```
In[•]:= ClearAll["Global`*"]

        (*
            Φ = {α₁, α₁+α₂, α₁ + 2α₂, α₂, -α₁, -(α₁+α₂), -(α₁ + 2α₂), -α₂}
        *)

In[•]:= Inverse[{{2, -2}, {-1, 2}}]
```

Out[•]= $\left\{\{1, 1\}, \left\{\frac{1}{2}, 1\right\}\right\}$

```
In[•]:= (* Derived from the FR of λ₁ *)
        H1 =
          {{1, 0, 0, 0, 0}, {0, -1, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 1, 0}, {0, 0, 0, 0, -1}};
        H2 = {{0, 0, 0, 0, 0}, {0, 2, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, -2, 0}, {0, 0, 0, 0, 0}};

        X1 = {{0, 1, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 0, 1}, {0, 0, 0, 0, 0}};
        X2 = {{0, 0, 0, 0, 0}, {0, 0, √2, 0, 0}, {0, 0, 0, √2, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}};
        X3 = {{0, 0, √2, 0, 0}, {0, 0, 0, 0, 0},
           {0, 0, 0, 0, -√2}, {0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}};
        X4 = {{0, 0, 0, -√2, 0}, {0, 0, 0, 0, -√2}, {0, 0, 0, 0, 0},
           {0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}};

        Y1 = {{0, 0, 0, 0, 0}, {1, 0, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 1, 0}};
        Y2 = {{0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, √2, 0, 0, 0}, {0, 0, √2, 0, 0}, {0, 0, 0, 0, 0}};
        Y3 = {{0, 0, 0, 0, 0}, {0, 0, 0, 0, 0},
           {√2, 0, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, -√2, 0, 0}};
        Y4 = {{0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 0, 0},
           {-√2, 0, 0, 0, 0}, {0, -√2, 0, 0, 0}};

In[•]:= LB[x_, y_] := x.y - y.x;
        LB[X3, Y3] // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -2 \end{pmatrix}$$

```
In[•]:= H2 // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -2 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

In[∘]:= (H1 + 2 H2) // MatrixForm

Out[∘]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -3 & 0 \\ 0 & 0 & 0 & 0 & -1 \end{pmatrix}$$

In[∘]:= M = (ⅈ h_1 H1 + ⅈ h_2 H2) + x_1 (X1 − Y1) + ⅈ y_1 (X1 + Y1) + x_2 (X2 − Y2) + ⅈ y_2 (X2 + Y2) + x_3 (X3 − Y3) + ⅈ y_3 (X3 + Y3) + x_4 (X4 − Y4) + ⅈ y_4 (X4 + Y4);
M // MatrixForm

Out[∘]//MatrixForm=

$$\begin{pmatrix} i h_1 & x_1 + i y_1 & \sqrt{2} x_3 + i \sqrt{2} y_3 & -\sqrt{2} x_4 - i \sqrt{2} y_4 & 0 \\ -x_1 + i y_1 & -i h_1 + 2 i h_2 & \sqrt{2} x_2 + i \sqrt{2} y_2 & 0 & -\sqrt{2} x_4 - i \sqrt{2} y_4 \\ -\sqrt{2} x_3 + i \sqrt{2} y_3 & -\sqrt{2} x_2 + i \sqrt{2} y_2 & 0 & \sqrt{2} x_2 + i \sqrt{2} y_2 & -\sqrt{2} x_3 - i \sqrt{2} y_3 \\ \sqrt{2} x_4 - i \sqrt{2} y_4 & 0 & -\sqrt{2} x_2 + i \sqrt{2} y_2 & i h_1 - 2 i h_2 & x_1 + i y_1 \\ 0 & \sqrt{2} x_4 - i \sqrt{2} y_4 & \sqrt{2} x_3 - i \sqrt{2} y_3 & -x_1 + i y_1 & -i h_1 \end{pmatrix}$$

In[∘]:= Eigenvalues[M] // MatrixForm

Out[∘]//MatrixForm=

$$\begin{pmatrix} -\sqrt{-h_1^2 + 2 h_1 h_2 - 2 h_2^2 - x_1^2 - 2 x_2^2 - 2 x_3^2 - 2 x_4^2 - y_1^2 - 2 y_2^2 - 2 y_3^2 - 2 y_4^2 - 2 \sqrt{h_1^2 h_2^2 - 2 h_1 h_2^3 + h_2^4 + h_2^2 x_1^2 - 2 h \ldots}} \\ \sqrt{-h_1^2 + 2 h_1 h_2 - 2 h_2^2 - x_1^2 - 2 x_2^2 - 2 x_3^2 - 2 x_4^2 - y_1^2 - 2 y_2^2 - 2 y_3^2 - 2 y_4^2 - 2 \sqrt{h_1^2 h_2^2 - 2 h_1 h_2^3 + h_2^4 + h_2^2 x_1^2 - 2 h \ldots}} \\ -\sqrt{-h_1^2 + 2 h_1 h_2 - 2 h_2^2 - x_1^2 - 2 x_2^2 - 2 x_3^2 - 2 x_4^2 - y_1^2 - 2 y_2^2 - 2 y_3^2 - 2 y_4^2 + 2 \sqrt{h_1^2 h_2^2 - 2 h_1 h_2^3 + h_2^4 + h_2^2 x_1^2 - 2 h \ldots}} \\ \sqrt{-h_1^2 + 2 h_1 h_2 - 2 h_2^2 - x_1^2 - 2 x_2^2 - 2 x_3^2 - 2 x_4^2 - y_1^2 - 2 y_2^2 - 2 y_3^2 - 2 y_4^2 + 2 \sqrt{h_1^2 h_2^2 - 2 h_1 h_2^3 + h_2^4 + h_2^2 x_1^2 - 2 h \ldots}} \end{pmatrix}$$

In[∘]:= M1 = (ⅈ h1 H1) + x1 (X1 − Y1) + ⅈ y1 (X1 + Y1);
M1 // MatrixForm

Out[∘]//MatrixForm=

$$\begin{pmatrix} i\, h1 & x1 + i\, y1 & 0 & 0 & 0 \\ -x1 + i\, y1 & -i\, h1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & i\, h1 & x1 + i\, y1 \\ 0 & 0 & 0 & -x1 + i\, y1 & -i\, h1 \end{pmatrix}$$

In[∘]:= M2 = (ⅈ h2 H2) + x2 (X2 − Y2) + ⅈ y2 (X2 + Y2);
M2 // MatrixForm

Out[∘]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 2 i\, h2 & \sqrt{2}\, x2 + i \sqrt{2}\, y2 & 0 & 0 \\ 0 & -\sqrt{2}\, x2 + i \sqrt{2}\, y2 & 0 & \sqrt{2}\, x2 + i \sqrt{2}\, y2 & 0 \\ 0 & 0 & -\sqrt{2}\, x2 + i \sqrt{2}\, y2 & -2 i\, h2 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

In[•]:=
```
M3 = (ⅈ h3 (2 H1 + H2)) + x3 (X3 - Y3) + ⅈ y3 (X3 + Y3);
M3 // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 2\,i\,h3 & 0 & \sqrt{2}\,x3 + i\sqrt{2}\,y3 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ -\sqrt{2}\,x3 + i\sqrt{2}\,y3 & 0 & 0 & 0 & -\sqrt{2}\,x3 - i\sqrt{2}\,y3 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \sqrt{2}\,x3 - i\sqrt{2}\,y3 & 0 & -2\,i\,h3 \end{pmatrix}$$

In[•]:=
```
M4 = (ⅈ 2 h4 (H1 + H2)) + x4 (X4 - Y4) + ⅈ y4 (X4 + Y4);
M4 // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 2\,i\,h4 & 0 & 0 & -\sqrt{2}\,x4 - i\sqrt{2}\,y4 & 0 \\ 0 & 2\,i\,h4 & 0 & 0 & -\sqrt{2}\,x4 - i\sqrt{2}\,y4 \\ 0 & 0 & 0 & 0 & 0 \\ \sqrt{2}\,x4 - i\sqrt{2}\,y4 & 0 & 0 & -2\,i\,h4 & 0 \\ 0 & \sqrt{2}\,x4 - i\sqrt{2}\,y4 & 0 & 0 & -2\,i\,h4 \end{pmatrix}$$

In[•]:=
```
M5 = (ⅈ h1 H1 + ⅈ h2 H2);
M5 // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} i\,h_1 & 0 & 0 & 0 & 0 \\ 0 & -i\,h_1 + 2\,i\,h_2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & i\,h_1 - 2\,i\,h_2 & 0 \\ 0 & 0 & 0 & 0 & -i\,h_1 \end{pmatrix}$$

In[•]:=
```
f[p_] := Sum[Binomial[p, q] (-1)^(p-q) (p - q)! (dγ) * If[q == 0, 1, f[q - 1]], {q, 0, p}];  i = 5;

n = 5;
A = Sum[Sum[Sum[ (-1)^(n-k-j-1) * Binomial[j, m] *
      ((n - 1)! / (n - j + m - 1)!) * If[k == 0, IdentityMatrix[i], MatrixPower[M, k]] *
      Tr[Minors[M, n - j - k - 1]] * If[m == 0, 1, f[m - 1]], {m, 0, j}], {j, 0, n-k-1}], {k, 0, n-1}];
```

$$f[p\_] := \sum_{q=0}^{p} \mathrm{Binomial}[p, q]\,(-1)^{p-q}\,(p-q)!\,(d\gamma) * \mathrm{If}[q == 0, 1, f[q-1]];\quad i = 5;$$

$$n = 5;$$

$$A = \sum_{k=0}^{n-1}\sum_{j=0}^{n-k-1}\sum_{m=0}^{j} (-1)^{n-k-j-1} * \mathrm{Binomial}[j, m] * \left(\frac{(n-1)!}{(n-j+m-1)!}\right) * \mathrm{If}[k == 0, \mathrm{IdentityMatrix}[i], \mathrm{MatrixPower}[M, k]] * \mathrm{Tr}[\mathrm{Minors}[M, n-j-k-1]] * \mathrm{If}[m == 0, 1, f[m-1]];$$

In[•]:=
```
Tr[A] // ExpandAll
```

Out[•]=

$$\begin{aligned}&120 + 250\,d\gamma + 175\,d\gamma^2 + 50\,d\gamma^3 + 5\,d\gamma^4 + 72\,h_1^2 + 42\,d\gamma\,h_1^2 + 6\,d\gamma^2\,h_1^2 + h_1^4 - 144\,h_1\,h_2 - 84\,d\gamma\,h_1\,h_2 - \\ &12\,d\gamma^2\,h_1\,h_2 - 4\,h_1^3\,h_2 + 144\,h_2^2 + 84\,d\gamma\,h_2^2 + 12\,d\gamma^2\,h_2^2 + 4\,h_1^2\,h_2^2 + 72\,x_1^2 + 42\,d\gamma\,x_1^2 + 6\,d\gamma^2\,x_1^2 + \\ &2\,h_1^2\,x_1^2 - 4\,h_1\,h_2\,x_1^2 + x_1^4 + 144\,x_2^2 + 84\,d\gamma\,x_2^2 + 12\,d\gamma^2\,x_2^2 + 4\,h_1^2\,x_2^2 + 4\,x_1^2\,x_2^2 + 144\,x_3^2 + 84\,d\gamma\,x_3^2 + \\ &12\,d\gamma^2\,x_3^2 + 4\,h_1^2\,x_3^2 - 16\,h_1\,h_2\,x_3^2 + 16\,h_2^2\,x_3^2 + 4\,x_1^2\,x_3^2 - 8\sqrt{2}\,x_1\,x_2^2\,x_4 - 8\sqrt{2}\,x_1\,x_3^2\,x_4 + 144\,x_4^2 + \\ &84\,d\gamma\,x_4^2 + 12\,d\gamma^2\,x_4^2 - 4\,h_1^2\,x_4^2 + 8\,h_1\,h_2\,x_4^2 - 4\,x_1^2\,x_4^2 + 8\,x_2^2\,x_4^2 + 8\,x_3^2\,x_4^2 + 4\,x_4^4 - 16\,h_2\,x_2\,x_3\,y_1 + \\ &72\,y_1^2 + 42\,d\gamma\,y_1^2 + 6\,d\gamma^2\,y_1^2 + 2\,h_1^2\,y_1^2 - 4\,h_1\,h_2\,y_1^2 + 2\,x_1^2\,y_1^2 + 4\,x_2^2\,y_1^2 + 4\,x_3^2\,y_1^2 - 4\,x_4^2\,y_1^2 + y_1^4 - \\ &16\,h_2\,x_1\,x_3\,y_2 + 16\sqrt{2}\,h_1\,x_3\,x_4\,y_2 - 16\sqrt{2}\,h_2\,x_3\,x_4\,y_2 + 16\sqrt{2}\,x_2\,x_4\,y_1\,y_2 + 144\,y_2^2 + 84\,d\gamma\,y_2^2 + \\ &12\,d\gamma^2\,y_2^2 + 4\,h_1^2\,y_2^2 + 4\,x_1^2\,y_2^2 + 8\sqrt{2}\,x_1\,x_4\,y_2^2 + 8\,x_4^2\,y_2^2 + 4\,y_1^2\,y_2^2 + 16\,h_2\,x_1\,x_2\,y_3 + 16\sqrt{2}\,h_1\,x_2\,x_4\,y_3 - \\ &16\sqrt{2}\,h_2\,x_2\,x_4\,y_3 - 16\sqrt{2}\,x_3\,x_4\,y_1\,y_3 - 16\,h_2\,y_1\,y_2\,y_3 + 144\,y_3^2 + 84\,d\gamma\,y_3^2 + 12\,d\gamma^2\,y_3^2 + \\ &4\,h_1^2\,y_3^2 - 16\,h_1\,h_2\,y_3^2 + 16\,h_2^2\,y_3^2 + 4\,x_1^2\,y_3^2 + 8\sqrt{2}\,x_1\,x_4\,y_3^2 + 8\,x_4^2\,y_3^2 + 4\,y_1^2\,y_3^2 - 16\sqrt{2}\,h_1\,x_2\,x_3\,y_4 + \\ &16\sqrt{2}\,h_2\,x_2\,x_3\,y_4 - 8\sqrt{2}\,x_2^2\,y_1\,y_4 + 8\sqrt{2}\,x_3^2\,y_1\,y_4 - 16\sqrt{2}\,x_1\,x_2\,y_2\,y_4 + 8\sqrt{2}\,y_1\,y_2^2\,y_4 - \\ &16\sqrt{2}\,x_1\,x_3\,y_3\,y_4 + 16\sqrt{2}\,h_1\,y_2\,y_3\,y_4 - 16\sqrt{2}\,h_2\,y_2\,y_3\,y_4 - 8\sqrt{2}\,y_1\,y_3^2\,y_4 + 144\,y_4^2 + 84\,d\gamma\,y_4^2 + \\ &12\,d\gamma^2\,y_4^2 - 4\,h_1^2\,y_4^2 + 8\,h_1\,h_2\,y_4^2 - 4\,x_1^2\,y_4^2 + 8\,x_2^2\,y_4^2 + 8\,x_3^2\,y_4^2 + 8\,x_4^2\,y_4^2 - 4\,y_1^2\,y_4^2 + 8\,y_2^2\,y_4^2 + 8\,y_3^2\,y_4^2 + 4\,y_4^4\end{aligned}$$

In[]:= **A[[1, 1]] // Expand**

Out[]= $24 + 50\,d\gamma + 35\,d\gamma^2 + 10\,d\gamma^3 + d\gamma^4 + 24\,i\,h_1 + 26\,i\,d\gamma\,h_1 + 9\,i\,d\gamma^2\,h_1 + i\,d\gamma^3\,h_1 + 12\,h_1^2 + 7\,d\gamma\,h_1^2 + d\gamma^2\,h_1^2 + 4\,i\,h_1^3 + i\,d\gamma\,h_1^3 - 48\,h_1\,h_2 - 28\,d\gamma\,h_1\,h_2 - 4\,d\gamma^2\,h_1\,h_2 - 16\,i\,h_1^2\,h_2 - 4\,i\,d\gamma\,h_1^2\,h_2 + 48\,h_2^2 + 28\,d\gamma\,h_2^2 + 4\,d\gamma^2\,h_2^2 + 16\,i\,h_1\,h_2^2 + 4\,i\,d\gamma\,h_1\,h_2^2 + 12\,x_1^2 + 7\,d\gamma\,x_1^2 + d\gamma^2\,x_1^2 + 4\,i\,h_1\,x_1^2 + i\,d\gamma\,h_1\,x_1^2 - 8\,i\,h_2\,x_1^2 - 2\,i\,d\gamma\,h_2\,x_1^2 + 48\,x_2^2 + 28\,d\gamma\,x_2^2 + 4\,d\gamma^2\,x_2^2 + 16\,i\,h_1\,x_2^2 + 4\,i\,d\gamma\,h_1\,x_2^2 + 2\,x_1^2\,x_2^2 + 24\,x_3^2 + 14\,d\gamma\,x_3^2 + 2\,d\gamma^2\,x_3^2 + 2\,h_1^2\,x_3^2 - 8\,h_1\,h_2\,x_3^2 + 8\,h_2^2\,x_3^2 - 4\sqrt{2}\,x_1\,x_2^2\,x_4 + 24\,x_4^2 + 14\,d\gamma\,x_4^2 + 2\,d\gamma^2\,x_4^2 - 8\,i\,h_1\,x_4^2 - 2\,i\,d\gamma\,h_1\,x_4^2 + 16\,i\,h_2\,x_4^2 + 4\,i\,d\gamma\,h_2\,x_4^2 + 4\,x_2^2\,x_4^2 - 16\,i\,x_2\,x_3\,y_1 - 4\,i\,d\gamma\,x_2\,x_3\,y_1 + 4\,h_1\,x_2\,x_3\,y_1 - 8\,h_2\,x_2\,x_3\,y_1 + 12\,y_1^2 + 7\,d\gamma\,y_1^2 + d\gamma^2\,y_1^2 + 4\,i\,h_1\,y_1^2 + i\,d\gamma\,h_1\,y_1^2 - 8\,i\,h_2\,y_1^2 - 2\,i\,d\gamma\,h_2\,y_1^2 + 2\,x_2^2\,y_1^2 - 16\,i\,x_1\,x_3\,y_2 - 4\,i\,d\gamma\,x_1\,x_3\,y_2 + 4\,h_1\,x_1\,x_3\,y_2 - 8\,h_2\,x_1\,x_3\,y_2 + 16\,i\sqrt{2}\,x_3\,x_4\,y_2 + 4\,i\sqrt{2}\,d\gamma\,x_3\,x_4\,y_2 + 4\sqrt{2}\,h_1\,x_3\,x_4\,y_2 - 8\sqrt{2}\,h_2\,x_3\,x_4\,y_2 + 8\sqrt{2}\,x_2\,x_4\,y_1\,y_2 + 48\,y_2^2 + 28\,d\gamma\,y_2^2 + 4\,d\gamma^2\,y_2^2 + 16\,i\,h_1\,y_2^2 + 4\,i\,d\gamma\,h_1\,y_2^2 + 2\,x_1^2\,y_2^2 + 4\sqrt{2}\,x_1\,x_4\,y_2^2 + 4\,x_4^2\,y_2^2 + 2\,y_1^2\,y_2^2 + 16\,i\,x_1\,x_2\,y_3 + 4\,i\,d\gamma\,x_1\,x_2\,y_3 - 4\,h_1\,x_1\,x_2\,y_3 + 8\,h_2\,x_1\,x_2\,y_3 + 16\,i\sqrt{2}\,x_2\,x_4\,y_3 + 4\,i\sqrt{2}\,d\gamma\,x_2\,x_4\,y_3 + 4\sqrt{2}\,h_1\,x_2\,x_4\,y_3 - 8\sqrt{2}\,h_2\,x_2\,x_4\,y_3 - 16\,i\,y_1\,y_2\,y_3 - 4\,i\,d\gamma\,y_1\,y_2\,y_3 + 4\,h_1\,y_1\,y_2\,y_3 - 8\,h_2\,y_1\,y_2\,y_3 + 24\,y_3^2 + 14\,d\gamma\,y_3^2 + 2\,d\gamma^2\,y_3^2 + 2\,h_1^2\,y_3^2 - 8\,h_1\,h_2\,y_3^2 + 8\,h_2^2\,y_3^2 - 16\,i\sqrt{2}\,x_2\,x_3\,y_4 - 4\,i\sqrt{2}\,d\gamma\,x_2\,x_3\,y_4 - 4\sqrt{2}\,h_1\,x_2\,x_3\,y_4 + 8\sqrt{2}\,h_2\,x_2\,x_3\,y_4 - 4\sqrt{2}\,x_2^2\,y_1\,y_4 - 8\sqrt{2}\,x_1\,x_2\,y_2\,y_4 + 4\sqrt{2}\,y_1\,y_2^2\,y_4 + 16\,i\sqrt{2}\,y_2\,y_3\,y_4 + 4\,i\sqrt{2}\,d\gamma\,y_2\,y_3\,y_4 + 4\sqrt{2}\,h_1\,y_2\,y_3\,y_4 - 8\sqrt{2}\,h_2\,y_2\,y_3\,y_4 + 24\,y_4^2 + 14\,d\gamma\,y_4^2 + 2\,d\gamma^2\,y_4^2 - 8\,i\,h_1\,y_4^2 - 2\,i\,d\gamma\,h_1\,y_4^2 + 16\,i\,h_2\,y_4^2 + 4\,i\,d\gamma\,h_2\,y_4^2 + 4\,x_2^2\,y_4^2 + 4\,y_2^2\,y_4^2$

In[]:= **A[[3, 3]] // Expand**

Out[]= $24 + 50\,d\gamma + 35\,d\gamma^2 + 10\,d\gamma^3 + d\gamma^4 + 24\,h_1^2 + 14\,d\gamma\,h_1^2 + 2\,d\gamma^2\,h_1^2 + h_1^4 - 48\,h_1\,h_2 - 28\,d\gamma\,h_1\,h_2 - 4\,d\gamma^2\,h_1\,h_2 - 4\,h_1^3\,h_2 + 48\,h_2^2 + 28\,d\gamma\,h_2^2 + 4\,d\gamma^2\,h_2^2 + 4\,h_1^2\,h_2^2 + 24\,x_1^2 + 14\,d\gamma\,x_1^2 + 2\,d\gamma^2\,x_1^2 + 2\,h_1^2\,x_1^2 - 4\,h_1\,h_2\,x_1^2 + x_1^4 + 48\,x_4^2 + 28\,d\gamma\,x_4^2 + 4\,d\gamma^2\,x_4^2 - 4\,h_1^2\,x_4^2 + 8\,h_1\,h_2\,x_4^2 - 4\,x_1^2\,x_4^2 + 4\,x_4^4 + 24\,y_1^2 + 14\,d\gamma\,y_1^2 + 2\,d\gamma^2\,y_1^2 + 2\,h_1^2\,y_1^2 - 4\,h_1\,h_2\,y_1^2 + 2\,x_1^2\,y_1^2 - 4\,x_4^2\,y_1^2 + y_1^4 + 48\,y_4^2 + 28\,d\gamma\,y_4^2 + 4\,d\gamma^2\,y_4^2 - 4\,h_1^2\,y_4^2 + 8\,h_1\,h_2\,y_4^2 - 4\,x_1^2\,y_4^2 + 8\,x_4^2\,y_4^2 - 4\,y_1^2\,y_4^2 + 4\,y_4^4$

(*

G - induced differential operators:

X1 : 2y1 dh1 + (2h2-2h1) dy1 + x2 dx3 + y2 dy3 - x3 dx2 - y3 dy2 ;

Y1: -2x1 dh1 - (2h2-2h1) dx1 - y2 dx3 + x2 dy3 - y3 dx2 + x3 dy2 ;

X2: $2y2\ dh2 + (h1 - 2h2)\ dy2 + 2x3\ dx1 + 2y3\ dy1 + \left(-x1 - \sqrt{2}\ x4\right)\ dx3 + \left(-y1 - \sqrt{2}y4\right)\ dy3 - \sqrt{2}x3\ dx4 - \sqrt{2}y3\ dy4$ **;**

Y2: $-2x2\ dh2 + (-h1 + 2h2)\ dx2 + 2y3\ dx1 - 2x3\ dy1 + \left(y1 - \sqrt{2}y4\right)\ dx3 + \left(-x1 + \sqrt{2}x4\right)\ dy3 + \sqrt{2}y3\ dx4 - \sqrt{2}x3\ dy4$ **;**

$Y^G{}_{\alpha_1} = -\frac{1}{2}\left(X_1{}^G + i\ Y_1{}^G\right)$,

we know $Y_{\alpha_1}.\ \pi_{1,1} = \pi_{1,2}$ **and** $-Y^G{}_{\alpha_1}.\ \pi_{1,1}(\exp) = \pi_{1,2}(\exp)$;

This holds true for all $\lambda = \sum_i c_i\, \lambda_i$

***)**

In[◦]:=

$$\begin{aligned}&-\Big(-(y_1-i\,x_1)\,D[A[\![1,1]\!],h_1]-\frac{1}{2}*(2h_2-2h_1)\,D[A[\![1,1]\!],y_1]+i\,\frac{1}{2}*(2h_2-2h_1)\\&\quad D[A[\![1,1]\!],x_1]-\frac{1}{2}*(x_2-i\,y_2)\,D[A[\![1,1]\!],x_3]-\frac{1}{2}*(y_2+i\,x_2)\,D[A[\![1,1]\!],y_3]-\\&\quad\frac{1}{2}*(-x_3-i\,y_3)\,D[A[\![1,1]\!],x_2]-\frac{1}{2}*(-y_3+i\,x_3)\,D[A[\![1,1]\!],y_2]\Big)\ \text{// Expand}\end{aligned}$$

In[◦]:=

$$\begin{aligned}&(*\ \text{Apply } X_{\alpha 1} \text{ to } t^{\lambda_1}{}_{15}\ *)\\&l=2;\ k=5;\\&\frac{1}{2}\,((2y_1+i\,2x_1)\,D[A[\![l,k]\!],h_1]+(2h_2-2h_1)\,D[A[\![l,k]\!],y_1]+\\&\quad i\,(2h_2-2h_1)\,D[A[\![l,k]\!],x_1]+(x_2+i\,y_2)\,D[A[\![l,k]\!],x_3]+(y_2-i\,x_2)\,D[A[\![l,k]\!],y_3]+\\&\quad(-x_3+i\,y_3)\,D[A[\![l,k]\!],x_2]+(-y_3-i\,x_3)\,D[A[\![l,k]\!],y_2])\ \text{// Expand}\end{aligned}$$

In[◦]:=

$$\begin{aligned}&-24x_2^2-14\,d\gamma\,x_2^2-2\,d\gamma^2x_2^2-2h_1^2x_2^2+4i\,h_1x_1x_2x_3+2x_1^2x_3^2-24\sqrt{2}\,x_1x_4-14\sqrt{2}\,d\gamma\,x_1x_4-\\&2\sqrt{2}\,d\gamma^2x_1x_4-4i\sqrt{2}\,h_1x_2x_3x_4-4\sqrt{2}\,x_1x_3^2x_4+4x_3^2x_4^2+4h_1x_2x_3y_1-4i\,x_1x_3^2y_1+\\&24i\sqrt{2}\,x_4y_1+14i\sqrt{2}\,d\gamma\,x_4y_1+2i\sqrt{2}\,d\gamma^2x_4y_1+4i\sqrt{2}\,x_3^2x_4y_1-2x_3^2y_1^2-48i\,x_2y_2-\\&28i\,d\gamma\,x_2y_2-4i\,d\gamma^2x_2y_2-4i\,h_1^2x_2y_2-4h_1x_1x_3y_2+4\sqrt{2}\,h_1x_3x_4y_2+4i\,h_1x_3y_1y_2+\\&24y_2^2+14\,d\gamma\,y_2^2+2\,d\gamma^2y_2^2+2h_1^2y_2^2-4h_1x_1x_2y_3+4i\,x_1^2x_3y_3-4\sqrt{2}\,h_1x_2x_4y_3-\\&8i\,x_3x_4^2y_3+4i\,h_1x_2y_1y_3+8x_1x_3y_1y_3-4i\,x_3y_1^2y_3-4i\,h_1x_1y_2y_3-4i\sqrt{2}\,h_1x_4y_2y_3-\\&4h_1y_1y_2y_3-2x_1^2y_3^2-4\sqrt{2}\,x_1x_4y_3^2-4x_4^2y_3^2+4i\,x_1y_1y_3^2+4i\sqrt{2}\,x_4y_1y_3^2+2y_1^2y_3^2-\\&24i\sqrt{2}\,x_1y_4-14i\sqrt{2}\,d\gamma\,x_1y_4-2i\sqrt{2}\,d\gamma^2x_1y_4+4\sqrt{2}\,h_1x_2x_3y_4-4i\sqrt{2}\,x_1x_3^2y_4+\\&8i\,x_3^2x_4y_4-24\sqrt{2}\,y_1y_4-14\sqrt{2}\,d\gamma\,y_1y_4-2\sqrt{2}\,d\gamma^2y_1y_4-4\sqrt{2}\,x_3^2y_1y_4+\\&4i\sqrt{2}\,h_1x_3y_2y_4-4i\sqrt{2}\,h_1x_2y_3y_4+16x_3x_4y_3y_4+4\sqrt{2}\,h_1y_2y_3y_4-4i\sqrt{2}\,x_1y_3^2y_4-\\&8i\,x_4y_3^2y_4-4\sqrt{2}\,y_1y_3^2y_4-4x_3^2y_4^2+8i\,x_3y_3y_4^2+4y_3^2y_4^2+A[\![2,4]\!]\ \text{// Expand}\end{aligned}$$

Out[◦]= 0

In[◦]:= $A[\![2,4]\!]\ \text{// Expand}$

Out[◦]=

$$\begin{aligned}&24x_2^2+14\,d\gamma\,x_2^2+2\,d\gamma^2x_2^2+2h_1^2x_2^2-4i\,h_1x_1x_2x_3-2x_1^2x_3^2+24\sqrt{2}\,x_1x_4+14\sqrt{2}\,d\gamma\,x_1x_4+\\&2\sqrt{2}\,d\gamma^2x_1x_4+4i\sqrt{2}\,h_1x_2x_3x_4+4\sqrt{2}\,x_1x_3^2x_4-4x_3^2x_4^2-4h_1x_2x_3y_1+4i\,x_1x_3^2y_1-\\&24i\sqrt{2}\,x_4y_1-14i\sqrt{2}\,d\gamma\,x_4y_1-2i\sqrt{2}\,d\gamma^2x_4y_1-4i\sqrt{2}\,x_3^2x_4y_1+2x_3^2y_1^2+48i\,x_2y_2+\\&28i\,d\gamma\,x_2y_2+4i\,d\gamma^2x_2y_2+4i\,h_1^2x_2y_2+4h_1x_1x_3y_2-4\sqrt{2}\,h_1x_3x_4y_2-4i\,h_1x_3y_1y_2-\\&24y_2^2-14\,d\gamma\,y_2^2-2\,d\gamma^2y_2^2-2h_1^2y_2^2+4h_1x_1x_2y_3-4i\,x_1^2x_3y_3+4\sqrt{2}\,h_1x_2x_4y_3+8i\,x_3x_4^2y_3-\\&4i\,h_1x_2y_1y_3-8x_1x_3y_1y_3+4i\,x_3y_1^2y_3+4i\,h_1x_1y_2y_3+4i\sqrt{2}\,h_1x_4y_2y_3+4h_1y_1y_2y_3+2x_1^2y_3^2+\\&4\sqrt{2}\,x_1x_4y_3^2+4x_4^2y_3^2-4i\,x_1y_1y_3^2-4i\sqrt{2}\,x_4y_1y_3^2-2y_1^2y_3^2+24i\sqrt{2}\,x_1y_4+14i\sqrt{2}\,d\gamma\,x_1y_4+\\&2i\sqrt{2}\,d\gamma^2x_1y_4-4\sqrt{2}\,h_1x_2x_3y_4+4i\sqrt{2}\,x_1x_3^2y_4-8i\,x_3^2x_4y_4+24\sqrt{2}\,y_1y_4+14\sqrt{2}\,d\gamma\,y_1y_4+\\&2\sqrt{2}\,d\gamma^2y_1y_4+4\sqrt{2}\,x_3^2y_1y_4-4i\sqrt{2}\,h_1x_3y_2y_4+4i\sqrt{2}\,h_1x_2y_3y_4-16x_3x_4y_3y_4-\\&4\sqrt{2}\,h_1y_2y_3y_4+4i\sqrt{2}\,x_1y_3^2y_4+8i\,x_4y_3^2y_4+4\sqrt{2}\,y_1y_3^2y_4+4x_3^2y_4^2-8i\,x_3y_3y_4^2-4y_3^2y_4^2\end{aligned}$$

In[•]:=

$$\begin{aligned}
&-4\,\mathrm{i}\,h_1\,x_1\,x_2^2-48\,x_2\,x_3-28\,d\gamma\,x_2\,x_3-4\,d\gamma^2\,x_2\,x_3+4\,h_1^2\,x_2\,x_3-8\,h_1\,h_2\,x_2\,x_3-4\,x_1^2\,x_2\,x_3-4\,\mathrm{i}\,h_1\,x_1\,x_3^2+\\
&8\,\mathrm{i}\,h_2\,x_1\,x_3^2+48\,\mathrm{i}\,\sqrt{2}\,h_1\,x_4+28\,\mathrm{i}\,\sqrt{2}\,d\gamma\,h_1\,x_4+4\,\mathrm{i}\,\sqrt{2}\,d\gamma^2\,h_1\,x_4-48\,\mathrm{i}\,\sqrt{2}\,h_2\,x_4-\\
&28\,\mathrm{i}\,\sqrt{2}\,d\gamma\,h_2\,x_4-4\,\mathrm{i}\,\sqrt{2}\,d\gamma^2\,h_2\,x_4+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_2^2\,x_4+8\,\sqrt{2}\,x_1\,x_2\,x_3\,x_4+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_3^2\,x_4-\\
&8\,\mathrm{i}\,\sqrt{2}\,h_2\,x_3^2\,x_4-8\,x_2\,x_3\,x_4^2+4\,h_1\,x_2^2\,y_1-4\,h_1\,x_3^2\,y_1+8\,h_2\,x_3^2\,y_1-4\,x_2\,x_3\,y_1^2+8\,h_1\,x_1\,x_2\,y_2-\\
&48\,\mathrm{i}\,x_3\,y_2-28\,\mathrm{i}\,d\gamma\,x_3\,y_2-4\,\mathrm{i}\,d\gamma^2\,x_3\,y_2+4\,\mathrm{i}\,h_1^2\,x_3\,y_2-8\,\mathrm{i}\,h_1\,h_2\,x_3\,y_2-4\,\mathrm{i}\,x_1^2\,x_3\,y_2+8\,\mathrm{i}\,x_3\,x_4^2\,y_2+\\
&8\,\mathrm{i}\,h_1\,x_2\,y_1\,y_2-8\,\sqrt{2}\,x_3\,x_4\,y_1\,y_2-4\,\mathrm{i}\,x_3\,y_1^2\,y_2+4\,\mathrm{i}\,h_1\,x_1\,y_2^2+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_4\,y_2^2-4\,h_1\,y_1\,y_2^2-\\
&48\,\mathrm{i}\,x_2\,y_3-28\,\mathrm{i}\,d\gamma\,x_2\,y_3-4\,\mathrm{i}\,d\gamma^2\,x_2\,y_3+4\,\mathrm{i}\,h_1^2\,x_2\,y_3-8\,\mathrm{i}\,h_1\,h_2\,x_2\,y_3-4\,\mathrm{i}\,x_1^2\,x_2\,y_3+8\,h_1\,x_1\,x_3\,y_3-\\
&16\,h_2\,x_1\,x_3\,y_3+8\,\mathrm{i}\,x_2\,x_4^2\,y_3-8\,\mathrm{i}\,h_1\,x_3\,y_1\,y_3+16\,\mathrm{i}\,h_2\,x_3\,y_1\,y_3+8\,\sqrt{2}\,x_2\,x_4\,y_1\,y_3-4\,\mathrm{i}\,x_2\,y_1^2\,y_3+\\
&48\,y_2\,y_3+28\,d\gamma\,y_2\,y_3+4\,d\gamma^2\,y_2\,y_3-4\,h_1^2\,y_2\,y_3+8\,h_1\,h_2\,y_2\,y_3+4\,x_1^2\,y_2\,y_3+8\,\sqrt{2}\,x_1\,x_4\,y_2\,y_3+\\
&8\,x_4^2\,y_2\,y_3+4\,y_1^2\,y_2\,y_3+4\,\mathrm{i}\,h_1\,x_1\,y_3^2-8\,\mathrm{i}\,h_2\,x_1\,y_3^2+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_4\,y_3^2-8\,\mathrm{i}\,\sqrt{2}\,h_2\,x_4\,y_3^2+\\
&4\,h_1\,y_1\,y_3^2-8\,h_2\,y_1\,y_3^2-48\,\sqrt{2}\,h_1\,y_4-28\,\sqrt{2}\,d\gamma\,h_1\,y_4-4\,\sqrt{2}\,d\gamma^2\,h_1\,y_4+48\,\sqrt{2}\,h_2\,y_4+\\
&28\,\sqrt{2}\,d\gamma\,h_2\,y_4+4\,\sqrt{2}\,d\gamma^2\,h_2\,y_4-4\,\sqrt{2}\,h_1\,x_2^2\,y_4+8\,\mathrm{i}\,\sqrt{2}\,x_1\,x_2\,x_3\,y_4-4\,\sqrt{2}\,h_1\,x_3^2\,y_4+\\
&8\,\sqrt{2}\,h_2\,x_3^2\,y_4-16\,\mathrm{i}\,x_2\,x_3\,x_4\,y_4-16\,x_3\,x_4\,y_2\,y_4-8\,\mathrm{i}\,\sqrt{2}\,x_3\,y_1\,y_2\,y_4-4\,\sqrt{2}\,h_1\,y_2^2\,y_4-\\
&16\,x_2\,x_4\,y_3\,y_4+8\,\mathrm{i}\,\sqrt{2}\,x_2\,y_1\,y_3\,y_4+8\,\mathrm{i}\,\sqrt{2}\,x_1\,y_2\,y_3\,y_4+16\,\mathrm{i}\,x_4\,y_2\,y_3\,y_4-4\,\sqrt{2}\,h_1\,y_3^2\,y_4+\\
&8\,\sqrt{2}\,h_2\,y_3^2\,y_4+8\,x_2\,x_3\,y_4^2-8\,\mathrm{i}\,x_3\,y_2\,y_4^2-8\,\mathrm{i}\,x_2\,y_3\,y_4^2-8\,y_2\,y_3\,y_4^2-(\mathrm{A}[\![2,5]\!]-\mathrm{A}[\![1,4]\!])\ \text{// Expand}
\end{aligned}$$

Out[•]= 0

In[•]:= `A[[2, 5]] - A[[1, 4]] // Expand`

Out[•]=

$$\begin{aligned}
&-4\,\mathrm{i}\,h_1\,x_1\,x_2^2-48\,x_2\,x_3-28\,d\gamma\,x_2\,x_3-4\,d\gamma^2\,x_2\,x_3+4\,h_1^2\,x_2\,x_3-8\,h_1\,h_2\,x_2\,x_3-4\,x_1^2\,x_2\,x_3-\\
&4\,\mathrm{i}\,h_1\,x_1\,x_3^2+8\,\mathrm{i}\,h_2\,x_1\,x_3^2+48\,\mathrm{i}\,\sqrt{2}\,h_1\,x_4+28\,\mathrm{i}\,\sqrt{2}\,d\gamma\,h_1\,x_4+4\,\mathrm{i}\,\sqrt{2}\,d\gamma^2\,h_1\,x_4-48\,\mathrm{i}\,\sqrt{2}\,h_2\,x_4-\\
&28\,\mathrm{i}\,\sqrt{2}\,d\gamma\,h_2\,x_4-4\,\mathrm{i}\,\sqrt{2}\,d\gamma^2\,h_2\,x_4+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_2^2\,x_4+8\,\sqrt{2}\,x_1\,x_2\,x_3\,x_4+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_3^2\,x_4-\\
&8\,\mathrm{i}\,\sqrt{2}\,h_2\,x_3^2\,x_4-8\,x_2\,x_3\,x_4^2+4\,h_1\,x_2^2\,y_1-4\,h_1\,x_3^2\,y_1+8\,h_2\,x_3^2\,y_1-4\,x_2\,x_3\,y_1^2+8\,h_1\,x_1\,x_2\,y_2-\\
&48\,\mathrm{i}\,x_3\,y_2-28\,\mathrm{i}\,d\gamma\,x_3\,y_2-4\,\mathrm{i}\,d\gamma^2\,x_3\,y_2+4\,\mathrm{i}\,h_1^2\,x_3\,y_2-8\,\mathrm{i}\,h_1\,h_2\,x_3\,y_2-4\,\mathrm{i}\,x_1^2\,x_3\,y_2+8\,\mathrm{i}\,x_3\,x_4^2\,y_2+\\
&8\,\mathrm{i}\,h_1\,x_2\,y_1\,y_2-8\,\sqrt{2}\,x_3\,x_4\,y_1\,y_2-4\,\mathrm{i}\,x_3\,y_1^2\,y_2+4\,\mathrm{i}\,h_1\,x_1\,y_2^2+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_4\,y_2^2-4\,h_1\,y_1\,y_2^2-\\
&48\,\mathrm{i}\,x_2\,y_3-28\,\mathrm{i}\,d\gamma\,x_2\,y_3-4\,\mathrm{i}\,d\gamma^2\,x_2\,y_3+4\,\mathrm{i}\,h_1^2\,x_2\,y_3-8\,\mathrm{i}\,h_1\,h_2\,x_2\,y_3-4\,\mathrm{i}\,x_1^2\,x_2\,y_3+8\,h_1\,x_1\,x_3\,y_3-\\
&16\,h_2\,x_1\,x_3\,y_3+8\,\mathrm{i}\,x_2\,x_4^2\,y_3-8\,\mathrm{i}\,h_1\,x_3\,y_1\,y_3+16\,\mathrm{i}\,h_2\,x_3\,y_1\,y_3+8\,\sqrt{2}\,x_2\,x_4\,y_1\,y_3-4\,\mathrm{i}\,x_2\,y_1^2\,y_3+\\
&48\,y_2\,y_3+28\,d\gamma\,y_2\,y_3+4\,d\gamma^2\,y_2\,y_3-4\,h_1^2\,y_2\,y_3+8\,h_1\,h_2\,y_2\,y_3+4\,x_1^2\,y_2\,y_3+8\,\sqrt{2}\,x_1\,x_4\,y_2\,y_3+8\,x_4^2\,y_2\,y_3+\\
&4\,y_1^2\,y_2\,y_3+4\,\mathrm{i}\,h_1\,x_1\,y_3^2-8\,\mathrm{i}\,h_2\,x_1\,y_3^2+4\,\mathrm{i}\,\sqrt{2}\,h_1\,x_4\,y_3^2-8\,\mathrm{i}\,\sqrt{2}\,h_2\,x_4\,y_3^2+4\,h_1\,y_1\,y_3^2-8\,h_2\,y_1\,y_3^2-\\
&48\,\sqrt{2}\,h_1\,y_4-28\,\sqrt{2}\,d\gamma\,h_1\,y_4-4\,\sqrt{2}\,d\gamma^2\,h_1\,y_4+48\,\sqrt{2}\,h_2\,y_4+28\,\sqrt{2}\,d\gamma\,h_2\,y_4+4\,\sqrt{2}\,d\gamma^2\,h_2\,y_4-\\
&4\,\sqrt{2}\,h_1\,x_2^2\,y_4+8\,\mathrm{i}\,\sqrt{2}\,x_1\,x_2\,x_3\,y_4-4\,\sqrt{2}\,h_1\,x_3^2\,y_4+8\,\sqrt{2}\,h_2\,x_3^2\,y_4-16\,\mathrm{i}\,x_2\,x_3\,x_4\,y_4-16\,x_3\,x_4\,y_2\,y_4-\\
&8\,\mathrm{i}\,\sqrt{2}\,x_3\,y_1\,y_2\,y_4-4\,\sqrt{2}\,h_1\,y_2^2\,y_4-16\,x_2\,x_4\,y_3\,y_4+8\,\mathrm{i}\,\sqrt{2}\,x_2\,y_1\,y_3\,y_4+8\,\mathrm{i}\,\sqrt{2}\,x_1\,y_2\,y_3\,y_4+\\
&16\,\mathrm{i}\,x_4\,y_2\,y_3\,y_4-4\,\sqrt{2}\,h_1\,y_3^2\,y_4+8\,\sqrt{2}\,h_2\,y_3^2\,y_4+8\,x_2\,x_3\,y_4^2-8\,\mathrm{i}\,x_3\,y_2\,y_4^2-8\,\mathrm{i}\,x_2\,y_3\,y_4^2-8\,y_2\,y_3\,y_4^2
\end{aligned}$$

In[•]:= `A // Expand`

In[ ]:=

$$\begin{aligned}
&\{\{24+50\,d\gamma+35\,d\gamma^2+10\,d\gamma^3+d\gamma^4+24\,\mathrm{i}\,h_1+26\,\mathrm{i}\,d\gamma\,h_1+9\,\mathrm{i}\,d\gamma^2\,h_1+\mathrm{i}\,d\gamma^3\,h_1+12\,h_1^2+\\
&\quad 7\,d\gamma\,h_1^2+d\gamma^2\,h_1^2+4\,\mathrm{i}\,h_1^3+\mathrm{i}\,d\gamma\,h_1^3+12\,x_1^2+7\,d\gamma\,x_1^2+d\gamma^2\,x_1^2+4\,\mathrm{i}\,h_1\,x_1^2+\mathrm{i}\,d\gamma\,h_1\,x_1^2+\\
&\quad 12\,y_1^2+7\,d\gamma\,y_1^2+d\gamma^2\,y_1^2+4\,\mathrm{i}\,h_1\,y_1^2+\mathrm{i}\,d\gamma\,h_1\,y_1^2,\ 24\,x_1+26\,d\gamma\,x_1+9\,d\gamma^2\,x_1+d\gamma^3\,x_1+\\
&\quad 4\,h_1^2\,x_1+d\gamma\,h_1^2\,x_1+4\,x_1^3+d\gamma\,x_1^3+24\,\mathrm{i}\,y_1+26\,\mathrm{i}\,d\gamma\,y_1+9\,\mathrm{i}\,d\gamma^2\,y_1+\mathrm{i}\,d\gamma^3\,y_1+4\,\mathrm{i}\,h_1^2\,y_1+\\
&\quad \mathrm{i}\,d\gamma\,h_1^2\,y_1+4\,\mathrm{i}\,x_1^2\,y_1+\mathrm{i}\,d\gamma\,x_1^2\,y_1+4\,x_1\,y_1^2+d\gamma\,x_1\,y_1^2+4\,\mathrm{i}\,y_1^3+\mathrm{i}\,d\gamma\,y_1^3,\ 0,\ 0,\ 0\},\\
&\ \{-24\,x_1-26\,d\gamma\,x_1-9\,d\gamma^2\,x_1-d\gamma^3\,x_1-4\,h_1^2\,x_1-d\gamma\,h_1^2\,x_1-4\,x_1^3-d\gamma\,x_1^3+24\,\mathrm{i}\,y_1+\\
&\quad 26\,\mathrm{i}\,d\gamma\,y_1+9\,\mathrm{i}\,d\gamma^2\,y_1+\mathrm{i}\,d\gamma^3\,y_1+4\,\mathrm{i}\,h_1^2\,y_1+\mathrm{i}\,d\gamma\,h_1^2\,y_1+4\,\mathrm{i}\,x_1^2\,y_1+\mathrm{i}\,d\gamma\,x_1^2\,y_1-4\,x_1\,y_1^2-\\
&\quad d\gamma\,x_1\,y_1^2+4\,\mathrm{i}\,y_1^3+\mathrm{i}\,d\gamma\,y_1^3,\ 24+50\,d\gamma+35\,d\gamma^2+10\,d\gamma^3+d\gamma^4-24\,\mathrm{i}\,h_1-26\,\mathrm{i}\,d\gamma\,h_1-\\
&\quad 9\,\mathrm{i}\,d\gamma^2\,h_1-\mathrm{i}\,d\gamma^3\,h_1+12\,h_1^2+7\,d\gamma\,h_1^2+d\gamma^2\,h_1^2-4\,\mathrm{i}\,h_1^3-\mathrm{i}\,d\gamma\,h_1^3+12\,x_1^2+7\,d\gamma\,x_1^2+\\
&\quad d\gamma^2\,x_1^2-4\,\mathrm{i}\,h_1\,x_1^2-\mathrm{i}\,d\gamma\,h_1\,x_1^2+12\,y_1^2+7\,d\gamma\,y_1^2+d\gamma^2\,y_1^2-4\,\mathrm{i}\,h_1\,y_1^2-\mathrm{i}\,d\gamma\,h_1\,y_1^2,\ 0,\ 0,\ 0\},\\
&\ \{0,\ 0,\ 24+50\,d\gamma+35\,d\gamma^2+10\,d\gamma^3+d\gamma^4+24\,h_1^2+14\,d\gamma\,h_1^2+2\,d\gamma^2\,h_1^2+h_1^4+24\,x_1^2+\\
&\quad 14\,d\gamma\,x_1^2+2\,d\gamma^2\,x_1^2+2\,h_1^2\,x_1^2+x_1^4+24\,y_1^2+14\,d\gamma\,y_1^2+2\,d\gamma^2\,y_1^2+2\,h_1^2\,y_1^2+2\,x_1^2\,y_1^2+y_1^4,\ 0,\ 0\},\\
&\ \{0,\ 0,\ 0,\ 24+50\,d\gamma+35\,d\gamma^2+10\,d\gamma^3+d\gamma^4+24\,\mathrm{i}\,h_1+26\,\mathrm{i}\,d\gamma\,h_1+9\,\mathrm{i}\,d\gamma^2\,h_1+\mathrm{i}\,d\gamma^3\,h_1+\\
&\quad 12\,h_1^2+7\,d\gamma\,h_1^2+d\gamma^2\,h_1^2+4\,\mathrm{i}\,h_1^3+\mathrm{i}\,d\gamma\,h_1^3+12\,x_1^2+7\,d\gamma\,x_1^2+d\gamma^2\,x_1^2+4\,\mathrm{i}\,h_1\,x_1^2+\\
&\quad \mathrm{i}\,d\gamma\,h_1\,x_1^2+12\,y_1^2+7\,d\gamma\,y_1^2+d\gamma^2\,y_1^2+4\,\mathrm{i}\,h_1\,y_1^2+\mathrm{i}\,d\gamma\,h_1\,y_1^2,\ 24\,x_1+26\,d\gamma\,x_1+9\,d\gamma^2\,x_1+\\
&\quad d\gamma^3\,x_1+4\,h_1^2\,x_1+d\gamma\,h_1^2\,x_1+4\,x_1^3+d\gamma\,x_1^3+24\,\mathrm{i}\,y_1+26\,\mathrm{i}\,d\gamma\,y_1+9\,\mathrm{i}\,d\gamma^2\,y_1+\mathrm{i}\,d\gamma^3\,y_1+\\
&\quad 4\,\mathrm{i}\,h_1^2\,y_1+\mathrm{i}\,d\gamma\,h_1^2\,y_1+4\,\mathrm{i}\,x_1^2\,y_1+\mathrm{i}\,d\gamma\,x_1^2\,y_1+4\,x_1\,y_1^2+d\gamma\,x_1\,y_1^2+4\,\mathrm{i}\,y_1^3+\mathrm{i}\,d\gamma\,y_1^3\},\\
&\ \{0,\ 0,\ 0,\ -24\,x_1-26\,d\gamma\,x_1-9\,d\gamma^2\,x_1-d\gamma^3\,x_1-4\,h_1^2\,x_1-d\gamma\,h_1^2\,x_1-4\,x_1^3-d\gamma\,x_1^3+24\,\mathrm{i}\,y_1+\\
&\quad 26\,\mathrm{i}\,d\gamma\,y_1+9\,\mathrm{i}\,d\gamma^2\,y_1+\mathrm{i}\,d\gamma^3\,y_1+4\,\mathrm{i}\,h_1^2\,y_1+\mathrm{i}\,d\gamma\,h_1^2\,y_1+4\,\mathrm{i}\,x_1^2\,y_1+\mathrm{i}\,d\gamma\,x_1^2\,y_1-4\,x_1\,y_1^2-\\
&\quad d\gamma\,x_1\,y_1^2+4\,\mathrm{i}\,y_1^3+\mathrm{i}\,d\gamma\,y_1^3,\ 24+50\,d\gamma+35\,d\gamma^2+10\,d\gamma^3+d\gamma^4-24\,\mathrm{i}\,h_1-26\,\mathrm{i}\,d\gamma\,h_1-\\
&\quad 9\,\mathrm{i}\,d\gamma^2\,h_1-\mathrm{i}\,d\gamma^3\,h_1+12\,h_1^2+7\,d\gamma\,h_1^2+d\gamma^2\,h_1^2-4\,\mathrm{i}\,h_1^3-\mathrm{i}\,d\gamma\,h_1^3+12\,x_1^2+7\,d\gamma\,x_1^2+d\gamma^2\,x_1^2-\\
&\quad 4\,\mathrm{i}\,h_1\,x_1^2-\mathrm{i}\,d\gamma\,h_1\,x_1^2+12\,y_1^2+7\,d\gamma\,y_1^2+d\gamma^2\,y_1^2-4\,\mathrm{i}\,h_1\,y_1^2-\mathrm{i}\,d\gamma\,h_1\,y_1^2\}\}\ \texttt{// MatrixForm}
\end{aligned}$$

In[ ]:= (* Apply $Y_{\alpha 1}$ to $t^{\lambda_1}{}_{11}$ *)

$$\begin{aligned}
&-\Big(-(y_1-\mathrm{i}\,x_1)\ \texttt{D[A[[1, 1]], }h_1\texttt{]}-\frac{1}{2}*(2\,h_2-2\,h_1)\ \texttt{D[A[[1, 1]], }y_1\texttt{]}+\mathrm{i}\,\frac{1}{2}*(2\,h_2-2\,h_1)\\
&\quad \texttt{D[A[[1, 1]], }x_1\texttt{]}-\frac{1}{2}*(x_2-\mathrm{i}\,y_2)\ \texttt{D[A[[1, 1]], }x_3\texttt{]}-\frac{1}{2}*(y_2+\mathrm{i}\,x_2)\ \texttt{D[A[[1, 1]], }y_3\texttt{]}-\\
&\quad \frac{1}{2}*(-x_3-\mathrm{i}\,y_3)\ \texttt{D[A[[1, 1]], }x_2\texttt{]}-\frac{1}{2}*(-y_3+\mathrm{i}\,x_3)\ \texttt{D[A[[1, 1]], }y_2\texttt{]}\Big)\ \texttt{// Expand}
\end{aligned}$$

In[ ]:=

$$
\begin{aligned}
&24 x_1 + 26\, d\gamma\, x_1 + 9\, d\gamma^2 x_1 + d\gamma^3 x_1 + 4 h_1^2 x_1 + d\gamma\, h_1^2 x_1 + 24\, \mathrm{i}\, h_2 x_1 + 14\, \mathrm{i}\, d\gamma\, h_2 x_1 + 2\, \mathrm{i}\, d\gamma^2 h_2 x_1 - \\
&8 h_1 h_2 x_1 - 2\, d\gamma\, h_1 h_2 x_1 + 4 x_1^3 + d\gamma\, x_1^3 + 8 x_1 x_2^2 + 2\, d\gamma\, x_1 x_2^2 + 2\, \mathrm{i}\, h_1 x_1 x_2^2 - 24 x_2 x_3 - 14\, d\gamma\, x_2 x_3 - \\
&2\, d\gamma^2 x_2 x_3 - 2 h_1^2 x_2 x_3 - 16\, \mathrm{i}\, h_2 x_2 x_3 - 4\, \mathrm{i}\, d\gamma\, h_2 x_2 x_3 + 4 h_1 h_2 x_2 x_3 - 2 x_1^2 x_2 x_3 + 8 x_1 x_3^2 + \\
&2\, d\gamma\, x_1 x_3^2 - 2\, \mathrm{i}\, h_1 x_1 x_3^2 + 4\, \mathrm{i}\, h_2 x_1 x_3^2 - 8 \sqrt{2}\, x_2^2 x_4 - 2 \sqrt{2}\, d\gamma\, x_2^2 x_4 - 2\, \mathrm{i} \sqrt{2}\, h_1 x_2^2 x_4 + \\
&4 \sqrt{2}\, x_1 x_2 x_3 x_4 - 8 \sqrt{2}\, x_3^2 x_4 - 2 \sqrt{2}\, d\gamma\, x_3^2 x_4 + 2\, \mathrm{i} \sqrt{2}\, h_1 x_3^2 x_4 - 4\, \mathrm{i} \sqrt{2}\, h_2 x_3^2 x_4 - 8 x_1 x_4^2 - \\
&2\, d\gamma\, x_1 x_4^2 - 4 x_2 x_3 x_4^2 + 24\, \mathrm{i}\, y_1 + 26\, \mathrm{i}\, d\gamma\, y_1 + 9\, \mathrm{i}\, d\gamma^2 y_1 + \mathrm{i}\, d\gamma^3 y_1 + 4\, \mathrm{i}\, h_1^2 y_1 + \mathrm{i}\, d\gamma\, h_1^2 y_1 - \\
&24 h_2 y_1 - 14\, d\gamma\, h_2 y_1 - 2\, d\gamma^2 h_2 y_1 - 8\, \mathrm{i}\, h_1 h_2 y_1 - 2\, \mathrm{i}\, d\gamma\, h_1 h_2 y_1 + 4\, \mathrm{i}\, x_1^2 y_1 + \mathrm{i}\, d\gamma\, x_1^2 y_1 + 8\, \mathrm{i}\, x_2^2 y_1 + \\
&2\, \mathrm{i}\, d\gamma\, x_2^2 y_1 - 2 h_1 x_2^2 y_1 - 4\, \mathrm{i}\, x_1 x_2 x_3 y_1 + 8\, \mathrm{i}\, x_3^2 y_1 + 2\, \mathrm{i}\, d\gamma\, x_3^2 y_1 + 2 h_1 x_3^2 y_1 - 4 h_2 x_3^2 y_1 + \\
&4\, \mathrm{i} \sqrt{2}\, x_2 x_3 x_4 y_1 - 8\, \mathrm{i}\, x_4^2 y_1 - 2\, \mathrm{i}\, d\gamma\, x_4^2 y_1 + 4 x_1 y_1^2 + d\gamma\, x_1 y_1^2 + 2 x_2 x_3 y_1^2 + 4\, \mathrm{i}\, y_1^3 + \mathrm{i}\, d\gamma\, y_1^3 + \\
&24\, \mathrm{i}\, x_3 y_2 + 14\, \mathrm{i}\, d\gamma\, x_3 y_2 + 2\, \mathrm{i}\, d\gamma^2 x_3 y_2 + 2\, \mathrm{i}\, h_1^2 x_3 y_2 - 16 h_2 x_3 y_2 - 4\, d\gamma\, h_2 x_3 y_2 - 4\, \mathrm{i}\, h_1 h_2 x_3 y_2 - \\
&2\, \mathrm{i}\, x_1^2 x_3 y_2 + 16\, \mathrm{i} \sqrt{2}\, x_2 x_4 y_2 + 4\, \mathrm{i} \sqrt{2}\, d\gamma\, x_2 x_4 y_2 - 4 \sqrt{2}\, h_1 x_2 x_4 y_2 + 4\, \mathrm{i}\, x_3 x_4^2 y_2 + \\
&4 x_1 x_3 y_1 y_2 + 2\, \mathrm{i}\, x_3 y_1^2 y_2 + 8 x_1 y_2^2 + 2\, d\gamma\, x_1 y_2^2 + 2\, \mathrm{i}\, h_1 x_1 y_2^2 + 8 \sqrt{2}\, x_4 y_2^2 + 2 \sqrt{2}\, d\gamma\, x_4 y_2^2 + \\
&2\, \mathrm{i} \sqrt{2}\, h_1 x_4 y_2^2 + 8\, \mathrm{i}\, y_1 y_2^2 + 2\, \mathrm{i}\, d\gamma\, y_1 y_2^2 - 2 h_1 y_1 y_2^2 - 24\, \mathrm{i}\, x_2 y_3 - 14\, \mathrm{i}\, d\gamma\, x_2 y_3 - 2\, \mathrm{i}\, d\gamma^2 x_2 y_3 - \\
&2\, \mathrm{i}\, h_1^2 x_2 y_3 + 16 h_2 x_2 y_3 + 4\, d\gamma\, h_2 x_2 y_3 + 4\, \mathrm{i}\, h_1 h_2 x_2 y_3 + 2\, \mathrm{i}\, x_1^2 x_2 y_3 - 16\, \mathrm{i} \sqrt{2}\, x_3 x_4 y_3 - \\
&4\, \mathrm{i} \sqrt{2}\, d\gamma\, x_3 x_4 y_3 - 4 \sqrt{2}\, h_1 x_3 x_4 y_3 + 8 \sqrt{2}\, h_2 x_3 x_4 y_3 - 4\, \mathrm{i}\, x_2 x_4^2 y_3 - 4 x_1 x_2 y_1 y_3 - \\
&2\, \mathrm{i}\, x_2 y_1^2 y_3 - 24 y_2 y_3 - 14\, d\gamma\, y_2 y_3 - 2\, d\gamma^2 y_2 y_3 - 2 h_1^2 y_2 y_3 - 16\, \mathrm{i}\, h_2 y_2 y_3 - 4\, \mathrm{i}\, d\gamma\, h_2 y_2 y_3 + \\
&4 h_1 h_2 y_2 y_3 - 2 x_1^2 y_2 y_3 - 4 \sqrt{2}\, x_1 x_4 y_2 y_3 - 4 x_4^2 y_2 y_3 - 4\, \mathrm{i}\, x_1 y_1 y_2 y_3 - 4\, \mathrm{i} \sqrt{2}\, x_4 y_1 y_2 y_3 + \\
&2 y_1^2 y_2 y_3 + 8 x_1 y_3^2 + 2\, d\gamma\, x_1 y_3^2 - 2\, \mathrm{i}\, h_1 x_1 y_3^2 + 4\, \mathrm{i}\, h_2 x_1 y_3^2 + 8 \sqrt{2}\, x_4 y_3^2 + 2 \sqrt{2}\, d\gamma\, x_4 y_3^2 - \\
&2\, \mathrm{i} \sqrt{2}\, h_1 x_4 y_3^2 + 4\, \mathrm{i} \sqrt{2}\, h_2 x_4 y_3^2 + 8\, \mathrm{i}\, y_1 y_3^2 + 2\, \mathrm{i}\, d\gamma\, y_1 y_3^2 + 2 h_1 y_1 y_3^2 - 4 h_2 y_1 y_3^2 - 8\, \mathrm{i} \sqrt{2}\, x_2^2 y_4 - \\
&2\, \mathrm{i} \sqrt{2}\, d\gamma\, x_2^2 y_4 + 2 \sqrt{2}\, h_1 x_2^2 y_4 + 8\, \mathrm{i} \sqrt{2}\, x_3^2 y_4 + 2\, \mathrm{i} \sqrt{2}\, d\gamma\, x_3^2 y_4 + 2 \sqrt{2}\, h_1 x_3^2 y_4 - \\
&4 \sqrt{2}\, h_2 x_3^2 y_4 - 16 \sqrt{2}\, x_2 y_2 y_4 - 4 \sqrt{2}\, d\gamma\, x_2 y_2 y_4 - 4\, \mathrm{i} \sqrt{2}\, h_1 x_2 y_2 y_4 + 4 \sqrt{2}\, x_1 x_3 y_2 y_4 + \\
&4\, \mathrm{i} \sqrt{2}\, x_3 y_1 y_2 y_4 + 8\, \mathrm{i} \sqrt{2}\, y_2^2 y_4 + 2\, \mathrm{i} \sqrt{2}\, d\gamma\, y_2^2 y_4 - 2 \sqrt{2}\, h_1 y_2^2 y_4 + 4 \sqrt{2}\, x_1 x_2 y_3 y_4 - \\
&16 \sqrt{2}\, x_3 y_3 y_4 - 4 \sqrt{2}\, d\gamma\, x_3 y_3 y_4 + 4\, \mathrm{i} \sqrt{2}\, h_1 x_3 y_3 y_4 - 8\, \mathrm{i} \sqrt{2}\, h_2 x_3 y_3 y_4 + 4\, \mathrm{i} \sqrt{2}\, x_2 y_1 y_3 y_4 - \\
&8\, \mathrm{i} \sqrt{2}\, y_3^2 y_4 - 2\, \mathrm{i} \sqrt{2}\, d\gamma\, y_3^2 y_4 - 2 \sqrt{2}\, h_1 y_3^2 y_4 + 4 \sqrt{2}\, h_2 y_3^2 y_4 - 8 x_1 y_4^2 - 2\, d\gamma\, x_1 y_4^2 - \\
&4 x_2 x_3 y_4^2 - 8\, \mathrm{i}\, y_1 y_4^2 - 2\, \mathrm{i}\, d\gamma\, y_1 y_4^2 + 4\, \mathrm{i}\, x_3 y_2 y_4^2 - 4\, \mathrm{i}\, x_2 y_3 y_4^2 - 4 y_2 y_3 y_4^2 - A[[1, 2]] \;//\; \mathrm{Expand}
\end{aligned}
$$

Out[ ]= 0

In[•]:= **A[[1, 2]] // Expand**

Out[•]= $24\, x_1 + 26\, d\gamma\, x_1 + 9\, d\gamma^2\, x_1 + d\gamma^3\, x_1 + 4\, h_1^2\, x_1 + d\gamma\, h_1^2\, x_1 + 24\, i\, h_2\, x_1 + 14\, i\, d\gamma\, h_2\, x_1 + 2\, i\, d\gamma^2\, h_2\, x_1 - 8\, h_1\, h_2\, x_1 - 2\, d\gamma\, h_1\, h_2\, x_1 + 4\, x_1^3 + d\gamma\, x_1^3 + 8\, x_1\, x_2^2 + 2\, d\gamma\, x_1\, x_2^2 + 2\, i\, h_1\, x_1\, x_2^2 - 24\, x_2\, x_3 - 14\, d\gamma\, x_2\, x_3 - 2\, d\gamma^2\, x_2\, x_3 - 2\, h_1^2\, x_2\, x_3 - 16\, i\, h_2\, x_2\, x_3 - 4\, i\, d\gamma\, h_2\, x_2\, x_3 + 4\, h_1\, h_2\, x_2\, x_3 - 2\, x_1^2\, x_2\, x_3 + 8\, x_1\, x_3^2 + 2\, d\gamma\, x_1\, x_3^2 - 2\, i\, h_1\, x_1\, x_3^2 + 4\, i\, h_2\, x_1\, x_3^2 - 8\sqrt{2}\, x_2^2\, x_4 - 2\sqrt{2}\, d\gamma\, x_2^2\, x_4 - 2\, i\sqrt{2}\, h_1\, x_2^2\, x_4 + 4\sqrt{2}\, x_1\, x_2\, x_3\, x_4 - 8\sqrt{2}\, x_3^2\, x_4 - 2\sqrt{2}\, d\gamma\, x_3^2\, x_4 + 2\, i\sqrt{2}\, h_1\, x_3^2\, x_4 - 4\, i\sqrt{2}\, h_2\, x_3^2\, x_4 - 8\, x_1\, x_4^2 - 2\, d\gamma\, x_1\, x_4^2 - 4\, x_2\, x_3\, x_4^2 + 24\, i\, y_1 + 26\, i\, d\gamma\, y_1 + 9\, i\, d\gamma^2\, y_1 + i\, d\gamma^3\, y_1 + 4\, i\, h_1^2\, y_1 + i\, d\gamma\, h_1^2\, y_1 - 24\, h_2\, y_1 - 14\, d\gamma\, h_2\, y_1 - 2\, d\gamma^2\, h_2\, y_1 - 8\, i\, h_1\, h_2\, y_1 - 2\, i\, d\gamma\, h_1\, h_2\, y_1 + 4\, i\, x_1^2\, y_1 + i\, d\gamma\, x_1^2\, y_1 + 8\, i\, x_2^2\, y_1 + 2\, i\, d\gamma\, x_2^2\, y_1 - 2\, h_1\, x_2^2\, y_1 - 4\, i\, x_1\, x_2\, x_3\, y_1 + 8\, i\, x_3^2\, y_1 + 2\, i\, d\gamma\, x_3^2\, y_1 + 2\, h_1\, x_3^2\, y_1 - 4\, h_2\, x_3^2\, y_1 + 4\, i\sqrt{2}\, x_2\, x_3\, x_4\, y_1 - 8\, i\, x_4^2\, y_1 - 2\, i\, d\gamma\, x_4^2\, y_1 + 4\, x_1\, y_1^2 + d\gamma\, x_1\, y_1^2 + 2\, x_2\, x_3\, y_1^2 + 4\, i\, y_1^3 + i\, d\gamma\, y_1^3 + 24\, i\, x_3\, y_2 + 14\, i\, d\gamma\, x_3\, y_2 + 2\, i\, d\gamma^2\, x_3\, y_2 + 2\, i\, h_1^2\, x_3\, y_2 - 16\, h_2\, x_3\, y_2 - 4\, d\gamma\, h_2\, x_3\, y_2 - 4\, i\, h_1\, h_2\, x_3\, y_2 - 2\, i\, x_1^2\, x_3\, y_2 + 16\, i\sqrt{2}\, x_2\, x_4\, y_2 + 4\, i\sqrt{2}\, d\gamma\, x_2\, x_4\, y_2 - 4\sqrt{2}\, h_1\, x_2\, x_4\, y_2 + 4\, i\, x_3\, x_4^2\, y_2 + 4\, x_1\, x_3\, y_1\, y_2 + 2\, i\, x_3\, y_1^2\, y_2 + 8\, x_1\, y_2^2 + 2\, d\gamma\, x_1\, y_2^2 + 2\, i\, h_1\, x_1\, y_2^2 + 8\sqrt{2}\, x_4\, y_2^2 + 2\sqrt{2}\, d\gamma\, x_4\, y_2^2 + 2\, i\sqrt{2}\, h_1\, x_4\, y_2^2 + 8\, i\, y_1\, y_2^2 + 2\, i\, d\gamma\, y_1\, y_2^2 - 2\, h_1\, y_1\, y_2^2 - 24\, i\, x_2\, y_3 - 14\, i\, d\gamma\, x_2\, y_3 - 2\, i\, d\gamma^2\, x_2\, y_3 - 2\, i\, h_1^2\, x_2\, y_3 + 16\, h_2\, x_2\, y_3 + 4\, d\gamma\, h_2\, x_2\, y_3 + 4\, i\, h_1\, h_2\, x_2\, y_3 + 2\, i\, x_1^2\, x_2\, y_3 - 16\, i\sqrt{2}\, x_3\, x_4\, y_3 - 4\, i\sqrt{2}\, d\gamma\, x_3\, x_4\, y_3 - 4\sqrt{2}\, h_1\, x_3\, x_4\, y_3 + 8\sqrt{2}\, h_2\, x_3\, x_4\, y_3 - 4\, i\, x_2\, x_4^2\, y_3 - 4\, x_1\, x_2\, y_1\, y_3 - 2\, i\, x_2\, y_1^2\, y_3 - 24\, y_2\, y_3 - 14\, d\gamma\, y_2\, y_3 - 2\, d\gamma^2\, y_2\, y_3 - 2\, h_1^2\, y_2\, y_3 - 16\, i\, h_2\, y_2\, y_3 - 4\, i\, d\gamma\, h_2\, y_2\, y_3 + 4\, h_1\, h_2\, y_2\, y_3 - 2\, x_1^2\, y_2\, y_3 - 4\sqrt{2}\, x_1\, x_4\, y_2\, y_3 - 4\, x_4^2\, y_2\, y_3 - 4\, i\, x_1\, y_1\, y_2\, y_3 - 4\, i\sqrt{2}\, x_4\, y_1\, y_2\, y_3 + 2\, y_1^2\, y_2\, y_3 + 8\, x_1\, y_3^2 + 2\, d\gamma\, x_1\, y_3^2 - 2\, i\, h_1\, x_1\, y_3^2 + 4\, i\, h_2\, x_1\, y_3^2 + 8\sqrt{2}\, x_4\, y_3^2 + 2\sqrt{2}\, d\gamma\, x_4\, y_3^2 - 2\, i\sqrt{2}\, h_1\, x_4\, y_3^2 + 4\, i\sqrt{2}\, h_2\, x_4\, y_3^2 + 8\, i\, y_1\, y_3^2 + 2\, i\, d\gamma\, y_1\, y_3^2 + 2\, h_1\, y_1\, y_3^2 - 4\, h_2\, y_1\, y_3^2 - 8\, i\sqrt{2}\, x_2^2\, y_4 - 2\, i\sqrt{2}\, d\gamma\, x_2^2\, y_4 + 2\sqrt{2}\, h_1\, x_2^2\, y_4 + 8\, i\sqrt{2}\, x_3^2\, y_4 + 2\, i\sqrt{2}\, d\gamma\, x_3^2\, y_4 + 2\sqrt{2}\, h_1\, x_3^2\, y_4 - 4\sqrt{2}\, h_2\, x_3^2\, y_4 - 16\sqrt{2}\, x_2\, y_2\, y_4 - 4\sqrt{2}\, d\gamma\, x_2\, y_2\, y_4 - 4\, i\sqrt{2}\, h_1\, x_2\, y_2\, y_4 + 4\sqrt{2}\, x_1\, x_3\, y_2\, y_4 + 4\, i\sqrt{2}\, x_3\, y_1\, y_2\, y_4 + 8\, i\sqrt{2}\, y_2^2\, y_4 + 2\, i\sqrt{2}\, d\gamma\, y_2^2\, y_4 - 2\sqrt{2}\, h_1\, y_2^2\, y_4 + 4\sqrt{2}\, x_1\, x_2\, y_3\, y_4 - 16\sqrt{2}\, x_3\, y_3\, y_4 - 4\sqrt{2}\, d\gamma\, x_3\, y_3\, y_4 + 4\, i\sqrt{2}\, h_1\, x_3\, y_3\, y_4 - 8\, i\sqrt{2}\, h_2\, x_3\, y_3\, y_4 + 4\, i\sqrt{2}\, x_2\, y_1\, y_3\, y_4 - 8\, i\sqrt{2}\, y_3^2\, y_4 - 2\, i\sqrt{2}\, d\gamma\, y_3^2\, y_4 - 2\sqrt{2}\, h_1\, y_3^2\, y_4 + 4\sqrt{2}\, h_2\, y_3^2\, y_4 - 8\, x_1\, y_4^2 - 2\, d\gamma\, x_1\, y_4^2 - 4\, x_2\, x_3\, y_4^2 - 8\, i\, y_1\, y_4^2 - 2\, i\, d\gamma\, y_1\, y_4^2 + 4\, i\, x_3\, y_2\, y_4^2 - 4\, i\, x_2\, y_3\, y_4^2 - 4\, y_2\, y_3\, y_4^2$

In[•]:= **(* Apply $Y_{\alpha 1}$ to $t^{\lambda_1}{}_{14}$ *)**
k = 4;
$$-\left(-(y_1 - i\, x_1)\, D[A[[1,k]], h_1] - \frac{1}{2} * (2\, h_2 - 2\, h_1)\, D[A[[1,k]], y_1] + i\, \frac{1}{2} * (2\, h_2 - 2\, h_1)\, D[A[[1,k]], x_1] - \frac{1}{2} * (x_2 - i\, y_2)\, D[A[[1,k]], x_3] - \frac{1}{2} * (y_2 + i\, x_2)\, D[A[[1,k]], y_3] - \frac{1}{2} * (-x_3 - i\, y_3)\, D[A[[1,k]], x_2] - \frac{1}{2} * (-y_3 + i\, x_3)\, D[A[[1,k]], y_2]\right) \text{ // Expand}$$

In[∘]:=

$$
\begin{aligned}
&2 x_1^2 x_2^2 + 4 \mathrm{i}\, h_1 x_1 x_2 x_3 - 8 \mathrm{i}\, h_2 x_1 x_2 x_3 - 24 x_3^2 - 14\, d\gamma\, x_3^2 - 2\, d\gamma^2 x_3^2 - 2 h_1^2 x_3^2 + 8 h_1 h_2 x_3^2 - 8 h_2^2 x_3^2 - \\
&\quad 24 \sqrt{2}\, x_1 x_4 - 14 \sqrt{2}\, d\gamma\, x_1 x_4 - 2 \sqrt{2}\, d\gamma^2 x_1 x_4 - 4 \sqrt{2}\, x_1 x_2^2 x_4 - 4 \mathrm{i} \sqrt{2}\, h_1 x_2 x_3 x_4 + \\
&\quad 8 \mathrm{i} \sqrt{2}\, h_2 x_2 x_3 x_4 + 4 x_2^2 x_4^2 + 4 \mathrm{i}\, x_1 x_2^2 y_1 - 4 h_1 x_2 x_3 y_1 + 8 h_2 x_2 x_3 y_1 - 24 \mathrm{i} \sqrt{2}\, x_4 y_1 - \\
&\quad 14 \mathrm{i} \sqrt{2}\, d\gamma\, x_4 y_1 - 2 \mathrm{i} \sqrt{2}\, d\gamma^2 x_4 y_1 - 4 \mathrm{i} \sqrt{2}\, x_2^2 x_4 y_1 - 2 x_2^2 y_1^2 + 4 \mathrm{i}\, x_1^2 x_2 y_2 - 4 h_1 x_1 x_3 y_2 + \\
&\quad 8 h_2 x_1 x_3 y_2 - 4 \sqrt{2}\, h_1 x_3 x_4 y_2 + 8 \sqrt{2}\, h_2 x_3 x_4 y_2 - 8 \mathrm{i}\, x_2 x_4^2 y_2 - 8 x_1 x_2 y_1 y_2 - \\
&\quad 4 \mathrm{i}\, h_1 x_3 y_1 y_2 + 8 \mathrm{i}\, h_2 x_3 y_1 y_2 - 4 \mathrm{i}\, x_2 y_1^2 y_2 - 2 x_1^2 y_2^2 - 4 \sqrt{2}\, x_1 x_4 y_2^2 - 4 x_4^2 y_2^2 - 4 \mathrm{i}\, x_1 y_1 y_2^2 - \\
&\quad 4 \mathrm{i} \sqrt{2}\, x_4 y_1 y_2^2 + 2 y_1^2 y_2^2 - 4 h_1 x_1 x_2 y_3 + 8 h_2 x_1 x_2 y_3 - 48 \mathrm{i}\, x_3 y_3 - 28 \mathrm{i}\, d\gamma\, x_3 y_3 - 4 \mathrm{i}\, d\gamma^2 x_3 y_3 - \\
&\quad 4 \mathrm{i}\, h_1^2 x_3 y_3 + 16 \mathrm{i}\, h_1 h_2 x_3 y_3 - 16 \mathrm{i}\, h_2^2 x_3 y_3 + 4 \sqrt{2}\, h_1 x_2 x_4 y_3 - 8 \sqrt{2}\, h_2 x_2 x_4 y_3 - \\
&\quad 4 \mathrm{i}\, h_1 x_2 y_1 y_3 + 8 \mathrm{i}\, h_2 x_2 y_1 y_3 - 4 \mathrm{i}\, h_1 x_1 y_2 y_3 + 8 \mathrm{i}\, h_2 x_1 y_2 y_3 - 4 \mathrm{i} \sqrt{2}\, h_1 x_4 y_2 y_3 + \\
&\quad 8 \mathrm{i} \sqrt{2}\, h_2 x_4 y_2 y_3 + 4 h_1 y_1 y_2 y_3 - 8 h_2 y_1 y_2 y_3 + 24 y_3^2 + 14\, d\gamma\, y_3^2 + 2\, d\gamma^2 y_3^2 + 2 h_1^2 y_3^2 - \\
&\quad 8 h_1 h_2 y_3^2 + 8 h_2^2 y_3^2 - 24 \mathrm{i} \sqrt{2}\, x_1 y_4 - 14 \mathrm{i} \sqrt{2}\, d\gamma\, x_1 y_4 - 2 \mathrm{i} \sqrt{2}\, d\gamma^2 x_1 y_4 - 4 \mathrm{i} \sqrt{2}\, x_1 x_2^2 y_4 + \\
&\quad 4 \sqrt{2}\, h_1 x_2 x_3 y_4 - 8 \sqrt{2}\, h_2 x_2 x_3 y_4 + 8 \mathrm{i}\, x_2^2 x_4 y_4 + 24 \sqrt{2}\, y_1 y_4 + 14 \sqrt{2}\, d\gamma\, y_1 y_4 + \\
&\quad 2 \sqrt{2}\, d\gamma^2 y_1 y_4 + 4 \sqrt{2}\, x_2^2 y_1 y_4 - 4 \mathrm{i} \sqrt{2}\, h_1 x_3 y_2 y_4 + 8 \mathrm{i} \sqrt{2}\, h_2 x_3 y_2 y_4 + 16 x_2 x_4 y_2 y_4 - \\
&\quad 4 \mathrm{i} \sqrt{2}\, x_1 y_2^2 y_4 - 8 \mathrm{i}\, x_4 y_2^2 y_4 + 4 \sqrt{2}\, y_1 y_2^2 y_4 + 4 \mathrm{i} \sqrt{2}\, h_1 x_2 y_3 y_4 - 8 \mathrm{i} \sqrt{2}\, h_2 x_2 y_3 y_4 + \\
&\quad 4 \sqrt{2}\, h_1 y_2 y_3 y_4 - 8 \sqrt{2}\, h_2 y_2 y_3 y_4 - 4 x_2^2 y_4^2 + 8 \mathrm{i}\, x_2 y_2 y_4^2 + 4 y_2^2 y_4^2 - \mathrm{A}[\![1, 5]\!] \ /\!/ \ \mathrm{Expand}
\end{aligned}
$$

Out[∘]= 0

In[∘]:=

$$
\begin{aligned}
&x_1^2 x_2^2 + 2 \mathrm{i}\, h_1 x_1 x_2 x_3 - 4 \mathrm{i}\, h_2 x_1 x_2 x_3 - 12 x_3^2 - 7\, d\gamma\, x_3^2 - d\gamma^2 x_3^2 - h_1^2 x_3^2 + 4 h_1 h_2 x_3^2 - 4 h_2^2 x_3^2 - 24 x_1 x_4 - \\
&\quad 14\, d\gamma\, x_1 x_4 - 2\, d\gamma^2 x_1 x_4 - 2 x_1 x_2^2 x_4 - 2 \mathrm{i}\, h_1 x_2 x_3 x_4 + 4 \mathrm{i}\, h_2 x_2 x_3 x_4 + x_2^2 x_4^2 + 2 \mathrm{i}\, x_1 x_2^2 y_1 - \\
&\quad 2 h_1 x_2 x_3 y_1 + 4 h_2 x_2 x_3 y_1 - 24 \mathrm{i}\, x_4 y_1 - 14 \mathrm{i}\, d\gamma\, x_4 y_1 - 2 \mathrm{i}\, d\gamma^2 x_4 y_1 - 2 \mathrm{i}\, x_2^2 x_4 y_1 - x_2^2 y_1^2 + \\
&\quad 2 \mathrm{i}\, x_1^2 x_2 y_2 - 2 h_1 x_1 x_3 y_2 + 4 h_2 x_1 x_3 y_2 - 2 h_1 x_3 x_4 y_2 + 4 h_2 x_3 x_4 y_2 - 2 \mathrm{i}\, x_2 x_4^2 y_2 - 4 x_1 x_2 y_1 y_2 - \\
&\quad 2 \mathrm{i}\, h_1 x_3 y_1 y_2 + 4 \mathrm{i}\, h_2 x_3 y_1 y_2 - 2 \mathrm{i}\, x_2 y_1^2 y_2 - x_1^2 y_2^2 - 2 x_1 x_4 y_2^2 - x_4^2 y_2^2 - 2 \mathrm{i}\, x_1 y_1 y_2^2 - 2 \mathrm{i}\, x_4 y_1 y_2^2 + \\
&\quad y_1^2 y_2^2 - 2 h_1 x_1 x_2 y_3 + 4 h_2 x_1 x_2 y_3 - 24 \mathrm{i}\, x_3 y_3 - 14 \mathrm{i}\, d\gamma\, x_3 y_3 - 2 \mathrm{i}\, d\gamma^2 x_3 y_3 - 2 \mathrm{i}\, h_1^2 x_3 y_3 + \\
&\quad 8 \mathrm{i}\, h_1 h_2 x_3 y_3 - 8 \mathrm{i}\, h_2^2 x_3 y_3 + 2 h_1 x_2 x_4 y_3 - 4 h_2 x_2 x_4 y_3 - 2 \mathrm{i}\, h_1 x_2 y_1 y_3 + 4 \mathrm{i}\, h_2 x_2 y_1 y_3 - \\
&\quad 2 \mathrm{i}\, h_1 x_1 y_2 y_3 + 4 \mathrm{i}\, h_2 x_1 y_2 y_3 - 2 \mathrm{i}\, h_1 x_4 y_2 y_3 + 4 \mathrm{i}\, h_2 x_4 y_2 y_3 + 2 h_1 y_1 y_2 y_3 - 4 h_2 y_1 y_2 y_3 + 12 y_3^2 + \\
&\quad 7\, d\gamma\, y_3^2 + d\gamma^2 y_3^2 + h_1^2 y_3^2 - 4 h_1 h_2 y_3^2 + 4 h_2^2 y_3^2 - 24 \mathrm{i}\, x_1 y_4 - 14 \mathrm{i}\, d\gamma\, x_1 y_4 - 2 \mathrm{i}\, d\gamma^2 x_1 y_4 - 2 \mathrm{i}\, x_1 x_2^2 y_4 + \\
&\quad 2 h_1 x_2 x_3 y_4 - 4 h_2 x_2 x_3 y_4 + 2 \mathrm{i}\, x_2^2 x_4 y_4 + 24 y_1 y_4 + 14\, d\gamma\, y_1 y_4 + 2\, d\gamma^2 y_1 y_4 + 2 x_2^2 y_1 y_4 - \\
&\quad 2 \mathrm{i}\, h_1 x_3 y_2 y_4 + 4 \mathrm{i}\, h_2 x_3 y_2 y_4 + 4 x_2 x_4 y_2 y_4 - 2 \mathrm{i}\, x_1 y_2^2 y_4 - 2 \mathrm{i}\, x_4 y_2^2 y_4 + 2 y_1 y_2^2 y_4 + 2 \mathrm{i}\, h_1 x_2 y_3 y_4 - \\
&\quad 4 \mathrm{i}\, h_2 x_2 y_3 y_4 + 2 h_1 y_2 y_3 y_4 - 4 h_2 y_2 y_3 y_4 - x_2^2 y_4^2 + 2 \mathrm{i}\, x_2 y_2 y_4^2 + y_2^2 y_4^2 - \mathrm{A}[\![1, 5]\!] \ /\!/ \ \mathrm{Expand}
\end{aligned}
$$

Out[∘]= 0

In[∘]:=

$$
\begin{aligned}
&(*\ \text{Apply } Y_{\alpha 2} \text{ to } t^{\lambda_1}{}_{11}\ *) \\
&k = 2; \\
&-\Bigg(-\frac{1}{2} \Big((2 y_2 - \mathrm{i}\, 2 x_2)\, \mathrm{D}[\mathrm{A}[\![1, k]\!], h_2] + (h_1 - 2 h_2)\, \mathrm{D}[\mathrm{A}[\![1, k]\!], y_2] + \\
&\qquad \mathrm{i}\, (-h_1 + 2 h_2)\, \mathrm{D}[\mathrm{A}[\![1, k]\!], x_2] + (2 x_3 + \mathrm{i}\, 2 y_3)\, \mathrm{D}[\mathrm{A}[\![1, k]\!], x_1] + \\
&\qquad (2 y_3 - \mathrm{i}\, 2 x_3)\, \mathrm{D}[\mathrm{A}[\![1, k]\!], y_1] + \left(\left(-x_1 - \sqrt{2}\, x_4\right) + \mathrm{i} \left(y_1 - \sqrt{2}\, y_4\right)\right) \mathrm{D}[\mathrm{A}[\![1, k]\!], x_3] + \\
&\qquad \left(\left(-y_1 - \sqrt{2}\, y_4\right) + \mathrm{i} \left(-x_1 + \sqrt{2}\, x_4\right)\right) \mathrm{D}[\mathrm{A}[\![1, k]\!], y_3] + \\
&\qquad \left(\sqrt{2}\, x_3 - \mathrm{i} \sqrt{2}\, y_3\right) \mathrm{D}[\mathrm{A}[\![1, k]\!], x_4] + \left(\sqrt{2}\, y_3 + \mathrm{i} \sqrt{2}\, x_3\right) \mathrm{D}[\mathrm{A}[\![1, k]\!], y_4]\Big)\Bigg) \ /\!/ \ \mathrm{Expand}
\end{aligned}
$$

In[ ]:=

$$
\begin{aligned}
&24 x_1 x_2 + 14 d\gamma\, x_1 x_2 + 2 d\gamma^2 x_1 x_2 + 2 h_1^2 x_1 x_2 + 16 i\, h_2 x_1 x_2 + 4 i\, d\gamma\, h_2 x_1 x_2 - 4 h_1 h_2 x_1 x_2 + 2 x_1^3 x_2 + \\
&48 x_3 + 52 d\gamma\, x_3 + 18 d\gamma^2 x_3 + 2 d\gamma^3 x_3 + 24 i\, h_1 x_3 + 14 i\, d\gamma\, h_1 x_3 + 2 i\, d\gamma^2 h_1 x_3 + 8 h_1^2 x_3 + \\
&2 d\gamma\, h_1^2 x_3 + 2 i\, h_1^3 x_3 - 32 h_1 h_2 x_3 - 8 d\gamma\, h_1 h_2 x_3 - 8 i\, h_1^2 h_2 x_3 + 32 h_2^2 x_3 + 8 d\gamma\, h_2^2 x_3 + 8 i\, h_1 h_2^2 x_3 + \\
&8 x_1^2 x_3 + 2 d\gamma\, x_1^2 x_3 + 2 i\, h_1 x_1^2 x_3 - 4 i\, h_2 x_1^2 x_3 + 24 \sqrt{2}\, x_2 x_4 + 14 \sqrt{2}\, d\gamma\, x_2 x_4 + 2 \sqrt{2}\, d\gamma^2 x_2 x_4 + \\
&16 i \sqrt{2}\, h_1 x_2 x_4 + 4 i \sqrt{2}\, d\gamma\, h_1 x_2 x_4 - 2 \sqrt{2}\, h_1^2 x_2 x_4 - 16 i \sqrt{2}\, h_2 x_2 x_4 - 4 i \sqrt{2}\, d\gamma\, h_2 x_2 x_4 + \\
&4 \sqrt{2}\, h_1 h_2 x_2 x_4 - 2 \sqrt{2}\, x_1^2 x_2 x_4 - 16 \sqrt{2}\, x_1 x_3 x_4 - 4 \sqrt{2}\, d\gamma\, x_1 x_3 x_4 - 4 x_1 x_2 x_4^2 + 16 x_3 x_4^2 + \\
&4 d\gamma\, x_3 x_4^2 - 4 i\, h_1 x_3 x_4^2 + 8 i\, h_2 x_3 x_4^2 + 4 \sqrt{2}\, x_2 x_4^3 + 24 i\, x_2 y_1 + 14 i\, d\gamma\, x_2 y_1 + 2 i\, d\gamma^2 x_2 y_1 + \\
&2 i\, h_1^2 x_2 y_1 - 16 h_2 x_2 y_1 - 4 d\gamma\, h_2 x_2 y_1 - 4 i\, h_1 h_2 x_2 y_1 + 2 i\, x_1^2 x_2 y_1 - 16 i \sqrt{2}\, x_3 x_4 y_1 - \\
&4 i \sqrt{2}\, d\gamma\, x_3 x_4 y_1 - 4 i\, x_2 x_4^2 y_1 + 2 x_1 x_2 y_1^2 + 8 x_3 y_1^2 + 2 d\gamma\, x_3 y_1^2 + 2 i\, h_1 x_3 y_1^2 - 4 i\, h_2 x_3 y_1^2 - \\
&2 \sqrt{2}\, x_2 x_4 y_1^2 + 2 i\, x_2 y_1^3 + 24 i\, x_1 y_2 + 14 i\, d\gamma\, x_1 y_2 + 2 i\, d\gamma^2 x_1 y_2 + 2 i\, h_1^2 x_1 y_2 - 16 h_2 x_1 y_2 - \\
&4 d\gamma\, h_2 x_1 y_2 - 4 i\, h_1 h_2 x_1 y_2 + 2 i\, x_1^3 y_2 - 24 i \sqrt{2}\, x_4 y_2 - 14 i \sqrt{2}\, d\gamma\, x_4 y_2 - 2 i \sqrt{2}\, d\gamma^2 x_4 y_2 + \\
&16 \sqrt{2}\, h_1 x_4 y_2 + 4 \sqrt{2}\, d\gamma\, h_1 x_4 y_2 + 2 i \sqrt{2}\, h_1^2 x_4 y_2 - 16 \sqrt{2}\, h_2 x_4 y_2 - 4 \sqrt{2}\, d\gamma\, h_2 x_4 y_2 - \\
&4 i \sqrt{2}\, h_1 h_2 x_4 y_2 + 2 i \sqrt{2}\, x_1^2 x_4 y_2 - 4 i\, x_1 x_4^2 y_2 - 4 i \sqrt{2}\, x_4^3 y_2 - 24 y_1 y_2 - 14 d\gamma\, y_1 y_2 - \\
&2 d\gamma^2 y_1 y_2 - 2 h_1^2 y_1 y_2 - 16 i\, h_2 y_1 y_2 - 4 i\, d\gamma\, h_2 y_1 y_2 + 4 h_1 h_2 y_1 y_2 - 2 x_1^2 y_1 y_2 + 4 x_4^2 y_1 y_2 + \\
&2 i\, x_1 y_1^2 y_2 + 2 i \sqrt{2}\, x_4 y_1^2 y_2 - 2 y_1^3 y_2 + 48 i\, y_3 + 52 i\, d\gamma\, y_3 + 18 i\, d\gamma^2 y_3 + 2 i\, d\gamma^3 y_3 - 24 h_1 y_3 - \\
&14 d\gamma\, h_1 y_3 - 2 d\gamma^2 h_1 y_3 + 8 i\, h_1^2 y_3 + 2 i\, d\gamma\, h_1^2 y_3 - 2 h_1^3 y_3 - 32 i\, h_1 h_2 y_3 - 8 i\, d\gamma\, h_1 h_2 y_3 + \\
&8 h_1^2 h_2 y_3 + 32 i\, h_2^2 y_3 + 8 i\, d\gamma\, h_2^2 y_3 - 8 h_1 h_2^2 y_3 + 8 i\, x_1^2 y_3 + 2 i\, d\gamma\, x_1^2 y_3 - 2 h_1 x_1^2 y_3 + \\
&4 h_2 x_1^2 y_3 + 16 i \sqrt{2}\, x_1 x_4 y_3 + 4 i \sqrt{2}\, d\gamma\, x_1 x_4 y_3 + 16 i\, x_4^2 y_3 + 4 i\, d\gamma\, x_4^2 y_3 + 4 h_1 x_4^2 y_3 - \\
&8 h_2 x_4^2 y_3 - 16 \sqrt{2}\, x_4 y_1 y_3 - 4 \sqrt{2}\, d\gamma\, x_4 y_1 y_3 + 8 i\, y_1^2 y_3 + 2 i\, d\gamma\, y_1^2 y_3 - 2 h_1 y_1^2 y_3 + 4 h_2 y_1^2 y_3 + \\
&24 i \sqrt{2}\, x_2 y_4 + 14 i \sqrt{2}\, d\gamma\, x_2 y_4 + 2 i \sqrt{2}\, d\gamma^2 x_2 y_4 - 16 \sqrt{2}\, h_1 x_2 y_4 - 4 \sqrt{2}\, d\gamma\, h_1 x_2 y_4 - \\
&2 i \sqrt{2}\, h_1^2 x_2 y_4 + 16 \sqrt{2}\, h_2 x_2 y_4 + 4 \sqrt{2}\, d\gamma\, h_2 x_2 y_4 + 4 i \sqrt{2}\, h_1 h_2 x_2 y_4 - 2 i \sqrt{2}\, x_1^2 x_2 y_4 - \\
&16 i \sqrt{2}\, x_1 x_3 y_4 - 4 i \sqrt{2}\, d\gamma\, x_1 x_3 y_4 + 4 i \sqrt{2}\, x_2 x_4^2 y_4 + 16 \sqrt{2}\, x_3 y_1 y_4 + 4 \sqrt{2}\, d\gamma\, x_3 y_1 y_4 - \\
&2 i \sqrt{2}\, x_2 y_1^2 y_4 + 24 \sqrt{2}\, y_2 y_4 + 14 \sqrt{2}\, d\gamma\, y_2 y_4 + 2 \sqrt{2}\, d\gamma^2 y_2 y_4 + 16 i \sqrt{2}\, h_1 y_2 y_4 + \\
&4 i \sqrt{2}\, d\gamma\, h_1 y_2 y_4 - 2 \sqrt{2}\, h_1^2 y_2 y_4 - 16 i \sqrt{2}\, h_2 y_2 y_4 - 4 i \sqrt{2}\, d\gamma\, h_2 y_2 y_4 + 4 \sqrt{2}\, h_1 h_2 y_2 y_4 - \\
&2 \sqrt{2}\, x_1^2 y_2 y_4 + 4 \sqrt{2}\, x_4^2 y_2 y_4 - 2 \sqrt{2}\, y_1^2 y_2 y_4 - 16 \sqrt{2}\, x_1 y_3 y_4 - 4 \sqrt{2}\, d\gamma\, x_1 y_3 y_4 - \\
&16 i \sqrt{2}\, y_1 y_3 y_4 - 4 i \sqrt{2}\, d\gamma\, y_1 y_3 y_4 - 4 x_1 x_2 y_4^2 + 16 x_3 y_4^2 + 4 d\gamma\, x_3 y_4^2 - 4 i\, h_1 x_3 y_4^2 + \\
&8 i\, h_2 x_3 y_4^2 + 4 \sqrt{2}\, x_2 x_4 y_4^2 - 4 i\, x_2 y_1 y_4^2 - 4 i\, x_1 y_2 y_4^2 - 4 i \sqrt{2}\, x_4 y_2 y_4^2 + 4 y_1 y_2 y_4^2 + 16 i\, y_3 y_4^2 + \\
&4 i\, d\gamma\, y_3 y_4^2 + 4 h_1 y_3 y_4^2 - 8 h_2 y_3 y_4^2 + 4 i \sqrt{2}\, x_2 y_4^3 + 4 \sqrt{2}\, y_2 y_4^3 - \sqrt{2}\, A[[1, 3]] \;//\; \mathrm{Expand}
\end{aligned}
$$

Out[ ]= 0

In[ ]:= (* Apply $Y_{\alpha 2}$ to $t^{\lambda_1}{}_{11}$ *)

k = 3;

$$
\begin{aligned}
-\Bigg(-\frac{1}{2}\, \Big(&(2 y_2 - i\, 2 x_2)\, D[A[[1, k]], h_2] + (h_1 - 2 h_2)\, D[A[[1, k]], y_2] + \\
&i\, (-h_1 + 2 h_2)\, D[A[[1, k]], x_2] + (2 x_3 + i\, 2 y_3)\, D[A[[1, k]], x_1] + \\
&(2 y_3 - i\, 2 x_3)\, D[A[[1, k]], y_1] + \left(\left(-x_1 - \sqrt{2}\, x_4\right) + i \left(y_1 - \sqrt{2}\, y_4\right)\right) D[A[[1, k]], x_3] + \\
&\left(\left(-y_1 - \sqrt{2}\, y_4\right) + i \left(-x_1 + \sqrt{2}\, x_4\right)\right) D[A[[1, k]], y_3] + \\
&\left(\sqrt{2}\, x_3 - i \sqrt{2}\, y_3\right) D[A[[1, k]], x_4] + \left(\sqrt{2}\, y_3 + i \sqrt{2}\, x_3\right) D[A[[1, k]], y_4]\Big)\Bigg) \;//\; \mathrm{Expand}
\end{aligned}
$$

In[∘]:=

$$
\begin{array}{l}
8 \sqrt{2}\, x_1 x_2^2 + 2 \sqrt{2}\, d\gamma\, x_1 x_2^2 + 2 i \sqrt{2}\, h_1 x_1 x_2^2 + 24 \sqrt{2}\, x_2 x_3 + 14 \sqrt{2}\, d\gamma\, x_2 x_3 + 2 \sqrt{2}\, d\gamma^2 x_2 x_3 + \\
16 i \sqrt{2}\, h_1 x_2 x_3 + 4 i \sqrt{2}\, d\gamma\, h_1 x_2 x_3 - 2 \sqrt{2}\, h_1^2 x_2 x_3 - 16 i \sqrt{2}\, h_2 x_2 x_3 - 4 i \sqrt{2}\, d\gamma\, h_2 x_2 x_3 + \\
4 \sqrt{2}\, h_1 h_2 x_2 x_3 + 2 \sqrt{2}\, x_1^2 x_2 x_3 + 8 \sqrt{2}\, x_1 x_3^2 + 2 \sqrt{2}\, d\gamma\, x_1 x_3^2 + 2 i \sqrt{2}\, h_1 x_1 x_3^2 - \\
4 i \sqrt{2}\, h_2 x_1 x_3^2 - 48 x_4 - 52\, d\gamma\, x_4 - 18\, d\gamma^2 x_4 - 2\, d\gamma^3 x_4 - 48 i h_1 x_4 - 28 i\, d\gamma\, h_1 x_4 - \\
4 i\, d\gamma^2 h_1 x_4 + 8 h_1^2 x_4 + 2\, d\gamma\, h_1^2 x_4 + 48 i h_2 x_4 + 28 i\, d\gamma\, h_2 x_4 + 4 i\, d\gamma^2 h_2 x_4 - 16 h_1 h_2 x_4 - \\
4\, d\gamma\, h_1 h_2 x_4 + 8 x_1^2 x_4 + 2\, d\gamma\, x_1^2 x_4 - 16 x_2^2 x_4 - 4\, d\gamma\, x_2^2 x_4 - 4 i h_1 x_2^2 x_4 - 8 x_1 x_2 x_3 x_4 - 16 x_3^2 x_4 - \\
4\, d\gamma\, x_3^2 x_4 - 4 i h_1 x_3^2 x_4 + 8 i h_2 x_3^2 x_4 + 4 \sqrt{2}\, x_2 x_3 x_4^2 - 16 x_4^3 - 4\, d\gamma\, x_4^3 + 8 i \sqrt{2}\, x_2^2 y_1 + \\
2 i \sqrt{2}\, d\gamma\, x_2^2 y_1 - 2 \sqrt{2}\, h_1 x_2^2 y_1 - 8 i \sqrt{2}\, x_3^2 y_1 - 2 i \sqrt{2}\, d\gamma\, x_3^2 y_1 + 2 \sqrt{2}\, h_1 x_3^2 y_1 - \\
4 \sqrt{2}\, h_2 x_3^2 y_1 + 2 \sqrt{2}\, x_2 x_3 y_1^2 + 8 x_4 y_1^2 + 2\, d\gamma\, x_4 y_1^2 + 16 i \sqrt{2}\, x_1 x_2 y_2 + 4 i \sqrt{2}\, d\gamma\, x_1 x_2 y_2 - \\
4 \sqrt{2}\, h_1 x_1 x_2 y_2 + 24 i \sqrt{2}\, x_3 y_2 + 14 i \sqrt{2}\, d\gamma\, x_3 y_2 + 2 i \sqrt{2}\, d\gamma^2 x_3 y_2 - 16 \sqrt{2}\, h_1 x_3 y_2 - \\
4 \sqrt{2}\, d\gamma\, h_1 x_3 y_2 - 2 i \sqrt{2}\, h_1^2 x_3 y_2 + 16 \sqrt{2}\, h_2 x_3 y_2 + 4 \sqrt{2}\, d\gamma\, h_2 x_3 y_2 + 4 i \sqrt{2}\, h_1 h_2 x_3 y_2 + \\
2 i \sqrt{2}\, x_1^2 x_3 y_2 - 4 i \sqrt{2}\, x_3 x_4^2 y_2 - 16 \sqrt{2}\, x_2 y_1 y_2 - 4 \sqrt{2}\, d\gamma\, x_2 y_1 y_2 - 4 i \sqrt{2}\, h_1 x_2 y_1 y_2 + \\
8 x_3 x_4 y_1 y_2 + 2 i \sqrt{2}\, x_3 y_1^2 y_2 - 8 \sqrt{2}\, x_1 y_2^2 - 2 \sqrt{2}\, d\gamma\, x_1 y_2^2 - 2 i \sqrt{2}\, h_1 x_1 y_2^2 - 16 x_4 y_2^2 - \\
4\, d\gamma\, x_4 y_2^2 - 4 i h_1 x_4 y_2^2 - 8 i \sqrt{2}\, y_1 y_2^2 - 2 i \sqrt{2}\, d\gamma\, y_1 y_2^2 + 2 \sqrt{2}\, h_1 y_1 y_2^2 + 24 i \sqrt{2}\, x_2 y_3 + \\
14 i \sqrt{2}\, d\gamma\, x_2 y_3 + 2 i \sqrt{2}\, d\gamma^2 x_2 y_3 - 16 \sqrt{2}\, h_1 x_2 y_3 - 4 \sqrt{2}\, d\gamma\, h_1 x_2 y_3 - 2 i \sqrt{2}\, h_1^2 x_2 y_3 + \\
16 \sqrt{2}\, h_2 x_2 y_3 + 4 \sqrt{2}\, d\gamma\, h_2 x_2 y_3 + 4 i \sqrt{2}\, h_1 h_2 x_2 y_3 + 2 i \sqrt{2}\, x_1^2 x_2 y_3 + 16 i \sqrt{2}\, x_1 x_3 y_3 + \\
4 i \sqrt{2}\, d\gamma\, x_1 x_3 y_3 - 4 \sqrt{2}\, h_1 x_1 x_3 y_3 + 8 \sqrt{2}\, h_2 x_1 x_3 y_3 - 4 i \sqrt{2}\, x_2 x_4^2 y_3 + 16 \sqrt{2}\, x_3 y_1 y_3 + \\
4 \sqrt{2}\, d\gamma\, x_3 y_1 y_3 + 4 i \sqrt{2}\, h_1 x_3 y_1 y_3 - 8 i \sqrt{2}\, h_2 x_3 y_1 y_3 - 8 x_2 x_4 y_1 y_3 + 2 i \sqrt{2}\, x_2 y_1^2 y_3 - \\
24 \sqrt{2}\, y_2 y_3 - 14 \sqrt{2}\, d\gamma\, y_2 y_3 - 2 \sqrt{2}\, d\gamma^2 y_2 y_3 - 16 i \sqrt{2}\, h_1 y_2 y_3 - 4 i \sqrt{2}\, d\gamma\, h_1 y_2 y_3 + \\
2 \sqrt{2}\, h_1^2 y_2 y_3 + 16 i \sqrt{2}\, h_2 y_2 y_3 + 4 i \sqrt{2}\, d\gamma\, h_2 y_2 y_3 - 4 \sqrt{2}\, h_1 h_2 y_2 y_3 - 2 \sqrt{2}\, x_1^2 y_2 y_3 - \\
8 x_1 x_4 y_2 y_3 - 4 \sqrt{2}\, x_4^2 y_2 y_3 - 2 \sqrt{2}\, y_1^2 y_2 y_3 - 8 \sqrt{2}\, x_1 y_3^2 - 2 \sqrt{2}\, d\gamma\, x_1 y_3^2 - 2 i \sqrt{2}\, h_1 x_1 y_3^2 + \\
4 i \sqrt{2}\, h_2 x_1 y_3^2 - 16 x_4 y_3^2 - 4\, d\gamma\, x_4 y_3^2 - 4 i h_1 x_4 y_3^2 + 8 i h_2 x_4 y_3^2 + 8 i \sqrt{2}\, y_1 y_3^2 + 2 i \sqrt{2}\, d\gamma\, y_1 y_3^2 - \\
2 \sqrt{2}\, h_1 y_1 y_3^2 + 4 \sqrt{2}\, h_2 y_1 y_3^2 - 48 i y_4 - 52 i\, d\gamma\, y_4 - 18 i\, d\gamma^2 y_4 - 2 i\, d\gamma^3 y_4 + 48 h_1 y_4 + \\
28\, d\gamma\, h_1 y_4 + 4\, d\gamma^2 h_1 y_4 + 8 i h_1^2 y_4 + 2 i\, d\gamma\, h_1^2 y_4 - 48 h_2 y_4 - 28\, d\gamma\, h_2 y_4 - 4\, d\gamma^2 h_2 y_4 - \\
16 i h_1 h_2 y_4 - 4 i\, d\gamma\, h_1 h_2 y_4 + 8 i x_1^2 y_4 + 2 i\, d\gamma\, x_1^2 y_4 - 16 i x_2^2 y_4 - 4 i\, d\gamma\, x_2^2 y_4 + 4 h_1 x_2^2 y_4 - \\
8 i x_1 x_2 x_3 y_4 - 16 i x_3^2 y_4 - 4 i\, d\gamma\, x_3^2 y_4 + 4 h_1 x_3^2 y_4 - 8 h_2 x_3^2 y_4 + 8 i \sqrt{2}\, x_2 x_3 x_4 y_4 - \\
16 i x_4^2 y_4 - 4 i\, d\gamma\, x_4^2 y_4 + 8 i y_1^2 y_4 + 2 i\, d\gamma\, y_1^2 y_4 + 8 \sqrt{2}\, x_3 x_4 y_2 y_4 + 8 i x_3 y_1 y_2 y_4 - 16 i y_2^2 y_4 - \\
4 i\, d\gamma\, y_2^2 y_4 + 4 h_1 y_2^2 y_4 + 8 \sqrt{2}\, x_2 x_4 y_3 y_4 - 8 i x_2 y_1 y_3 y_4 - 8 i x_1 y_2 y_3 y_4 - 8 i \sqrt{2}\, x_4 y_2 y_3 y_4 - \\
16 i y_3^2 y_4 - 4 i\, d\gamma\, y_3^2 y_4 + 4 h_1 y_3^2 y_4 - 8 h_2 y_3^2 y_4 - 4 \sqrt{2}\, x_2 x_3 y_4^2 - 16 x_4 y_4^2 - 4\, d\gamma\, x_4 y_4^2 + \\
4 i \sqrt{2}\, x_3 y_2 y_4^2 + 4 i \sqrt{2}\, x_2 y_3 y_4^2 + 4 \sqrt{2}\, y_2 y_3 y_4^2 - 16 i y_4^3 - 4 i\, d\gamma\, y_4^3 - \sqrt{2}\, A[[1, 4]] \;//\; \mathrm{Expand}
\end{array}
$$

Out[∘]= 0

```
(*****************************************)
```

In[∘]:= MatrixExp[t * X1] // MatrixForm

Out[∘]//MatrixForm=

$$
\begin{pmatrix}
1 & t & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & -t \\
0 & 0 & 0 & 0 & 1
\end{pmatrix}
$$

In[∘]:=
```
Temp = {{a1, a2, a3, a4, a5}, {b1, b2, b3, b4, b5},
    {c1, c2, c3, c4, c5}, {d1, d2, d3, d4, d5}, {e1, e2, e3, e4, e5}};
Temp // MatrixForm
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} a1 & a2 & a3 & a4 & a5 \\ b1 & b2 & b3 & b4 & b5 \\ c1 & c2 & c3 & c4 & c5 \\ d1 & d2 & d3 & d4 & d5 \\ e1 & e2 & e3 & e4 & e5 \end{pmatrix}$$

In[∘]:=
```
D[Temp.MatrixExp[t * Y1], t] // MatrixForm
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} a2 & 0 & 0 & -a5 & 0 \\ b2 & 0 & 0 & -b5 & 0 \\ c2 & 0 & 0 & -c5 & 0 \\ d2 & 0 & 0 & -d5 & 0 \\ e2 & 0 & 0 & -e5 & 0 \end{pmatrix}$$

In[∘]:=

$$\mathbf{D}\left[\mathbf{MatrixExp[t * X1].}\begin{pmatrix} \mathbf{a2} & \mathbf{0} & \mathbf{0} & \mathbf{-a5} & \mathbf{0} \\ \mathbf{b2} & \mathbf{0} & \mathbf{0} & \mathbf{-b5} & \mathbf{0} \\ \mathbf{c2} & \mathbf{0} & \mathbf{0} & \mathbf{-c5} & \mathbf{0} \\ \mathbf{d2} & \mathbf{0} & \mathbf{0} & \mathbf{-d5} & \mathbf{0} \\ \mathbf{e2} & \mathbf{0} & \mathbf{0} & \mathbf{-e5} & \mathbf{0} \end{pmatrix}, \mathbf{t}\right] \mathbf{//\ MatrixForm}$$

Out[∘]//MatrixForm=

$$\begin{pmatrix} b2 & 0 & 0 & -b5 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ -e2 & 0 & 0 & e5 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

In[∘]:=
```
(* Calculate G-induced Yα *)
X11 = t (X1 - Y1);
Y11 = i t (X1 + Y1);
X22 = t (X2 - Y2);
Y22 = i t (X2 + Y2);
MatrixExp[Y11].M.Inverse[MatrixExp[Y11]] // MatrixForm
```

Out[∘]//MatrixForm=

$$\left(\begin{array}{l}
\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\ \text{Sin}[t]^2\right)\ (i\ \text{Cos}[t]\ h_1+i\ \text{Sin}[t]\ (-x_1+i\ y_1))}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(-i\ \text{Cos}[t]^2\ \text{Sin}[t]-i\ \text{Sin}[t]^3\right)\ (i\ \text{Sin}[t]\ (-i\ h_1+2\ i\ h_2)+\text{Cos}[t]\ (x_1+}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\ \text{Sin}[t]^2\right)\ (-\text{Sin}[t]\ h_1+\text{Cos}[t]\ (-x_1+i\ y_1))}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(-i\ \text{Cos}[t]^2\ \text{Sin}[t]-i\ \text{Sin}[t]^3\right)\ (\text{Cos}[t]\ (-i\ h_1+2\ i\ h_2)+i\ \text{Sin}[t]\ (x_1+i}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\left(-i\ \text{Cos}[t]^2\ \text{Sin}[t]-i\ \text{Sin}[t]^3\right)\ \left(-\sqrt{2}\ x_2+i\ \sqrt{2}\ y_2\right)}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\ \text{Sin}[t]^2\right)\ \left(-\sqrt{2}\ x_3+i\ \sqrt{2}\ y_3\right)}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\text{Cos}[t]\ \left(\text{Cos}[t]^3+\text{Cos}[t]\ \text{Sin}[t]^2\right)\ \left(\sqrt{2}\ x_4-i\ \sqrt{2}\ y_4\right)}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{i\ \text{Sin}[t]\ \left(-i\ \text{Cos}[t]^2\ \text{Sin}[t]-i\ \text{Sin}[t]^3\right)\ \left(\sqrt{2}\ x_4-i\ \sqrt{2}\ y_4\right)}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{i\ \text{Sin}[t]\ \left(\text{Cos}[t]^3+\text{Cos}[t]\ \text{Sin}[t]^2\right)\ \left(\sqrt{2}\ x_4-i\ \sqrt{2}\ y_4\right)}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\text{Cos}[t]\ \left(-i\ \text{Cos}[t]^2\ \text{Sin}[t]-i\ \text{Sin}[t]^3\right)\ \left(\sqrt{2}\ x_4-i\ \sqrt{2}\ y_4\right)}{\text{Cos}[t]^4+2\ \text{Cos}[t]^2\ \text{Sin}[t]^2+\text{Sin}[t]^4}
\end{array}\right.$$

In[•]:= $$\mathrm{D}\Big[\left(\begin{array}{l}
\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,(i\,\text{Cos}[t]\,h_1+i\,\text{Sin}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(-i\,\text{Cos}[t]^2\,\text{Sin}[t]-i\,\text{Sin}[t]^3\right)\,(i\,\text{Sin}[t]\,(-i\,h_1+2\,i\,h_2)+\text{Cos}[t]\,(\cdots}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,(-\text{Sin}[t]\,h_1+\text{Cos}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(-i\,\text{Cos}[t]^2\,\text{Sin}[t]-i\,\text{Sin}[t]^3\right)\,(\text{Cos}[t]\,(-i\,h_1+2\,i\,h_2)+i\,\text{Sin}[t]\,(x\cdots}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\left(-i\,\text{Cos}[t]^2\,\text{Sin}[t]-i\,\text{Sin}[t]^3\right)\,\left(-\sqrt{2}\,x_2+i\,\sqrt{2}\,y_2\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(-\sqrt{2}\,x_3+i\,\sqrt{2}\,y_3\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\text{Cos}[t]\,\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{i\,\text{Sin}[t]\,\left(-i\,\text{Cos}[t]^2\,\text{Sin}[t]-i\,\text{Sin}[t]^3\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{i\,\text{Sin}[t]\,\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\text{Cos}[t]\,\left(-i\,\text{Cos}[t]^2\,\text{Sin}[t]-i\,\text{Sin}[t]^3\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}
\end{array}\right.$$

Out[•]//MatrixForm=

$$\left(\begin{array}{l}
\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,(-i\,\text{Sin}[t]\,h_1+i\,\text{Cos}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(-\text{Cos}[t]^2\,\text{Sin}[t]-\text{Sin}[t]^3\right)\,(i\,\text{Cos}[t]\,h_1+i\,\text{Sin}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{(\cdots}{} \\
\frac{\left(-\text{Cos}[t]^2\,\text{Sin}[t]-\text{Sin}[t]^3\right)\,(-\text{Sin}[t]\,h_1+\text{Cos}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,(-\text{Cos}[t]\,h_1-\text{Sin}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{(-i\,\text{C}\cdots}{} \\
\frac{\left(-i\,\text{Cos}[t]^3-i\,\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(-\sqrt{2}\,x_2+\cdots\right.}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t\cdots} \\
\frac{i\,\text{Sin}[t]\,\left(-i\,\text{Cos}[t]^3-i\,\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}-\frac{\text{Sin}[t]\,\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\cdots\right.}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\text{Cos}[t]\,\left(-i\,\text{Cos}[t]^3-i\,\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{i\,\text{Cos}[t]\,\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\cdots\right.}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}
\end{array}\right.$$

In[•]:= $$\text{f}[\text{t_}]:=\left(\begin{array}{l}
\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,(-i\,\text{Sin}[t]\,h_1+i\,\text{Cos}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(-\text{Cos}[t]^2\,\text{Sin}[t]-\text{Sin}[t]^3\right)\,(i\,\text{Cos}[t]\,h_1+i\,\text{Sin}[t]\,(-x\cdots}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\left(-\text{Cos}[t]^2\,\text{Sin}[t]-\text{Sin}[t]^3\right)\,(-\text{Sin}[t]\,h_1+\text{Cos}[t]\,(-x_1+i\,y_1))}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\right)\,(-\text{Cos}[t]\,h_1-\text{Sin}[t]\,(-x_1+i\cdots}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4} \\
\frac{\left(-i\,\text{Cos}[t]^3-i\,\text{Cos}[t]\,\text{Sin}[t]\cdots\right.}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Si}\cdots} \\
\frac{i\,\text{Sin}[t]\,\left(-i\,\text{Cos}[t]^3-i\,\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}-\frac{\text{Sin}[t]\,\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\cdots\right.}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t\cdots} \\
\frac{\text{Cos}[t]\,\left(-i\,\text{Cos}[t]^3-i\,\text{Cos}[t]\,\text{Sin}[t]^2\right)\,\left(\sqrt{2}\,x_4-i\,\sqrt{2}\,y_4\right)}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t]^2+\text{Sin}[t]^4}+\frac{i\,\text{Cos}[t]\,\left(\text{Cos}[t]^3+\text{Cos}[t]\,\text{Sin}[t]^2\cdots\right.}{\text{Cos}[t]^4+2\,\text{Cos}[t]^2\,\text{Sin}[t\cdots}
\end{array}\right.$$

In[•]:= `f[0] // Expand`

In[•]:= $\{\{-2\,i\,x_1,\ 2\,h_1-2\,h_2,\ i\,\sqrt{2}\,x_2-\sqrt{2}\,y_2,\ 0,\ 0\},\ \{-2\,h_1+2\,h_2,\ 2\,i\,x_1,\ i\,\sqrt{2}\,x_3-\sqrt{2}\,y_3,\ 0,\ 0\},$
$\{i\,\sqrt{2}\,x_2+\sqrt{2}\,y_2,\ i\,\sqrt{2}\,x_3+\sqrt{2}\,y_3,\ 0,\ i\,\sqrt{2}\,x_3-\sqrt{2}\,y_3,\ -i\,\sqrt{2}\,x_2+\sqrt{2}\,y_2\},$
$\{0,\ 0,\ i\,\sqrt{2}\,x_3+\sqrt{2}\,y_3,\ -2\,i\,x_1,\ 2\,h_1-2\,h_2\},$
$\{0,\ 0,\ -i\,\sqrt{2}\,x_2-\sqrt{2}\,y_2,\ -2\,h_1+2\,h_2,\ 2\,i\,x_1\}\}$ // MatrixForm

Out[•]//MatrixForm=

$$\begin{pmatrix}
-2\,i\,x_1 & 2\,h_1-2\,h_2 & i\,\sqrt{2}\,x_2-\sqrt{2}\,y_2 & 0 & 0 \\
-2\,h_1+2\,h_2 & 2\,i\,x_1 & i\,\sqrt{2}\,x_3-\sqrt{2}\,y_3 & 0 & 0 \\
i\,\sqrt{2}\,x_2+\sqrt{2}\,y_2 & i\,\sqrt{2}\,x_3+\sqrt{2}\,y_3 & 0 & i\,\sqrt{2}\,x_3-\sqrt{2}\,y_3 & -i\,\sqrt{2}\,x_2+\sqrt{2}\,y_2 \\
0 & 0 & i\,\sqrt{2}\,x_3+\sqrt{2}\,y_3 & -2\,i\,x_1 & 2\,h_1-2\,h_2 \\
0 & 0 & -i\,\sqrt{2}\,x_2-\sqrt{2}\,y_2 & -2\,h_1+2\,h_2 & 2\,i\,x_1
\end{pmatrix}$$

$$\begin{pmatrix}
2\,i\,y_1 & -2\,i\,h_1+2\,i\,h_2 & \sqrt{2}\,x_2+i\,\sqrt{2}\,y_2 & 0 & 0 \\
-2\,i\,h_1+2\,i\,h_2 & -2\,i\,y_1 & -\sqrt{2}\,x_3-i\,\sqrt{2}\,y_3 & 0 & 0 \\
-\sqrt{2}\,x_2+i\,\sqrt{2}\,y_2 & \sqrt{2}\,x_3-i\,\sqrt{2}\,y_3 & 0 & -\sqrt{2}\,x_3-i\,\sqrt{2}\,y_3 & -\sqrt{2}\,x_2-i\,\sqrt{2}\,y_2 \\
0 & 0 & \sqrt{2}\,x_3-i\,\sqrt{2}\,y_3 & 2\,i\,y_1 & -2\,i\,h_1+2\,i\,h_2 \\
0 & 0 & \sqrt{2}\,x_2-i\,\sqrt{2}\,y_2 & -2\,i\,h_1+2\,i\,h_2 & -2\,i\,y_1
\end{pmatrix}$$

In[*]:= `M // MatrixForm`

Out[*]//MatrixForm=

$$\begin{pmatrix} i\, h_1 & x_1 + i\, y_1 & \sqrt{2}\, x_3 + i\, \sqrt{2}\, y_3 & -\sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 & 0 \\ -x_1 + i\, y_1 & -i\, h_1 + 2\, i\, h_2 & \sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & 0 & -\sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 \\ -\sqrt{2}\, x_3 + i\, \sqrt{2}\, y_3 & -\sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & 0 & \sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & -\sqrt{2}\, x_3 - i\, \sqrt{2}\, y_3 \\ \sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 & 0 & -\sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & i\, h_1 - 2\, i\, h_2 & x_1 + i\, y_1 \\ 0 & \sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 & \sqrt{2}\, x_3 - i\, \sqrt{2}\, y_3 & -x_1 + i\, y_1 & -i\, h_1 \end{pmatrix}$$

(*

G – induced differential operators:

X1 : 2y1 dh1 + (2h2-2h1) dy1 + x2 dx3 + y2 dy3 – x3 dx2 – y3 dy2 ;

Y1: -2x1 dh1 – (2h2-2h1) dx1 – y2 dx3 + x2 dy3 – y3 dx2 + x3 dy2 ;

X2: 2y2 dh2 + (h1 – 2h2) dy2 + 2x3 dx1 + 2y3 dy1 + (-x1 – $\sqrt{2}$ x4) dx3 + (-y1 – $\sqrt{2}$y4) dy3 – $\sqrt{2}$x3 dx4 – $\sqrt{2}$y3 dy4 ;

Y2: -2x2 dh2 + (-h1 + 2h2) dx2 + 2y3 dx1 – 2x3 dy1 + (y1 – $\sqrt{2}$y4) dx3 + (-x1 + $\sqrt{2}$x4) dy3 + $\sqrt{2}$y3 dx4 – $\sqrt{2}$x3 dy4 ;

$Y^G{}_{\alpha_1} = -\frac{1}{2}\left(X_1{}^G + i\, Y_1{}^G\right)$,

we know $Y_{\alpha_1}.\ \pi_{1,1} = \pi_{1,2}$ and $-Y^G{}_{\alpha_1}.\ \pi_{1,1}(\exp) = \pi_{1,2}(\exp)$;

This holds true for all $\lambda = \sum_i c_i\, \lambda_i$

***)**

$$\begin{pmatrix} 0 & 2\, x_3 + 2\, i\, y_3 & -\sqrt{2}\, x_1 - 2\, x_4 - i\, \sqrt{2}\, y_1 - 2\, i\, y_4 & -2\, x_3 - 2 \\ -2\, x_3 + 2\, i\, y_3 & 4\, i\, y_2 & i\, \sqrt{2}\, h_1 - 2\, i\, \sqrt{2}\, h_2 & 0 \\ \sqrt{2}\, x_1 + 2\, x_4 - i\, \sqrt{2}\, y_1 - 2\, i\, y_4 & i\, \sqrt{2}\, h_1 - 2\, i\, \sqrt{2}\, h_2 & 0 & i\, \sqrt{2}\, h_1 - 2 \\ 2\, x_3 - 2\, i\, y_3 & 0 & i\, \sqrt{2}\, h_1 - 2\, i\, \sqrt{2}\, h_2 & -4\, i \\ 0 & 2\, x_3 - 2\, i\, y_3 & -\sqrt{2}\, x_1 - 2\, x_4 + i\, \sqrt{2}\, y_1 + 2\, i\, y_4 & -2\, x_3 + 2 \end{pmatrix}$$

$$\begin{pmatrix} i\, h_1 & x_1 + i\, y_1 & \sqrt{2}\, x_3 + i\, \sqrt{2}\, y_3 & -\sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 & 0 \\ -x_1 + i\, y_1 & -i\, h_1 + 2\, i\, h_2 & \sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & 0 & -\sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 \\ -\sqrt{2}\, x_3 + i\, \sqrt{2}\, y_3 & -\sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & 0 & \sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & -\sqrt{2}\, x_3 - i\, \sqrt{2}\, y_3 \\ \sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 & 0 & -\sqrt{2}\, x_2 + i\, \sqrt{2}\, y_2 & i\, h_1 - 2\, i\, h_2 & x_1 + i\, y_1 \\ 0 & \sqrt{2}\, x_4 - i\, \sqrt{2}\, y_4 & \sqrt{2}\, x_3 - i\, \sqrt{2}\, y_3 & -x_1 + i\, y_1 & -i\, h_1 \end{pmatrix}$$

$$\begin{pmatrix} 0 & -2\,i\,x_3+2\,y_3 & -i\,\sqrt{2}\,x_1+2\,i\,x_4+\sqrt{2}\,y_1-2\,y_4 & -2\,i\,x_3+2\,\cdots \\ -2\,i\,x_3-2\,y_3 & -4\,i\,x_2 & -\sqrt{2}\,h_1+2\,\sqrt{2}\,h_2 & 0 \\ -i\,\sqrt{2}\,x_1+2\,i\,x_4-\sqrt{2}\,y_1+2\,y_4 & \sqrt{2}\,h_1-2\,\sqrt{2}\,h_2 & 0 & -\sqrt{2}\,h_1+2\,\sqrt{\cdots} \\ -2\,i\,x_3-2\,y_3 & 0 & \sqrt{2}\,h_1-2\,\sqrt{2}\,h_2 & 4\,i\,x_2 \\ 0 & -2\,i\,x_3-2\,y_3 & i\,\sqrt{2}\,x_1-2\,i\,x_4+\sqrt{2}\,y_1-2\,y_4 & -2\,i\,x_3-2\,\cdots \end{pmatrix}$$

```
(*
    G - induced differential operators:
       X1 : 2y1 dh1 + (2h2-2h1) dy1 + x2 dx3 + y2 dy3 - x3 dx2 - y3 dy2

       Y1:  -2x1 dh1 + (2h1-2h1) dx1 - y2 dx3 + x2 dy3 - y3 dx2 - x3 dy2

*)
```

In[]:= `Tr[M1.M1] // Simplify`

Out[]= $-4\left(h1^2+x1^2+y1^2\right)$

(* B_2 : λ_1 measure *)

a1 = {2, 0};

a2 = {0, 2}; λ1 = a1 + a2; H1 = $\left(1, \frac{-1}{2}\right)$;

H2 = (-1, 1);(* H1 = $\left(1, \frac{-1}{2}\right)$, H2 = (-1,1) *)

a1 = {1, 1};

a2 = {0, -1}; λ1 = a1 + a2; (* H1 = (1,1),

H2 = (0,-2) *) (* I need a new basis *)

In[]:= a1 = {2, 0}; a2 = {0, 2}; λ1 = a1 + a2; H1 = $\left\{1, \frac{-1}{2}\right\}$; H2 = {-1, 1};

In[]:= `a2.H2`

Out[]= 2

In[]:=

$$f[x\_, y\_] := \frac{e^{i\,(\lambda 1).\{x,y\}}}{(i\,a1.\{x,y\})\,(i\,(a1+a2).\{x,y\})\,(i\,(a1+2\,a2).\{x,y\})} - \frac{e^{i\,(\lambda 1-a1).\{x,y\}}}{(i\,a1.\{x,y\})\,(i\,a2.\{x,y\})\,(i\,(a1+2\,a2).\{x,y\})} + \frac{e^{i\,(\lambda 1-a1-2\,a2).\{x,y\}}}{(i\,a1.\{x,y\})\,(i\,a2.\{x,y\})\,(i\,(a1+2\,a2).\{x,y\})} - \frac{e^{i\,(\lambda 1-2\,a1-2\,a2).\{x,y\}}}{(i\,a1.\{x,y\})\,(i\,(a1+a2).\{x,y\})\,(i\,(a1+2\,a2).\{x,y\})};$$

In[∘]:= fff[h1_, h2_] := $\frac{e^{i\,h1}}{-i\,(2\,h1-2\,h2)\,(h1)\,(2\,h2)}-\frac{e^{i\,(-h1)}}{-i\,(2\,h1-2\,h2)\,(-h1+2\,h2)\,(2\,h2)}+\frac{e^{-i\,(-h1)}}{-i\,(2\,h1-2\,h2)\,(-h1+2\,h2)\,(2\,h2)}-\frac{e^{-i\,h1}}{-i\,(2\,h1-2\,h2)\,(h1)\,(2\,h2)}$;

In[∘]:= f[h1 - 2 h2, h1] // FullSimplify

Out[∘]= $\frac{-h1\,\mathrm{Sin}[h1]+2\,h2\,\mathrm{Sin}[h1]+h1\,\mathrm{Sin}[h1-2\,h2]}{2\,h1\,h2\,\left(h1^2-3\,h1\,h2+2\,h2^2\right)}$

In[∘]:= fff[h1, h2] // FullSimplify

Out[∘]= $\frac{\mathrm{Sin}[h1]}{h1^3-3\,h1^2\,h2+2\,h1\,h2^2}$

In[∘]:= (2 h1 - 2 h2) (-h1 + 2 h2) (2 h2) // Expand

Out[∘]= $-4\,h1^2\,h2+12\,h1\,h2^2-8\,h2^3$

In[∘]:= $\frac{e^{i\,h1}}{-i\,(2\,h1-2\,h2)\,(h1)\,(2\,h2)}-\frac{e^{i\,(-h1)}}{-i\,(2\,h1-2\,h2)\,(-h1+2\,h2)\,(2\,h2)}$ // Simplify

Out[∘]= $\frac{i\,e^{-i\,h1}\left(h1+e^{2\,i\,h1}\,h1-2\,e^{2\,i\,h1}\,h2\right)}{4\,h1\,(h1-2\,h2)\,(h1-h2)\,h2}$

In[∘]:= $-\frac{e^{i\,(-h1+2\,h2)}}{-i\,(2\,h1-2\,h2)\,(-h1+2\,h2)\,(2\,h2)}+\frac{e^{-i\,(-h1+2\,h2)}}{-i\,(2\,h1-2\,h2)\,(-h1+2\,h2)\,(2\,h2)}$ // FullSimplify

Out[∘]= $\frac{\mathrm{Sin}[h1-2\,h2]}{2\,h1^2\,h2-6\,h1\,h2^2+4\,h2^3}$

$\frac{-\mathrm{Sin}[2\,h2]}{4\;h2^3}$

In[∘]:= f[h1, h1 - 2 h2] // FullSimplify

Out[∘]= $\frac{-h1\,\mathrm{Sin}[h1]+2\,h2\,\mathrm{Sin}[h1]+h1\,\mathrm{Sin}[h1-2\,h2]}{2\,h1\,h2\,\left(h1^2-3\,h1\,h2+2\,h2^2\right)}$

In[∘]:= D[-h1 Sin[h1] + h1 Sin[h1 - 2 h2], h2] // FullSimplify

Out[∘]= -2 h1 Cos[h1 - 2 h2]

In[∘]:= D[2 h1 h2 $\left(h1^2-3\,h1\,h2+2\,h2^2\right)$, h2] // FullSimplify

Out[∘]= $2\,h1\,\left(h1^2-6\,h1\,h2+6\,h2^2\right)$

In[∘]:= $\frac{-2\,h1\,\mathrm{Cos}[h1-2\,h2]+2\,\mathrm{Sin}[h1]}{2\,h1\,\left(h1^2-6\,h1\,h2+6\,h2^2\right)}$ // Simplify

In[∘]:= g[h1_, h2_] := $\frac{-h1\,\mathrm{Sin}[h1]+h1\,\mathrm{Sin}[h1-2\,h2]}{2\,h1\,h2\,\left(h1^2-3\,h1\,h2+2\,h2^2\right)}$;

In[∘]:= `g[1, h2]`

Out[∘]= $$\frac{-\text{Sin}[1]+\text{Sin}[1-2\,\text{h2}]}{2\,\text{h2}\,\left(1-3\,\text{h2}+2\,\text{h2}^2\right)}$$

```
(* Use L'Hopotial rule to approximate λ1 measure restriction to h1 *)
```

In[∘]:= $$\text{measure0}[\text{h2\_},\text{x2\_},\text{y2\_}]:=-\frac{\text{Cos}\left[\sqrt{\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}\right]\,\text{Sin}\left[\sqrt{\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}\right]}{\left(2\left(\sqrt{\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}\right)^3\right)};$$

```
h2 D[measure0[h2, x2, y2], h2] +
  x2 D[measure0[h2, x2, y2], x2] + y2 D[measure0[h2, x2, y2], y2] // Simplify
```

Out[∘]= $$-\frac{\text{Cos}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{2\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}+\frac{3\,\text{Sin}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{4\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)^{3/2}}$$

In[∘]:= $$\text{measure1}[\text{h2\_},\text{x2\_},\text{y2\_}]:=-\frac{\text{Cos}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{2\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}+\frac{3\,\text{Sin}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{4\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)^{3/2}};$$

In[∘]:=
```
h2 D[measure1[h2, x2, y2], h2] +
  x2 D[measure1[h2, x2, y2], x2] + y2 D[measure1[h2, x2, y2], y2] // Simplify
```

Out[∘]= $$\frac{5\,\text{Cos}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{2\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}+\frac{\left(-9+4\,\text{h2}^2+4\,\text{x2}^2+4\,\text{y2}^2\right)\,\text{Sin}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{4\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)^{3/2}}$$

In[∘]:= $$\text{measure2}[\text{h2\_},\text{x2\_},\text{y2\_}]:=\frac{5\,\text{Cos}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{2\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}+\frac{\left(-9+4\,\text{h2}^2+4\,\text{x2}^2+4\,\text{y2}^2\right)\,\text{Sin}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{4\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)^{3/2}};$$

In[∘]:=
```
h2 D[measure2[h2, x2, y2], h2] +
  x2 D[measure2[h2, x2, y2], x2] + y2 D[measure2[h2, x2, y2], y2] // Simplify
```

Out[∘]= $$\frac{\left(-19+4\,\text{h2}^2+4\,\text{x2}^2+4\,\text{y2}^2\right)\,\text{Cos}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{2\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}-\frac{3\times\left(-9+8\,\text{h2}^2+8\,\text{x2}^2+8\,\text{y2}^2\right)\,\text{Sin}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{4\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)^{3/2}}$$

In[∘]:= $$\text{measure3}[\text{h2\_},\text{x2\_},\text{y2\_}]:=\frac{\left(-19+4\,\text{h2}^2+4\,\text{x2}^2+4\,\text{y2}^2\right)\,\text{Cos}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{2\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)}-\frac{3\times\left(-9+8\,\text{h2}^2+8\,\text{x2}^2+8\,\text{y2}^2\right)\,\text{Sin}\left[2\,\sqrt{\text{h2}^2+\text{x2}^2+\text{y2}^2}\right]}{4\left(\text{h2}^2+\text{x2}^2+\text{y2}^2\right)^{3/2}};$$

In[∘]:=
```
h2 D[measure3[h2, x2, y2], h2] +
  x2 D[measure3[h2, x2, y2], x2] + y2 D[measure3[h2, x2, y2], y2] // Simplify
```

Out[∘]=
$$-\frac{\left(-65+24\,h2^2+24\,x2^2+24\,y2^2\right)\mathrm{Cos}\left[2\sqrt{h2^2+x2^2+y2^2}\right]}{2\left(h2^2+x2^2+y2^2\right)}-\frac{1}{4\left(h2^2+x2^2+y2^2\right)^{3/2}}\left(81+16\,h2^4+16\,x2^4-100\,y2^2+16\,y2^4+4\,x2^2\left(-25+8\,y2^2\right)+4\,h2^2\left(-25+8\,x2^2+8\,y2^2\right)\right)\mathrm{Sin}\left[2\sqrt{h2^2+x2^2+y2^2}\right]$$

In[∘]:= measure4[h2_, x2_, y2_] :=

$$-\frac{\left(-65+24\,h2^2+24\,x2^2+24\,y2^2\right)\mathrm{Cos}\left[2\sqrt{h2^2+x2^2+y2^2}\right]}{2\left(h2^2+x2^2+y2^2\right)}-\frac{1}{4\left(h2^2+x2^2+y2^2\right)^{3/2}}\left(81+16\,h2^4+16\,x2^4-100\,y2^2+16\,y2^4+4\,x2^2\left(-25+8\,y2^2\right)+4\,h2^2\left(-25+8\,x2^2+8\,y2^2\right)\right)\mathrm{Sin}\left[2\sqrt{h2^2+x2^2+y2^2}\right];$$

In[∘]:=
```
A // Expand
```

In[∘]:=
```
A[[2, 2]] // Expand
```

Out[∘]=
$$24+50\,d\gamma+35\,d\gamma^2+10\,d\gamma^3+d\gamma^4+48\,i\,h2+52\,i\,d\gamma\,h2+18\,i\,d\gamma^2\,h2+2\,i\,d\gamma^3\,h2+24\,x2^2+14\,d\gamma\,x2^2+2\,d\gamma^2\,x2^2+24\,y2^2+14\,d\gamma\,y2^2+2\,d\gamma^2\,y2^2$$

In[∘]:=
```
24 measure0[h2, x2, y2] + 50 measure1[h2, x2, y2] + 35 measure2[h2, x2, y2] +
  10 measure3[h2, x2, y2] + measure4[h2, x2, y2] + 48 i h2 measure0[h2, x2, y2] +
  52 i h2 measure1[h2, x2, y2] + 18 i h2 measure2[h2, x2, y2] +
  2 i h2 measure3[h2, x2, y2] + 24 x2^2 measure0[h2, x2, y2] +
  14 x2^2 measure1[h2, x2, y2] + 2 x2^2 measure2[h2, x2, y2] + 24 y2^2 measure0[h2, x2, y2] +
  14 y2^2 measure1[h2, x2, y2] + 2 y2^2 measure2[h2, x2, y2] // FullSimplify
```

In[∘]:=
$$\frac{1}{h2^2+x2^2+y2^2}\,2\times\left(3\left(x2^2+y2^2\right)+2\,i\,h2\left(h2\,(-2\,i+h2)+x2^2+y2^2\right)\right)\left(\mathrm{Cos}\left[\sqrt{h2^2+x2^2+y2^2}\right]^2-\mathrm{Sin}\left[\sqrt{h2^2+x2^2+y2^2}\right]^2\right)-\frac{1}{\sqrt{h2^2+x2^2+y2^2}}\,2\left(h2\,(-3\,i+2\,h2)+x2^2+y2^2\right)\left(\mathrm{Sin}\left[\sqrt{h2^2+x2^2+y2^2}\right]\mathrm{Cos}\left[\sqrt{h2^2+x2^2+y2^2}\right]-\mathrm{Cos}\left[\sqrt{h2^2+x2^2+y2^2}\right]\mathrm{Sin}\left[\sqrt{h2^2+x2^2+y2^2}\right]\right)$$

Out[∘]=
$$\frac{1}{h2^2+x2^2+y2^2}\,2\times\left(3\left(x2^2+y2^2\right)+2\,i\,h2\left(h2\,(-2\,i+h2)+x2^2+y2^2\right)\right)\left(\mathrm{Cos}\left[\sqrt{h2^2+x2^2+y2^2}\right]^2-\mathrm{Sin}\left[\sqrt{h2^2+x2^2+y2^2}\right]^2\right)$$

In[]:=
$$\text{t1}[\text{h2\_}, \text{x2\_}, \text{y2\_}] := \frac{1}{\text{h2}^2 + \text{x2}^2 + \text{y2}^2} 2 \times \left(3 \left(\text{x2}^2 + \text{y2}^2\right) + 2\, i\, \text{h2} \left(\text{h2} (-2\, i + \text{h2}) + \text{x2}^2 + \text{y2}^2\right)\right) \left(\text{Cos}\left[\sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2}\right]^2 - \text{Sin}\left[\sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2}\right]^2\right);$$

$$\text{t2}[\text{h2\_}, \text{x2\_}, \text{y2\_}] := \left(\text{Cos}\left[\sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2}\right] + i\, \text{h2} \frac{\text{Sin}\left[\sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2}\right]}{\sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2}}\right)^2;$$

In[]:= t1[1, 1, 1] // N

Out[]= $-6.32295 - 3.79377\, i$

In[]:= t2[1, 1, 1] // N

Out[]= $-0.298962 - 0.18299\, i$

In[]:=
$$\text{temp3}[\text{h2\_}, \text{x2\_}, \text{y2\_}] := \frac{1}{\text{h2}^2 + \text{x2}^2 + \text{y2}^2} 2 \left(\text{x2}^2 + \text{y2}^2 + \left(3 \left(\text{x2}^2 + \text{y2}^2\right) + 2\, i\, \text{h2} \left(\text{h2} (-2\, i + \text{h2}) + \text{x2}^2 + \text{y2}^2\right)\right) \text{Cos}\left[2 \sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2}\right] - \sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2} \left(\text{h2} (-3\, i + 2\, \text{h2}) + \text{x2}^2 + \text{y2}^2\right) \text{Sin}\left[2 \sqrt{\text{h2}^2 + \text{x2}^2 + \text{y2}^2}\right]\right);$$

In[]:= temp3[h2, 0, 0] // Simplify

Out[]=
$$(8 + 4\, i\, \text{h2})\, \text{Cos}\left[2 \sqrt{\text{h2}^2}\right] + \frac{2 \times (3\, i - 2\, \text{h2}) \sqrt{\text{h2}^2}\, \text{Sin}\left[2 \sqrt{\text{h2}^2}\right]}{\text{h2}}$$

In[]:= A⟦1, 1⟧ // Expand

Out[]=
$$24 + 50\, d\gamma + 35\, d\gamma^2 + 10\, d\gamma^3 + d\gamma^4 + 24\, i\, \text{h1} + 26\, i\, d\gamma\, \text{h1} + 9\, i\, d\gamma^2\, \text{h1} + i\, d\gamma^3\, \text{h1} + 12\, \text{h1}^2 + 7\, d\gamma\, \text{h1}^2 + d\gamma^2\, \text{h1}^2 + 4\, i\, \text{h1}^3 + i\, d\gamma\, \text{h1}^3 + 12\, \text{x1}^2 + 7\, d\gamma\, \text{x1}^2 + d\gamma^2\, \text{x1}^2 + 4\, i\, \text{h1}\, \text{x1}^2 + i\, d\gamma\, \text{h1}\, \text{x1}^2 + 12\, \text{y1}^2 + 7\, d\gamma\, \text{y1}^2 + d\gamma^2\, \text{y1}^2 + 4\, i\, \text{h1}\, \text{y1}^2 + i\, d\gamma\, \text{h1}\, \text{y1}^2$$

In[]:=
$$\text{measure00}[\text{h1\_}, \text{x1\_}, \text{y1\_}] := \frac{\text{Sin}\left[\sqrt{\text{h1}^2 + \text{x1}^2 + \text{y1}^2}\right]}{\left(\sqrt{\text{h1}^2 + \text{x1}^2 + \text{y1}^2}\right)^3};$$

In[]:= h1 D[measure00[h1, x1, y1], h1] +
 x1 D[measure00[h1, x1, y1], x1] + y1 D[measure00[h1, x1, y1], y1] // Simplify

Out[]=
$$\frac{\text{Cos}\left[\sqrt{\text{h1}^2 + \text{x1}^2 + \text{y1}^2}\right]}{\text{h1}^2 + \text{x1}^2 + \text{y1}^2} - \frac{3\, \text{Sin}\left[\sqrt{\text{h1}^2 + \text{x1}^2 + \text{y1}^2}\right]}{\left(\text{h1}^2 + \text{x1}^2 + \text{y1}^2\right)^{3/2}}$$

In[]:=
$$\text{measure11}[\text{h1\_}, \text{x1\_}, \text{y1\_}] := \frac{\text{Cos}\left[\sqrt{\text{h1}^2 + \text{x1}^2 + \text{y1}^2}\right]}{\text{h1}^2 + \text{x1}^2 + \text{y1}^2} - \frac{3\, \text{Sin}\left[\sqrt{\text{h1}^2 + \text{x1}^2 + \text{y1}^2}\right]}{\left(\text{h1}^2 + \text{x1}^2 + \text{y1}^2\right)^{3/2}};$$

In[∘]:=
```
h1 D[measure11[h1, x1, y1], h1] +
  x1 D[measure11[h1, x1, y1], x1] + y1 D[measure11[h1, x1, y1], y1] // Simplify
```

Out[∘]=
$$-\frac{5\,\mathrm{Cos}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{h1^2+x1^2+y1^2}-\frac{\left(-9+h1^2+x1^2+y1^2\right)\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{\left(h1^2+x1^2+y1^2\right)^{3/2}}$$

In[∘]:= measure22[h1_, x1_, y1_] :=
$$-\frac{5\,\mathrm{Cos}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{h1^2+x1^2+y1^2}-\frac{\left(-9+h1^2+x1^2+y1^2\right)\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{\left(h1^2+x1^2+y1^2\right)^{3/2}};$$

In[∘]:=
```
h1 D[measure22[h1, x1, y1], h1] +
  x1 D[measure22[h1, x1, y1], x1] + y1 D[measure22[h1, x1, y1], y1] // Simplify
```

Out[∘]=
$$-\frac{\left(-19+h1^2+x1^2+y1^2\right)\,\mathrm{Cos}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{h1^2+x1^2+y1^2}+\frac{3\times\left(-9+2\,h1^2+2\,x1^2+2\,y1^2\right)\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{\left(h1^2+x1^2+y1^2\right)^{3/2}}$$

In[∘]:= measure33[h1_, x1_, y1_] :=
$$-\frac{\left(-19+h1^2+x1^2+y1^2\right)\,\mathrm{Cos}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{h1^2+x1^2+y1^2}+\frac{3\times\left(-9+2\,h1^2+2\,x1^2+2\,y1^2\right)\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{\left(h1^2+x1^2+y1^2\right)^{3/2}};$$

In[∘]:=
```
h1 D[measure33[h1, x1, y1], h1] +
  x1 D[measure33[h1, x1, y1], x1] + y1 D[measure33[h1, x1, y1], y1] // Simplify
```

Out[∘]=
$$\frac{\left(-65+6\,h1^2+6\,x1^2+6\,y1^2\right)\,\mathrm{Cos}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{h1^2+x1^2+y1^2}+\frac{\left(81+h1^4+x1^4-25\,y1^2+y1^4+x1^2\,\left(-25+2\,y1^2\right)+h1^2\,\left(-25+2\,x1^2+2\,y1^2\right)\right)\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{\left(h1^2+x1^2+y1^2\right)^{3/2}}$$

In[∘]:= measure44[h1_, x1_, y1_] :=
$$\frac{\left(-65+6\,h1^2+6\,x1^2+6\,y1^2\right)\,\mathrm{Cos}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{h1^2+x1^2+y1^2}+\frac{1}{\left(h1^2+x1^2+y1^2\right)^{3/2}}\left(81+h1^4+x1^4-25\,y1^2+y1^4+x1^2\,\left(-25+2\,y1^2\right)+h1^2\,\left(-25+2\,x1^2+2\,y1^2\right)\right)\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right];$$

In[∘]:=
```
M1 // MatrixForm
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} i\,h1 & x1+i\,y1 & 0 & 0 & 0 \\ -x1+i\,y1 & -i\,h1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & i\,h1 & x1+i\,y1 \\ 0 & 0 & 0 & -x1+i\,y1 & -i\,h1 \end{pmatrix}$$

In[∘]:=
```
A[[1, 1]] // Expand
```

Out[∘]=
$$24+50\,d\gamma+35\,d\gamma^2+10\,d\gamma^3+d\gamma^4+24\,i\,h1+26\,i\,d\gamma\,h1+9\,i\,d\gamma^2\,h1+i\,d\gamma^3\,h1+12\,h1^2+7\,d\gamma\,h1^2+d\gamma^2\,h1^2+4\,i\,h1^3+i\,d\gamma\,h1^3+12\,x1^2+7\,d\gamma\,x1^2+d\gamma^2\,x1^2+4\,i\,h1\,x1^2+i\,d\gamma\,h1\,x1^2+12\,y1^2+7\,d\gamma\,y1^2+d\gamma^2\,y1^2+4\,i\,h1\,y1^2+i\,d\gamma\,h1\,y1^2$$

In[∘]:=
```
24 measure00[h1, x1, y1] + 50 measure11[h1, x1, y1] + 35 measure22[h1, x1, y1] +
  10 measure33[h1, x1, y1] + measure44[h1, x1, y1] + 24 i h1 measure00[h1, x1, y1] +
  26 i h1 measure11[h1, x1, y1] + 9 i h1 measure22[h1, x1, y1] +
  i h1 measure33[h1, x1, y1] + 12 h1^2 measure00[h1, x1, y1] + 7 h1^2 measure11[h1, x1, y1] +
  h1^2 measure22[h1, x1, y1] + 4 i h1^3 measure00[h1, x1, y1] + i h1^3 measure11[h1, x1, y1] +
  12 x1^2 measure00[h1, x1, y1] + 7 x1^2 measure11[h1, x1, y1] + x1^2 measure22[h1, x1, y1] +
  4 i h1 x1^2 measure00[h1, x1, y1] + i h1 x1^2 measure11[h1, x1, y1] +
  12 y1^2 measure00[h1, x1, y1] + 7 y1^2 measure11[h1, x1, y1] + y1^2 measure22[h1, x1, y1] +
  4 i h1 y1^2 measure00[h1, x1, y1] + i h1 y1^2 measure11[h1, x1, y1] // Simplify
```

Out[∘]=
$$-2\,\mathrm{Cos}\left[\sqrt{h1^2+x1^2+y1^2}\right]-\frac{2\,i\,h1\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{\sqrt{h1^2+x1^2+y1^2}}$$

In[∘]:=
```
A[[1, 2]] // Expand
```

Out[∘]=
$$24\,x1+26\,d\gamma\,x1+9\,d\gamma^2\,x1+d\gamma^3\,x1+4\,h1^2\,x1+d\gamma\,h1^2\,x1+4\,x1^3+d\gamma\,x1^3+24\,i\,y1+26\,i\,d\gamma\,y1+9\,i\,d\gamma^2\,y1+i\,d\gamma^3\,y1+4\,i\,h1^2\,y1+i\,d\gamma\,h1^2\,y1+4\,i\,x1^2\,y1+i\,d\gamma\,x1^2\,y1+4\,x1\,y1^2+d\gamma\,x1\,y1^2+4\,i\,y1^3+i\,d\gamma\,y1^3$$

In[∘]:=
```
24 x1 measure00[h1, x1, y1] + 26 x1 measure11[h1, x1, y1] + 9 x1 measure22[h1, x1, y1] +
  x1 measure33[h1, x1, y1] + 4 h1^2 x1 measure00[h1, x1, y1] + h1^2 x1 measure11[h1, x1, y1] +
  4 x1^3 measure00[h1, x1, y1] + x1^3 measure11[h1, x1, y1] + 24 i y1 measure00[h1, x1, y1] +
  26 i y1 measure11[h1, x1, y1] + 9 i y1 measure22[h1, x1, y1] + i y1 measure33[h1, x1, y1] +
  4 i h1^2 y1 measure00[h1, x1, y1] + i h1^2 y1 measure11[h1, x1, y1] +
  4 i x1^2 y1 measure00[h1, x1, y1] + i x1^2 y1 measure11[h1, x1, y1] +
  4 x1 y1^2 measure00[h1, x1, y1] + x1 y1^2 measure11[h1, x1, y1] +
  4 i y1^3 measure00[h1, x1, y1] + i y1^3 measure11[h1, x1, y1] // Simplify
```

Out[∘]=
$$-\frac{2\,(x1+i\,y1)\,\mathrm{Sin}\left[\sqrt{h1^2+x1^2+y1^2}\right]}{\sqrt{h1^2+x1^2+y1^2}}$$

In[•]:=
```
adH1 = {{0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 2, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, -1, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 1, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, -2, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 1, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, -1, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}};

adX1 = {{0, 0, 0, 0, 0, 0, 1, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {-2, 2, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 1, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, -1, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}};

adY1 = {{0, 0, -1, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 1, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {2, -1, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, -1, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0}};
```

In[•]:=
```
adH1 // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0\\ 0&0&2&0&0&0&0&0&0&0\\ 0&0&0&-1&0&0&0&0&0&0\\ 0&0&0&0&1&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&-2&0&0&0\\ 0&0&0&0&0&0&0&1&0&0\\ 0&0&0&0&0&0&0&0&-1&0\\ 0&0&0&0&0&0&0&0&0&0 \end{pmatrix}$$

In[•]:=
```
adX1 // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 0&0&0&0&0&0&1&0&0&0\\ 0&0&0&0&0&0&0&0&0&0\\ -2&2&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0\\ 0&0&0&1&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&-1&0\\ 0&0&0&0&0&0&0&0&0&0\\ 0&0&0&0&0&0&0&0&0&0 \end{pmatrix}$$

In[]:=
```
adY1 // MatrixForm
```

Out[]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 2 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

In[]:=
```
T = h1 ⅈ adH1 + x1 (adX1 - adY1) + ⅈ y1 (adX1 + adY1);
```

In[]:=
```
Tr[T.T] // Simplify
```

Out[]= $-12 \left(h1^2 + x1^2 + y1^2\right)$