```
ρ := z1 + Z1 - z2 * Z2 - z3 * Z3 - g * z2^2 * Z3^2 - G * z3^2 * Z2^2
```

```
ρ
```

Out[•]= $z1 + Z1 - z2\ Z2 - G\ Z2^2\ z3^2 - z3\ Z3 - g\ z2^2\ Z3^2$

```
ρ2 := D[ρ, z2]
ρ20 := D[ρ, Z2]
ρ3 := D[ρ, z3]
ρ30 := D[ρ, Z3]
ρ22 := D[ρ, z2, Z2]
ρ22
```

Out[•]= -1

```
ρ23 := D[ρ, z2, Z3]
ρ23
```

Out[•]= $-4\ g\ z2\ Z3$

```
ρ33 := D[ρ, z3, Z3]
ρ32 := D[ρ, z3, Z2]
A := {{0, I, I * ρ20, I * ρ30}, {-I, 0, 0, 0},
  {-I * ρ2, 0, 4 * ρ22, 4 * ρ23}, {-I * ρ3, 0, 4 * ρ32, 4 * ρ33}}
MatrixForm[A]
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 0 & i & i\left(-z2-2\,G\,Z2\,z3^2\right) & i\left(-z3-2\,g\,z2^2\,Z3\right) \\ -i & 0 & 0 & 0 \\ -i\left(-Z2-2\,g\,z2\,Z3^2\right) & 0 & -4 & -16\,g\,z2\,Z3 \\ -i\left(-2\,G\,Z2^2\,z3-Z3\right) & 0 & -16\,G\,Z2\,z3 & -4 \end{pmatrix}$$

```
B := Inverse[A]
MatrixForm[B]
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 0 & \frac{-16\,i+256\,i\,g\,G\,z2\,Z2\,z3\,Z3}{-16+256\,g\,G\,z2\,Z2\,z3\,Z3} \\ \frac{16\,i-256\,i\,g\,G\,z2\,Z2\,z3\,Z3}{-16+256\,g\,G\,z2\,Z2\,z3\,Z3} & \frac{4\,z2\,Z2+4\,z3\,Z3-48\,g\,G\,z2^2\,Z2^2\,z3\,Z3-64\,g\,G^2\,z2\,Z2^3\,z3^3\,Z3-48\,g\,G\,z2\,Z2\,z3^2\,Z3^2-64\,g^2\,G\,z2^3\,Z2\,z3\,Z3^3}{-16+256\,g\,G\,z2\,Z2\,z3\,Z3} \\ 0 & \frac{4\,Z2-32\,g\,G\,z2\,Z2^2\,z3\,Z3-8\,g\,z2\,Z3^2}{-16+256\,g\,G\,z2\,Z2\,z3\,Z3} \\ 0 & \frac{-8\,G\,Z2^2\,z3+4\,Z3-32\,g\,G\,z2\,Z2\,z3\,Z3^2}{-16+256\,g\,G\,z2\,Z2\,z3\,Z3} \end{pmatrix}$$

```
L := {{0, I, 0, 0},
  {-I, -(z2 * Z2 + z3 * Z3) / 4, -(z2 - 2 * G * Z2 * z3^2) / 4, -(z3 - 2 * g * z2^2 * Z3) / 4},
  {0, -(Z2 - 2 * g * z2 * Z3^2) / 4, -1 / 4, g * z2 * Z3},
  {0, -(Z3 - 2 * G * Z2^2 * z3) / 4, G * Z2 * z3, -1 / 4}}
```

In[•]:= MatrixForm[L]

Out[•]//MatrixForm=

$$\begin{pmatrix} 0 & i & 0 & 0 \\ -i & \frac{1}{4}\left(-z2\ Z2 - z3\ Z3\right) & \frac{1}{4}\left(-z2 + 2\ G\ Z2\ z3^2\right) & \frac{1}{4}\left(-z3 + 2\ g\ z2^2\ Z3\right) \\ 0 & \frac{1}{4}\left(-Z2 + 2\ g\ z2\ Z3^2\right) & -\frac{1}{4} & g\ z2\ Z3 \\ 0 & \frac{1}{4}\left(2\ G\ Z2^2\ z3 - Z3\right) & G\ Z2\ z3 & -\frac{1}{4} \end{pmatrix}$$

In[•]:= q := {p0, I * p1, p2, p3}

In[•]:= Q := {p0, -I * p1, P2, P3}

In[•]:= q.L.Q

Out[•]= $p0\ p1 + P2\left(-\frac{p2}{4} + G\ p3\ Z2\ z3 + \frac{1}{4}\ i\ p1\left(-z2 + 2\ G\ Z2\ z3^2\right)\right) +$
$P3\left(-\frac{p3}{4} + g\ p2\ z2\ Z3 + \frac{1}{4}\ i\ p1\left(-z3 + 2\ g\ z2^2\ Z3\right)\right) -$
$i\ p1\left(i\ p0 + \frac{1}{4}\ p3\left(2\ G\ Z2^2\ z3 - Z3\right) + \frac{1}{4}\ i\ p1\left(-z2\ Z2 - z3\ Z3\right) + \frac{1}{4}\ p2\left(-Z2 + 2\ g\ z2\ Z3^2\right)\right)$

In[•]:= Simplify[p0 p1 + P2 $\left(-\frac{p2}{4} + G\ p3\ Z2\ z3 + \frac{1}{4}\ i\ p1\left(-z2 + 2\ G\ Z2\ z3^2\right)\right)$ +
P3 $\left(-\frac{p3}{4} + g\ p2\ z2\ Z3 + \frac{1}{4}\ i\ p1\left(-z3 + 2\ g\ z2^2\ Z3\right)\right)$ -
$i\ p1\left(i\ p0 + \frac{1}{4}\ p3\left(2\ G\ Z2^2\ z3 - Z3\right) + \frac{1}{4}\ i\ p1\left(-z2\ Z2 - z3\ Z3\right) + \frac{1}{4}\ p2\left(-Z2 + 2\ g\ z2\ Z3^2\right)\right)$]

Out[•]= $2\ p0\ p1 - \frac{1}{4}\ i\ \left(p3\left(-i\ P3 + 2\ G\ Z2\left(2\ i\ P2 + p1\ Z2\right)\ z3 - p1\ Z3\right) +\right.$
$p2\left(-i\ P2 - p1\ Z2 + 4\ i\ g\ P3\ z2\ Z3 + 2\ g\ p1\ z2\ Z3^2\right) +$
$\left.p1\left(P2\left(z2 - 2\ G\ Z2\ z3^2\right) + P3\left(z3 - 2\ g\ z2^2\ Z3\right) - i\ p1\left(z2\ Z2 + z3\ Z3\right)\right)\right)$

In[•]:= Expand[2 p0 p1 - $\frac{1}{4}$ i (p3 (-i P3 + 2 G Z2 (2 i P2 + p1 Z2) z3 - p1 Z3) +
p2 (-i P2 - p1 Z2 + 4 i g P3 z2 Z3 + 2 g p1 z2 Z3^2) +
p1 (P2 (z2 - 2 G Z2 z3^2) + P3 (z3 - 2 g z2^2 Z3) - i p1 (z2 Z2 + z3 Z3)))]

Out[•]= $2\ p0\ p1 - \frac{p2\ P2}{4} - \frac{p3\ P3}{4} - \frac{1}{4}\ i\ p1\ P2\ z2 + \frac{1}{4}\ i\ p1\ p2\ Z2 - \frac{1}{4}\ p1^2\ z2\ Z2 -$
$\frac{1}{4}\ i\ p1\ P3\ z3 + G\ P2\ p3\ Z2\ z3 - \frac{1}{2}\ i\ G\ p1\ p3\ Z2^2\ z3 + \frac{1}{2}\ i\ G\ p1\ P2\ Z2\ z3^2 +$
$\frac{1}{4}\ i\ p1\ p3\ Z3 + g\ p2\ P3\ z2\ Z3 + \frac{1}{2}\ i\ g\ p1\ P3\ z2^2\ Z3 - \frac{1}{4}\ p1^2\ z3\ Z3 - \frac{1}{2}\ i\ g\ p1\ p2\ z2\ Z3^2$

In[•]:= H := 2 p0 p1 - $\frac{p2\ P2}{4}$ - $\frac{p3\ P3}{4}$ - $\frac{1}{4}$ i p1 P2 z2 + $\frac{1}{4}$ i p1 p2 Z2 - $\frac{1}{4}$ p1^2 z2 Z2 -
$\frac{1}{4}$ i p1 P3 z3 + G P2 p3 Z2 z3 - $\frac{1}{2}$ i G p1 p3 Z2^2 z3 + $\frac{1}{2}$ i G p1 P2 Z2 z3^2 +
$\frac{1}{4}$ i p1 p3 Z3 + g p2 P3 z2 Z3 + $\frac{1}{2}$ i g p1 P3 z2^2 Z3 - $\frac{1}{4}$ p1^2 z3 Z3 - $\frac{1}{2}$ i g p1 p2 z2 Z3^2

In[•]:= **Collect[H, p1 * P2]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 - \frac{1}{4}\,i\,p1\,P3\,z3 +$
$G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + p1\,P2\left(-\frac{i\,z2}{4} + \frac{1}{2}\,i\,G\,Z2\,z3^2\right) + \frac{1}{4}\,i\,p1\,p3\,Z3 +$
$g\,p2\,P3\,z2\,Z3 + \frac{1}{2}\,i\,g\,p1\,P3\,z2^2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2$

In[•]:= **H**

In[•]:= **ClearAll[H]**

In[•]:= **H := 2 p0 p1 - p2 P2/4 - p3 P3/4 - 1/4 i p1 P2 z2 + 1/4 i p1 p2 Z2 - 1/4 p1^2 z2 Z2 -**
1/4 i p1 P3 z3 + G P2 p3 Z2 z3 - 1/2 i G p1 p3 Z2^2 z3 + 1/2 i G p1 P2 Z2 z3^2 +
1/4 i p1 p3 Z3 + g p2 P3 z2 Z3 + 1/2 i g p1 P3 z2^2 Z3 - 1/4 p1^2 z3 Z3 - 1/2 i g p1 p2 z2 Z3^2

In[•]:= **H**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} - \frac{1}{4}\,i\,p1\,P2\,z2 + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 -$
$\frac{1}{4}\,i\,p1\,P3\,z3 + G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + \frac{1}{2}\,i\,G\,p1\,P2\,Z2\,z3^2 +$
$\frac{1}{2}\,i\,G\,p1\,P3\,Z2\,z3^2 + \frac{1}{4}\,i\,p1\,p3\,Z3 + g\,p2\,P3\,z2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2$

In[•]:= **Collect[H, p1 * P2]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 - \frac{1}{4}\,i\,p1\,P3\,z3 +$
$G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + p1\,P2\left(-\frac{i\,z2}{4} + \frac{1}{2}\,i\,G\,Z2\,z3^2\right) + \frac{1}{4}\,i\,p1\,p3\,Z3 +$
$g\,p2\,P3\,z2\,Z3 + \frac{1}{2}\,i\,g\,p1\,P3\,z2^2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2$

In[•]:= **Collect[H, p1 * P3]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} - \frac{1}{4}\,i\,p1\,P2\,z2 + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 +$
$G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + \frac{1}{2}\,i\,G\,p1\,P2\,Z2\,z3^2 + \frac{1}{4}\,i\,p1\,p3\,Z3 +$
$g\,p2\,P3\,z2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2 + p1\,P3\left(-\frac{i\,z3}{4} + \frac{1}{2}\,i\,g\,z2^2\,Z3\right)$

In[•]:= **Collect[H, p2 * P2]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} - \frac{1}{4}\,i\,p1\,P2\,z2 + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 -$
$\frac{1}{4}\,i\,p1\,P3\,z3 + G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + \frac{1}{2}\,i\,G\,p1\,P2\,Z2\,z3^2 +$
$\frac{1}{4}\,i\,p1\,p3\,Z3 + g\,p2\,P3\,z2\,Z3 + \frac{1}{2}\,i\,g\,p1\,P3\,z2^2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2$

In[•]:= **Collect[H, p2 * P3]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} - \frac{1}{4}\,i\,p1\,P2\,z2 + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 -$
$\frac{1}{4}\,i\,p1\,P3\,z3 + G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + \frac{1}{2}\,i\,G\,p1\,P2\,Z2\,z3^2 +$
$\frac{1}{4}\,i\,p1\,p3\,Z3 + g\,p2\,P3\,z2\,Z3 + \frac{1}{2}\,i\,g\,p1\,P3\,z2^2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2$

In[•]:= **Collect[H, p1 * p2]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} - \frac{1}{4}\,i\,p1\,P2\,z2 - \frac{1}{4}\,p1^2\,z2\,Z2 - \frac{1}{4}\,i\,p1\,P3\,z3 +$
$G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + \frac{1}{2}\,i\,G\,p1\,P2\,Z2\,z3^2 + \frac{1}{4}\,i\,p1\,p3\,Z3 +$
$g\,p2\,P3\,z2\,Z3 + \frac{1}{2}\,i\,g\,p1\,P3\,z2^2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 + p1\,p2\left(\frac{i\,Z2}{4} - \frac{1}{2}\,i\,g\,z2\,Z3^2\right)$

In[•]:= **Collect[H, p1 * p3]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} - \frac{1}{4}\,i\,p1\,P2\,z2 + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 -$
$\frac{1}{4}\,i\,p1\,P3\,z3 + G\,P2\,p3\,Z2\,z3 + \frac{1}{2}\,i\,G\,p1\,P2\,Z2\,z3^2 + p1\,p3\left(-\frac{1}{2}\,i\,G\,Z2^2\,z3 + \frac{i\,Z3}{4}\right) +$
$g\,p2\,P3\,z2\,Z3 + \frac{1}{2}\,i\,g\,p1\,P3\,z2^2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2$

In[•]:= **Collect[H, P2 * p3]**

Out[•]= $2\,p0\,p1 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} - \frac{1}{4}\,i\,p1\,P2\,z2 + \frac{1}{4}\,i\,p1\,p2\,Z2 - \frac{1}{4}\,p1^2\,z2\,Z2 -$
$\frac{1}{4}\,i\,p1\,P3\,z3 + G\,P2\,p3\,Z2\,z3 - \frac{1}{2}\,i\,G\,p1\,p3\,Z2^2\,z3 + \frac{1}{2}\,i\,G\,p1\,P2\,Z2\,z3^2 +$
$\frac{1}{4}\,i\,p1\,p3\,Z3 + g\,p2\,P3\,z2\,Z3 + \frac{1}{2}\,i\,g\,p1\,P3\,z2^2\,Z3 - \frac{1}{4}\,p1^2\,z3\,Z3 - \frac{1}{2}\,i\,g\,p1\,p2\,z2\,Z3^2$

In[•]:= **dz2 := 2 * D[H, P2]**

In[•]:= **dz2**

Out[•]= $2\left(-\frac{p2}{4} - \frac{i\,p1\,z2}{4} + G\,p3\,Z2\,z3 + \frac{1}{2}\,i\,G\,p1\,Z2\,z3^2\right)$

In[•]:= **Expand[2 (- p2/4 - i p1 z2/4 + G p3 Z2 z3 + 1/2 i G p1 Z2 z3^2)]**

Out[•]= $-\frac{p2}{2}-\frac{i\ p1\ z2}{2}+2\ G\ p3\ Z2\ z3+i\ G\ p1\ Z2\ z3^2$

In[•]:= **Collect[%, p1]**

Out[•]= $-\frac{p2}{2}+2\ G\ p3\ Z2\ z3+p1\ \left(-\frac{i\ z2}{2}+i\ G\ Z2\ z3^2\right)$

In[•]:= **dp2 := -2 * D[H, Z2]**

In[•]:= **dp2**

Out[•]= $-2\ \left(\frac{i\ p1\ p2}{4}-\frac{p1^2\ z2}{4}+G\ P2\ p3\ z3-i\ G\ p1\ p3\ Z2\ z3+\frac{1}{2}\ i\ G\ p1\ P2\ z3^2\right)$

In[•]:= **Expand[-2 (i p1 p2/4 - p1^2 z2/4 + G P2 p3 z3 - i G p1 p3 Z2 z3 + 1/2 i G p1 P2 z3^2)]**

Out[•]= $-\frac{1}{2}\ i\ p1\ p2+\frac{p1^2\ z2}{2}-2\ G\ P2\ p3\ z3+2\ i\ G\ p1\ p3\ Z2\ z3-i\ G\ p1\ P2\ z3^2$

In[•]:= **dz3 := 2 * D[H, P3]**

In[•]:= **dz3**

Out[•]= $2\ \left(-\frac{p3}{4}-\frac{i\ p1\ z3}{4}+g\ p2\ z2\ Z3+\frac{1}{2}\ i\ g\ p1\ z2^2\ Z3\right)$

In[•]:= **Expand[2 (- p3/4 - i p1 z3/4 + g p2 z2 Z3 + 1/2 i g p1 z2^2 Z3)]**

Out[•]= $-\frac{p3}{2}-\frac{i\ p1\ z3}{2}+2\ g\ p2\ z2\ Z3+i\ g\ p1\ z2^2\ Z3$

In[•]:= **Collect[%, p1]**

Out[•]= $-\frac{p3}{2}+2\ g\ p2\ z2\ Z3+p1\ \left(-\frac{i\ z3}{2}+i\ g\ z2^2\ Z3\right)$

In[•]:= **dp3 := -2 * D[H, Z3]**

In[•]:= **dp3**

Out[•]= $-2\ \left(\frac{i\ p1\ p3}{4}+g\ p2\ P3\ z2+\frac{1}{2}\ i\ g\ p1\ P3\ z2^2-\frac{p1^2\ z3}{4}-i\ g\ p1\ p2\ z2\ Z3\right)$

In[•]:= **Expand[-2 (i p1 p3/4 + g p2 P3 z2 + 1/2 i g p1 P3 z2^2 - p1^2 z3/4 - i g p1 p2 z2 Z3)]**

Out[•]= $-\frac{1}{2}\ i\ p1\ p3-2\ g\ p2\ P3\ z2-i\ g\ p1\ P3\ z2^2+\frac{p1^2\ z3}{2}+2\ i\ g\ p1\ p2\ z2\ Z3$

In[•]:= **z2st := s * Exp[I * t] + s^3 * v2**

In[•]:= **z2st**

Out[•]= $e^{i\,t}\,s + s^3\,v2$

In[•]:= **p2st := s * w21 + s^3 * w23**

In[•]:= **p2st**

Out[•]= $s\,w21 + s^3\,w23$

In[•]:= **p1 := -1**

In[•]:= **H**

Out[•]= $-2\,p0 - \frac{p2\,P2}{4} - \frac{p3\,P3}{4} + \frac{i\,P2\,z2}{4} - \frac{i\,p2\,Z2}{4} - \frac{z2\,Z2}{4} + \frac{i\,P3\,z3}{4} + G\,P2\,p3\,Z2\,z3 + \frac{1}{2}\,i\,G\,p3\,Z2^2\,z3 -$
$\frac{1}{2}\,i\,G\,P2\,Z2\,z3^2 - \frac{i\,p3\,Z3}{4} + g\,p2\,P3\,z2\,Z3 - \frac{1}{2}\,i\,g\,P3\,z2^2\,Z3 - \frac{z3\,Z3}{4} + \frac{1}{2}\,i\,g\,p2\,z2\,Z3^2$

In[•]:= **dz2 /. {z2 → z2st, Z2 → s * Exp[-I * t] + s^3 * V2, p2 → p2st, P2 → s * W21 + s^3 * W23}**

Out[•]= $2\left(\frac{1}{4}\,i\left(e^{i\,t}\,s + s^3\,v2\right) + \frac{1}{4}\left(-s\,w21 - s^3\,w23\right) + G\,p3\left(e^{-i\,t}\,s + s^3\,V2\right)\,z3 - \frac{1}{2}\,i\,G\left(e^{-i\,t}\,s + s^3\,V2\right)\,z3^2\right)$

In[•]:= **Expand[2 ((1/4) i (e^(i t) s + s^3 v2) + (1/4) (-s w21 - s^3 w23) + G p3 (e^(-i t) s + s^3 V2) z3 - (1/2) i G (e^(-i t) s + s^3 V2) z3^2)]**

Out[•]= $\frac{1}{2}\,i\,e^{i\,t}\,s + \frac{1}{2}\,i\,s^3\,v2 - \frac{s\,w21}{2} - \frac{s^3\,w23}{2} +$
$2\,e^{-i\,t}\,G\,p3\,s\,z3 + 2\,G\,p3\,s^3\,V2\,z3 - i\,e^{-i\,t}\,G\,s\,z3^2 - i\,G\,s^3\,V2\,z3^2$

In[•]:= **Collect[%, s]**

Out[•]= $s\left(\frac{1}{2}\,i\,e^{i\,t} - \frac{w21}{2} + 2\,e^{-i\,t}\,G\,p3\,z3 - i\,e^{-i\,t}\,G\,z3^2\right) + s^3\left(\frac{i\,v2}{2} - \frac{w23}{2} + 2\,G\,p3\,V2\,z3 - i\,G\,V2\,z3^2\right)$

In[•]:= **z3st := c * s + s^3 * v3**

In[•]:= **p3st := s * w31 + s^3 * w33**

In[•]:= **dz2 /. {z2 → z2st, Z2 → s * Exp[-I * t] + s^3 * V2,**
p2 → p2st, P2 → s * W21 + s^3 * W23, z3 → z3st,
Z3 → k * s + s^3 * V3, p3 → p3st, P3 → s * W31 + s^3 * W33}

Out[•]= $2\left(\frac{1}{4}\,i\left(e^{i\,t}\,s + s^3\,v2\right) - \frac{1}{2}\,i\,G\left(e^{-i\,t}\,s + s^3\,V2\right)\left(c\,s + s^3\,v3\right)^2 +$
$\frac{1}{4}\left(-s\,w21 - s^3\,w23\right) + G\left(e^{-i\,t}\,s + s^3\,V2\right)\left(c\,s + s^3\,v3\right)\left(s\,w31 + s^3\,w33\right)\right)$

In[•]:=
```
Expand[2 ((1/4) i (e^(i t) s + s^3 v2) - (1/2) i G (e^(-i t) s + s^3 V2) (c s + s^3 v3)^2 +
    (1/4) (-s w21 - s^3 w23) + G (e^(-i t) s + s^3 V2) (c s + s^3 v3) (s w31 + s^3 w33))]
```

Out[•]=
$$\frac{1}{2} i e^{i t} s - i c^2 e^{-i t} G s^3 + \frac{1}{2} i s^3 v2 - i c^2 G s^5 V2 - 2 i c e^{-i t} G s^5 v3 -$$
$$2 i c G s^7 V2 v3 - i e^{-i t} G s^7 v3^2 - i G s^9 V2 v3^2 - \frac{s w21}{2} - \frac{s^3 w23}{2} +$$
$$2 c e^{-i t} G s^3 w31 + 2 c G s^5 V2 w31 + 2 e^{-i t} G s^5 v3 w31 + 2 G s^7 V2 v3 w31 +$$
$$2 c e^{-i t} G s^5 w33 + 2 c G s^7 V2 w33 + 2 e^{-i t} G s^7 v3 w33 + 2 G s^9 V2 v3 w33$$

In[•]:=
```
Collect[%, s]
```

Out[•]=
$$s \left(\frac{1}{2} i e^{i t} - \frac{w21}{2}\right) + s^3 \left(-i c^2 e^{-i t} G + \frac{i v2}{2} - \frac{w23}{2} + 2 c e^{-i t} G w31\right) +$$
$$s^5 \left(-i c^2 G V2 - 2 i c e^{-i t} G v3 + 2 c G V2 w31 + 2 e^{-i t} G v3 w31 + 2 c e^{-i t} G w33\right) +$$
$$s^7 \left(-2 i c G V2 v3 - i e^{-i t} G v3^2 + 2 G V2 v3 w31 + 2 c G V2 w33 + 2 e^{-i t} G v3 w33\right) +$$
$$s^9 \left(-i G V2 v3^2 + 2 G V2 v3 w33\right)$$

In[•]:=
```
dp2 /. {z2 → z2st, Z2 → s * Exp[-I * t] + s^3 * V2,
  p2 → p2st, P2 → s * W21 + s^3 * W23, z3 → z3st,
  Z3 → k * s + s^3 * V3, p3 → p3st, P3 → s * W31 + s^3 * W33}
```

Out[•]=
$$-2 \left(\frac{1}{4} \left(-e^{i t} s - s^3 v2\right) - \frac{1}{4} i \left(s w21 + s^3 w23\right) -\right.$$
$$\frac{1}{2} i G \left(c s + s^3 v3\right)^2 \left(s W21 + s^3 W23\right) + i G \left(e^{-i t} s + s^3 V2\right) \left(c s + s^3 v3\right) \left(s w31 + s^3 w33\right) +$$
$$\left. G \left(c s + s^3 v3\right) \left(s W21 + s^3 W23\right) \left(s w31 + s^3 w33\right)\right)$$

In[•]:=
```
Expand[-2 ((1/4) (-e^(i t) s - s^3 v2) - (1/4) i (s w21 + s^3 w23) -
    (1/2) i G (c s + s^3 v3)^2 (s W21 + s^3 W23) + i G (e^(-i t) s + s^3 V2) (c s + s^3 v3) (s w31 + s^3 w33) +
    G (c s + s^3 v3) (s W21 + s^3 W23) (s w31 + s^3 w33))]
```

Out[•]=
$$\frac{1}{2} e^{i t} s + \frac{s^3 v2}{2} + \frac{i s w21}{2} + i c^2 G s^3 W21 + 2 i c G s^5 v3 W21 + i G s^7 v3^2 W21 + \frac{1}{2} i s^3 w23 +$$
$$i c^2 G s^5 W23 + 2 i c G s^7 v3 W23 + i G s^9 v3^2 W23 - 2 i c e^{-i t} G s^3 w31 - 2 i c G s^5 V2 w31 -$$
$$2 i e^{-i t} G s^5 v3 w31 - 2 i G s^7 V2 v3 w31 - 2 c G s^3 W21 w31 - 2 G s^5 v3 W21 w31 - 2 c G s^5 W23 w31 -$$
$$2 G s^7 v3 W23 w31 - 2 i c e^{-i t} G s^5 w33 - 2 i c G s^7 V2 w33 - 2 i e^{-i t} G s^7 v3 w33 -$$
$$2 i G s^9 V2 v3 w33 - 2 c G s^5 W21 w33 - 2 G s^7 v3 W21 w33 - 2 c G s^7 W23 w33 - 2 G s^9 v3 W23 w33$$

In[•]:=
```
Collect[%, s]
```

Out[•]=
$$s\left(\frac{e^{i t}}{2}+\frac{i\, w21}{2}\right)+s^3\left(\frac{v2}{2}+i\, c^2\, G\, W21+\frac{i\, w23}{2}-2\, i\, c\, e^{-i t}\, G\, w31-2\, c\, G\, W21\, w31\right)+$$
$$s^5\left(2\, i\, c\, G\, v3\, W21+i\, c^2\, G\, W23-2\, i\, c\, G\, V2\, w31-2\, i\, e^{-i t}\, G\, v3\, w31-\right.$$
$$\left.2\, G\, v3\, W21\, w31-2\, c\, G\, W23\, w31-2\, i\, c\, e^{-i t}\, G\, w33-2\, c\, G\, W21\, w33\right)+$$
$$s^7\left(i\, G\, v3^2\, W21+2\, i\, c\, G\, v3\, W23-2\, i\, G\, V2\, v3\, w31-2\, G\, v3\, W23\, w31-\right.$$
$$\left.2\, i\, c\, G\, V2\, w33-2\, i\, e^{-i t}\, G\, v3\, w33-2\, G\, v3\, W21\, w33-2\, c\, G\, W23\, w33\right)+$$
$$s^9\left(i\, G\, v3^2\, W23-2\, i\, G\, V2\, v3\, w33-2\, G\, v3\, W23\, w33\right)$$

In[•]:=
```
w21 := -I * Exp[I * t]
```

In[•]:=
```
dz2
```

Out[•]=
$$2\left(-\frac{p2}{4}+\frac{i\, z2}{4}+G\, p3\, Z2\, z3-\frac{1}{2}\, i\, G\, Z2\, z3^2\right)$$

In[•]:=
```
s (1/2 i e^(i t) - w21/2) + s^3 (-i c^2 e^(-i t) G + (i v2)/2 - w23/2 + 2 c e^(-i t) G w31)
```

Out[•]=
$$i\, e^{i t}\, s+s^3\left(-i\, c^2\, e^{-i t}\, G+\frac{i\, v2}{2}-\frac{w23}{2}+2\, c\, e^{-i t}\, G\, w31\right)$$

In[•]:=
```
s (e^(i t)/2 + (i w21)/2) + s^3 (v2/2 + i c^2 G W21 + (i w23)/2 - 2 i c e^(-i t) G w31 - 2 c G W21 w31)
```

Out[•]=
$$e^{i t}\, s+s^3\left(\frac{v2}{2}+i\, c^2\, G\, W21+\frac{i\, w23}{2}-2\, i\, c\, e^{-i t}\, G\, w31-2\, c\, G\, W21\, w31\right)$$

In[•]:=
```
W21 := I * Exp[-I * t]
```

In[•]:=
```
dz3 /. {z2 → z2st, Z2 → s * Exp[-I * t] + s^3 * V2,
  p2 → p2st, P2 → s * W21 + s^3 * W23, z3 → z3st,
  Z3 → k * s + s^3 * V3, p3 → p3st, P3 → s * W31 + s^3 * W33}
```

Out[•]=
$$2\left(\frac{1}{4}\, i\, \left(c\, s+s^3\, v3\right)-\frac{1}{2}\, i\, g\, \left(e^{i t}\, s+s^3\, v2\right)^2\, \left(k\, s+s^3\, V3\right)+\right.$$
$$\left.g\, \left(e^{i t}\, s+s^3\, v2\right)\, \left(k\, s+s^3\, V3\right)\, \left(-i\, e^{i t}\, s+s^3\, w23\right)+\frac{1}{4}\, \left(-s\, w31-s^3\, w33\right)\right)$$

In[•]:=
```
Expand[2 (1/4 i (c s + s^3 v3) - 1/2 i g (e^(i t) s + s^3 v2)^2 (k s + s^3 V3) +
  g (e^(i t) s + s^3 v2) (k s + s^3 V3) (-i e^(i t) s + s^3 w23) + 1/4 (-s w31 - s^3 w33))]
```

Out[•]=
$$\frac{i\, c\, s}{2}-3\, i\, e^{2\, i t}\, g\, k\, s^3-4\, i\, e^{i t}\, g\, k\, s^5\, v2-i\, g\, k\, s^7\, v2^2+\frac{1}{2}\, i\, s^3\, v3-$$
$$3\, i\, e^{2\, i t}\, g\, s^5\, V3-4\, i\, e^{i t}\, g\, s^7\, v2\, V3-i\, g\, s^9\, v2^2\, V3+2\, e^{i t}\, g\, k\, s^5\, w23+$$
$$2\, g\, k\, s^7\, v2\, w23+2\, e^{i t}\, g\, s^7\, V3\, w23+2\, g\, s^9\, v2\, V3\, w23-\frac{s\, w31}{2}-\frac{s^3\, w33}{2}$$

In[•]:= **Collect[%, s]**

Out[•]= $s^5 \left(-4\,i\,e^{i\,t}\,g\,k\,v2 - 3\,i\,e^{2\,i\,t}\,g\,V3 + 2\,e^{i\,t}\,g\,k\,w23\right) +$
$s^7 \left(-i\,g\,k\,v2^2 - 4\,i\,e^{i\,t}\,g\,v2\,V3 + 2\,g\,k\,v2\,w23 + 2\,e^{i\,t}\,g\,V3\,w23\right) +$
$s^9 \left(-i\,g\,v2^2\,V3 + 2\,g\,v2\,V3\,w23\right) + s\left(\frac{i\,c}{2} - \frac{w31}{2}\right) + s^3\left(-3\,i\,e^{2\,i\,t}\,g\,k + \frac{i\,v3}{2} - \frac{w33}{2}\right)$

In[•]:=
```
dp3 /. {z2 → z2st, Z2 → s * Exp[-I * t] + s^3 * V2,
  p2 → p2st, P2 → s * W21 + s^3 * W23, z3 → z3st,
  Z3 → k * s + s^3 * V3, p3 → p3st, P3 → s * W31 + s^3 * W33}
```

Out[•]= $-2\left(\frac{1}{4}\left(-c\,s - s^3\,v3\right) + i\,g\left(e^{i\,t}\,s + s^3\,v2\right)\left(k\,s + s^3\,V3\right)\left(-i\,e^{i\,t}\,s + s^3\,w23\right) - \frac{1}{4}\,i\left(s\,w31 + s^3\,w33\right) - \frac{1}{2}\,i\,g\left(e^{i\,t}\,s + s^3\,v2\right)^2\left(s\,W31 + s^3\,W33\right) + g\left(e^{i\,t}\,s + s^3\,v2\right)\left(-i\,e^{i\,t}\,s + s^3\,w23\right)\left(s\,W31 + s^3\,W33\right)\right)$

In[•]:= **Expand[%99]**

Out[•]= $\frac{c\,s}{2} - 2\,e^{2\,i\,t}\,g\,k\,s^3 - 2\,e^{i\,t}\,g\,k\,s^5\,v2 + \frac{s^3\,v3}{2} - 2\,e^{2\,i\,t}\,g\,s^5\,V3 - 2\,e^{i\,t}\,g\,s^7\,v2\,V3 - 2\,i\,e^{i\,t}\,g\,k\,s^5\,w23 -$
$2\,i\,g\,k\,s^7\,v2\,w23 - 2\,i\,e^{i\,t}\,g\,s^7\,V3\,w23 - 2\,i\,g\,s^9\,v2\,V3\,w23 + \frac{i\,s\,w31}{2} + 3\,i\,e^{2\,i\,t}\,g\,s^3\,W31 +$
$4\,i\,e^{i\,t}\,g\,s^5\,v2\,W31 + i\,g\,s^7\,v2^2\,W31 - 2\,e^{i\,t}\,g\,s^5\,w23\,W31 - 2\,g\,s^7\,v2\,w23\,W31 + \frac{1}{2}\,i\,s^3\,w33 +$
$3\,i\,e^{2\,i\,t}\,g\,s^5\,W33 + 4\,i\,e^{i\,t}\,g\,s^7\,v2\,W33 + i\,g\,s^9\,v2^2\,W33 - 2\,e^{i\,t}\,g\,s^7\,w23\,W33 - 2\,g\,s^9\,v2\,w23\,W33$

In[•]:= **Collect[%, s]**

Out[•]= $s\left(\frac{c}{2} + \frac{i\,w31}{2}\right) + s^3\left(-2\,e^{2\,i\,t}\,g\,k + \frac{v3}{2} + 3\,i\,e^{2\,i\,t}\,g\,W31 + \frac{i\,w33}{2}\right) +$
$s^5\left(-2\,e^{i\,t}\,g\,k\,v2 - 2\,e^{2\,i\,t}\,g\,V3 - 2\,i\,e^{i\,t}\,g\,k\,w23 + 4\,i\,e^{i\,t}\,g\,v2\,W31 - 2\,e^{i\,t}\,g\,w23\,W31 + 3\,i\,e^{2\,i\,t}\,g\,W33\right) +$
$s^7\left(-2\,e^{i\,t}\,g\,v2\,V3 - 2\,i\,g\,k\,v2\,w23 - 2\,i\,e^{i\,t}\,g\,V3\,w23 + i\,g\,v2^2\,W31 - 2\,g\,v2\,w23\,W31 + 4\,i\,e^{i\,t}\,g\,v2\,W33 - 2\,e^{i\,t}\,g\,w23\,W33\right) + s^9\left(-2\,i\,g\,v2\,V3\,w23 + i\,g\,v2^2\,W33 - 2\,g\,v2\,w23\,W33\right)$

In[•]:= **w31 := I * c**

In[•]:= **W31 := -I * k**

In[•]:=
```
dz3 /. {z2 → z2st, Z2 → s * Exp[-I * t] + s^3 * V2,
  p2 → p2st, P2 → s * W21 + s^3 * W23, z3 → z3st,
  Z3 → k * s + s^3 * V3, p3 → p3st, P3 → s * W31 + s^3 * W33}
```

Out[•]= $2\left(\frac{1}{4}\,i\left(c\,s + s^3\,v3\right) - \frac{1}{2}\,i\,g\left(e^{i\,t}\,s + s^3\,v2\right)^2\left(k\,s + s^3\,V3\right) + g\left(e^{i\,t}\,s + s^3\,v2\right)\left(k\,s + s^3\,V3\right)\left(-i\,e^{i\,t}\,s + s^3\,w23\right) + \frac{1}{4}\left(-i\,c\,s - s^3\,w33\right)\right)$

In[•]:=
```
Expand[2 ((1/4) i (c s + s^3 v3) - (1/2) i g (e^(i t) s + s^3 v2)^2 (k s + s^3 V3) +
    g (e^(i t) s + s^3 v2) (k s + s^3 V3) (-i e^(i t) s + s^3 w23) + (1/4) (-i c s - s^3 w33))]
```

Out[•]=
$$-3\,i\,e^{2\,i\,t}\,g\,k\,s^3 - 4\,i\,e^{i\,t}\,g\,k\,s^5\,v2 - i\,g\,k\,s^7\,v2^2 + \frac{1}{2}\,i\,s^3\,v3 - 3\,i\,e^{2\,i\,t}\,g\,s^5\,V3 - 4\,i\,e^{i\,t}\,g\,s^7\,v2\,V3 - i\,g\,s^9\,v2^2\,V3 + 2\,e^{i\,t}\,g\,k\,s^5\,w23 + 2\,g\,k\,s^7\,v2\,w23 + 2\,e^{i\,t}\,g\,s^7\,V3\,w23 + 2\,g\,s^9\,v2\,V3\,w23 - \frac{s^3\,w33}{2}$$

In[•]:=
```
Collect[%, s]
```

Out[•]=
$$s^5\left(-4\,i\,e^{i\,t}\,g\,k\,v2 - 3\,i\,e^{2\,i\,t}\,g\,V3 + 2\,e^{i\,t}\,g\,k\,w23\right) + s^7\left(-i\,g\,k\,v2^2 - 4\,i\,e^{i\,t}\,g\,v2\,V3 + 2\,g\,k\,v2\,w23 + 2\,e^{i\,t}\,g\,V3\,w23\right) + s^9\left(-i\,g\,v2^2\,V3 + 2\,g\,v2\,V3\,w23\right) + s^3\left(-3\,i\,e^{2\,i\,t}\,g\,k + \frac{i\,v3}{2} - \frac{w33}{2}\right)$$

In[•]:=
```
dp3 /. {z2 → z2st, Z2 → s * Exp[-I * t] + s^3 * V2,
  p2 → p2st, P2 → s * W21 + s^3 * W23, z3 → z3st,
  Z3 → k * s + s^3 * V3, p3 → p3st, P3 → s * W31 + s^3 * W33}
```

Out[•]=
$$-2\left(\frac{1}{4}\left(-c\,s - s^3\,v3\right) + i\,g\left(e^{i\,t}\,s + s^3\,v2\right)\left(k\,s + s^3\,V3\right)\left(-i\,e^{i\,t}\,s + s^3\,w23\right) - \frac{1}{4}\,i\left(i\,c\,s + s^3\,w33\right) - \frac{1}{2}\,i\,g\left(e^{i\,t}\,s + s^3\,v2\right)^2\left(-i\,k\,s + s^3\,W33\right) + g\left(e^{i\,t}\,s + s^3\,v2\right)\left(-i\,e^{i\,t}\,s + s^3\,w23\right)\left(-i\,k\,s + s^3\,W33\right)\right)$$

In[•]:=
```
Expand[%107]
```

Out[•]=
$$e^{2\,i\,t}\,g\,k\,s^3 + 2\,e^{i\,t}\,g\,k\,s^5\,v2 + g\,k\,s^7\,v2^2 + \frac{s^3\,v3}{2} - 2\,e^{2\,i\,t}\,g\,s^5\,V3 - 2\,e^{i\,t}\,g\,s^7\,v2\,V3 - 2\,i\,e^{i\,t}\,g\,s^7\,V3\,w23 - 2\,i\,g\,s^9\,v2\,V3\,w23 + \frac{1}{2}\,i\,s^3\,w33 + 3\,i\,e^{2\,i\,t}\,g\,s^5\,W33 + 4\,i\,e^{i\,t}\,g\,s^7\,v2\,W33 + i\,g\,s^9\,v2^2\,W33 - 2\,e^{i\,t}\,g\,s^7\,w23\,W33 - 2\,g\,s^9\,v2\,w23\,W33$$

In[•]:=
```
Collect[%, s]
```

Out[•]=
$$s^3\left(e^{2\,i\,t}\,g\,k + \frac{v3}{2} + \frac{i\,w33}{2}\right) + s^5\left(2\,e^{i\,t}\,g\,k\,v2 - 2\,e^{2\,i\,t}\,g\,V3 + 3\,i\,e^{2\,i\,t}\,g\,W33\right) + s^7\left(g\,k\,v2^2 - 2\,e^{i\,t}\,g\,v2\,V3 - 2\,i\,e^{i\,t}\,g\,V3\,w23 + 4\,i\,e^{i\,t}\,g\,v2\,W33 - 2\,e^{i\,t}\,g\,w23\,W33\right) + s^9\left(-2\,i\,g\,v2\,V3\,w23 + i\,g\,v2^2\,W33 - 2\,g\,v2\,w23\,W33\right)$$

In[•]:=
```
dz2trunc := s ((1/2) i e^(i t) - w21/2) + s^3 (-i c^2 e^(-i t) G + (i v2)/2 - w23/2 + 2 c e^(-i t) G w31)
```

In[•]:=
```
dz2trunc
```

Out[•]=
$$i\,e^{i\,t}\,s + s^3\left(i\,c^2\,e^{-i\,t}\,G + \frac{i\,v2}{2} - \frac{w23}{2}\right)$$

In[•]:=
```
dp2trunc := s (e^(i t)/2 + (i w21)/2) + s^3 (v2/2 + i c^2 G W21 + (i w23)/2 - 2 i c e^(-i t) G w31 - 2 c G W21 w31)
```

In[•]:= **dp2trunc**

Out[•]= $e^{i t} s + s^3 \left(3 c^2 e^{-i t} G + \frac{v2}{2} + \frac{i\, w23}{2}\right)$

In[•]:= **dz3trunc := s $\left(\frac{i\, c}{2} - \frac{w31}{2}\right)$ + s^3 $\left(-3\, i\, e^{2 i t}\, g\, k + \frac{i\, v3}{2} - \frac{w33}{2}\right)$**

In[•]:= **dz3trunc**

Out[•]= $s^3 \left(-3\, i\, e^{2 i t}\, g\, k + \frac{i\, v3}{2} - \frac{w33}{2}\right)$

In[•]:= **dp3trunc := s^3 $\left(e^{2 i t}\, g\, k + \frac{v3}{2} + \frac{i\, w33}{2}\right)$**

In[•]:= **dp3trunc**

Out[•]= $s^3 \left(e^{2 i t}\, g\, k + \frac{v3}{2} + \frac{i\, w33}{2}\right)$

In[•]:=
```
DSolve[{l'[t] == i c^2 e^(-i t) G + i l[t]/2 - m[t]/2,
  m'[t] == 3 c^2 e^(-i t) G + l[t]/2 + i m[t]/2}, {l[t], m[t]}, t]
```

Out[•]=
$$\left\{\left\{l[t] \to c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[1] \operatorname{Cos}\left[\frac{t}{2}\right] - i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right] - e^{\frac{i t}{2}} C[2] \operatorname{Sin}\left[\frac{t}{2}\right], m[t] \to i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[2] \operatorname{Cos}\left[\frac{t}{2}\right] + c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[1] \operatorname{Sin}\left[\frac{t}{2}\right]\right\}\right\}$$

In[•]:= $c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] - i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right]$

Out[•]= $c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] - i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right]$

In[•]:= $\operatorname{TrigReduce}\left[c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] - i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right]\right]$

Out[•]= 0

In[•]:= $c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[1] \operatorname{Cos}\left[\frac{t}{2}\right] - i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right] - e^{\frac{i t}{2}} C[2] \operatorname{Sin}\left[\frac{t}{2}\right]$

Out[•]= $c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[1] \operatorname{Cos}\left[\frac{t}{2}\right] - i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right] - e^{\frac{i t}{2}} C[2] \operatorname{Sin}\left[\frac{t}{2}\right]$

In[•]:= $\operatorname{TrigReduce}\left[c^2 e^{-\frac{3 i t}{2}} \left(-1 + e^{i t}\right) G \operatorname{Cos}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[1] \operatorname{Cos}\left[\frac{t}{2}\right] - i\, c^2 e^{-\frac{3 i t}{2}} \left(1 + e^{i t}\right) G \operatorname{Sin}\left[\frac{t}{2}\right] - e^{\frac{i t}{2}} C[2] \operatorname{Sin}\left[\frac{t}{2}\right]\right]$

Out[•]= $\frac{1}{2} \left(C[1] + e^{i t} C[1] - i\, C[2] + i\, e^{i t} C[2]\right)$

In[]:=
$$\mathbb{i}\, c^2\, \mathbb{e}^{-\frac{3\mathbb{i}t}{2}} \left(1+\mathbb{e}^{\mathbb{i}t}\right) G\, \text{Cos}\left[\frac{t}{2}\right] + c^2\, \mathbb{e}^{-\frac{3\mathbb{i}t}{2}} \left(-1+\mathbb{e}^{\mathbb{i}t}\right) G\, \text{Sin}\left[\frac{t}{2}\right]$$

Out[]=
$$\mathbb{i}\, c^2\, \mathbb{e}^{-\frac{3\mathbb{i}t}{2}} \left(1+\mathbb{e}^{\mathbb{i}t}\right) G\, \text{Cos}\left[\frac{t}{2}\right] + c^2\, \mathbb{e}^{-\frac{3\mathbb{i}t}{2}} \left(-1+\mathbb{e}^{\mathbb{i}t}\right) G\, \text{Sin}\left[\frac{t}{2}\right]$$

In[]:=
$$\text{TrigReduce}\left[\mathbb{i}\, c^2\, \mathbb{e}^{-\frac{3\mathbb{i}t}{2}} \left(1+\mathbb{e}^{\mathbb{i}t}\right) G\, \text{Cos}\left[\frac{t}{2}\right] + c^2\, \mathbb{e}^{-\frac{3\mathbb{i}t}{2}} \left(-1+\mathbb{e}^{\mathbb{i}t}\right) G\, \text{Sin}\left[\frac{t}{2}\right]\right]$$

Out[]=
$$2\,\mathbb{i}\, c^2\, \mathbb{e}^{-\mathbb{i}t}\, G$$