> $diff(\sin(t), t\$4) - \sin(t);$

$$0 \tag{1}$$

> $diff(\cos(t), t\$4) - \cos(t);$

$$0 \tag{2}$$

> $diff(\sinh(t), t\$4) - \sinh(t);$

$$0 \tag{3}$$

> $diff(\cosh(t), t\$4) - \cosh(t);$

$$0 \tag{4}$$

> $eq := diff(x(t), t\$1) + t \cdot x(t);$

$$eq := \frac{d}{dt} x(t) + t\, x(t) \tag{5}$$

> $dsolve(eq, x(t));$

$$x(t) = \_C1\, e^{-\frac{t^2}{2}} \tag{6}$$

> $eq := diff(x(t), t\$2) + x(t);$

$$eq := \frac{d^2}{dt^2} x(t) + x(t) \tag{7}$$

> $dsolve(eq, x(t));$

$$x(t) = \_C1 \sin(t) + \_C2 \cos(t) \tag{8}$$

> $eq := 4 \cdot diff(x(t), t\$2) + 8 \cdot diff(x(t), t\$1) + 5 \cdot x(t);$

$$eq := 4 \frac{d^2}{dt^2} x(t) + 8 \frac{d}{dt} x(t) + 5\, x(t) \tag{9}$$

> $dsolve(eq, x(t));$

$$x(t) = \_C1\, e^{-t} \sin\left(\frac{t}{2}\right) + \_C2\, e^{-t} \cos\left(\frac{t}{2}\right) \tag{10}$$

> $eq := diff(x(t), t\$2) - 3 \cdot diff(x(t), t\$1) + 2 \cdot x(t);$

$$eq := \frac{d^2}{dt^2} x(t) - 3 \frac{d}{dt} x(t) + 2\, x(t) \tag{11}$$

> $dsolve(eq, x(t));$

$$x(t) = \_C1\, e^{2t} + \_C2\, e^{t} \tag{12}$$

> $infolevel[dsolve] := 1;$

$$infolevel_{dsolve} := 1 \tag{13}$$

> $eq := diff(x(t), t\$2) + x(t);$

$$eq := \frac{d^2}{dt^2} x(t) + x(t) \tag{14}$$

> $ic1 := x\left(\frac{Pi}{2}\right) = 1;$

(15)

$$ic1 := x\left(\frac{\pi}{2}\right) = 1 \quad (15)$$

> $ic2 := \mathrm{D}(x)\left(\frac{\mathrm{Pi}}{2}\right) = -2;$

$$ic2 := \mathrm{D}(x)\left(\frac{\pi}{2}\right) = -2 \quad (16)$$

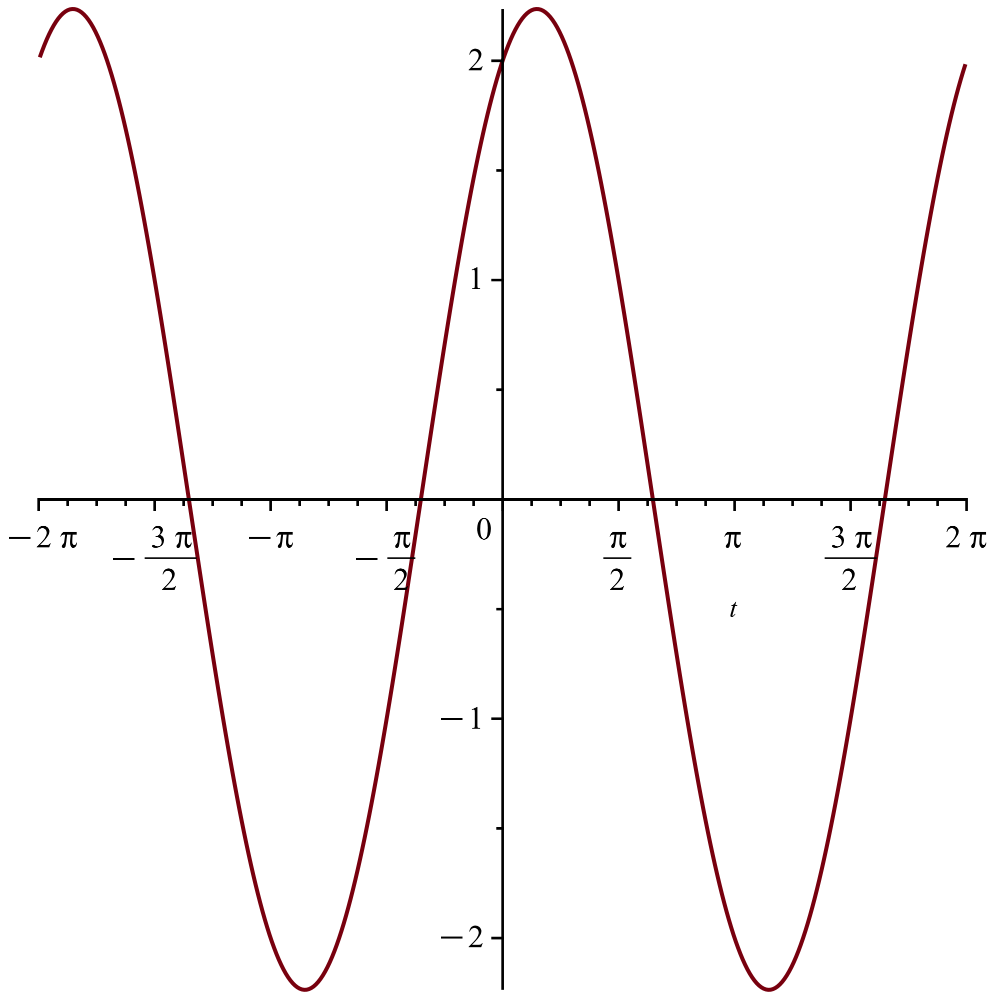
> $dsolve(\{eq, ic1, ic2\}, x(t));$

$$x(t) = \sin(t) + 2\cos(t) \quad (17)$$

> $graph := \sin(t) + 2\cdot\cos(t);$

$$graph := \sin(t) + 2\cos(t) \quad (18)$$

> $plot(graph);$



> $expand\left(\mathrm{sqrt}(5)\cdot\cos\left(t - \arctan\left(\frac{1}{2}\right)\right)\right);$

$$\sin(t) + 2\cos(t) \quad (19)$$

> $eq := 4\cdot diff(x(t), t\$2) + 8\cdot diff(x(t), t\$1) + 5\cdot x(t);$

$$eq := 4\,\frac{\mathrm{d}^2}{\mathrm{d}t^2}\,x(t) + 8\,\frac{\mathrm{d}}{\mathrm{d}t}\,x(t) + 5\,x(t) \quad (20)$$

> $ic1 := x(0) = 0;$

$$ic1 := x(0) = 0 \tag{21}$$

> $ic2 := \mathrm{D}(x)(0) = 0.5;$

$$ic2 := \mathrm{D}(x)(0) = 0.5 \tag{22}$$

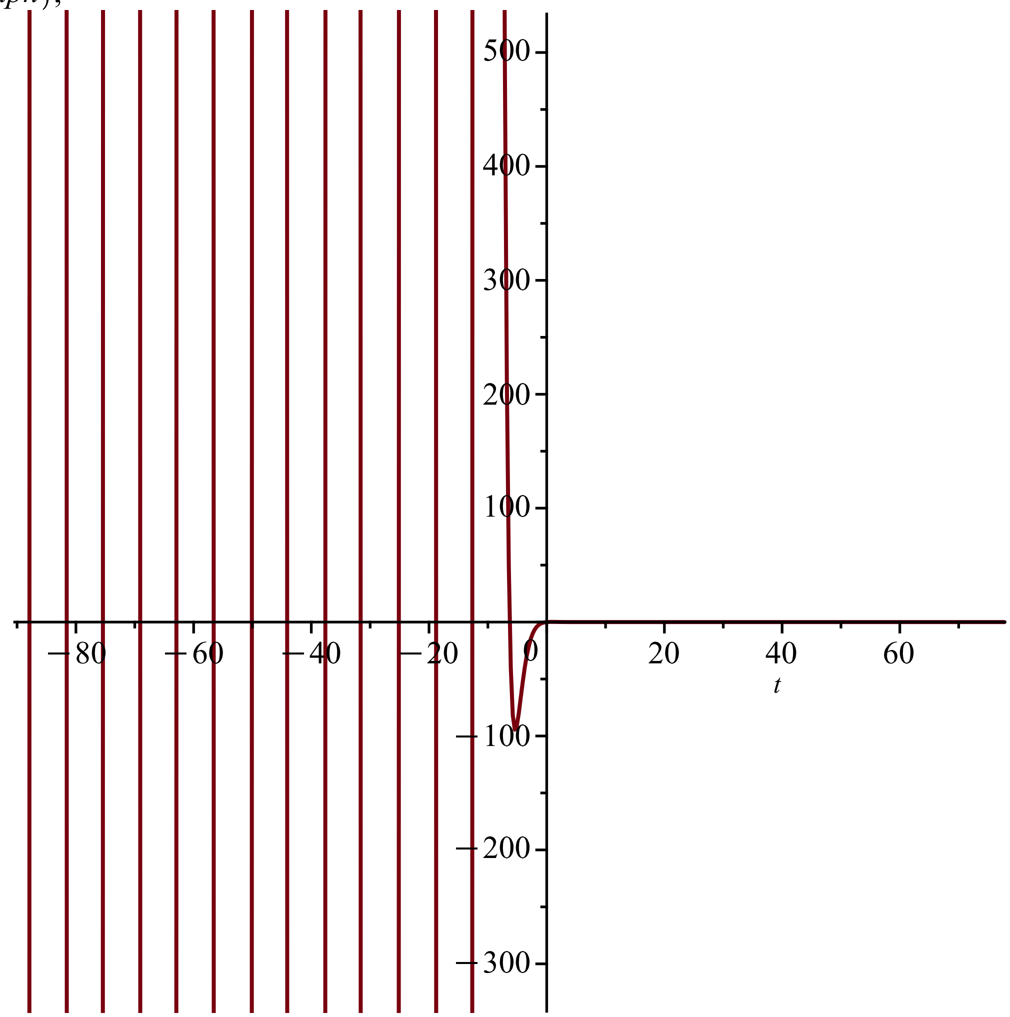
> $dsolve(\{eq, ic1, ic2\}, x(t));$

$$x(t) = \mathrm{e}^{-t} \sin\left(\frac{t}{2}\right) \tag{23}$$

> $graph := \mathrm{e}^{-t} \sin\left(\frac{t}{2}\right);$

$$graph := \mathrm{e}^{-t} \sin\left(\frac{t}{2}\right) \tag{24}$$

> $plot(graph);$



> $eq := diff(x(t), t\$2) - 3 \cdot diff(x(t), t\$1) + 2 \cdot x(t);$

$$eq := \frac{\mathrm{d}^2}{\mathrm{d}t^2} x(t) - 3 \frac{\mathrm{d}}{\mathrm{d}t} x(t) + 2\, x(t) \tag{25}$$

> $ic1 := x(0) = 2;$

$$ic1 := x(0) = 2 \tag{26}$$

> $ic2 := \mathrm{D}(x)(0) = 3;$

$$ic2 := D(x)(0) = 3 \quad \mathbf{(27)}$$

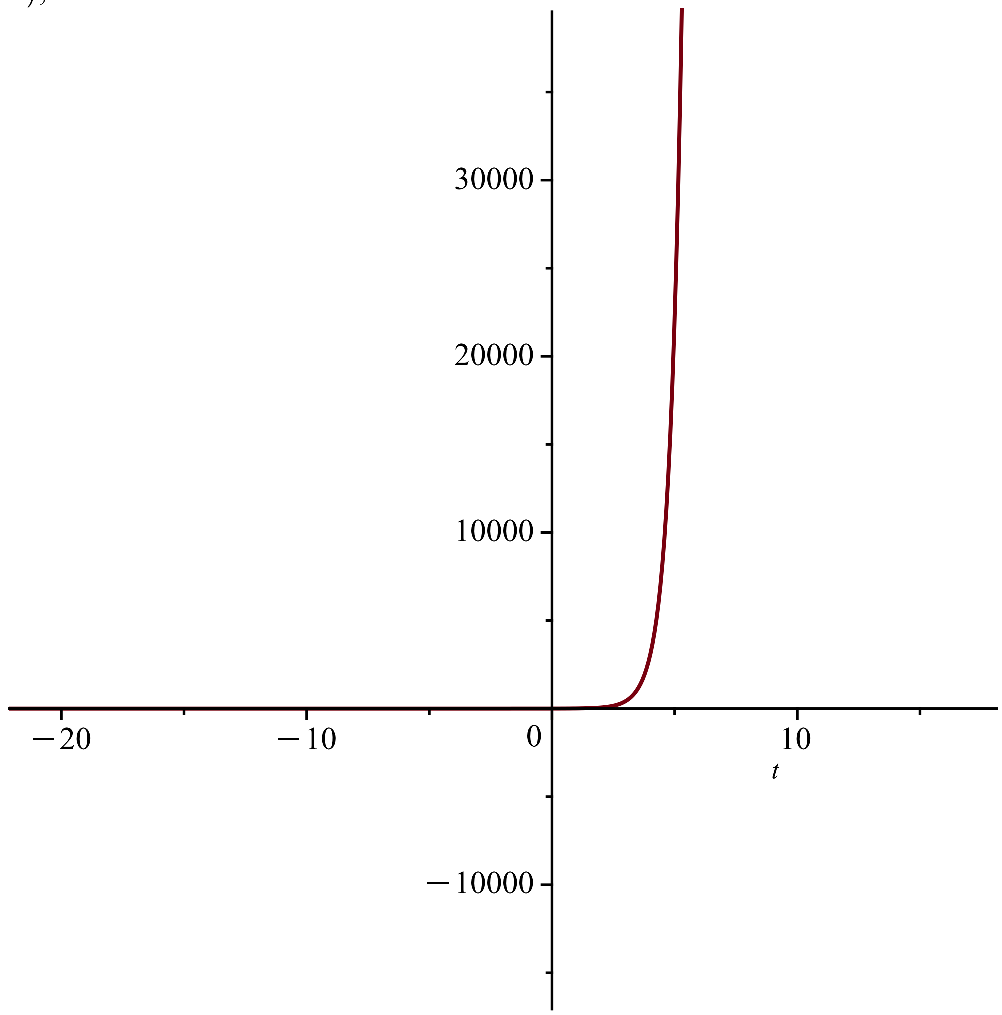
> $dsolve(\{\boldsymbol{eq, ic1, ic2}\}, x(t));$

$$x(t) = e^{2t} + e^{t} \quad \mathbf{(28)}$$

> $graph := e^{2t} + e^{t};$

$$graph := e^{2t} + e^{t} \quad \mathbf{(29)}$$

> $plot(graph);$



> $infolevel[dsolve] := 3;$

$$infolevel_{dsolve} := 3 \quad \mathbf{(30)}$$

> $eq := diff(x(t), t\$2) + 5 \cdot x(t);$

$$eq := \frac{d^2}{dt^2}\, x(t) + 5\, x(t) \quad \mathbf{(31)}$$

> $dsolve(eq, x(t));$

```
Methods for second order ODEs:
--- Trying classification methods ---
trying a quadrature
checking if the LODE has constant coefficients
<- constant coefficients successful
```

$$x(t) = \_C1 \sin\left(\sqrt{5}\, t\right) + \_C2 \cos\left(\sqrt{5}\, t\right) \quad \mathbf{(32)}$$

> $eq := diff(x(t), t\$2) + t \cdot x(t);$

$$eq := \frac{d^2}{dt^2}\, x(t) + t\, x(t) \tag{33}$$

> $dsolve(eq, x(t));$

```
Methods for second order ODEs:
--- Trying classification methods ---
trying a quadrature
checking if the LODE has constant coefficients
checking if the LODE is of Euler type
trying a symmetry of the form [xi=0, eta=F(x)]
checking if the LODE is missing 'y'
-> Trying a Liouvillian solution using Kovacic's algorithm
<- No Liouvillian solutions exists
-> Trying a solution in terms of special functions:
   -> Bessel
   <- Bessel successful
<- special function solution successful
```

$$x(t) = \_C1\ \mathrm{AiryAi}(-t) + \_C2\ \mathrm{AiryBi}(-t) \tag{34}$$

> $?AiryAi;$

> $eq := diff(x(t), t\$2) + (t^5) \cdot x(t);$

$$eq := \frac{d^2}{dt^2}\, x(t) + t^5\, x(t) \tag{35}$$

> $dsolve(eq, x(t));$

```
Methods for second order ODEs:
--- Trying classification methods ---
trying a quadrature
checking if the LODE has constant coefficients
checking if the LODE is of Euler type
trying a symmetry of the form [xi=0, eta=F(x)]
checking if the LODE is missing 'y'
-> Trying a Liouvillian solution using Kovacic's algorithm
<- No Liouvillian solutions exists
-> Trying a solution in terms of special functions:
   -> Bessel
   <- Bessel successful
<- special function solution successful
```

$$x(t) = \_C1\ \sqrt{t}\ \mathrm{BesselJ}\left(\frac{1}{7}, \frac{2\, t^{7/2}}{7}\right) + \_C2\ \sqrt{t}\ \mathrm{BesselY}\left(\frac{1}{7}, \frac{2\, t^{7/2}}{7}\right) \tag{36}$$

> $?BesselJ;$

> $eq := diff(x(t), t\$2) + x(t);$

$$eq := \frac{d^2}{dt^2}\, x(t) + x(t) \tag{37}$$

> $ic1 := x(0) = 0;$

$$ic1 := x(0) = 0 \tag{38}$$

> $ic2 := x(\mathrm{Pi}) = 0;$

$$ic2 := x(\pi) = 0 \tag{39}$$

> $infolevel[dsolve] := 1;$

$$infolevel_{dsolve} := 1 \tag{40}$$

> $dsolve(\{eq, ic1, ic2\}, x(t));$

$$x(t) = \_C1 \sin(t) \tag{41}$$

> $ic2 := x(1) = 0;$

$$ic2 := x(1) = 0 \tag{42}$$

> $dsolve(\{eq, ic1, ic2\}, x(t));$

$$x(t) = 0 \tag{43}$$

> $eq := diff(x(t), t\$2) + x(t) = 1;$

$$eq := \frac{d^2}{dt^2} x(t) + x(t) = 1 \tag{44}$$

> $ic2 := x(\mathrm{Pi}) = 0;$

$$ic2 := x(\pi) = 0 \tag{45}$$

> $dsolve(\{eq, ic1, ic2\}, x(t));$

> $bessel := \mathrm{BesselJ}(1, t);$

$$bessel := \mathrm{BesselJ}(1, t) \tag{46}$$

> $plot(bessel, t = -1000000..1000000);$