^{\alpha 2-2\,\beta 2}\,\epsilon\,\zeta 1\,\lambda^2\,\Upsilon 2\,\Omega 2+9\,e^{\alpha 2-2\,\beta 2}\,s\,t\,\epsilon\,\zeta 1\,\lambda^2\,\Upsilon 2\,\Omega 2-16\,e^{\alpha 2-2\,\beta 2}\,s\,t\,\epsilon\,\eta 1\,\lambda^3\,\xi 1\,\Upsilon 2\,\Omega 2+8\,e^{\alpha 2-2\,\beta 2}\,s\,\epsilon\,\zeta 1\,\lambda^3\,\xi 1\,\Omega 2^2-16\,e^{\alpha 2-2\,\beta 2}\,s^2\,t\,\epsilon\,\zeta 1\,\lambda^3\,\xi 1\,\Omega 2^2-5\,e^{\alpha 2-2\,\beta 2}\,s^2\,\epsilon\,\eta 1\,\lambda^4\,\xi 1^2\,\Omega 2^2+15\,e^{\alpha 2-2\,\beta 2}\,s^2\,t\,\epsilon\,\eta 1\,\lambda^4\,\xi 1^2\,\Omega 2^2-e^{\alpha 1+\alpha 2-2\,\beta 1-2\,\beta 2}\,\epsilon\,fY1'[\lambda]$$

In[∘]:= {sol32} =
 DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /.
 sol9 /. sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
 sol16 /. sol17 /. sol18 /. sol19 /. sol20 /. sol21 /.
 sol22 /. sol23 /. sol24 /. sol25 /. sol26 /. sol27 /. sol28 /.
 sol29 /. sol30 /. sol31], QU[Y]] == 0 ∧ fY1[0] == 0, fY1, λ]

Out[∘]=

$$\left\{\left\{fY1\to\text{Function}\left[\{\lambda\},\ e^{-\alpha 1+2\,\beta 1}\,\lambda^2\,\left(-2\,s\,\lambda\,\xi 1\,\Xi 2\,\Upsilon 2-\eta 1\,\lambda\,\Upsilon 2^2+3\,t\,\eta 1\,\lambda\,\Upsilon 2^2-s\,\xi 1\,\Omega 2+s\,\lambda^2\,\xi 1^2\,\Xi 2\,\Omega 2-s^2\,\lambda^2\,\xi 1^2\,\Xi 2\,\Omega 2-\zeta 1\,\lambda\,\Upsilon 2\,\Omega 2+3\,s\,t\,\zeta 1\,\lambda\,\Upsilon 2\,\Omega 2-4\,s\,t\,\eta 1\,\lambda^2\,\xi 1\,\Upsilon 2\,\Omega 2+2\,s\,\zeta 1\,\lambda^2\,\xi 1\,\Omega 2^2-4\,s^2\,t\,\zeta 1\,\lambda^2\,\xi 1\,\Omega 2^2-s^2\,\eta 1\,\lambda^3\,\xi 1^2\,\Omega 2^2+3\,s^2\,t\,\eta 1\,\lambda^3\,\xi 1^2\,\Omega 2^2\right)\right]\right\}\right\}$$

```
In[]:= {sol33} =
  DSolve[Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /.
        sol9 /. sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
       sol16 /. sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /.
      sol23 /. sol24 /. sol25 /. sol26 /. sol27 /. sol28 /. sol29 /.
     sol30 /. sol31 /. sol32], QU[X]] == 0 ∧ fX1[0] == 0, fX1, λ]
```

Out[]=

$$\{\{fX1 \to \text{Function}[\{\lambda\}, -e^{2\alpha1-\beta1}\lambda^3(\xi1\,\Xi2^2 - 3\,s\,\xi1\,\Xi2^2 - \eta1\,\Xi2\,\Upsilon2 + t\,\eta1\,\Xi2\,\Upsilon2 - \zeta1\,\Xi2\,\Omega2 - s\,t\,\zeta1\,\Xi2\,\Omega2 - 3\,s\,\eta1\,\lambda\,\xi1\,\Xi2\,\Omega2 + s\,t\,\eta1\,\lambda\,\xi1\,\Xi2\,\Omega2 + \eta1^2\,\lambda\,\Upsilon2\,\Omega2 - t\,\eta1^2\,\lambda\,\Upsilon2\,\Omega2 - 2\,s\,t\,\zeta1\,\eta1\,\lambda\,\Omega2^2 - 2\,s\,\eta1^2\,\lambda^2\,\xi1\,\Omega2^2 + 2\,s\,t\,\eta1^2\,\lambda^2\,\xi1\,\Omega2^2)]\}\}$$

```
In[]:= Coefficient[CE[
   diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
          sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18 /.
        sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24 /. sol25 /. sol26 /.
     sol27 /. sol28 /. sol29 /. sol30 /. sol31 /. sol32 /. sol33], QU[z]]
```

Out[]=

$$6\,e^{\alpha2+\beta2}\,s\,\epsilon\,\zeta1\,\lambda^2\,\xi1\,\Xi2 - 4\,e^{2\alpha2-\beta2}\,\epsilon\,\eta2\,\lambda^3\,\xi1^2\,\Xi2 + 12\,e^{2\alpha2-\beta2}\,s\,\epsilon\,\eta2\,\lambda^3\,\xi1^2\,\Xi2 - 6\,e^{2\alpha2-\beta2}\,t\,\epsilon\,\zeta1\,\eta2\,\lambda^2\,\Upsilon2 + 4\,e^{2\alpha2-\beta2}\,\epsilon\,\eta1\,\eta2\,\lambda^3\,\xi1\,\Upsilon2 - 4\,e^{2\alpha2-\beta2}\,t\,\epsilon\,\eta1\,\eta2\,\lambda^3\,\xi1\,\Upsilon2 - 3\,e^{\alpha2+\beta2}\,\epsilon\,\zeta1^2\,\lambda^2\,\Omega2 + 9\,e^{\alpha2+\beta2}\,s\,t\,\epsilon\,\zeta1^2\,\lambda^2\,\Omega2 + 8\,e^{\alpha2+\beta2}\,s\,\epsilon\,\zeta1\,\eta1\,\lambda^3\,\xi1\,\Omega2 - 8\,e^{\alpha2+\beta2}\,s\,t\,\epsilon\,\zeta1\,\eta1\,\lambda^3\,\xi1\,\Omega2 - 4\,e^{2\alpha2-\beta2}\,\epsilon\,\zeta1\,\eta2\,\lambda^3\,\xi1\,\Omega2 + 12\,e^{2\alpha2-\beta2}\,s\,t\,\epsilon\,\zeta1\,\eta2\,\lambda^3\,\xi1\,\Omega2 + 10\,e^{2\alpha2-\beta2}\,s\,\epsilon\,\eta1\,\eta2\,\lambda^4\,\xi1^2\,\Omega2 - 10\,e^{2\alpha2-\beta2}\,s\,t\,\epsilon\,\eta1\,\eta2\,\lambda^4\,\xi1^2\,\Omega2 - \epsilon\,fz1'[\lambda]$$

```
In[]:= {sol34} = DSolve[
   Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
        sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
       sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /.
      sol24 /. sol25 /. sol26 /. sol27 /. sol28 /. sol29 /. sol30 /.
     sol31 /. sol32 /. sol33], QU[z]] == 0 ∧ fz1[0] == 0, fz1, λ]
```

Out[]=

$$\{\{fz1 \to \text{Function}[\{\lambda\}, -e^{\alpha2-\beta2}\lambda^3(-2\,e^{2\beta2}\,s\,\zeta1\,\xi1\,\Xi2 + e^{\alpha2}\,\eta2\,\lambda\,\xi1^2\,\Xi2 - 3\,e^{\alpha2}\,s\,\eta2\,\lambda\,\xi1^2\,\Xi2 + 2\,e^{\alpha2}\,t\,\zeta1\,\eta2\,\Upsilon2 - e^{\alpha2}\,\eta1\,\eta2\,\lambda\,\xi1\,\Upsilon2 + e^{\alpha2}\,t\,\eta1\,\eta2\,\lambda\,\xi1\,\Upsilon2 + e^{2\beta2}\,\zeta1^2\,\Omega2 - 3\,e^{2\beta2}\,s\,t\,\zeta1^2\,\Omega2 - 2\,e^{2\beta2}\,s\,\zeta1\,\eta1\,\lambda\,\xi1\,\Omega2 + 2\,e^{2\beta2}\,s\,t\,\zeta1\,\eta1\,\lambda\,\xi1\,\Omega2 + e^{\alpha2}\,\zeta1\,\eta2\,\lambda\,\xi1\,\Omega2 - 3\,e^{\alpha2}\,s\,t\,\zeta1\,\eta2\,\lambda\,\xi1\,\Omega2 - 2\,e^{\alpha2}\,s\,\eta1\,\eta2\,\lambda^2\,\xi1^2\,\Omega2 + 2\,e^{\alpha2}\,s\,t\,\eta1\,\eta2\,\lambda^2\,\xi1^2\,\Omega2)]\}\}$$

In[ ]:=
```
{sol35} = DSolve[
  Coefficient[CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
                sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /. sol16 /.
              sol17 /. sol18 /. sol19 /. sol20 /. sol21 /. sol22 /. sol23 /.
            sol24 /. sol25 /. sol26 /. sol27 /. sol28 /. sol29 /. sol30 /.
          sol31 /. sol32 /. sol33 /. sol34], QU[]] == 0 ∧ ft1[0] == 0, ft1, λ]
```

Out[ ]=

$$\Big\{\Big\{\text{ft1}\to\text{Function}\Big[\{\lambda\},\ \frac{1}{2}\big(-\lambda^4\,\xi1^2\,\Xi2^2+4\,s\,\lambda^4\,\xi1^2\,\Xi2^2-3\,s^2\,\lambda^4\,\xi1^2\,\Xi2^2+4\,\zeta1\,\lambda^3\,\Xi2\,\Upsilon2-4\,t\,\zeta1\,\lambda^3\,\Xi2\,\Upsilon2-4\,s\,\eta1\,\lambda^4\,\xi1\,\Xi2\,\Upsilon2+4\,s\,t\,\eta1\,\lambda^4\,\xi1\,\Xi2\,\Upsilon2-\eta1^2\,\lambda^4\,\Upsilon2^2+4\,t\,\eta1^2\,\lambda^4\,\Upsilon2^2-3\,t^2\,\eta1^2\,\lambda^4\,\Upsilon2^2-2\,s\,\eta1\,\lambda^3\,\xi1\,\Omega2+2\,s\,t\,\eta1\,\lambda^3\,\xi1\,\Omega2+4\,s\,t\,\zeta1\,\lambda^4\,\xi1\,\Xi2\,\Omega2-4\,s^2\,t\,\zeta1\,\lambda^4\,\xi1\,\Xi2\,\Omega2+2\,s\,\eta1\,\lambda^5\,\xi1^2\,\Xi2\,\Omega2-2\,s^2\,\eta1\,\lambda^5\,\xi1^2\,\Xi2\,\Omega2-2\,s\,t\,\eta1\,\lambda^5\,\xi1^2\,\Xi2\,\Omega2+2\,s^2\,t\,\eta1\,\lambda^5\,\xi1^2\,\Xi2\,\Omega2+4\,s\,t\,\zeta1\,\eta1\,\lambda^4\,\Upsilon2\,\Omega2-4\,s\,t^2\,\zeta1\,\eta1\,\lambda^4\,\Upsilon2\,\Omega2-4\,s\,t\,\eta1^2\,\lambda^5\,\xi1\,\Upsilon2\,\Omega2+4\,s\,t^2\,\eta1^2\,\lambda^5\,\xi1\,\Upsilon2\,\Omega2-\zeta1^2\,\lambda^4\,\Omega2^2+4\,s\,t\,\zeta1^2\,\lambda^4\,\Omega2^2-3\,s^2\,t^2\,\zeta1^2\,\lambda^4\,\Omega2^2+2\,s\,\zeta1\,\eta1\,\lambda^5\,\xi1\,\Omega2^2-2\,s\,t\,\zeta1\,\eta1\,\lambda^5\,\xi1\,\Omega2^2-6\,s^2\,t\,\zeta1\,\eta1\,\lambda^5\,\xi1\,\Omega2^2+6\,s^2\,t^2\,\zeta1\,\eta1\,\lambda^5\,\xi1\,\Omega2^2-s^2\,\eta1^2\,\lambda^6\,\xi1^2\,\Omega2^2+4\,s^2\,t\,\eta1^2\,\lambda^6\,\xi1^2\,\Omega2^2-3\,s^2\,t^2\,\eta1^2\,\lambda^6\,\xi1^2\,\Omega2^2\big)\Big]\Big\}\Big\}$$

In[ ]:=
```
CE[diff /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /. sol10 /. sol11 /.
          sol12 /. sol13 /. sol14 /. sol15 /. sol16 /. sol17 /. sol18 /.
        sol19 /. sol20 /. sol21 /. sol22 /. sol23 /. sol24 /. sol25 /. sol26 /.
    sol27 /. sol28 /. sol29 /. sol30 /. sol31 /. sol32 /. sol33 /. sol34 /. sol35]
```

Out[ ]=

0

In[ ]:=
```
g
```

Out[ ]=

$$\text{ft0}[\lambda]+\epsilon\,\text{ft1}[\lambda]+\epsilon\,\big(x\,X\,\text{f1}_{x\,X}[\lambda]+X^2\,\text{f1}_{X^2}[\lambda]+x\,y\,\text{f1}_{x\,y}[\lambda]+X\,y\,\text{f1}_{X\,y}[\lambda]+a\,Y\,\text{f1}_{a\,Y}[\lambda]+x\,Y\,\text{f1}_{x\,Y}[\lambda]+X\,Y\,\text{f1}_{X\,Y}[\lambda]+y\,Y\,\text{f1}_{y\,Y}[\lambda]+Y^2\,\text{f1}_{Y^2}[\lambda]+x\,z\,\text{f1}_{x\,z}[\lambda]+X\,z\,\text{f1}_{X\,z}[\lambda]+y\,z\,\text{f1}_{y\,z}[\lambda]+Y\,z\,\text{f1}_{Y\,z}[\lambda]+z^2\,\text{f1}_{z^2}[\lambda]+x\,Z\,\text{f1}_{x\,Z}[\lambda]+X\,Z\,\text{f1}_{X\,Z}[\lambda]+y\,Z\,\text{f1}_{y\,Z}[\lambda]+Y\,Z\,\text{f1}_{Y\,Z}[\lambda]+z\,Z\,\text{f1}_{z\,Z}[\lambda]\big)$$

```
In[•]:= Simplify[
  (f.QU@Generators + g) /. sol1 /. sol2 /. sol3 /. sol4 /. sol5 /. sol6 /. sol7 /. sol8 /. sol9 /.
         sol10 /. sol11 /. sol12 /. sol13 /. sol14 /. sol15 /.
       sol16 /. sol17 /. sol18 /. sol19 /. sol20 /. sol21 /.
     sol22 /. sol23 /. sol24 /. sol25 /. sol26 /. sol27 /. sol28 /.
   sol29 /. sol30 /. sol31 /. sol32 /. sol33 /. sol34 /. sol35]
```

Out[•]=

$$
\begin{aligned}
&b\left(\beta1+\beta2+2t\epsilon\lambda^2(\eta1\Upsilon2+s\zeta1\Omega2-s\eta1\lambda\xi1\Omega2)\right)+\\
&a\left(\alpha1+\alpha2+2s\epsilon\lambda^2\left(t\zeta1\Omega2+\xi1\left(\Xi2+e^{-\alpha1+2\beta1}Y\Omega2-(-1+t)\eta1\lambda\Omega2\right)\right)\right)-\\
&\frac{1}{2}e^{-2\alpha1-\alpha2-2\beta1-\beta2}\lambda\Big(-2e^{4\alpha1+\beta1+3\beta2}Xy\epsilon\eta1\lambda\Xi2+4e^{\alpha1+4\beta1+3\beta2}yY\epsilon\eta1\lambda\Upsilon2+\\
&4e^{3\alpha1+2\alpha2+3\beta1+2\beta2}zZ\epsilon\zeta1\lambda\Omega2+2e^{3(\alpha1+\beta1+\beta2)}yZ\epsilon\eta1\lambda\Omega2+2e^{3(\alpha1+\alpha2+\beta1)}Z\epsilon\lambda(x+z\eta2\lambda)\xi1\Omega2-\\
&2e^{6\alpha1+\alpha2+\beta2}X^2\epsilon\eta1\lambda^2\Xi2\Omega2+2e^{\alpha2+6\beta1+\beta2}sY^2\epsilon\lambda^2\xi1\Upsilon2\Omega2+2e^{5\alpha1+\alpha2+2\beta1+\beta2}XZ\epsilon\eta1\lambda^2\Omega2^2-\\
&2e^{2\alpha1+\alpha2+5\beta1+\beta2}sYZ\epsilon\lambda^2\xi1\Omega2^2+2e^{4\alpha1+2\alpha2+\beta1+2\beta2}Xz\epsilon\zeta1\lambda(\Xi2+\eta1\lambda\Omega2)+\\
&2e^{4\alpha1+3\alpha2+\beta1}X\epsilon\lambda(x+z\eta2\lambda)\xi1(2\Xi2+\eta1\lambda\Omega2)-2e^{\alpha1+3\alpha2+4\beta1}Y\epsilon\lambda(x+z\eta2\lambda)\\
&\xi1(\Upsilon2+2s\lambda\xi1\Omega2)-2e^{\alpha1+2(\alpha2+2\beta1+\beta2)}Yz\epsilon\zeta1\lambda(-\Upsilon2+3s\lambda\xi1\Omega2)+\\
&e^{2\alpha1+\alpha2+2\beta1+\beta2}\Big(-2z\zeta2-2y\eta2-2X\Xi1-2x\xi2-2\lambda\xi1\Xi2+2s\lambda\xi1\Xi2+\epsilon\lambda^3\xi1^2\Xi2^2-\\
&4s\epsilon\lambda^3\xi1^2\Xi2^2+3s^2\epsilon\lambda^3\xi1^2\Xi2^2-2Y\Upsilon1-2\eta1\lambda\Upsilon2+2t\eta1\lambda\Upsilon2-4\epsilon\zeta1\lambda^2\Xi2\Upsilon2+\\
&4t\epsilon\zeta1\lambda^2\Xi2\Upsilon2+4s\epsilon\eta1\lambda^3\xi1\Xi2\Upsilon2-4st\epsilon\eta1\lambda^3\xi1\Xi2\Upsilon2+\epsilon\eta1^2\lambda^3\Upsilon2^2-\\
&4t\epsilon\eta1^2\lambda^3\Upsilon2^2+3t^2\epsilon\eta1^2\lambda^3\Upsilon2^2-2Z\Omega1-2\zeta1\lambda\Omega2+2st\zeta1\lambda\Omega2+2s\eta1\lambda^2\xi1\Omega2-\\
&2st\eta1\lambda^2\xi1\Omega2+2s\epsilon\eta1\lambda^2\xi1\Omega2-2st\epsilon\eta1\lambda^2\xi1\Omega2-4st\epsilon\zeta1\lambda^3\xi1\Xi2\Omega2+\\
&4s^2t\epsilon\zeta1\lambda^3\xi1\Xi2\Omega2-2s\epsilon\eta1\lambda^4\xi1^2\Xi2\Omega2+2s^2\epsilon\eta1\lambda^4\xi1^2\Xi2\Omega2+2st\epsilon\eta1\lambda^4\xi1^2\Xi2\Omega2-\\
&2s^2t\epsilon\eta1\lambda^4\xi1^2\Xi2\Omega2-4st\epsilon\zeta1\eta1\lambda^3\Upsilon2\Omega2+4st^2\epsilon\zeta1\eta1\lambda^3\Upsilon2\Omega2+4st\epsilon\eta1^2\lambda^4\xi1\Upsilon2\Omega2-\\
&4st^2\epsilon\eta1^2\lambda^4\xi1\Upsilon2\Omega2+\epsilon\zeta1^2\lambda^3\Omega2^2-4st\epsilon\zeta1^2\lambda^3\Omega2^2+3s^2t^2\epsilon\zeta1^2\lambda^3\Omega2^2-\\
&2s\epsilon\zeta1\eta1\lambda^4\xi1\Omega2^2+2st\epsilon\zeta1\eta1\lambda^4\xi1\Omega2^2+6s^2t\epsilon\zeta1\eta1\lambda^4\xi1\Omega2^2-6s^2t^2\epsilon\zeta1\eta1\lambda^4\xi1\Omega2^2+\\
&s^2\epsilon\eta1^2\lambda^5\xi1^2\Omega2^2-4s^2t\epsilon\eta1^2\lambda^5\xi1^2\Omega2^2+3s^2t^2\epsilon\eta1^2\lambda^5\xi1^2\Omega2^2\Big)-2e^{2(\alpha1+\alpha2+\beta1+\beta2)}z\\
&\Big(\zeta1-y\epsilon\eta1\eta2\lambda^2\xi1+(-1+3st)\epsilon\zeta1^2\lambda^2\Omega2+2s\epsilon\zeta1\lambda^2\xi1(\Xi2-(-1+t)\eta1\lambda\Omega2)\Big)+\\
&2e^{2\alpha1+3\alpha2+2\beta1}(x+z\eta2\lambda)\Big(2t\epsilon\zeta1\lambda\Upsilon2+\epsilon\lambda^2\xi1^2(\Xi2-3s\Xi2+2s(-1+t)\eta1\lambda\Omega2)+\\
&\xi1\Big(-1-z\epsilon\zeta2\lambda+y\epsilon\eta2\lambda-\epsilon\eta1\lambda^2\Upsilon2+t\epsilon\eta1\lambda^2\Upsilon2+\epsilon\zeta1\lambda^2\Omega2-3st\epsilon\zeta1\lambda^2\Omega2\Big)\Big)+\\
&2e^{2\alpha1+2\beta1+3\beta2}y\Big(-2\epsilon\zeta1\lambda\Xi2+\epsilon\eta1^2\lambda^2(\Upsilon2-3t\Upsilon2+s(1+t)\lambda\xi1\Omega2)+\\
&\eta1\Big(-1+z\epsilon\zeta2\lambda-\epsilon\zeta1\lambda^2\Omega2+s\epsilon\lambda^2(2\xi1\Xi2-t\zeta1\Omega2)\Big)\Big)+2e^{3\alpha1+\alpha2+3\beta1+\beta2}\Omega2\\
&\Big(XY\epsilon\lambda^2(\eta1\Upsilon2-2s\xi1(\Xi2+\eta1\lambda\Omega2))+Z\Big(-1+\epsilon\lambda^2(-2(-1+t)\eta1\Upsilon2+\zeta1\Omega2)+s\epsilon\lambda^2\\
&(-2\xi1\Xi2-3t\zeta1\Omega2+3(-1+t)\eta1\lambda\xi1\Omega2)\Big)\Big)+2e^{\alpha1+\alpha2+4\beta1+\beta2}Y\Big((1-3t)\epsilon\eta1\lambda^2\Upsilon2^2+\\
&\Upsilon2\Big(-1-Z\epsilon\lambda\Omega1+\epsilon\zeta1\lambda^2\Omega2+s\epsilon\lambda^2(2\xi1\Xi2-3t\zeta1\Omega2+4t\eta1\lambda\xi1\Omega2)\Big)+s\lambda\xi1\\
&\Omega2\Big(1+\epsilon\Big(1+Z\lambda\Omega1+s(1-3t)\eta1\lambda^3\xi1\Omega2+\lambda^2((-1+s)\xi1\Xi2+2(-1+2st)\zeta1\Omega2)\Big)\Big)\Big)-\\
&2e^{4\alpha1+\alpha2+\beta1+\beta2}\Big(-2Z\epsilon\lambda\Upsilon1(\Xi2+\eta1\lambda\Omega2)+X\Big((-1+3s)\epsilon\lambda^2\xi1\Xi2^2+\\
&\eta1\lambda\Omega2(1+Y\epsilon\lambda\Upsilon1+\epsilon\lambda(-Z\Omega1+2st\zeta1\lambda\Omega2+(-1+t)\eta1\lambda(\Upsilon2-2s\lambda\xi1\Omega2)))+\\
&\Xi2(1+Y\epsilon\lambda\Upsilon1+\epsilon\lambda(-Z\Omega1+(1+st)\zeta1\lambda\Omega2+\eta1\lambda(\Upsilon2-t\Upsilon2-s(-3+t)\lambda\xi1\Omega2)))\Big)\Big)\Big)
\end{aligned}
$$