```
In[•]:= z2st := s * z21 + s^3 * z23

In[•]:= z2st
Out[•]= s z21 + s^3 z23

In[•]:= p2st := s * p21 + s^3 * p23

In[•]:= z3st := s * z31 + s^3 * z33

In[•]:= p3st := s * p31 + s^3 * p33

In[•]:= dz2 := -p2/2 - (i p1 z2)/2 + 2 G p3 Z2 z3 + i G p1 Z2 z3^2

In[•]:= dz2
Out[•]= -p2/2 - (i p1 z2)/2 + 2 G p3 Z2 z3 + i G p1 Z2 z3^2

In[•]:= dp2 := -1/2 i p1 p2 + p1^2 z2/2 - 2 G P2 p3 z3 + 2 i G p1 p3 Z2 z3 - i G p1 P2 z3^2

In[•]:= dp2
Out[•]= -1/2 i p1 p2 + p1^2 z2/2 - 2 G P2 p3 z3 + 2 i G p1 p3 Z2 z3 - i G p1 P2 z3^2

In[•]:= dz3 := -p3/2 - (i p1 z3)/2 + 2 g p2 z2 Z3 + i g p1 z2^2 Z3

In[•]:= dz3
Out[•]= -p3/2 - (i p1 z3)/2 + 2 g p2 z2 Z3 + i g p1 z2^2 Z3

In[•]:= dp3 := -1/2 i p1 p3 - 2 g p2 P3 z2 - i g p1 P3 z2^2 + p1^2 z3/2 + 2 i g p1 p2 z2 Z3

In[•]:= dp3
Out[•]= -1/2 i p1 p3 - 2 g p2 P3 z2 - i g p1 P3 z2^2 + p1^2 z3/2 + 2 i g p1 p2 z2 Z3

In[•]:= Z2st := s * Z21 + s^3 * Z23

In[•]:= Z3st := s * Z31 + s^3 * Z33

In[•]:= P2st := s * P21 + s^3 * P23

In[•]:= P3st := s * P31 + s^3 * P33

In[•]:= dz2 /. {z2 → z2st, z3 → z3st, Z2 → Z2st,
    Z3 → Z3st, p2 → p2st, p3 → p3st, P2 → P2st, P3 → P3st}
Out[•]= 1/2 (-p21 s - p23 s^3) - 1/2 i p1 (s z21 + s^3 z23) +
  2 G (p31 s + p33 s^3) (s Z21 + s^3 Z23) (s z31 + s^3 z33) + i G p1 (s Z21 + s^3 Z23) (s z31 + s^3 z33)^2
```

In[•]:=
```
Expand[1/2 (-p21 s - p23 s^3) - 1/2 i p1 (s z21 + s^3 z23) +
  2 G (p31 s + p33 s^3) (s Z21 + s^3 Z23) (s z31 + s^3 z33) + i G p1 (s Z21 + s^3 Z23) (s z31 + s^3 z33)^2]
```

Out[•]=
$$-\frac{p21\ s}{2}-\frac{p23\ s^3}{2}-\frac{1}{2}\,i\,p1\,s\,z21-\frac{1}{2}\,i\,p1\,s^3\,z23+2\,G\,p31\,s^3\,Z21\,z31+2\,G\,p33\,s^5\,Z21\,z31+$$
$$2\,G\,p31\,s^5\,Z23\,z31+2\,G\,p33\,s^7\,Z23\,z31+i\,G\,p1\,s^3\,Z21\,z31^2+i\,G\,p1\,s^5\,Z23\,z31^2+$$
$$2\,G\,p31\,s^5\,Z21\,z33+2\,G\,p33\,s^7\,Z21\,z33+2\,G\,p31\,s^7\,Z23\,z33+2\,G\,p33\,s^9\,Z23\,z33+$$
$$2\,i\,G\,p1\,s^5\,Z21\,z31\,z33+2\,i\,G\,p1\,s^7\,Z23\,z31\,z33+i\,G\,p1\,s^7\,Z21\,z33^2+i\,G\,p1\,s^9\,Z23\,z33^2$$

In[•]:=
```
Collect[%, s]
```

Out[•]=
$$s\left(-\frac{p21}{2}-\frac{i\,p1\,z21}{2}\right)+s^3\left(-\frac{p23}{2}-\frac{i\,p1\,z23}{2}+2\,G\,p31\,Z21\,z31+i\,G\,p1\,Z21\,z31^2\right)+$$
$$s^5\left(2\,G\,p33\,Z21\,z31+2\,G\,p31\,Z23\,z31+i\,G\,p1\,Z23\,z31^2+2\,G\,p31\,Z21\,z33+2\,i\,G\,p1\,Z21\,z31\,z33\right)+$$
$$s^7\left(2\,G\,p33\,Z23\,z31+2\,G\,p33\,Z21\,z33+2\,G\,p31\,Z23\,z33+2\,i\,G\,p1\,Z23\,z31\,z33+i\,G\,p1\,Z21\,z33^2\right)+$$
$$s^9\left(2\,G\,p33\,Z23\,z33+i\,G\,p1\,Z23\,z33^2\right)$$

In[•]:=
```
dp2 /. {z2 → z2st, z3 → z3st, Z2 → Z2st,
  Z3 → Z3st, p2 → p2st, p3 → p3st, P2 → P2st, P3 → P3st}
```

Out[•]=
$$-\frac{1}{2}\,i\,p1\left(p21\,s+p23\,s^3\right)+\frac{1}{2}\,p1^2\left(s\,z21+s^3\,z23\right)-$$
$$2\,G\left(P21\,s+P23\,s^3\right)\left(p31\,s+p33\,s^3\right)\left(s\,z31+s^3\,z33\right)+$$
$$2\,i\,G\,p1\left(p31\,s+p33\,s^3\right)\left(s\,Z21+s^3\,Z23\right)\left(s\,z31+s^3\,z33\right)-$$
$$i\,G\,p1\left(P21\,s+P23\,s^3\right)\left(s\,z31+s^3\,z33\right)^2$$

In[•]:=
```
Expand[-1/2 i p1 (p21 s + p23 s^3) + 1/2 p1^2 (s z21 + s^3 z23) -
  2 G (P21 s + P23 s^3) (p31 s + p33 s^3) (s z31 + s^3 z33) + 2 i G p1 (p31 s + p33 s^3)
   (s Z21 + s^3 Z23) (s z31 + s^3 z33) - i G p1 (P21 s + P23 s^3) (s z31 + s^3 z33)^2]
```

Out[•]=
$$-\frac{1}{2}\,i\,p1\,p21\,s-\frac{1}{2}\,i\,p1\,p23\,s^3+\frac{1}{2}\,p1^2\,s\,z21+\frac{1}{2}\,p1^2\,s^3\,z23-$$
$$2\,G\,P21\,p31\,s^3\,z31-2\,G\,P23\,p31\,s^5\,z31-2\,G\,P21\,p33\,s^5\,z31-2\,G\,P23\,p33\,s^7\,z31+$$
$$2\,i\,G\,p1\,p31\,s^3\,Z21\,z31+2\,i\,G\,p1\,p33\,s^5\,Z21\,z31+2\,i\,G\,p1\,p31\,s^5\,Z23\,z31+$$
$$2\,i\,G\,p1\,p33\,s^7\,Z23\,z31-i\,G\,p1\,P21\,s^3\,z31^2-i\,G\,p1\,P23\,s^5\,z31^2-2\,G\,P21\,p31\,s^5\,z33-$$
$$2\,G\,P23\,p31\,s^7\,z33-2\,G\,P21\,p33\,s^7\,z33-2\,G\,P23\,p33\,s^9\,z33+2\,i\,G\,p1\,p31\,s^5\,Z21\,z33+$$
$$2\,i\,G\,p1\,p33\,s^7\,Z21\,z33+2\,i\,G\,p1\,p31\,s^7\,Z23\,z33+2\,i\,G\,p1\,p33\,s^9\,Z23\,z33-$$
$$2\,i\,G\,p1\,P21\,s^5\,z31\,z33-2\,i\,G\,p1\,P23\,s^7\,z31\,z33-i\,G\,p1\,P21\,s^7\,z33^2-i\,G\,p1\,P23\,s^9\,z33^2$$

```
In[•]:= Collect[%, s]
```

$$\text{Out}[\bullet]= s\left(-\frac{1}{2}\,i\,p1\,p21+\frac{p1^2\,z21}{2}\right)+ s^3\left(-\frac{1}{2}\,i\,p1\,p23+\frac{p1^2\,z23}{2}-2\,G\,P21\,p31\,z31+2\,i\,G\,p1\,p31\,Z21\,z31-i\,G\,p1\,P21\,z31^2\right)+ s^5\left(-2\,G\,P23\,p31\,z31-2\,G\,P21\,p33\,z31+2\,i\,G\,p1\,p33\,Z21\,z31+2\,i\,G\,p1\,p31\,Z23\,z31-i\,G\,p1\,P23\,z31^2-2\,G\,P21\,p31\,z33+2\,i\,G\,p1\,p31\,Z21\,z33-2\,i\,G\,p1\,P21\,z31\,z33\right)+ s^7\left(-2\,G\,P23\,p33\,z31+2\,i\,G\,p1\,p33\,Z23\,z31-2\,G\,P23\,p31\,z33-2\,G\,P21\,p33\,z33+2\,i\,G\,p1\,p33\,Z21\,z33+2\,i\,G\,p1\,p31\,Z23\,z33-2\,i\,G\,p1\,P23\,z31\,z33-i\,G\,p1\,P21\,z33^2\right)+ s^9\left(-2\,G\,P23\,p33\,z33+2\,i\,G\,p1\,p33\,Z23\,z33-i\,G\,p1\,P23\,z33^2\right)$$

```
In[•]:= DSolve[{l'[t] == -m[t]/2 - i p1 * l[t]/2,
    m'[t] == -1/2 i p1 * m[t] + p1^2 * l[t]/2}, {l[t], m[t]}, t]
```

$$\text{Out}[\bullet]= \left\{\left\{l[t]\to\frac{1}{2}e^{-i\,p1\,t}\left(1+e^{i\,p1\,t}\right)C[1]+\frac{i\,e^{-i\,p1\,t}\left(-1+e^{i\,p1\,t}\right)C[2]}{2\,p1},\ m[t]\to-\frac{1}{2}i\,e^{-i\,p1\,t}\left(-1+e^{i\,p1\,t}\right)p1\,C[1]+\frac{1}{2}e^{-i\,p1\,t}\left(1+e^{i\,p1\,t}\right)C[2]\right\}\right\}$$

```
In[•]:= 1/2 e^(-i p1 t) (1 + e^(i p1 t)) C[1] + (i e^(-i p1 t) (-1 + e^(i p1 t)) C[2])/(2 p1)
```

$$\text{Out}[\bullet]= \frac{1}{2}e^{-i\,p1\,t}\left(1+e^{i\,p1\,t}\right)C[1]+\frac{i\,e^{-i\,p1\,t}\left(-1+e^{i\,p1\,t}\right)C[2]}{2\,p1}$$

```
In[•]:= Expand[1/2 e^(-i p1 t) (1 + e^(i p1 t)) C[1] + (i e^(-i p1 t) (-1 + e^(i p1 t)) C[2])/(2 p1)]
```

$$\text{Out}[\bullet]= \frac{C[1]}{2}+\frac{1}{2}e^{-i\,p1\,t}C[1]+\frac{i\,C[2]}{2\,p1}-\frac{i\,e^{-i\,p1\,t}C[2]}{2\,p1}$$

```
In[•]:= dz3 /. {z2 → z2st, z3 → z3st, Z2 → Z2st,
    Z3 → Z3st, p2 → p2st, p3 → p3st, P2 → P2st, P3 → P3st}
```

$$\text{Out}[\bullet]= \frac{1}{2}\left(-p31\,s-p33\,s^3\right)-\frac{1}{2}i\,p1\left(s\,z31+s^3\,z33\right)+ 2\,g\left(p21\,s+p23\,s^3\right)\left(s\,z21+s^3\,z23\right)\left(s\,Z31+s^3\,Z33\right)+i\,g\,p1\left(s\,z21+s^3\,z23\right)^2\left(s\,Z31+s^3\,Z33\right)$$

```
In[•]:= Expand[1/2 (-p31 s - p33 s^3) - 1/2 i p1 (s z31 + s^3 z33) +
    2 g (p21 s + p23 s^3) (s z21 + s^3 z23) (s Z31 + s^3 Z33) + i g p1 (s z21 + s^3 z23)^2 (s Z31 + s^3 Z33)]
```

$$\text{Out}[\bullet]= -\frac{p31\,s}{2}-\frac{p33\,s^3}{2}-\frac{1}{2}i\,p1\,s\,z31+2\,g\,p21\,s^3\,z21\,Z31+2\,g\,p23\,s^5\,z21\,Z31+i\,g\,p1\,s^3\,z21^2\,Z31+ 2\,g\,p21\,s^5\,z23\,Z31+2\,g\,p23\,s^7\,z23\,Z31+2\,i\,g\,p1\,s^5\,z21\,z23\,Z31+i\,g\,p1\,s^7\,z23^2\,Z31- \frac{1}{2}i\,p1\,s^3\,z33+2\,g\,p21\,s^5\,z21\,Z33+2\,g\,p23\,s^7\,z21\,Z33+i\,g\,p1\,s^5\,z21^2\,Z33+ 2\,g\,p21\,s^7\,z23\,Z33+2\,g\,p23\,s^9\,z23\,Z33+2\,i\,g\,p1\,s^7\,z21\,z23\,Z33+i\,g\,p1\,s^9\,z23^2\,Z33$$

In[•]:=
```
Collect[%, s]
```

Out[•]=
$$s\left(-\frac{p31}{2}-\frac{i\ p1\ z31}{2}\right)+s^3\left(-\frac{p33}{2}+2\ g\ p21\ z21\ Z31+i\ g\ p1\ z21^2\ Z31-\frac{i\ p1\ z33}{2}\right)+$$
$$s^5\left(2\ g\ p23\ z21\ Z31+2\ g\ p21\ z23\ Z31+2\ i\ g\ p1\ z21\ z23\ Z31+2\ g\ p21\ z21\ Z33+i\ g\ p1\ z21^2\ Z33\right)+$$
$$s^7\left(2\ g\ p23\ z23\ Z31+i\ g\ p1\ z23^2\ Z31+2\ g\ p23\ z21\ Z33+2\ g\ p21\ z23\ Z33+2\ i\ g\ p1\ z21\ z23\ Z33\right)+$$
$$s^9\left(2\ g\ p23\ z23\ Z33+i\ g\ p1\ z23^2\ Z33\right)$$

In[•]:=
```
dp3 /. {z2 → z2st, z3 → z3st, Z2 → Z2st,
  Z3 → Z3st, p2 → p2st, p3 → p3st, P2 → P2st, P3 → P3st}
```

Out[•]=
$$-\frac{1}{2}i\ p1\left(p31\ s+p33\ s^3\right)-2\ g\left(p21\ s+p23\ s^3\right)\left(P31\ s+P33\ s^3\right)\left(s\ z21+s^3\ z23\right)-$$
$$i\ g\ p1\left(P31\ s+P33\ s^3\right)\left(s\ z21+s^3\ z23\right)^2+\frac{1}{2}p1^2\left(s\ z31+s^3\ z33\right)+$$
$$2\ i\ g\ p1\left(p21\ s+p23\ s^3\right)\left(s\ z21+s^3\ z23\right)\left(s\ Z31+s^3\ Z33\right)$$

In[•]:=
```
Expand[-1/2 i p1 (p31 s + p33 s^3) - 2 g (p21 s + p23 s^3) (P31 s + P33 s^3) (s z21 + s^3 z23) -
  i g p1 (P31 s + P33 s^3) (s z21 + s^3 z23)^2 + 1/2 p1^2 (s z31 + s^3 z33) +
  2 i g p1 (p21 s + p23 s^3) (s z21 + s^3 z23) (s Z31 + s^3 Z33)]
```

Out[•]=
$$-\frac{1}{2}i\ p1\ p31\ s-\frac{1}{2}i\ p1\ p33\ s^3-2\ g\ p21\ P31\ s^3\ z21-2\ g\ p23\ P31\ s^5\ z21-$$
$$2\ g\ p21\ P33\ s^5\ z21-2\ g\ p23\ P33\ s^7\ z21-i\ g\ p1\ P31\ s^3\ z21^2-i\ g\ p1\ P33\ s^5\ z21^2-$$
$$2\ g\ p21\ P31\ s^5\ z23-2\ g\ p23\ P31\ s^7\ z23-2\ g\ p21\ P33\ s^7\ z23-2\ g\ p23\ P33\ s^9\ z23-$$
$$2\ i\ g\ p1\ P31\ s^5\ z21\ z23-2\ i\ g\ p1\ P33\ s^7\ z21\ z23-i\ g\ p1\ P31\ s^7\ z23^2-$$
$$i\ g\ p1\ P33\ s^9\ z23^2+\frac{1}{2}p1^2\ s\ z31+2\ i\ g\ p1\ p21\ s^3\ z21\ Z31+2\ i\ g\ p1\ p23\ s^5\ z21\ Z31+$$
$$2\ i\ g\ p1\ p21\ s^5\ z23\ Z31+2\ i\ g\ p1\ p23\ s^7\ z23\ Z31+\frac{1}{2}p1^2\ s^3\ z33+2\ i\ g\ p1\ p21\ s^5\ z21\ Z33+$$
$$2\ i\ g\ p1\ p23\ s^7\ z21\ Z33+2\ i\ g\ p1\ p21\ s^7\ z23\ Z33+2\ i\ g\ p1\ p23\ s^9\ z23\ Z33$$

In[•]:=
```
Collect[%, s]
```

Out[•]=
$$s\left(-\frac{1}{2}i\ p1\ p31+\frac{p1^2\ z31}{2}\right)+$$
$$s^3\left(-\frac{1}{2}i\ p1\ p33-2\ g\ p21\ P31\ z21-i\ g\ p1\ P31\ z21^2+2\ i\ g\ p1\ p21\ z21\ Z31+\frac{p1^2\ z33}{2}\right)+$$
$$s^5\left(-2\ g\ p23\ P31\ z21-2\ g\ p21\ P33\ z21-i\ g\ p1\ P33\ z21^2-2\ g\ p21\ P31\ z23-\right.$$
$$\left.2\ i\ g\ p1\ P31\ z21\ z23+2\ i\ g\ p1\ p23\ z21\ Z31+2\ i\ g\ p1\ p21\ z23\ Z31+2\ i\ g\ p1\ p21\ z21\ Z33\right)+$$
$$s^7\left(-2\ g\ p23\ P33\ z21-2\ g\ p23\ P31\ z23-2\ g\ p21\ P33\ z23-2\ i\ g\ p1\ P33\ z21\ z23-\right.$$
$$\left.i\ g\ p1\ P31\ z23^2+2\ i\ g\ p1\ p23\ z23\ Z31+2\ i\ g\ p1\ p23\ z21\ Z33+2\ i\ g\ p1\ p21\ z23\ Z33\right)+$$
$$s^9\left(-2\ g\ p23\ P33\ z23-i\ g\ p1\ P33\ z23^2+2\ i\ g\ p1\ p23\ z23\ Z33\right)$$

In[•]:=
$$\text{DSolve}\left[\left\{l'[t] == -\frac{m[t]}{2} - \frac{i\, p1 * l[t]}{2},\ m'[t] == -\frac{1}{2} i\, p1 * m[t] + \frac{p1^2 * l[t]}{2}\right\}, \{l[t], m[t]\}, t\right]$$

Out[•]=
$$\left\{\left\{l[t] \to \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) C[1] + \frac{i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) C[2]}{2\,p1},\ m[t] \to -\frac{1}{2} i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) p1\, C[1] + \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) C[2]\right\}\right\}$$

In[•]:=
$$-\frac{1}{2} i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) p1\, C[1] + \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) C[2]$$

Out[•]=
$$-\frac{1}{2} i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) p1\, C[1] + \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) C[2]$$

In[•]:=
$$-\frac{1}{2} i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) p1\, C[1] + \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) C[2]$$

Out[•]=
$$-\frac{1}{2} i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) p1\, C[1] + \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) C[2]$$

In[•]:=
$$p1 := -1$$

In[•]:=
$$z21$$

Out[•]=
$$z21$$

In[•]:=
$$z21 := \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) * c1 + \frac{i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) * c2}{2\,p1}$$

In[•]:=
$$z21$$

Out[•]=
$$-\frac{1}{2} i\, c2\, e^{i\,t}\left(-1 + e^{-i\,t}\right) + \frac{1}{2} c1\, e^{i\,t}\left(1 + e^{-i\,t}\right)$$

In[•]:=
$$Z21 := \frac{1}{2} i * C2 * e^{-i\,t}\left(-1 + e^{i\,t}\right) + \frac{1}{2} C1 * e^{-i\,t}\left(1 + e^{i\,t}\right)$$

In[•]:=
$$p21 := -\frac{1}{2} i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) * p1 * c1 + \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) * c2$$

In[•]:=
$$p21$$

Out[•]=
$$\frac{1}{2} i\, c1\, e^{i\,t}\left(-1 + e^{-i\,t}\right) + \frac{1}{2} c2\, e^{i\,t}\left(1 + e^{-i\,t}\right)$$

In[•]:=
$$P21 := -\frac{1}{2} i * C1 * e^{-i\,t}\left(-1 + e^{i\,t}\right) + \frac{1}{2} * C2 * e^{-i\,t}\left(1 + e^{i\,t}\right)$$

In[•]:=
$$z31 := \frac{1}{2} e^{-i\,p1\,t}\left(1 + e^{i\,p1\,t}\right) * d1 + \frac{i\, e^{-i\,p1\,t}\left(-1 + e^{i\,p1\,t}\right) * d2}{2\,p1}$$

In[•]:=
$$z31$$

Out[•]=
$$-\frac{1}{2} i\, d2\, e^{i\,t}\left(-1 + e^{-i\,t}\right) + \frac{1}{2} d1\, e^{i\,t}\left(1 + e^{-i\,t}\right)$$

In[•]:=
$$Z31 := \frac{1}{2} i * D2 * e^{-i t} \left(-1 + e^{i t}\right) + \frac{1}{2} * D2 * e^{-i t} \left(1 + e^{i t}\right)$$

In[•]:=
$$p31 := -\frac{1}{2} i e^{-i p1 t} \left(-1 + e^{i p1 t}\right) p1 * d1 + \frac{1}{2} e^{-i p1 t} \left(1 + e^{i p1 t}\right) * d2$$

In[•]:=
$$p31$$

Out[•]=
$$\frac{1}{2} i\, d1\, e^{i t} \left(-1 + e^{-i t}\right) + \frac{1}{2} d2\, e^{i t} \left(1 + e^{-i t}\right)$$

In[•]:=
$$P31 := -\frac{1}{2} i * D1 * e^{-i t} \left(-1 + e^{i t}\right) + \frac{1}{2} * D2 * e^{-i t} \left(1 + e^{i t}\right)$$

In[•]:=
$$z2st$$

Out[•]=
$$\left(-\frac{1}{2} i\, c2\, e^{i t} \left(-1 + e^{-i t}\right) + \frac{1}{2} c1\, e^{i t} \left(1 + e^{-i t}\right)\right) s + s^3\, z23$$

In[•]:=
$$\text{Expand}\left[\left(-\frac{1}{2} i\, c2\, e^{i t} \left(-1 + e^{-i t}\right) + \frac{1}{2} c1\, e^{i t} \left(1 + e^{-i t}\right)\right) s + s^3\, z23\right]$$

Out[•]=
$$\frac{c1\, s}{2} - \frac{i\, c2\, s}{2} + \frac{1}{2} c1\, e^{i t}\, s + \frac{1}{2} i\, c2\, e^{i t}\, s + s^3\, z23$$

In[•]:=
$$\text{Collect}[\%, s]$$

Out[•]=
$$\left(\frac{c1}{2} - \frac{i\, c2}{2} + \frac{1}{2} c1\, e^{i t} + \frac{1}{2} i\, c2\, e^{i t}\right) s + s^3\, z23$$

In[•]:=
$$Z2st$$

Out[•]=
$$\left(\frac{1}{2} i\, C2\, e^{-i t} \left(-1 + e^{i t}\right) + \frac{1}{2} C1\, e^{-i t} \left(1 + e^{i t}\right)\right) s + s^3\, Z23$$

In[•]:=
$$\text{Expand}\left[\left(\frac{1}{2} i\, C2\, e^{-i t} \left(-1 + e^{i t}\right) + \frac{1}{2} C1\, e^{-i t} \left(1 + e^{i t}\right)\right) s + s^3\, Z23\right]$$

Out[•]=
$$\frac{C1\, s}{2} + \frac{i\, C2\, s}{2} + \frac{1}{2} C1\, e^{-i t}\, s - \frac{1}{2} i\, C2\, e^{-i t}\, s + s^3\, Z23$$

In[•]:=
$$\text{Collect}[\%, s]$$

Out[•]=
$$\left(\frac{C1}{2} + \frac{i\, C2}{2} + \frac{1}{2} C1\, e^{-i t} - \frac{1}{2} i\, C2\, e^{-i t}\right) s + s^3\, Z23$$

In[•]:=
$$dz2$$

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

In[•]:=
```
dz2 /. {z2 → z2st, z3 → z3st, Z2 → Z2st,
  Z3 → Z3st, p2 → p2st, p3 → p3st, P2 → P2st, P3 → P3st}
```

Out[•]=
$$\frac{1}{2}\left(-\left(\frac{1}{2}\,i\,c1\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,c2\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s-p23\,s^3\right)+\frac{1}{2}\,i\left(\left(-\frac{1}{2}\,i\,c2\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,c1\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+s^3\,z23\right)+2\,G\left(\left(\frac{1}{2}\,i\,d1\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d2\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+p33\,s^3\right)\left(\left(\frac{1}{2}\,i\,C2\,e^{-i\,t}\left(-1+e^{i\,t}\right)+\frac{1}{2}\,C1\,e^{-i\,t}\left(1+e^{i\,t}\right)\right)s+s^3\,Z23\right)\left(\left(-\frac{1}{2}\,i\,d2\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d1\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+s^3\,z33\right)-i\,G\left(\left(\frac{1}{2}\,i\,C2\,e^{-i\,t}\left(-1+e^{i\,t}\right)+\frac{1}{2}\,C1\,e^{-i\,t}\left(1+e^{i\,t}\right)\right)s+s^3\,Z23\right)\left(\left(-\frac{1}{2}\,i\,d2\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d1\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+s^3\,z33\right)^2$$

In[•]:=
```
Expand[%60]
```

Out[•]=
$$\frac{1}{2}\,i\,c1\,e^{i\,t}\,s-\frac{1}{2}\,c2\,e^{i\,t}\,s-\frac{1}{8}\,i\,C1\,d1^2\,G\,s^3-\frac{3}{8}\,C2\,d1^2\,G\,s^3+\frac{1}{4}\,C1\,d1\,d2\,G\,s^3+\frac{1}{4}\,i\,C2\,d1\,d2\,G\,s^3-\frac{3}{8}\,i\,C1\,d2^2\,G\,s^3-\frac{1}{8}\,C2\,d2^2\,G\,s^3+\frac{1}{8}\,i\,C1\,d1^2\,e^{-i\,t}\,G\,s^3+\frac{1}{8}\,C2\,d1^2\,e^{-i\,t}\,G\,s^3+\frac{1}{4}\,C1\,d1\,d2\,e^{-i\,t}\,G\,s^3-\frac{1}{4}\,i\,C2\,d1\,d2\,e^{-i\,t}\,G\,s^3-\frac{1}{8}\,i\,C1\,d2^2\,e^{-i\,t}\,G\,s^3-\frac{1}{8}\,C2\,d2^2\,e^{-i\,t}\,G\,s^3-\frac{5}{8}\,i\,C1\,d1^2\,e^{i\,t}\,G\,s^3-\frac{1}{8}\,C2\,d1^2\,e^{i\,t}\,G\,s^3+\frac{3}{4}\,C1\,d1\,d2\,e^{i\,t}\,G\,s^3-\frac{3}{4}\,i\,C2\,d1\,d2\,e^{i\,t}\,G\,s^3+\frac{1}{8}\,i\,C1\,d2^2\,e^{i\,t}\,G\,s^3+\frac{5}{8}\,C2\,d2^2\,e^{i\,t}\,G\,s^3-\frac{3}{8}\,i\,C1\,d1^2\,e^{2\,i\,t}\,G\,s^3+\frac{3}{8}\,C2\,d1^2\,e^{2\,i\,t}\,G\,s^3+\frac{3}{4}\,C1\,d1\,d2\,e^{2\,i\,t}\,G\,s^3+\frac{3}{4}\,i\,C2\,d1\,d2\,e^{2\,i\,t}\,G\,s^3+\frac{3}{8}\,i\,C1\,d2^2\,e^{2\,i\,t}\,G\,s^3-\frac{3}{8}\,C2\,d2^2\,e^{2\,i\,t}\,G\,s^3-\frac{p23\,s^3}{2}+C1\,d1\,G\,p33\,s^5+C2\,d2\,G\,p33\,s^5+\frac{1}{2}\,C1\,d1\,e^{-i\,t}\,G\,p33\,s^5-\frac{1}{2}\,i\,C2\,d1\,e^{-i\,t}\,G\,p33\,s^5-\frac{1}{2}\,i\,C1\,d2\,e^{-i\,t}\,G\,p33\,s^5-\frac{1}{2}\,C2\,d2\,e^{-i\,t}\,G\,p33\,s^5+\frac{1}{2}\,C1\,d1\,e^{i\,t}\,G\,p33\,s^5+\frac{1}{2}\,i\,C2\,d1\,e^{i\,t}\,G\,p33\,s^5+\frac{1}{2}\,i\,C1\,d2\,e^{i\,t}\,G\,p33\,s^5-\frac{1}{2}\,C2\,d2\,e^{i\,t}\,G\,p33\,s^5+\frac{1}{2}\,i\,s^3\,z23+\frac{1}{4}\,i\,d1^2\,G\,s^5\,Z23+\frac{1}{2}\,d1\,d2\,G\,s^5\,Z23-\frac{1}{4}\,i\,d2^2\,G\,s^5\,Z23-\frac{1}{2}\,i\,d1^2\,e^{i\,t}\,G\,s^5\,Z23-\frac{1}{2}\,i\,d2^2\,e^{i\,t}\,G\,s^5\,Z23-\frac{3}{4}\,i\,d1^2\,e^{2\,i\,t}\,G\,s^5\,Z23+\frac{3}{2}\,d1\,d2\,e^{2\,i\,t}\,G\,s^5\,Z23+\frac{3}{4}\,i\,d2^2\,e^{2\,i\,t}\,G\,s^5\,Z23+d1\,G\,p33\,s^7\,Z23-i\,d2\,G\,p33\,s^7\,Z23+d1\,e^{i\,t}\,G\,p33\,s^7\,Z23+i\,d2\,e^{i\,t}\,G\,p33\,s^7\,Z23-i\,C1\,d1\,G\,s^5\,z33-C2\,d1\,G\,s^5\,z33+C1\,d2\,G\,s^5\,z33-i\,C2\,d2\,G\,s^5\,z33-i\,C1\,d1\,e^{i\,t}\,G\,s^5\,z33+C2\,d1\,e^{i\,t}\,G\,s^5\,z33+C1\,d2\,e^{i\,t}\,G\,s^5\,z33+i\,C2\,d2\,e^{i\,t}\,G\,s^5\,z33+C1\,G\,p33\,s^7\,z33+i\,C2\,G\,p33\,s^7\,z33+C1\,e^{-i\,t}\,G\,p33\,s^7\,z33-i\,C2\,e^{-i\,t}\,G\,p33\,s^7\,z33-2\,i\,d1\,e^{i\,t}\,G\,s^7\,Z23\,z33+2\,d2\,e^{i\,t}\,G\,s^7\,Z23\,z33+2\,G\,p33\,s^9\,Z23\,z33-\frac{1}{2}\,i\,C1\,G\,s^7\,z33^2+\frac{1}{2}\,C2\,G\,s^7\,z33^2-\frac{1}{2}\,i\,C1\,e^{-i\,t}\,G\,s^7\,z33^2-\frac{1}{2}\,C2\,e^{-i\,t}\,G\,s^7\,z33^2-i\,G\,s^9\,Z23\,z33^2$$

In[•]:= **Collect[%, s]**

Out[•]=

$$\left(\frac{1}{2}\,i\,c1\,e^{i\,t}-\frac{1}{2}\,c2\,e^{i\,t}\right)s+$$
$$s^3\left(-\frac{1}{8}\,i\,C1\,d1^2\,G-\frac{3}{8}\,C2\,d1^2\,G+\frac{1}{4}\,C1\,d1\,d2\,G+\frac{1}{4}\,i\,C2\,d1\,d2\,G-\frac{3}{8}\,i\,C1\,d2^2\,G-\frac{1}{8}\,C2\,d2^2\,G+\right.$$
$$\frac{1}{8}\,i\,C1\,d1^2\,e^{-i\,t}\,G+\frac{1}{8}\,C2\,d1^2\,e^{-i\,t}\,G+\frac{1}{4}\,C1\,d1\,d2\,e^{-i\,t}\,G-\frac{1}{4}\,i\,C2\,d1\,d2\,e^{-i\,t}\,G-$$
$$\frac{1}{8}\,i\,C1\,d2^2\,e^{-i\,t}\,G-\frac{1}{8}\,C2\,d2^2\,e^{-i\,t}\,G-\frac{5}{8}\,i\,C1\,d1^2\,e^{i\,t}\,G-\frac{1}{8}\,C2\,d1^2\,e^{i\,t}\,G+\frac{3}{4}\,C1\,d1\,d2\,e^{i\,t}\,G-$$
$$\frac{3}{4}\,i\,C2\,d1\,d2\,e^{i\,t}\,G+\frac{1}{8}\,i\,C1\,d2^2\,e^{i\,t}\,G+\frac{5}{8}\,C2\,d2^2\,e^{i\,t}\,G-\frac{3}{8}\,i\,C1\,d1^2\,e^{2\,i\,t}\,G+\frac{3}{8}\,C2\,d1^2\,e^{2\,i\,t}\,G+$$
$$\left.\frac{3}{4}\,C1\,d1\,d2\,e^{2\,i\,t}\,G+\frac{3}{4}\,i\,C2\,d1\,d2\,e^{2\,i\,t}\,G+\frac{3}{8}\,i\,C1\,d2^2\,e^{2\,i\,t}\,G-\frac{3}{8}\,C2\,d2^2\,e^{2\,i\,t}\,G-\frac{p23}{2}+\frac{i\,z23}{2}\right)+$$
$$s^5\left(C1\,d1\,G\,p33+C2\,d2\,G\,p33+\frac{1}{2}\,C1\,d1\,e^{-i\,t}\,G\,p33-\frac{1}{2}\,i\,C2\,d1\,e^{-i\,t}\,G\,p33-\right.$$
$$\frac{1}{2}\,i\,C1\,d2\,e^{-i\,t}\,G\,p33-\frac{1}{2}\,C2\,d2\,e^{-i\,t}\,G\,p33+\frac{1}{2}\,C1\,d1\,e^{i\,t}\,G\,p33+\frac{1}{2}\,i\,C2\,d1\,e^{i\,t}\,G\,p33+$$
$$\frac{1}{2}\,i\,C1\,d2\,e^{i\,t}\,G\,p33-\frac{1}{2}\,C2\,d2\,e^{i\,t}\,G\,p33+\frac{1}{4}\,i\,d1^2\,G\,Z23+\frac{1}{2}\,d1\,d2\,G\,Z23-\frac{1}{4}\,i\,d2^2\,G\,Z23-$$
$$\frac{1}{2}\,i\,d1^2\,e^{i\,t}\,G\,Z23-\frac{1}{2}\,i\,d2^2\,e^{i\,t}\,G\,Z23-\frac{3}{4}\,i\,d1^2\,e^{2\,i\,t}\,G\,Z23+\frac{3}{2}\,d1\,d2\,e^{2\,i\,t}\,G\,Z23+$$
$$\frac{3}{4}\,i\,d2^2\,e^{2\,i\,t}\,G\,Z23-i\,C1\,d1\,G\,z33-C2\,d1\,G\,z33+C1\,d2\,G\,z33-i\,C2\,d2\,G\,z33-$$
$$\left.i\,C1\,d1\,e^{i\,t}\,G\,z33+C2\,d1\,e^{i\,t}\,G\,z33+C1\,d2\,e^{i\,t}\,G\,z33+i\,C2\,d2\,e^{i\,t}\,G\,z33\right)+$$
$$s^7\left(d1\,G\,p33\,Z23-i\,d2\,G\,p33\,Z23+d1\,e^{i\,t}\,G\,p33\,Z23+i\,d2\,e^{i\,t}\,G\,p33\,Z23+C1\,G\,p33\,z33+\right.$$
$$i\,C2\,G\,p33\,z33+C1\,e^{-i\,t}\,G\,p33\,z33-i\,C2\,e^{-i\,t}\,G\,p33\,z33-2\,i\,d1\,e^{i\,t}\,G\,Z23\,z33+$$
$$\left.2\,d2\,e^{i\,t}\,G\,Z23\,z33-\frac{1}{2}\,i\,C1\,G\,z33^2+\frac{1}{2}\,C2\,G\,z33^2-\frac{1}{2}\,i\,C1\,e^{-i\,t}\,G\,z33^2-\frac{1}{2}\,C2\,e^{-i\,t}\,G\,z33^2\right)+$$
$$s^9\left(2\,G\,p33\,Z23\,z33-i\,G\,Z23\,z33^2\right)$$

In[•]:=
```
dp2 /. {z2 → z2st, z3 → z3st, Z2 → Z2st,
  Z3 → Z3st, p2 → p2st, p3 → p3st, P2 → P2st, P3 → P3st}
```

Out[•]=
$$\frac{1}{2}\,i\left(\left(\frac{1}{2}\,i\,c1\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,c2\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+p23\,s^3\right)+$$
$$\frac{1}{2}\left(\left(-\frac{1}{2}\,i\,c2\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,c1\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+s^3\,z23\right)-$$
$$2\,G\left(\left(-\frac{1}{2}\,i\,C1\,e^{-i\,t}\left(-1+e^{i\,t}\right)+\frac{1}{2}\,C2\,e^{-i\,t}\left(1+e^{i\,t}\right)\right)s+P23\,s^3\right)$$
$$\left(\left(\frac{1}{2}\,i\,d1\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d2\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+p33\,s^3\right)$$
$$\left(\left(-\frac{1}{2}\,i\,d2\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d1\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+s^3\,z33\right)-$$
$$2\,i\,G\left(\left(\frac{1}{2}\,i\,d1\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d2\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+p33\,s^3\right)$$
$$\left(\left(\frac{1}{2}\,i\,C2\,e^{-i\,t}\left(-1+e^{i\,t}\right)+\frac{1}{2}\,C1\,e^{-i\,t}\left(1+e^{i\,t}\right)\right)s+s^3\,Z23\right)$$
$$\left(\left(-\frac{1}{2}\,i\,d2\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d1\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+s^3\,z33\right)+$$
$$i\,G\left(\left(-\frac{1}{2}\,i\,C1\,e^{-i\,t}\left(-1+e^{i\,t}\right)+\frac{1}{2}\,C2\,e^{-i\,t}\left(1+e^{i\,t}\right)\right)s+P23\,s^3\right)$$
$$\left(\left(-\frac{1}{2}\,i\,d2\,e^{i\,t}\left(-1+e^{-i\,t}\right)+\frac{1}{2}\,d1\,e^{i\,t}\left(1+e^{-i\,t}\right)\right)s+s^3\,z33\right)^2$$

In[•]:= **Expand[%63]**

Out[•]=

$$\frac{1}{2} c1\, e^{i t}\, s + \frac{1}{2} i\, c2\, e^{i t}\, s - \frac{1}{8} C1\, d1^2\, G\, s^3 + \frac{3}{8} i\, C2\, d1^2\, G\, s^3 - \frac{1}{4} i\, C1\, d1\, d2\, G\, s^3 +$$
$$\frac{1}{4} C2\, d1\, d2\, G\, s^3 - \frac{3}{8} C1\, d2^2\, G\, s^3 + \frac{1}{8} i\, C2\, d2^2\, G\, s^3 + \frac{3}{8} C1\, d1^2\, e^{-i t}\, G\, s^3 - \frac{3}{8} i\, C2\, d1^2\, e^{-i t}\, G\, s^3 -$$
$$\frac{3}{4} i\, C1\, d1\, d2\, e^{-i t}\, G\, s^3 - \frac{3}{4} C2\, d1\, d2\, e^{-i t}\, G\, s^3 - \frac{3}{8} C1\, d2^2\, e^{-i t}\, G\, s^3 + \frac{3}{8} i\, C2\, d2^2\, e^{-i t}\, G\, s^3 -$$
$$\frac{3}{8} C1\, d1^2\, e^{i t}\, G\, s^3 + \frac{7}{8} i\, C2\, d1^2\, e^{i t}\, G\, s^3 - \frac{5}{4} i\, C1\, d1\, d2\, e^{i t}\, G\, s^3 - \frac{5}{4} C2\, d1\, d2\, e^{i t}\, G\, s^3 +$$
$$\frac{7}{8} C1\, d2^2\, e^{i t}\, G\, s^3 - \frac{3}{8} i\, C2\, d2^2\, e^{i t}\, G\, s^3 + \frac{1}{8} C1\, d1^2\, e^{2 i t}\, G\, s^3 + \frac{1}{8} i\, C2\, d1^2\, e^{2 i t}\, G\, s^3 +$$
$$\frac{1}{4} i\, C1\, d1\, d2\, e^{2 i t}\, G\, s^3 - \frac{1}{4} C2\, d1\, d2\, e^{2 i t}\, G\, s^3 - \frac{1}{8} C1\, d2^2\, e^{2 i t}\, G\, s^3 - \frac{1}{8} i\, C2\, d2^2\, e^{2 i t}\, G\, s^3 +$$
$$\frac{1}{2} i\, p23\, s^3 - \frac{1}{4} i\, d1^2\, G\, P23\, s^5 - \frac{1}{2} d1\, d2\, G\, P23\, s^5 + \frac{1}{4} i\, d2^2\, G\, P23\, s^5 + \frac{1}{2} i\, d1^2\, e^{i t}\, G\, P23\, s^5 +$$
$$\frac{1}{2} i\, d2^2\, e^{i t}\, G\, P23\, s^5 + \frac{3}{4} i\, d1^2\, e^{2 i t}\, G\, P23\, s^5 - \frac{3}{2} d1\, d2\, e^{2 i t}\, G\, P23\, s^5 - \frac{3}{4} i\, d2^2\, e^{2 i t}\, G\, P23\, s^5 -$$
$$i\, C1\, d1\, G\, p33\, s^5 - C2\, d1\, G\, p33\, s^5 + C1\, d2\, G\, p33\, s^5 - i\, C2\, d2\, G\, p33\, s^5 - i\, C1\, d1\, e^{-i t}\, G\, p33\, s^5 -$$
$$C2\, d1\, e^{-i t}\, G\, p33\, s^5 - C1\, d2\, e^{-i t}\, G\, p33\, s^5 + i\, C2\, d2\, e^{-i t}\, G\, p33\, s^5 - d1\, G\, P23\, p33\, s^7 +$$
$$i\, d2\, G\, P23\, p33\, s^7 - d1\, e^{i t}\, G\, P23\, p33\, s^7 - i\, d2\, e^{i t}\, G\, P23\, p33\, s^7 + \frac{s^3\, z23}{2} + \frac{1}{2} d1^2\, G\, s^5\, Z23 -$$
$$i\, d1\, d2\, G\, s^5\, Z23 - \frac{1}{2} d2^2\, G\, s^5\, Z23 - \frac{1}{2} d1^2\, e^{2 i t}\, G\, s^5\, Z23 - i\, d1\, d2\, e^{2 i t}\, G\, s^5\, Z23 +$$
$$\frac{1}{2} d2^2\, e^{2 i t}\, G\, s^5\, Z23 - i\, d1\, G\, p33\, s^7\, Z23 - d2\, G\, p33\, s^7\, Z23 - i\, d1\, e^{i t}\, G\, p33\, s^7\, Z23 +$$
$$d2\, e^{i t}\, G\, p33\, s^7\, Z23 - C1\, d1\, G\, s^5\, z33 + 2\, i\, C2\, d1\, G\, s^5\, z33 - 2\, i\, C1\, d2\, G\, s^5\, z33 -$$
$$C2\, d2\, G\, s^5\, z33 + \frac{1}{2} C1\, d1\, e^{-i t}\, G\, s^5\, z33 - \frac{1}{2} i\, C2\, d1\, e^{-i t}\, G\, s^5\, z33 - \frac{1}{2} i\, C1\, d2\, e^{-i t}\, G\, s^5\, z33 -$$
$$\frac{1}{2} C2\, d2\, e^{-i t}\, G\, s^5\, z33 + \frac{1}{2} C1\, d1\, e^{i t}\, G\, s^5\, z33 + \frac{1}{2} i\, C2\, d1\, e^{i t}\, G\, s^5\, z33 + \frac{1}{2} i\, C1\, d2\, e^{i t}\, G\, s^5\, z33 -$$
$$\frac{1}{2} C2\, d2\, e^{i t}\, G\, s^5\, z33 + 2\, i\, d1\, e^{i t}\, G\, P23\, s^7\, z33 - 2\, d2\, e^{i t}\, G\, P23\, s^7\, z33 - 2\, i\, C1\, e^{-i t}\, G\, p33\, s^7\, z33 -$$
$$2\, C2\, e^{-i t}\, G\, p33\, s^7\, z33 - 2\, G\, P23\, p33\, s^9\, z33 + d1\, G\, s^7\, Z23\, z33 - i\, d2\, G\, s^7\, Z23\, z33 -$$
$$d1\, e^{i t}\, G\, s^7\, Z23\, z33 - i\, d2\, e^{i t}\, G\, s^7\, Z23\, z33 - 2\, i\, G\, p33\, s^9\, Z23\, z33 + \frac{1}{2} C1\, G\, s^7\, z33^2 +$$
$$\frac{1}{2} i\, C2\, G\, s^7\, z33^2 - \frac{1}{2} C1\, e^{-i t}\, G\, s^7\, z33^2 + \frac{1}{2} i\, C2\, e^{-i t}\, G\, s^7\, z33^2 + i\, G\, P23\, s^9\, z33^2$$

In[•]:= **Collect[%, s]**

Out[•]=

$$\left(\frac{1}{2}\,c1\,e^{i\,t}+\frac{1}{2}\,i\,c2\,e^{i\,t}\right)s+$$
$$s^3\left(-\frac{1}{8}\,C1\,d1^2\,G+\frac{3}{8}\,i\,C2\,d1^2\,G-\frac{1}{4}\,i\,C1\,d1\,d2\,G+\frac{1}{4}\,C2\,d1\,d2\,G-\frac{3}{8}\,C1\,d2^2\,G+\frac{1}{8}\,i\,C2\,d2^2\,G+\right.$$
$$\frac{3}{8}\,C1\,d1^2\,e^{-i\,t}\,G-\frac{3}{8}\,i\,C2\,d1^2\,e^{-i\,t}\,G-\frac{3}{4}\,i\,C1\,d1\,d2\,e^{-i\,t}\,G-\frac{3}{4}\,C2\,d1\,d2\,e^{-i\,t}\,G-$$
$$\frac{3}{8}\,C1\,d2^2\,e^{-i\,t}\,G+\frac{3}{8}\,i\,C2\,d2^2\,e^{-i\,t}\,G-\frac{3}{8}\,C1\,d1^2\,e^{i\,t}\,G+\frac{7}{8}\,i\,C2\,d1^2\,e^{i\,t}\,G-\frac{5}{4}\,i\,C1\,d1\,d2\,e^{i\,t}\,G-$$
$$\frac{5}{4}\,C2\,d1\,d2\,e^{i\,t}\,G+\frac{7}{8}\,C1\,d2^2\,e^{i\,t}\,G-\frac{3}{8}\,i\,C2\,d2^2\,e^{i\,t}\,G+\frac{1}{8}\,C1\,d1^2\,e^{2\,i\,t}\,G+\frac{1}{8}\,i\,C2\,d1^2\,e^{2\,i\,t}\,G+$$
$$\left.\frac{1}{4}\,i\,C1\,d1\,d2\,e^{2\,i\,t}\,G-\frac{1}{4}\,C2\,d1\,d2\,e^{2\,i\,t}\,G-\frac{1}{8}\,C1\,d2^2\,e^{2\,i\,t}\,G-\frac{1}{8}\,i\,C2\,d2^2\,e^{2\,i\,t}\,G+\frac{i\,p23}{2}+\frac{z23}{2}\right)+$$
$$s^5\left(-\frac{1}{4}\,i\,d1^2\,G\,P23-\frac{1}{2}\,d1\,d2\,G\,P23+\frac{1}{4}\,i\,d2^2\,G\,P23+\frac{1}{2}\,i\,d1^2\,e^{i\,t}\,G\,P23+\frac{1}{2}\,i\,d2^2\,e^{i\,t}\,G\,P23+\right.$$
$$\frac{3}{4}\,i\,d1^2\,e^{2\,i\,t}\,G\,P23-\frac{3}{2}\,d1\,d2\,e^{2\,i\,t}\,G\,P23-\frac{3}{4}\,i\,d2^2\,e^{2\,i\,t}\,G\,P23-i\,C1\,d1\,G\,p33-$$
$$C2\,d1\,G\,p33+C1\,d2\,G\,p33-i\,C2\,d2\,G\,p33-i\,C1\,d1\,e^{-i\,t}\,G\,p33-C2\,d1\,e^{-i\,t}\,G\,p33-$$
$$C1\,d2\,e^{-i\,t}\,G\,p33+i\,C2\,d2\,e^{-i\,t}\,G\,p33+\frac{1}{2}\,d1^2\,G\,Z23-i\,d1\,d2\,G\,Z23-\frac{1}{2}\,d2^2\,G\,Z23-$$
$$\frac{1}{2}\,d1^2\,e^{2\,i\,t}\,G\,Z23-i\,d1\,d2\,e^{2\,i\,t}\,G\,Z23+\frac{1}{2}\,d2^2\,e^{2\,i\,t}\,G\,Z23-C1\,d1\,G\,z33+$$
$$2\,i\,C2\,d1\,G\,z33-2\,i\,C1\,d2\,G\,z33-C2\,d2\,G\,z33+\frac{1}{2}\,C1\,d1\,e^{-i\,t}\,G\,z33-$$
$$\frac{1}{2}\,i\,C2\,d1\,e^{-i\,t}\,G\,z33-\frac{1}{2}\,i\,C1\,d2\,e^{-i\,t}\,G\,z33-\frac{1}{2}\,C2\,d2\,e^{-i\,t}\,G\,z33+$$
$$\left.\frac{1}{2}\,C1\,d1\,e^{i\,t}\,G\,z33+\frac{1}{2}\,i\,C2\,d1\,e^{i\,t}\,G\,z33+\frac{1}{2}\,i\,C1\,d2\,e^{i\,t}\,G\,z33-\frac{1}{2}\,C2\,d2\,e^{i\,t}\,G\,z33\right)+$$
$$s^7\left(-d1\,G\,P23\,p33+i\,d2\,G\,P23\,p33-d1\,e^{i\,t}\,G\,P23\,p33-i\,d2\,e^{i\,t}\,G\,P23\,p33-\right.$$
$$i\,d1\,G\,p33\,Z23-d2\,G\,p33\,Z23-i\,d1\,e^{i\,t}\,G\,p33\,Z23+d2\,e^{i\,t}\,G\,p33\,Z23+$$
$$2\,i\,d1\,e^{i\,t}\,G\,P23\,z33-2\,d2\,e^{i\,t}\,G\,P23\,z33-2\,i\,C1\,e^{-i\,t}\,G\,p33\,z33-2\,C2\,e^{-i\,t}\,G\,p33\,z33+$$
$$d1\,G\,Z23\,z33-i\,d2\,G\,Z23\,z33-d1\,e^{i\,t}\,G\,Z23\,z33-i\,d2\,e^{i\,t}\,G\,Z23\,z33+$$
$$\left.\frac{1}{2}\,C1\,G\,z33^2+\frac{1}{2}\,i\,C2\,G\,z33^2-\frac{1}{2}\,C1\,e^{-i\,t}\,G\,z33^2+\frac{1}{2}\,i\,C2\,e^{-i\,t}\,G\,z33^2\right)+$$
$$s^9\left(-2\,G\,P23\,p33\,z33-2\,i\,G\,p33\,Z23\,z33+i\,G\,P23\,z33^2\right)$$

In[•]:=
$$\text{dz2trunc} := \left(\frac{1}{2}\,i\,c1\,e^{i\,t} - \frac{1}{2}\,c2\,e^{i\,t}\right) s + s^3 \left(-\frac{1}{8}\,i\,C1\,d1^2\,G - \frac{3}{8}\,C2\,d1^2\,G + \frac{1}{4}\,C1\,d1\,d2\,G + \frac{1}{4}\,i\,C2\,d1\,d2\,G - \frac{3}{8}\,i\,C1\,d2^2\,G - \frac{1}{8}\,C2\,d2^2\,G + \frac{1}{8}\,i\,C1\,d1^2\,e^{-i\,t}\,G + \frac{1}{8}\,C2\,d1^2\,e^{-i\,t}\,G + \frac{1}{4}\,C1\,d1\,d2\,e^{-i\,t}\,G - \frac{1}{4}\,i\,C2\,d1\,d2\,e^{-i\,t}\,G - \frac{1}{8}\,i\,C1\,d2^2\,e^{-i\,t}\,G - \frac{1}{8}\,C2\,d2^2\,e^{-i\,t}\,G - \frac{5}{8}\,i\,C1\,d1^2\,e^{i\,t}\,G - \frac{1}{8}\,C2\,d1^2\,e^{i\,t}\,G + \frac{3}{4}\,C1\,d1\,d2\,e^{i\,t}\,G - \frac{3}{4}\,i\,C2\,d1\,d2\,e^{i\,t}\,G + \frac{1}{8}\,i\,C1\,d2^2\,e^{i\,t}\,G + \frac{5}{8}\,C2\,d2^2\,e^{i\,t}\,G - \frac{3}{8}\,i\,C1\,d1^2\,e^{2\,i\,t}\,G + \frac{3}{8}\,C2\,d1^2\,e^{2\,i\,t}\,G + \frac{3}{4}\,C1\,d1\,d2\,e^{2\,i\,t}\,G + \frac{3}{4}\,i\,C2\,d1\,d2\,e^{2\,i\,t}\,G + \frac{3}{8}\,i\,C1\,d2^2\,e^{2\,i\,t}\,G - \frac{3}{8}\,C2\,d2^2\,e^{2\,i\,t}\,G - \frac{p23}{2} + \frac{i\,z23}{2}\right)$$

In[•]:=
$$\text{dz2trunc}$$

Out[•]=
$$\left(\frac{1}{2}\,i\,c1\,e^{i\,t} - \frac{1}{2}\,c2\,e^{i\,t}\right) s + s^3 \left(-\frac{1}{8}\,i\,C1\,d1^2\,G - \frac{3}{8}\,C2\,d1^2\,G + \frac{1}{4}\,C1\,d1\,d2\,G + \frac{1}{4}\,i\,C2\,d1\,d2\,G - \frac{3}{8}\,i\,C1\,d2^2\,G - \frac{1}{8}\,C2\,d2^2\,G + \frac{1}{8}\,i\,C1\,d1^2\,e^{-i\,t}\,G + \frac{1}{8}\,C2\,d1^2\,e^{-i\,t}\,G + \frac{1}{4}\,C1\,d1\,d2\,e^{-i\,t}\,G - \frac{1}{4}\,i\,C2\,d1\,d2\,e^{-i\,t}\,G - \frac{1}{8}\,i\,C1\,d2^2\,e^{-i\,t}\,G - \frac{1}{8}\,C2\,d2^2\,e^{-i\,t}\,G - \frac{5}{8}\,i\,C1\,d1^2\,e^{i\,t}\,G - \frac{1}{8}\,C2\,d1^2\,e^{i\,t}\,G + \frac{3}{4}\,C1\,d1\,d2\,e^{i\,t}\,G - \frac{3}{4}\,i\,C2\,d1\,d2\,e^{i\,t}\,G + \frac{1}{8}\,i\,C1\,d2^2\,e^{i\,t}\,G + \frac{5}{8}\,C2\,d2^2\,e^{i\,t}\,G - \frac{3}{8}\,i\,C1\,d1^2\,e^{2\,i\,t}\,G + \frac{3}{8}\,C2\,d1^2\,e^{2\,i\,t}\,G + \frac{3}{4}\,C1\,d1\,d2\,e^{2\,i\,t}\,G + \frac{3}{4}\,i\,C2\,d1\,d2\,e^{2\,i\,t}\,G + \frac{3}{8}\,i\,C1\,d2^2\,e^{2\,i\,t}\,G - \frac{3}{8}\,C2\,d2^2\,e^{2\,i\,t}\,G - \frac{p23}{2} + \frac{i\,z23}{2}\right)$$

In[•]:=
$$\text{dp2trunc} := \left(\frac{1}{2}\,c1\,e^{i\,t} + \frac{1}{2}\,i\,c2\,e^{i\,t}\right) s + s^3 \left(-\frac{1}{8}\,C1\,d1^2\,G + \frac{3}{8}\,i\,C2\,d1^2\,G - \frac{1}{4}\,i\,C1\,d1\,d2\,G + \frac{1}{4}\,C2\,d1\,d2\,G - \frac{3}{8}\,C1\,d2^2\,G + \frac{1}{8}\,i\,C2\,d2^2\,G + \frac{3}{8}\,C1\,d1^2\,e^{-i\,t}\,G - \frac{3}{8}\,i\,C2\,d1^2\,e^{-i\,t}\,G - \frac{3}{4}\,i\,C1\,d1\,d2\,e^{-i\,t}\,G - \frac{3}{4}\,C2\,d1\,d2\,e^{-i\,t}\,G - \frac{3}{8}\,C1\,d2^2\,e^{-i\,t}\,G + \frac{3}{8}\,i\,C2\,d2^2\,e^{-i\,t}\,G - \frac{3}{8}\,C1\,d1^2\,e^{i\,t}\,G + \frac{7}{8}\,i\,C2\,d1^2\,e^{i\,t}\,G - \frac{5}{4}\,i\,C1\,d1\,d2\,e^{i\,t}\,G - \frac{5}{4}\,C2\,d1\,d2\,e^{i\,t}\,G + \frac{7}{8}\,C1\,d2^2\,e^{i\,t}\,G - \frac{3}{8}\,i\,C2\,d2^2\,e^{i\,t}\,G + \frac{1}{8}\,C1\,d1^2\,e^{2\,i\,t}\,G + \frac{1}{8}\,i\,C2\,d1^2\,e^{2\,i\,t}\,G + \frac{1}{4}\,i\,C1\,d1\,d2\,e^{2\,i\,t}\,G - \frac{1}{4}\,C2\,d1\,d2\,e^{2\,i\,t}\,G - \frac{1}{8}\,C1\,d2^2\,e^{2\,i\,t}\,G - \frac{1}{8}\,i\,C2\,d2^2\,e^{2\,i\,t}\,G + \frac{i\,p23}{2} + \frac{z23}{2}\right)$$

In[•]:= **dp2trunc**

Out[•]=
$$\left(\frac{1}{2}\,c1\,e^{i\,t}+\frac{1}{2}\,i\,c2\,e^{i\,t}\right)s+s^3\left(-\frac{1}{8}\,C1\,d1^2\,G+\frac{3}{8}\,i\,C2\,d1^2\,G-\frac{1}{4}\,i\,C1\,d1\,d2\,G+\frac{1}{4}\,C2\,d1\,d2\,G-\frac{3}{8}\,C1\,d2^2\,G+\frac{1}{8}\,i\,C2\,d2^2\,G+\frac{3}{8}\,C1\,d1^2\,e^{-i\,t}\,G-\frac{3}{8}\,i\,C2\,d1^2\,e^{-i\,t}\,G-\frac{3}{4}\,i\,C1\,d1\,d2\,e^{-i\,t}\,G-\frac{3}{4}\,C2\,d1\,d2\,e^{-i\,t}\,G-\frac{3}{8}\,C1\,d2^2\,e^{-i\,t}\,G+\frac{3}{8}\,i\,C2\,d2^2\,e^{-i\,t}\,G-\frac{3}{8}\,C1\,d1^2\,e^{i\,t}\,G+\frac{7}{8}\,i\,C2\,d1^2\,e^{i\,t}\,G-\frac{5}{4}\,i\,C1\,d1\,d2\,e^{i\,t}\,G-\frac{5}{4}\,C2\,d1\,d2\,e^{i\,t}\,G+\frac{7}{8}\,C1\,d2^2\,e^{i\,t}\,G-\frac{3}{8}\,i\,C2\,d2^2\,e^{i\,t}\,G+\frac{1}{8}\,C1\,d1^2\,e^{2\,i\,t}\,G+\frac{1}{8}\,i\,C2\,d1^2\,e^{2\,i\,t}\,G+\frac{1}{4}\,i\,C1\,d1\,d2\,e^{2\,i\,t}\,G-\frac{1}{4}\,C2\,d1\,d2\,e^{2\,i\,t}\,G-\frac{1}{8}\,C1\,d2^2\,e^{2\,i\,t}\,G-\frac{1}{8}\,i\,C2\,d2^2\,e^{2\,i\,t}\,G+\frac{i\,p23}{2}+\frac{z23}{2}\right)$$

In[•]:=
```
DSolve[
 {l'[t] == -1/8 i C1 d1^2 G - 3/8 C2 d1^2 G + 1/4 C1 d1 d2 G + 1/4 i C2 d1 d2 G - 3/8 i C1 d2^2 G - 1/8 C2 d2^2 G +
    1/8 i C1 d1^2 E^(-i t) G + 1/8 C2 d1^2 E^(-i t) G + 1/4 C1 d1 d2 E^(-i t) G - 1/4 i C2 d1 d2 E^(-i t) G -
    1/8 i C1 d2^2 E^(-i t) G - 1/8 C2 d2^2 E^(-i t) G - 5/8 i C1 d1^2 E^(i t) G - 1/8 C2 d1^2 E^(i t) G +
    3/4 C1 d1 d2 E^(i t) G - 3/4 i C2 d1 d2 E^(i t) G + 1/8 i C1 d2^2 E^(i t) G +
    5/8 C2 d2^2 E^(i t) G - 3/8 i C1 d1^2 E^(2 i t) G + 3/8 C2 d1^2 E^(2 i t) G + 3/4 C1 d1 d2 E^(2 i t) G +
    3/4 i C2 d1 d2 E^(2 i t) G + 3/8 i C1 d2^2 E^(2 i t) G - 3/8 C2 d2^2 E^(2 i t) G - m[t]/2 + (i * l[t])/2,
  m'[t] == -1/8 C1 d1^2 G + 3/8 i C2 d1^2 G - 1/4 i C1 d1 d2 G + 1/4 C2 d1 d2 G - 3/8 C1 d2^2 G +
    1/8 i C2 d2^2 G + 3/8 C1 d1^2 E^(-i t) G - 3/8 i C2 d1^2 E^(-i t) G - 3/4 i C1 d1 d2 E^(-i t) G -
    3/4 C2 d1 d2 E^(-i t) G - 3/8 C1 d2^2 E^(-i t) G + 3/8 i C2 d2^2 E^(-i t) G - 3/8 C1 d1^2 E^(i t) G + 7/8 i C2 d1^2 E^(i t) G -
    5/4 i C1 d1 d2 E^(i t) G - 5/4 C2 d1 d2 E^(i t) G + 7/8 C1 d2^2 E^(i t) G - 3/8 i C2 d2^2 E^(i t) G +
    1/8 C1 d1^2 E^(2 i t) G + 1/8 i C2 d1^2 E^(2 i t) G + 1/4 i C1 d1 d2 E^(2 i t) G - 1/4 C2 d1 d2 E^(2 i t) G -
    1/8 C1 d2^2 E^(2 i t) G - 1/8 i C2 d2^2 E^(2 i t) G + (i * m[t])/2 + l[t]/2}, {l[t], m[t]}, t]
```

Out[•]=
```
{{l[t] → 1/8 E^(i t/2) G (2 (-2 i C2 d1 + C1 (d1 + i d2)) (d1 - i d2) E^(-i t) +
      2 (-i d1 + d2) (-i C1 d1 + 2 C2 d1 - C1 d2) E^(i t) - (C1 - i C2) (d1 - i d2)^2 E^(-2 i t) -
      (C1 + i C2) (d1 + i d2)^2 E^(2 i t) - 4 (i C1 + C2) (d1 + i d2)^2 t) Cos[t/2] +
   E^(i t/2) C[1] Cos[t/2] + 1/8 E^(i t/2) G (2 (d1 - i d2) (C2 (d1 + i d2) - 2 C1 d2) E^(-i t) -
      2 (d1 + i d2) (C2 (d1 - i d2) - 2 C1 d2) E^(i t) - i (C1 - i C2) (d1 - i d2)^2 E^(-2 i t) +
      i (C1 + i C2) (d1 + i d2)^2 E^(2 i t) + 4 (C1 - i C2) (d1 + i d2)^2 t) Sin[t/2] - E^(i t/2) C[2] Sin[t/2],
  m[t] → -1/8 E^(i t/2) G (2 (d1 - i d2) (C2 (d1 + i d2) - 2 C1 d2) E^(-i t) -
      2 (d1 + i d2) (C2 (d1 - i d2) - 2 C1 d2) E^(i t) - i (C1 - i C2) (d1 - i d2)^2 E^(-2 i t) +
      i (C1 + i C2) (d1 + i d2)^2 E^(2 i t) + 4 (C1 - i C2) (d1 + i d2)^2 t) Cos[t/2] +
   E^(i t/2) C[2] Cos[t/2] + 1/8 E^(i t/2) G (2 (-2 i C2 d1 + C1 (d1 + i d2)) (d1 - i d2) E^(-i t) +
      2 (-i d1 + d2) (-i C1 d1 + 2 C2 d1 - C1 d2) E^(i t) - (C1 - i C2) (d1 - i d2)^2 E^(-2 i t) -
      (C1 + i C2) (d1 + i d2)^2 E^(2 i t) - 4 (i C1 + C2) (d1 + i d2)^2 t) Sin[t/2] + E^(i t/2) C[1] Sin[t/2]}}
```

In[•]:=
$$\frac{1}{8} e^{\frac{i t}{2}} G \left(2 \left(-2 i C2\, d1 + C1 \left(d1 + i\, d2\right)\right) \left(d1 - i\, d2\right) e^{-i t} + 2 \left(-i\, d1 + d2\right) \left(-i\, C1\, d1 + 2\, C2\, d1 - C1\, d2\right) e^{i t} - \left(C1 - i\, C2\right) \left(d1 - i\, d2\right)^2 e^{-2 i t} - \left(C1 + i\, C2\right) \left(d1 + i\, d2\right)^2 e^{2 i t} - 4 \left(i\, C1 + C2\right) \left(d1 + i\, d2\right)^2 t\right) \text{Cos}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[1] \text{Cos}\left[\frac{t}{2}\right] + \frac{1}{8} e^{\frac{i t}{2}} G \left(2 \left(d1 - i\, d2\right) \left(C2 \left(d1 + i\, d2\right) - 2\, C1\, d2\right) e^{-i t} - 2 \left(d1 + i\, d2\right) \left(C2 \left(d1 - i\, d2\right) - 2\, C1\, d2\right) e^{i t} - i \left(C1 - i\, C2\right) \left(d1 - i\, d2\right)^2 e^{-2 i t} + i \left(C1 + i\, C2\right) \left(d1 + i\, d2\right)^2 e^{2 i t} + 4 \left(C1 - i\, C2\right) \left(d1 + i\, d2\right)^2 t\right) \text{Sin}\left[\frac{t}{2}\right] - e^{\frac{i t}{2}} C[2] \text{Sin}\left[\frac{t}{2}\right]$$

Out[•]=
$$\frac{1}{8} e^{\frac{i t}{2}} G \left(2 \left(-2 i C2\, d1 + C1 \left(d1 + i\, d2\right)\right) \left(d1 - i\, d2\right) e^{-i t} + 2 \left(-i\, d1 + d2\right) \left(-i\, C1\, d1 + 2\, C2\, d1 - C1\, d2\right) e^{i t} - \left(C1 - i\, C2\right) \left(d1 - i\, d2\right)^2 e^{-2 i t} - \left(C1 + i\, C2\right) \left(d1 + i\, d2\right)^2 e^{2 i t} - 4 \left(i\, C1 + C2\right) \left(d1 + i\, d2\right)^2 t\right) \text{Cos}\left[\frac{t}{2}\right] + e^{\frac{i t}{2}} C[1] \text{Cos}\left[\frac{t}{2}\right] + \frac{1}{8} e^{\frac{i t}{2}} G \left(2 \left(d1 - i\, d2\right) \left(C2 \left(d1 + i\, d2\right) - 2\, C1\, d2\right) e^{-i t} - 2 \left(d1 + i\, d2\right) \left(C2 \left(d1 - i\, d2\right) - 2\, C1\, d2\right) e^{i t} - i \left(C1 - i\, C2\right) \left(d1 - i\, d2\right)^2 e^{-2 i t} + i \left(C1 + i\, C2\right) \left(d1 + i\, d2\right)^2 e^{2 i t} + 4 \left(C1 - i\, C2\right) \left(d1 + i\, d2\right)^2 t\right) \text{Sin}\left[\frac{t}{2}\right] - e^{\frac{i t}{2}} C[2] \text{Sin}\left[\frac{t}{2}\right]$$

In[•]:= `TrigReduce[%71]`

Out[•]=
$$\frac{1}{8} C1\, d1^2 G - \frac{3}{8} i\, C2\, d1^2 G + \frac{1}{4} i\, C1\, d1\, d2\, G - \frac{1}{4} C2\, d1\, d2\, G + \frac{3}{8} C1\, d2^2 G - \frac{1}{8} i\, C2\, d2^2 G - \frac{1}{8} C1\, d1^2 e^{i t} G - \frac{3}{8} i\, C2\, d1^2 e^{i t} G + \frac{1}{4} i\, C1\, d1\, d2\, e^{i t} G + \frac{1}{4} C2\, d1\, d2\, e^{i t} G - \frac{3}{8} C1\, d2^2 e^{i t} G - \frac{1}{8} i\, C2\, d2^2 e^{i t} G - \frac{1}{4} C1\, d1^2 e^{2 i t} G - \frac{1}{4} i\, C2\, d1^2 e^{2 i t} G - \frac{1}{2} i\, C1\, d1\, d2\, e^{2 i t} G + \frac{1}{2} C2\, d1\, d2\, e^{2 i t} G + \frac{1}{4} C1\, d2^2 e^{2 i t} G + \frac{1}{4} i\, C2\, d2^2 e^{2 i t} G - \frac{1}{2} i\, C1\, d1^2 e^{i t} G\, t - \frac{1}{2} C2\, d1^2 e^{i t} G\, t + C1\, d1\, d2\, e^{i t} G\, t - i\, C2\, d1\, d2\, e^{i t} G\, t + \frac{1}{2} i\, C1\, d2^2 e^{i t} G\, t + \frac{1}{2} C2\, d2^2 e^{i t} G\, t + \frac{C[1]}{2} + \frac{1}{2} e^{i t} C[1] - \frac{1}{2} i\, C[2] + \frac{1}{2} i\, e^{i t} C[2]$$

In[•]:=
$$\frac{1}{8} C1\, d1^2\, G - \frac{3}{8} i\, C2\, d1^2\, G + \frac{1}{4} i\, C1\, d1\, d2\, G - \frac{1}{4} C2\, d1\, d2\, G + \frac{3}{8} C1\, d2^2\, G - \frac{1}{8} i\, C2\, d2^2\, G - \frac{1}{8} C1\, d1^2\, e^{i t}\, G - \frac{3}{8} i\, C2\, d1^2\, e^{i t}\, G + \frac{1}{4} i\, C1\, d1\, d2\, e^{i t}\, G + \frac{1}{4} C2\, d1\, d2\, e^{i t}\, G - \frac{3}{8} C1\, d2^2\, e^{i t}\, G - \frac{1}{8} i\, C2\, d2^2\, e^{i t}\, G - \frac{1}{4} C1\, d1^2\, e^{2 i t}\, G - \frac{1}{4} i\, C2\, d1^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1\, d2\, e^{2 i t}\, G + \frac{1}{2} C2\, d1\, d2\, e^{2 i t}\, G + \frac{1}{4} C1\, d2^2\, e^{2 i t}\, G + \frac{1}{4} i\, C2\, d2^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1^2\, e^{i t}\, G\, t - \frac{1}{2} C2\, d1^2\, e^{i t}\, G\, t + C1\, d1\, d2\, e^{i t}\, G\, t - i\, C2\, d1\, d2\, e^{i t}\, G\, t + \frac{1}{2} i\, C1\, d2^2\, e^{i t}\, G\, t + \frac{1}{2} C2\, d2^2\, e^{i t}\, G\, t$$

Out[•]=
$$\frac{1}{8} C1\, d1^2\, G - \frac{3}{8} i\, C2\, d1^2\, G + \frac{1}{4} i\, C1\, d1\, d2\, G - \frac{1}{4} C2\, d1\, d2\, G + \frac{3}{8} C1\, d2^2\, G - \frac{1}{8} i\, C2\, d2^2\, G - \frac{1}{8} C1\, d1^2\, e^{i t}\, G - \frac{3}{8} i\, C2\, d1^2\, e^{i t}\, G + \frac{1}{4} i\, C1\, d1\, d2\, e^{i t}\, G + \frac{1}{4} C2\, d1\, d2\, e^{i t}\, G - \frac{3}{8} C1\, d2^2\, e^{i t}\, G - \frac{1}{8} i\, C2\, d2^2\, e^{i t}\, G - \frac{1}{4} C1\, d1^2\, e^{2 i t}\, G - \frac{1}{4} i\, C2\, d1^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1\, d2\, e^{2 i t}\, G + \frac{1}{2} C2\, d1\, d2\, e^{2 i t}\, G + \frac{1}{4} C1\, d2^2\, e^{2 i t}\, G + \frac{1}{4} i\, C2\, d2^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1^2\, e^{i t}\, G\, t - \frac{1}{2} C2\, d1^2\, e^{i t}\, G\, t + C1\, d1\, d2\, e^{i t}\, G\, t - i\, C2\, d1\, d2\, e^{i t}\, G\, t + \frac{1}{2} i\, C1\, d2^2\, e^{i t}\, G\, t + \frac{1}{2} C2\, d2^2\, e^{i t}\, G\, t$$

In[•]:=
```
Simplify[%73]
```

Out[•]=
$$-\frac{1}{8} G \left(C1 \left(-d2^2 \left(3 + 2\, e^{2 i t} + e^{i t} \left(-3 + 4 i t\right)\right) + 2 i\, d1\, d2 \left(-1 + 2\, e^{2 i t} + e^{i t} \left(-1 + 4 i t\right)\right) + d1^2 \left(-1 + 2\, e^{2 i t} + e^{i t} \left(1 + 4 i t\right)\right)\right) + C2 \left(-i\, d2^2 \left(-1 + 2\, e^{2 i t} + e^{i t} \left(-1 - 4 i t\right)\right) - 2\, d1\, d2 \left(-1 + 2\, e^{2 i t} + e^{i t} \left(1 - 4 i t\right)\right) + d1^2 \left(3 i + 2 i\, e^{2 i t} + e^{i t} \left(3 i + 4 t\right)\right)\right)\right)$$

In[•]:=
$$\frac{1}{8} C1\, d1^2\, G - \frac{3}{8} i\, C2\, d1^2\, G + \frac{1}{4} i\, C1\, d1\, d2\, G - \frac{1}{4} C2\, d1\, d2\, G + \frac{3}{8} C1\, d2^2\, G - \frac{1}{8} i\, C2\, d2^2\, G - \frac{1}{8} C1\, d1^2\, e^{i t}\, G - \frac{3}{8} i\, C2\, d1^2\, e^{i t}\, G + \frac{1}{4} i\, C1\, d1\, d2\, e^{i t}\, G + \frac{1}{4} C2\, d1\, d2\, e^{i t}\, G - \frac{3}{8} C1\, d2^2\, e^{i t}\, G - \frac{1}{8} i\, C2\, d2^2\, e^{i t}\, G - \frac{1}{4} C1\, d1^2\, e^{2 i t}\, G - \frac{1}{4} i\, C2\, d1^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1\, d2\, e^{2 i t}\, G + \frac{1}{2} C2\, d1\, d2\, e^{2 i t}\, G + \frac{1}{4} C1\, d2^2\, e^{2 i t}\, G + \frac{1}{4} i\, C2\, d2^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1^2\, e^{i t}\, G\, t - \frac{1}{2} C2\, d1^2\, e^{i t}\, G\, t + C1\, d1\, d2\, e^{i t}\, G\, t - i\, C2\, d1\, d2\, e^{i t}\, G\, t + \frac{1}{2} i\, C1\, d2^2\, e^{i t}\, G\, t + \frac{1}{2} C2\, d2^2\, e^{i t}\, G\, t$$

Out[•]=
$$\frac{1}{8} C1\, d1^2\, G - \frac{3}{8} i\, C2\, d1^2\, G + \frac{1}{4} i\, C1\, d1\, d2\, G - \frac{1}{4} C2\, d1\, d2\, G + \frac{3}{8} C1\, d2^2\, G - \frac{1}{8} i\, C2\, d2^2\, G - \frac{1}{8} C1\, d1^2\, e^{i t}\, G - \frac{3}{8} i\, C2\, d1^2\, e^{i t}\, G + \frac{1}{4} i\, C1\, d1\, d2\, e^{i t}\, G + \frac{1}{4} C2\, d1\, d2\, e^{i t}\, G - \frac{3}{8} C1\, d2^2\, e^{i t}\, G - \frac{1}{8} i\, C2\, d2^2\, e^{i t}\, G - \frac{1}{4} C1\, d1^2\, e^{2 i t}\, G - \frac{1}{4} i\, C2\, d1^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1\, d2\, e^{2 i t}\, G + \frac{1}{2} C2\, d1\, d2\, e^{2 i t}\, G + \frac{1}{4} C1\, d2^2\, e^{2 i t}\, G + \frac{1}{4} i\, C2\, d2^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1^2\, e^{i t}\, G\, t - \frac{1}{2} C2\, d1^2\, e^{i t}\, G\, t + C1\, d1\, d2\, e^{i t}\, G\, t - i\, C2\, d1\, d2\, e^{i t}\, G\, t + \frac{1}{2} i\, C1\, d2^2\, e^{i t}\, G\, t + \frac{1}{2} C2\, d2^2\, e^{i t}\, G\, t$$

In[•]:=
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Collect[%, t * Exp[I * t]]
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Out[•]=
$$\frac{1}{8} C1\, d1^2\, G - \frac{3}{8} i\, C2\, d1^2\, G + \frac{1}{4} i\, C1\, d1\, d2\, G - \frac{1}{4} C2\, d1\, d2\, G + \frac{3}{8} C1\, d2^2\, G - \frac{1}{8} i\, C2\, d2^2\, G - \frac{1}{8} C1\, d1^2\, e^{i t}\, G - \frac{3}{8} i\, C2\, d1^2\, e^{i t}\, G + \frac{1}{4} i\, C1\, d1\, d2\, e^{i t}\, G + \frac{1}{4} C2\, d1\, d2\, e^{i t}\, G - \frac{3}{8} C1\, d2^2\, e^{i t}\, G - \frac{1}{8} i\, C2\, d2^2\, e^{i t}\, G - \frac{1}{4} C1\, d1^2\, e^{2 i t}\, G - \frac{1}{4} i\, C2\, d1^2\, e^{2 i t}\, G - \frac{1}{2} i\, C1\, d1\, d2\, e^{2 i t}\, G + \frac{1}{2} C2\, d1\, d2\, e^{2 i t}\, G + \frac{1}{4} C1\, d2^2\, e^{2 i t}\, G + \frac{1}{4} i\, C2\, d2^2\, e^{2 i t}\, G + e^{i t} \left( -\frac{1}{2} i\, C1\, d1^2\, G - \frac{1}{2} C2\, d1^2\, G + C1\, d1\, d2\, G - i\, C2\, d1\, d2\, G + \frac{1}{2} i\, C1\, d2^2\, G + \frac{1}{2} C2\, d2^2\, G \right) t$$

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$$-\frac{1}{2} i\, C1\, d1^2\, G - \frac{1}{2} C2\, d1^2\, G + C1\, d1\, d2\, G - i\, C2\, d1\, d2\, G + \frac{1}{2} i\, C1\, d2^2\, G + \frac{1}{2} C2\, d2^2\, G$$

Out[•]=
$$-\frac{1}{2} i\, C1\, d1^2\, G - \frac{1}{2} C2\, d1^2\, G + C1\, d1\, d2\, G - i\, C2\, d1\, d2\, G + \frac{1}{2} i\, C1\, d2^2\, G + \frac{1}{2} C2\, d2^2\, G$$