

PRACTICAL 5

1. Find the solution of system of equations $x'[t] + y[t] = \sin[t]$, $y'[t] + x[t] = \cos[t]$

$$\begin{aligned} & \text{DSolve}[\{x'[t] + y[t] = \sin[t], y'[t] + x[t] = \cos[t]\}, \{x[t], y[t]\}, t] \\ & \left\{ \begin{aligned} x[t] \rightarrow & \frac{1}{2} e^{-t} (1 + e^{2t}) C[1] - \frac{1}{2} e^{-t} (-1 + e^{2t}) C[2] - \frac{1}{4} (1 + e^{-2t}) (-1 + e^{2t}) \sin[t] - \\ & \frac{1}{4} (-1 + e^{-2t}) (1 + e^{2t}) \sin[t], y[t] \rightarrow -\frac{1}{2} e^{-t} (-1 + e^{2t}) C[1] + \frac{1}{2} e^{-t} (1 + e^{2t}) C[2] + \\ & \frac{1}{4} (-1 + e^{-2t}) (-1 + e^{2t}) \sin[t] + \frac{1}{4} (1 + e^{-2t}) (1 + e^{2t}) \sin[t] \end{aligned} \right\} \end{aligned}$$

2. find the solution of system of equations $x'[t] + y[t] = \sin[t]$,
 $y'[t] + x[t] = \cos[t]$, $x[0] = 0$, $y[0] = 1$

$$\begin{aligned} & \text{DSolve}[\{x'[t] + y[t] = \sin[t], \\ & y'[t] + x[t] = \cos[t], x[0] = 0, y[0] = 1\}, \{x[t], y[t]\}, t] \\ & \left\{ \begin{aligned} x[t] \rightarrow & -\frac{1}{2} e^{-t} (-1 + e^{2t}), y[t] \rightarrow \frac{1}{2} e^{-t} (1 + e^{2t} + 2 e^t \sin[t]) \end{aligned} \right\} \end{aligned}$$

3. find the solution of system of equations $x'[t] - 7x[t] + y[t] = 0$,
 $y'[t] - 2x[t] - 5y[t] = 0$

$$\begin{aligned} & \text{DSolve}[\{x'[t] - 7x[t] + y[t] = 0, y'[t] - 2x[t] - 5y[t] == 0\}, \{x[t], y[t]\}, t] \\ & \left\{ \begin{aligned} x[t] \rightarrow & -e^{6t} C[2] \sin[t] + e^{6t} C[1] (\cos[t] + \sin[t]), \\ y[t] \rightarrow & e^{6t} C[2] (\cos[t] - \sin[t]) + 2 e^{6t} C[1] \sin[t] \end{aligned} \right\} \end{aligned}$$

4. find the solution of system of equations $x'[t] - e^t + \tan[t] = 0$,
 $y'[t] + \tan[t] - e^t = 0$

$$\begin{aligned} & \text{DSolve}[\{x'[t] - e^t + \tan[t] == 0, y'[t] + \tan[t] - e^t == 0\}, \{x[t], y[t]\}, t] \\ & \left\{ \begin{aligned} x[t] \rightarrow & C[1] + \frac{e^t}{\log[e]} + \log[\cos[t]], y[t] \rightarrow C[2] + \frac{e^t}{\log[e]} + \log[\cos[t]] \end{aligned} \right\} \end{aligned}$$

5. find the solution of system of equations $x'[t] - xe^t + 2y + 3z = 0$,
 $y'[t] + 2y - z = 0$,
 $z'[t] + z = 0$

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DSolve [{x'[t] - x[t] Exp[t] + 2 y[t] + 3 z[t] == 0, y'[t] + 2 y[t] - z[t] == 0,
z'[t] + z[t] == 0}, {x[t], y[t], z[t]}, t]
{ {x[t] → e^t C[1] - 5 e^t C[3] (-e^-t - ExpIntegralEi[-e^t]) -
2 e^t C[2] (e^-t (-1/2 e^-2 t + e^-t) + 1/2 ExpIntegralEi[-e^t]),
y[t] → e^-2 t C[2] + e^-t C[3], z[t] → e^-t C[3]} }
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6. find the solution of system of equation $x'''[t] + y[t] = 0$,
 $y'''[t] - 64 x[t] = 0$, $x[0] = 0$, $y[0] = 0$

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DSolve[{x'''[t] + y[t] == 0, y'''[t] - 64 x[t] == 0, x[0] == 0, y[0] == 0},
{x[t], y[t]}, t]
{ {x[t] → 1/192 e^-sqrt(3) t
(-16 sqrt(3) C[2] Cos[t] + 16 sqrt(3) e^2sqrt(3) t C[2] Cos[t] + 8 C[3] Cos[t] + 8 e^2sqrt(3) t C[3] Cos[t] +
2 C[5] Cos[t] + 2 e^2sqrt(3) t C[5] Cos[t] - sqrt(3) C[6] Cos[t] + sqrt(3) e^2sqrt(3) t C[6] Cos[t] -
16 e^sqrt(3) t C[3] Cos[2 t] - 4 e^sqrt(3) t C[5] Cos[2 t] + 16 C[2] Sin[t] +
16 e^2sqrt(3) t C[2] Sin[t] - 8 sqrt(3) C[3] Sin[t] + 8 sqrt(3) e^2sqrt(3) t C[3] Sin[t] +
2 sqrt(3) C[5] Sin[t] - 2 sqrt(3) e^2sqrt(3) t C[5] Sin[t] - C[6] Sin[t] -
e^2sqrt(3) t C[6] Sin[t] + 32 e^sqrt(3) t C[2] Sin[2 t] - 2 e^sqrt(3) t C[6] Sin[2 t]),
y[t] → -1/24 e^-sqrt(3) t (16 C[2] Cos[t] + 16 e^2sqrt(3) t C[2] Cos[t] - 8 sqrt(3) C[3] Cos[t] +
8 sqrt(3) e^2sqrt(3) t C[3] Cos[t] + 2 sqrt(3) C[5] Cos[t] - 2 sqrt(3) e^2sqrt(3) t C[5] Cos[t] -
C[6] Cos[t] - e^2sqrt(3) t C[6] Cos[t] - 32 e^sqrt(3) t C[2] Cos[2 t] + 2 e^sqrt(3) t C[6] Cos[2 t] +
16 sqrt(3) C[2] Sin[t] - 16 sqrt(3) e^2sqrt(3) t C[2] Sin[t] - 8 C[3] Sin[t] -
8 e^2sqrt(3) t C[3] Sin[t] - 2 C[5] Sin[t] - 2 e^2sqrt(3) t C[5] Sin[t] + sqrt(3) C[6] Sin[t] -
sqrt(3) e^2sqrt(3) t C[6] Sin[t] - 16 e^sqrt(3) t C[3] Sin[2 t] - 4 e^sqrt(3) t C[5] Sin[2 t])} }
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7. find the solution of system of equations $x''[t] + 2 y''[t] - x[t] + y[t] = 0$,
 $2 x''[t] + y''[t] + 2 x[t] + y[t] = 3 e^{-t}$

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DSolve[{x''[t] + 2 y''[t] - x[t] + y[t] == 0,
        2 x''[t] + y''[t] + 2 x[t] + y[t] == 3 Exp[-t]}, {x[t], y[t]}, t]

{ {x[t] → 1/48 e^{(-1-2 i) t} (2 i - 2 i e^{2 i t} + t + e^{2 i t} t)
   ((-3 + 4 i) + (1 + i) t + e^{2 i t} ((-3 - 4 i) + (1 - i) t)) +
  1/48 i e^{(-1-2 i) t} (-1 + e^{2 i t}) t (i - (1 - i) t - e^{2 i t} (i + (1 + i) t)) +
  1/48 i e^{(-1-2 i) t} (-i + i e^{2 i t} + t + e^{2 i t} t) (-1 - (1 - i) t + e^{2 i t} (1 + (1 + i) t)) +
  1/48 e^{(-1-2 i) t} (3 + 3 e^{2 i t} - i t + i e^{2 i t} t) ((3 + 2 i) + (1 - i) t + e^{2 i t} ((3 - 2 i) + (1 + i) t)) +
  1/6 e^{-i t} (3 + 3 e^{2 i t} - i t + i e^{2 i t} t) C[1] + 1/6 e^{-i t} (2 i - 2 i e^{2 i t} + t + e^{2 i t} t) C[2] +
  1/12 i e^{-i t} (-1 + e^{2 i t}) t C[3] + 1/12 e^{-i t} (-i + i e^{2 i t} + t + e^{2 i t} t) C[4],
 y[t] → -1/24 e^{(-1-2 i) t} (-i + i e^{2 i t} + t + e^{2 i t} t)
   ((-3 + 4 i) + (1 + i) t + e^{2 i t} ((-3 - 4 i) + (1 - i) t)) +
  1/24 e^{(-1-2 i) t} (3 + 3 e^{2 i t} + i t - i e^{2 i t} t) (i - (1 - i) t - e^{2 i t} (i + (1 + i) t)) -
  1/24 i e^{(-1-2 i) t} (-4 i + 4 i e^{2 i t} + t + e^{2 i t} t) (-1 - (1 - i) t + e^{2 i t} (1 + (1 + i) t)) -
  1/24 i e^{(-1-2 i) t} (-1 + e^{2 i t}) t ((3 + 2 i) + (1 - i) t + e^{2 i t} ((3 - 2 i) + (1 + i) t)) -
  1/3 i e^{-i t} (-1 + e^{2 i t}) t C[1] - 1/3 e^{-i t} (-i + i e^{2 i t} + t + e^{2 i t} t) C[2] +
  1/6 e^{-i t} (3 + 3 e^{2 i t} + i t - i e^{2 i t} t) C[3] - 1/6 e^{-i t} (-4 i + 4 i e^{2 i t} + t + e^{2 i t} t) C[4]}]
}

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8. find the solution of system of equations $x''[t] - y[t] = t^2$,
 $y''[t] + 4x[t] = t$, $x[0] = 0$, $y[0] = 3/4$

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DSolve[
 {x''[t] - y[t] == t^2, y''[t] + 4 x[t] == t, x[0] == 0, y[0] == 3/4}, {x[t], y[t]}, t]

{ {x[t] →
  -1/16 e^{-t} (4 Cos[t] + 4 e^{2 t} Cos[t] + 4 C[2] Cos[t] - 4 e^{2 t} C[2] Cos[t] - 2 C[4] Cos[t] + 2 e^{2 t}
  C[4] Cos[t] - 8 e^t Cos[t]^2 - 4 e^t t Cos[t]^2 + 3 Sin[t] - 3 e^{2 t} Sin[t] - 4 C[2] Sin[t] -
  4 e^{2 t} C[2] Sin[t] - 2 C[4] Sin[t] - 2 e^{2 t} C[4] Sin[t] - 8 e^t Sin[t]^2 - 4 e^t t Sin[t]^2),
 y[t] → 1/8 e^{-t} (3 Cos[t] + 3 e^{2 t} Cos[t] - 4 C[2] Cos[t] + 4 e^{2 t} C[2] Cos[t] - 2 C[4] Cos[t] +
  2 e^{2 t} C[4] Cos[t] - 8 e^t t^2 Cos[t]^2 - 4 Sin[t] + 4 e^{2 t} Sin[t] - 4 C[2] Sin[t] -
  4 e^{2 t} C[2] Sin[t] + 2 C[4] Sin[t] + 2 e^{2 t} C[4] Sin[t] - 8 e^t t^2 Sin[t]^2)}]
}

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9. solve the system of differentiation equations

- (i) $x'[t] = 2y, y'[t] = 2z, z'[t] = 2x$
- (ii) $x'[t] = x^2 + xy, y'[t] = y^2 + xy, x[0] = 1, y[0] = 2$
- (iii) $x''[t] - 3y[t] = \cos[t], y''[t] + x[t] = \sin[t]$

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DSolve[{x'[t] == 2 y[t], y'[t] == 2 z[t], z'[t] == 2 x[t]}, {x[t], y[t], z[t]}, t]
{{x[t] → 1/3 e^-t C[1] (e^(3t) + 2 Cos[Sqrt[3] t]) + 1/3 e^-t C[3] (e^(3t) - Cos[Sqrt[3] t] - Sqrt[3] Sin[Sqrt[3] t]) +
  1/3 e^-t C[2] (e^(3t) - Cos[Sqrt[3] t] + Sqrt[3] Sin[Sqrt[3] t]),

  y[t] → 1/3 e^-t C[2] (e^(3t) + 2 Cos[Sqrt[3] t]) + 1/3 e^-t C[1] (e^(3t) - Cos[Sqrt[3] t] - Sqrt[3] Sin[Sqrt[3] t]) +
  1/3 e^-t C[3] (e^(3t) - Cos[Sqrt[3] t] + Sqrt[3] Sin[Sqrt[3] t]),

  z[t] → 1/3 e^-t C[3] (e^(3t) + 2 Cos[Sqrt[3] t]) + 1/3 e^-t C[2] (e^(3t) - Cos[Sqrt[3] t] - Sqrt[3] Sin[Sqrt[3] t]) +
  1/3 e^-t C[1] (e^(3t) - Cos[Sqrt[3] t] + Sqrt[3] Sin[Sqrt[3] t])}]

DSolve[{x'[t] == x[t]^2 + x[t] y[t],
        y'[t] == y[t]^2 + x[t] y[t], x[0] == 1, y[0] == 2}, {x[t], y[t]}, t]
{{y[t] → -2/(1 + 3 t), x[t] → 1/(1 - 3 t)}}

DSolve[{x''[t] - 3 y[t] == Cos[t], y''[t] + x[t] == Sin[t]}, {x[t], y[t]}, t]
{{x[t] → 1/2 e^-3^(1/4) t/Sqrt[2] (1 + e^(Sqrt[2] 3^(1/4) t)) C[1] Cos[3^(1/4) t/Sqrt[2]] +
  1/2 Sqrt[3] e^-3^(1/4) t/Sqrt[2] (-1 + e^(Sqrt[2] 3^(1/4) t)) C[3] Sin[3^(1/4) t/Sqrt[2]] -
  1/(2 Sqrt[2]) 3^(1/4) e^-3^(1/4) t/Sqrt[2] C[4] (-Cos[3^(1/4) t/Sqrt[2]] + e^(Sqrt[2] 3^(1/4) t) Cos[3^(1/4) t/Sqrt[2]] -
  Sin[3^(1/4) t/Sqrt[2]] - e^(Sqrt[2] 3^(1/4) t) Sin[3^(1/4) t/Sqrt[2]]) + 1/(2 Sqrt[2] 3^(1/4))
  e^-3^(1/4) t/Sqrt[2] C[2] (-Cos[3^(1/4) t/Sqrt[2]] + e^(Sqrt[2] 3^(1/4) t) Cos[3^(1/4) t/Sqrt[2]] +
  Sin[3^(1/4) t/Sqrt[2]] + e^(Sqrt[2] 3^(1/4) t) Sin[3^(1/4) t/Sqrt[2]]) -
  1/(16 Sqrt[2] 3^(1/4)) e^-Sqrt[2] 3^(1/4) t (-1 + e^(Sqrt[2] 3^(1/4) t)) Sin[3^(1/4) t/Sqrt[2]] -
  (Cos[t] ((-3 + Sqrt[3] + Sqrt[2] 3^(3/4) + (3 - Sqrt[3] + Sqrt[2] 3^(3/4)) e^(Sqrt[2] 3^(1/4) t)) Cos[3^(1/4) t/Sqrt[2]] -
  (3 - Sqrt[2] 3^(1/4) + Sqrt[3] + (3 + Sqrt[2] 3^(1/4) + Sqrt[3]) e^(Sqrt[2] 3^(1/4) t)) Sin[3^(1/4) t/Sqrt[2]])}

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$$\begin{aligned}
& \text{Sin}[t] \left(\left(-1 - \sqrt{3} + \sqrt{2} 3^{3/4} + (1 + \sqrt{3} + \sqrt{2}) 3^{3/4} e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + \right. \\
& \quad \left. \left(-1 - 3 \sqrt{2} 3^{1/4} + \sqrt{3} + (-1 + 3 \sqrt{2} 3^{1/4} + \sqrt{3}) e^{\sqrt{2} 3^{1/4} t} \right) \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) + \\
& \frac{1}{16 \sqrt{2} 3^{3/4}} e^{-\sqrt{2} 3^{1/4} t} \left(1 + e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \\
& - \cos[t] \left(\left(-3 - 3 \sqrt{3} + \sqrt{2} 3^{3/4} + (3 + 3 \sqrt{3} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + \right. \\
& \quad \left. 3 \left(-1 - \sqrt{2} 3^{1/4} + \sqrt{3} + (-1 + \sqrt{2} 3^{1/4} + \sqrt{3}) e^{\sqrt{2} 3^{1/4} t} \right) \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) + \\
& \text{Sin}[t] \left(\left(-3 + \sqrt{3} + 3 \sqrt{2} 3^{3/4} + (3 - \sqrt{3} + 3 \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] - \right. \\
& \quad \left. \left(3 - 3 \sqrt{2} 3^{1/4} + \sqrt{3} + (3 + 3 \sqrt{2} 3^{1/4} + \sqrt{3}) e^{\sqrt{2} 3^{1/4} t} \right) \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) + \frac{1}{32 \sqrt{2} 3^{1/4}} \\
& e^{-\sqrt{2} 3^{1/4} t} \left(-\cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + e^{\sqrt{2} 3^{1/4} t} \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + e^{\sqrt{2} 3^{1/4} t} \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) \\
& \cos[t] \left(\left(6 - \sqrt{2} 3^{1/4} - \sqrt{2} 3^{3/4} + (6 + \sqrt{2} 3^{1/4} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + \right. \\
& \quad \left. 3^{1/4} \left(-\sqrt{2} + 2 \times 3^{1/4} + \sqrt{6} + (-\sqrt{2} - 2 \times 3^{1/4} + \sqrt{6}) e^{\sqrt{2} 3^{1/4} t} \right) \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) + \\
& \text{Sin}[t] \left(\left(2 + 3 \sqrt{2} 3^{1/4} - \sqrt{2} 3^{3/4} + (2 - 3 \sqrt{2} 3^{1/4} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + \right. \\
& \quad \left. 3^{1/4} \left(3 \sqrt{2} - 2 \times 3^{1/4} + \sqrt{6} + (3 \sqrt{2} + 2 \times 3^{1/4} + \sqrt{6}) e^{\sqrt{2} 3^{1/4} t} \right) \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) - \\
& \frac{1}{32 \sqrt{2} 3^{3/4}} e^{-\sqrt{2} 3^{1/4} t} \left(-\cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + e^{\sqrt{2} 3^{1/4} t} \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] - \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] - \right. \\
& \quad \left. e^{\sqrt{2} 3^{1/4} t} \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) \\
& - \cos[t] \left(\left(6 + 3 \sqrt{2} 3^{1/4} - \sqrt{2} 3^{3/4} + (6 - 3 \sqrt{2} 3^{1/4} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + \right. \\
& \quad \left. 3^{1/4} \left(3 \sqrt{2} - 6 \times 3^{1/4} + \sqrt{6} + (3 \sqrt{2} + 6 \times 3^{1/4} + \sqrt{6}) e^{\sqrt{2} 3^{1/4} t} \right) \sin \left[\frac{3^{1/4} t}{\sqrt{2}} \right] \right) + \sin[t] \\
& \left(3 \left(2 - \sqrt{2} 3^{1/4} - \sqrt{2} 3^{3/4} + (2 + \sqrt{2} 3^{1/4} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos \left[\frac{3^{1/4} t}{\sqrt{2}} \right] + 3^{1/4} \right)
\end{aligned}$$

$$\begin{aligned}
& \left(-3\sqrt{2} + 2 \times 3^{1/4} + 3\sqrt{6} + (-3\sqrt{2} - 2 \times 3^{1/4} + 3\sqrt{6}) e^{\sqrt{2} 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \Bigg), \\
y[t] \rightarrow & \frac{1}{2} e^{-\frac{3^{1/4} t}{\sqrt{2}}} \left(1 + e^{\sqrt{2} 3^{1/4} t} \right) C[3] \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] - \frac{e^{-\frac{3^{1/4} t}{\sqrt{2}}} \left(-1 + e^{\sqrt{2} 3^{1/4} t} \right) C[1] \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right]}{2\sqrt{3}} + \\
& \frac{1}{2\sqrt{2} 3^{3/4}} \\
& e^{-\frac{3^{1/4} t}{\sqrt{2}}} C[2] \\
& \left(-\cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + e^{\sqrt{2} 3^{1/4} t} \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] - \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] - e^{\sqrt{2} 3^{1/4} t} \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) + \frac{1}{2\sqrt{2} 3^{1/4}} \\
& e^{-\frac{3^{1/4} t}{\sqrt{2}}} C[4] \left(-\cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + e^{\sqrt{2} 3^{1/4} t} \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + e^{\sqrt{2} 3^{1/4} t} \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) - \\
& \frac{1}{16\sqrt{2} 3^{3/4}} e^{-\sqrt{2} 3^{1/4} t} \left(1 + e^{\sqrt{2} 3^{1/4} t} \right) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \\
& \left(\cos[t] \left((-3 + \sqrt{3} + \sqrt{2} 3^{3/4} + (3 - \sqrt{3} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t}) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] - \right. \right. \\
& \left. \left. \left(3 - \sqrt{2} 3^{1/4} + \sqrt{3} + (3 + \sqrt{2} 3^{1/4} + \sqrt{3}) e^{\sqrt{2} 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) + \right. \\
& \sin[t] \left(\left(-1 - \sqrt{3} + \sqrt{2} 3^{3/4} + (1 + \sqrt{3} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \right. \\
& \left. \left. \left(-1 - 3\sqrt{2} 3^{1/4} + \sqrt{3} + (-1 + 3\sqrt{2} 3^{1/4} + \sqrt{3}) e^{\sqrt{2} 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) - \right. \\
& \frac{1}{48\sqrt{2} 3^{1/4}} e^{-\sqrt{2} 3^{1/4} t} \left(-1 + e^{\sqrt{2} 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \\
& \left(-\cos[t] \left((-3 - 3\sqrt{3} + \sqrt{2} 3^{3/4} + (3 + 3\sqrt{3} + \sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t}) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \right. \right. \\
& \left. \left. 3 \left(-1 - \sqrt{2} 3^{1/4} + \sqrt{3} + (-1 + \sqrt{2} 3^{1/4} + \sqrt{3}) e^{\sqrt{2} 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) + \right. \\
& \sin[t] \left(\left(-3 + \sqrt{3} + 3\sqrt{2} 3^{3/4} + (3 - \sqrt{3} + 3\sqrt{2} 3^{3/4}) e^{\sqrt{2} 3^{1/4} t} \right) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] - \right. \\
& \left. \left. \left(3 - 3\sqrt{2} 3^{1/4} + \sqrt{3} + (3 + 3\sqrt{2} 3^{1/4} + \sqrt{3}) e^{\sqrt{2} 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) + \frac{1}{32\sqrt{2} 3^{3/4}} \right. \\
& \left. e^{-\sqrt{2} 3^{1/4} t} \left(-\cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + e^{\sqrt{2} 3^{1/4} t} \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] - \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] - e^{\sqrt{2} 3^{1/4} t} \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) \right)
\end{aligned}$$

$$\begin{aligned}
& \left(\cos[t] \left(\left(6 - \sqrt{2} \cdot 3^{1/4} - \sqrt{2} \cdot 3^{3/4} + (6 + \sqrt{2} \cdot 3^{1/4} + \sqrt{2} \cdot 3^{3/4}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \right. \right. \\
& \quad \left. \left. 3^{1/4} \left(-\sqrt{2} + 2 \times 3^{1/4} + \sqrt{6} + (-\sqrt{2} - 2 \times 3^{1/4} + \sqrt{6}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) + \right. \\
& \quad \left. \sin[t] \left(\left(2 + 3 \sqrt{2} \cdot 3^{1/4} - \sqrt{2} \cdot 3^{3/4} + (2 - 3 \sqrt{2} \cdot 3^{1/4} + \sqrt{2} \cdot 3^{3/4}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \right. \right. \\
& \quad \left. \left. 3^{1/4} \left(3 \sqrt{2} - 2 \times 3^{1/4} + \sqrt{6} + (3 \sqrt{2} + 2 \times 3^{1/4} + \sqrt{6}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) \right) + \\
& \quad \frac{1}{96 \sqrt{2} \cdot 3^{1/4}} e^{-\sqrt{2} \cdot 3^{1/4} t} \left(-\cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + e^{\sqrt{2} \cdot 3^{1/4} t} \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \right. \\
& \quad \left. e^{\sqrt{2} \cdot 3^{1/4} t} \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) \\
& \quad \left(-\cos[t] \left(\left(6 + 3 \sqrt{2} \cdot 3^{1/4} - \sqrt{2} \cdot 3^{3/4} + (6 - 3 \sqrt{2} \cdot 3^{1/4} + \sqrt{2} \cdot 3^{3/4}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + \right. \right. \\
& \quad \left. \left. 3^{1/4} \left(3 \sqrt{2} - 6 \times 3^{1/4} + \sqrt{6} + (3 \sqrt{2} + 6 \times 3^{1/4} + \sqrt{6}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) + \sin[t] \right. \\
& \quad \left. \left(3 \left(2 - \sqrt{2} \cdot 3^{1/4} - \sqrt{2} \cdot 3^{3/4} + (2 + \sqrt{2} \cdot 3^{1/4} + \sqrt{2} \cdot 3^{3/4}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \cos\left[\frac{3^{1/4} t}{\sqrt{2}}\right] + 3^{1/4} \right. \right. \\
& \quad \left. \left. \left(-3 \sqrt{2} + 2 \times 3^{1/4} + 3 \sqrt{6} + (-3 \sqrt{2} - 2 \times 3^{1/4} + 3 \sqrt{6}) e^{\sqrt{2} \cdot 3^{1/4} t} \right) \sin\left[\frac{3^{1/4} t}{\sqrt{2}}\right] \right) \right) \right\}
\end{aligned}$$