> $dsolve\left(diff(x(t),t)+x(t)=\frac{2}{\mathrm{sqrt}(\mathrm{Pi})}\cdot\exp(-t^{\wedge}2-t),x(t)\right)$

$$x(t)=\left(\mathrm{erf}(t)+c_1\right)\mathrm{e}^{-t} \tag{1}$$

> $int(\exp(t^{\wedge}2),t)$

$$\frac{\sqrt{\pi}\,\mathrm{erfi}(t)}{2} \tag{2}$$

> $int\left(\frac{2}{\mathrm{sqrt}(\mathrm{Pi})}\exp(-t^{\wedge}2),t\right)$

$$\mathrm{erf}(t) \tag{3}$$

> $eq1:=rhs(dsolve(diff(x(t),t\$2)+3\,diff(x(t),t)+x(t)=1,x(t)))$

$$eq1:=\mathrm{e}^{\frac{(\sqrt{5}-3)\,t}{2}}c_2+\mathrm{e}^{-\frac{(3+\sqrt{5})\,t}{2}}c_1+1 \tag{4}$$

> $limit(eq1,t=\mathrm{infinity})$

$$1 \tag{5}$$

> $ic:=x(0)=\frac{5}{4},\mathrm{D}(x)(0)=0$

$$ic:=x(0)=\frac{5}{4},\mathrm{D}(x)(0)=0 \tag{6}$$

> $expr:=dsolve(\{diff(x(t),t\$2)+4\,x(t)=1,ic\},x(t))$

$$expr:=x(t)=\frac{1}{4}+\cos(2\,t) \tag{7}$$

> $eval(expr,t=\mathrm{Pi})$

$$x(\pi)=\frac{5}{4} \tag{8}$$

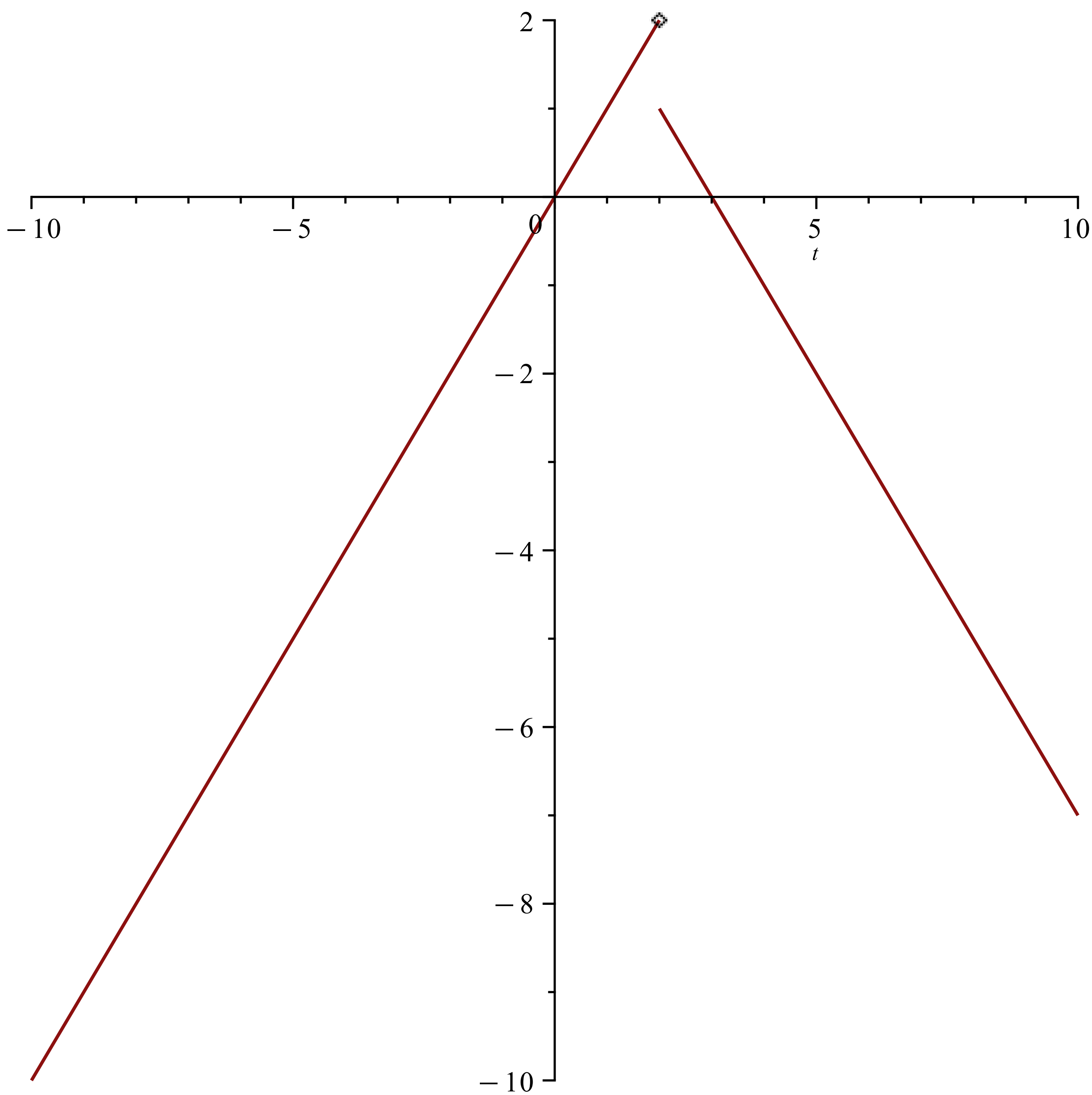
> $dsolve(diff(x(t),t)=x(t)+t^{\wedge}3,x(t))$

$$x(t)=-t^3-3\,t^2-6\,t-6+\mathrm{e}^t c_1 \tag{9}$$

> $f:=piecewise(t\le 2,t,3-t)$

$$f:=\begin{cases} t & t\le 2\\ 3-t & otherwise\end{cases} \tag{10}$$

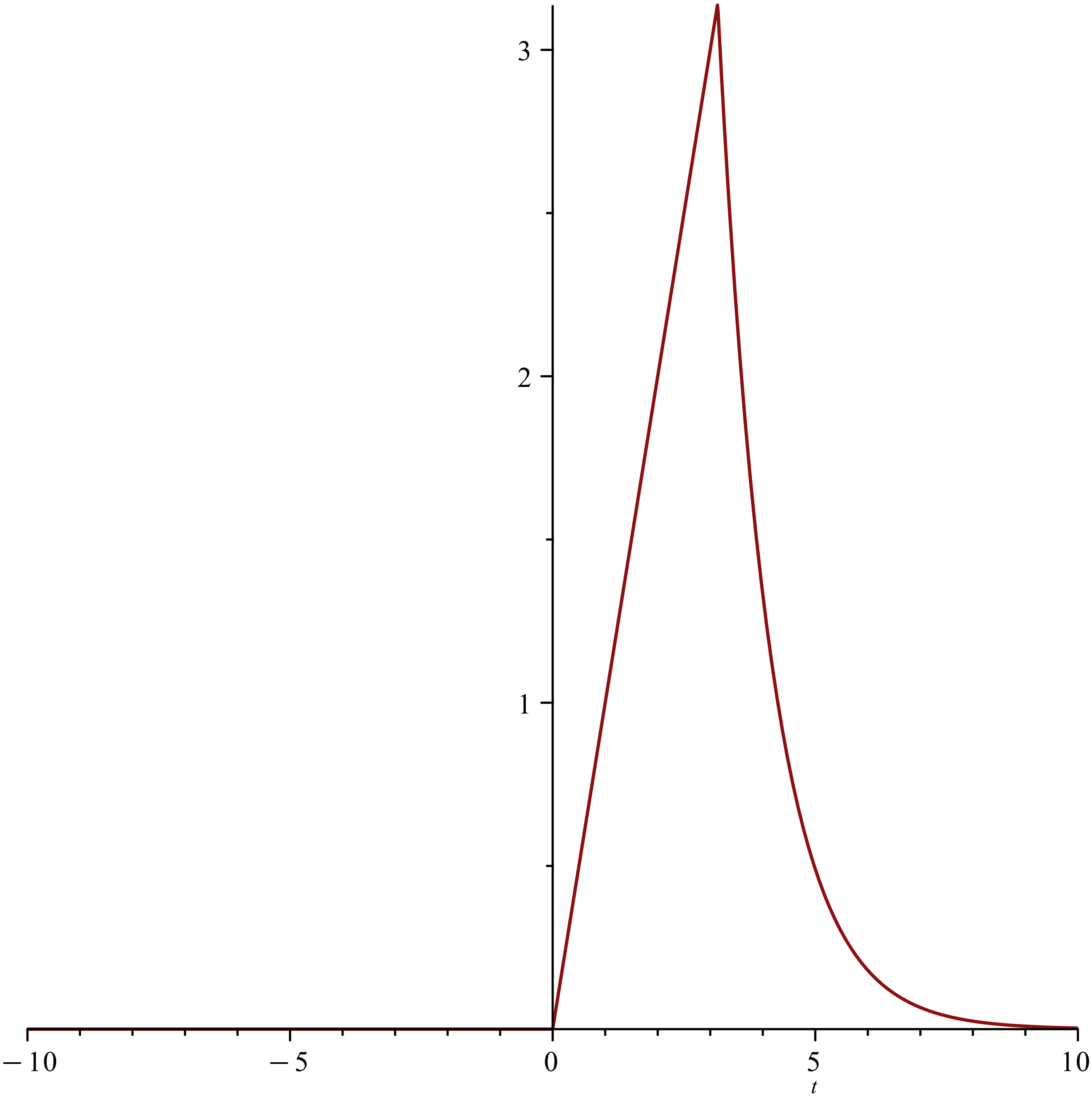
> $plot(f,discont=true)$



> $f := piecewise(0 \leq t \leq \mathrm{Pi}, t, t > \mathrm{Pi}, \mathrm{Pi} \cdot \exp(\mathrm{Pi} - t))$

$$f := \begin{cases} t & 0 \leq t \leq \pi \\ \pi\, \mathrm{e}^{\pi - t} & \pi < t \end{cases} \tag{11}$$

> $plot(f, discont = true)$



> $ic := x(0) = 0, \mathrm{D}(x)(0) = 1$

$$ic := x(0) = 0, \mathrm{D}(x)(0) = 1 \tag{12}$$

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

$$eq := \frac{\mathrm{d}^2}{\mathrm{d}t^2}\, x(t) + x(t) = \begin{cases} t & 0 \le t \le \pi \\ \pi\, \mathrm{e}^{\pi - t} & \pi < t \end{cases} \tag{13}$$

> $eq := dsolve(\{eq, ic\}, x(t))$

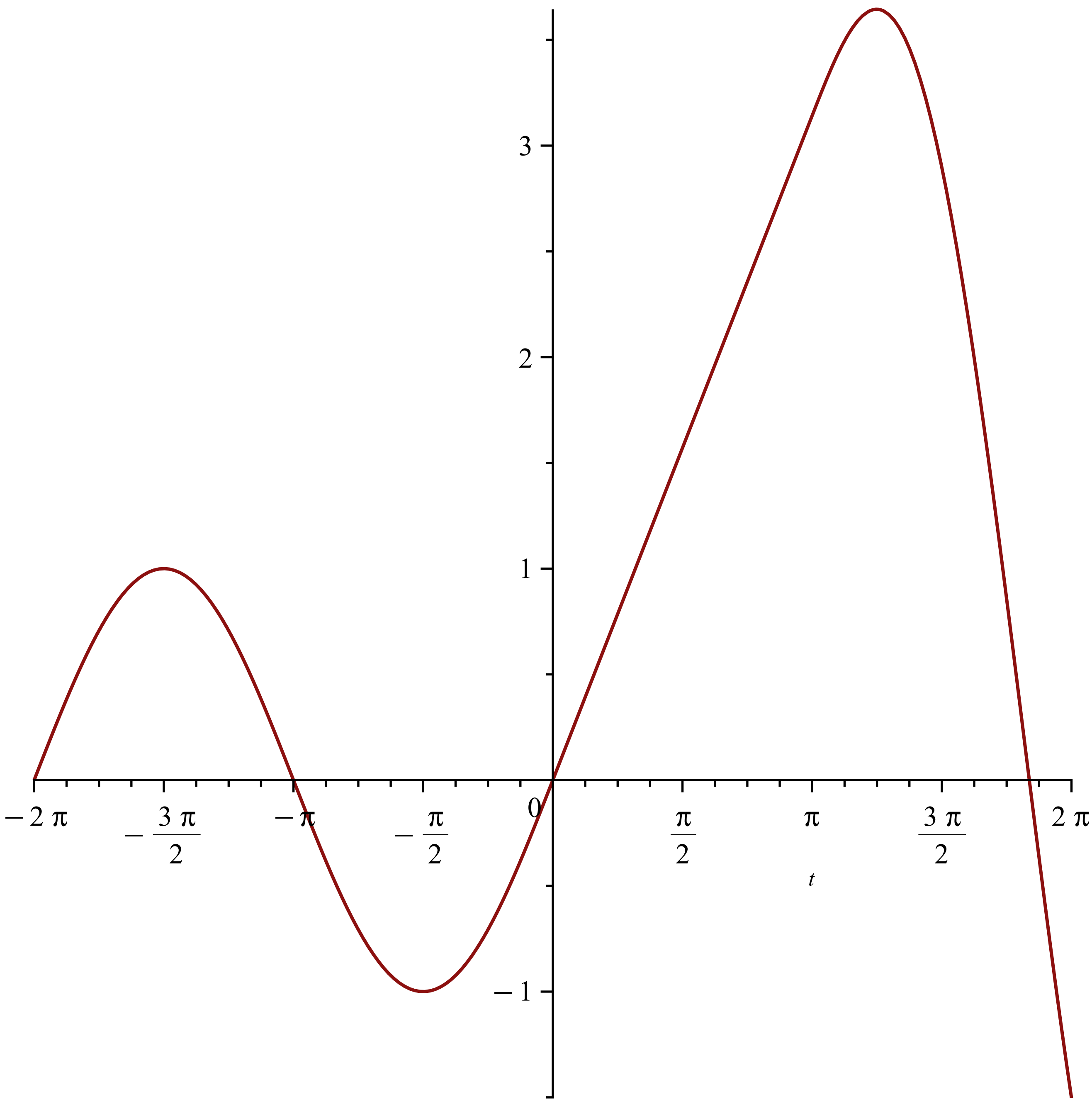
(14)

$$eq := x(t) = \begin{cases} \sin(t) & t < 0 \\ t & t < \pi \\ -\sin(t) - \frac{\sin(t)\,\pi}{2} - \frac{\cos(t)\,\pi}{2} + \frac{\pi\,e^{\pi - t}}{2} & \pi \le t \end{cases} \quad \textbf{(14)}$$

> $eq := rhs(eq)$

$$eq := \begin{cases} \sin(t) & t < 0 \\ t & t < \pi \\ -\sin(t) - \frac{\sin(t)\,\pi}{2} - \frac{\cos(t)\,\pi}{2} + \frac{\pi\,e^{\pi - t}}{2} & \pi \le t \end{cases} \quad \textbf{(15)}$$

> $plot(eq, discont = true)$



> $ic := x(0) = 0, \mathrm{D}(x)(0) = 0$

$$ic := x(0) = 0, \mathrm{D}(x)(0) = 0 \tag{16}$$

> $dsolve(\{diff(x(t), t\$2) + x(t) = \cos(\mathrm{omega} \cdot t), ic\}, x(t))$

$$x(t) = \frac{\cos(t) - \cos(\omega t)}{\omega^2 - 1} \tag{17}$$

> $\mathrm{phi} := dsolve(\{diff(x(t), t\$2) + x(t) = \cos(\mathrm{omega} \cdot t), ic\}, x(t))$

$$\phi := x(t) = \frac{\cos(t) - \cos(\omega t)}{\omega^2 - 1} \tag{18}$$

> $\mathrm{phi} := rhs(\mathrm{phi})$

(19)

$$\phi := \frac{\cos(t) - \cos(\omega t)}{\omega^2 - 1} \tag{19}$$

> $limit(\text{phi}, \text{omega} = 1)$

$$\frac{\sin(t)\, t}{2} \tag{20}$$

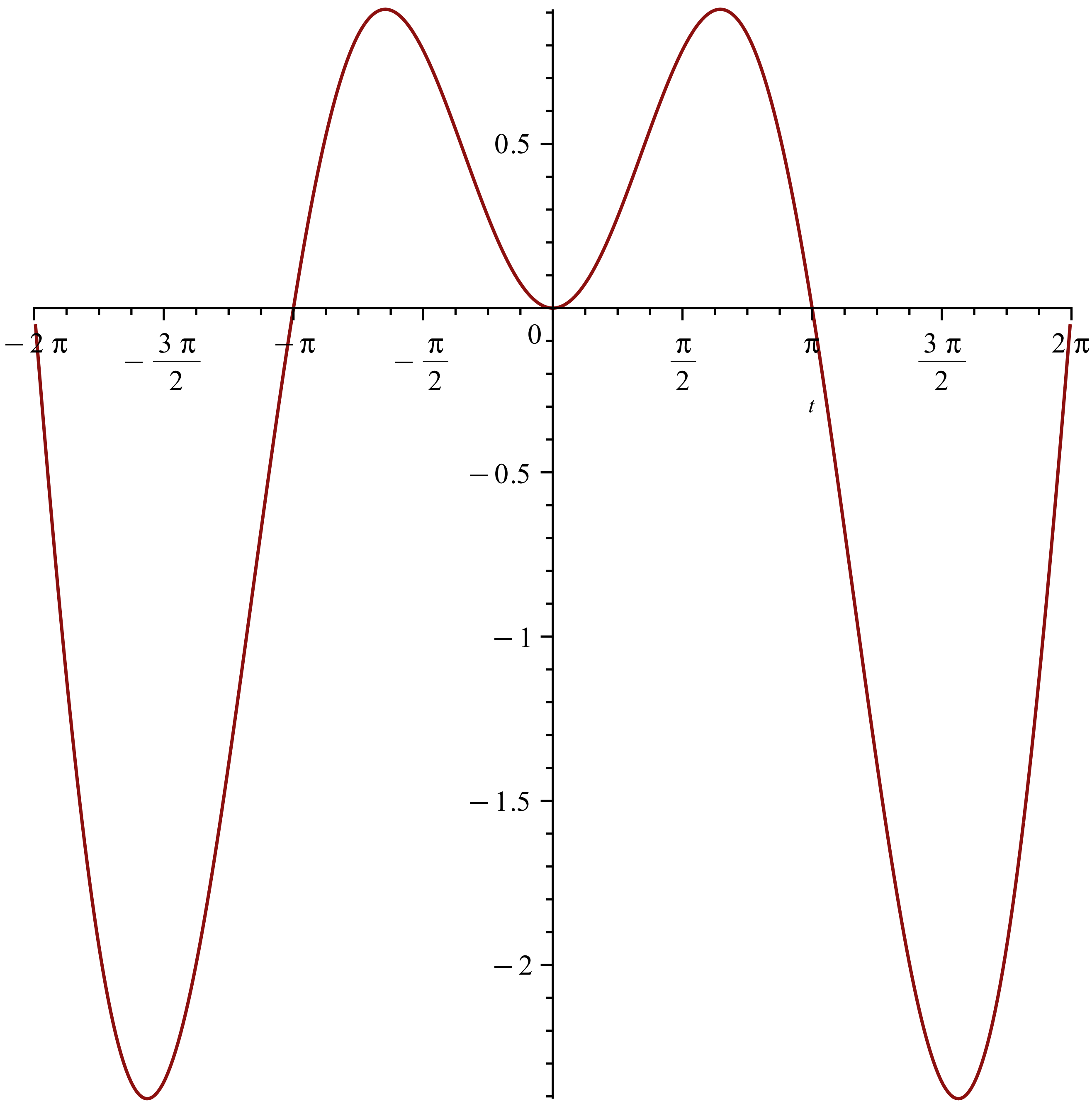
> $f := dsolve(\{diff(x(t), t\$2) + x(t) = \cos(t), ic\}, x(t))$

$$f := x(t) = \frac{\sin(t)\, t}{2} \tag{21}$$

> $f := rhs(f)$

$$f := \frac{\sin(t)\, t}{2} \tag{22}$$

> $plot(f)$



> phi := $dsolve(\{diff(x(t), t\$2) - 4\,x(t) = \exp(\text{alpha}\cdot t), ic\}, x(t))$

$$\phi := x(t) = \frac{(\alpha-2)\,e^{-2t} + (-\alpha-2)\,e^{2t} + 4\,e^{\alpha t}}{4\,\alpha^2 - 16} \quad \textbf{(23)}$$

> phi := $rhs(\text{phi})$

$$\phi := \frac{(\alpha-2)\,e^{-2t} + (-\alpha-2)\,e^{2t} + 4\,e^{\alpha t}}{4\,\alpha^2 - 16} \quad \textbf{(24)}$$

> $dsolve(\{diff(x(t), t\$2) - 4\,x(t) = \exp(2\cdot t), ic\}, x(t))$

$$x(t) = \frac{(4\,t-1)\,e^{2t}}{16} + \frac{e^{-2t}}{16} \quad \textbf{(25)}$$

> $limit(\text{phi}, \text{alpha} = 2)$

$$\frac{e^{-2t}}{16} - \frac{e^{2t}}{16} + \frac{t\,e^{2t}}{4} \tag{26}$$

> $f := piecewise\left(0 \le t < \frac{\mathrm{Pi}}{2}, t, \frac{\mathrm{Pi}}{2} \le t < \mathrm{Pi}, \mathrm{Pi} - t, \mathrm{Pi} < t, 0\right)$

$$f := \begin{cases} t & 0 \le t < \frac{\pi}{2} \\ \pi - t & \frac{\pi}{2} \le t < \pi \\ 0 & \pi < t \end{cases} \tag{27}$$

> $ic := x(0) = 5, \mathrm{D}(x)(0) = 0$

$$ic := x(0) = 5, \mathrm{D}(x)(0) = 0 \tag{28}$$

> $expr := diff(x(t), t\$2) + x(t) = f$

$$expr := \frac{d^2}{dt^2}\,x(t) + x(t) = \begin{cases} t & 0 \le t < \frac{\pi}{2} \\ \pi - t & \frac{\pi}{2} \le t < \pi \\ 0 & \pi < t \end{cases} \tag{29}$$

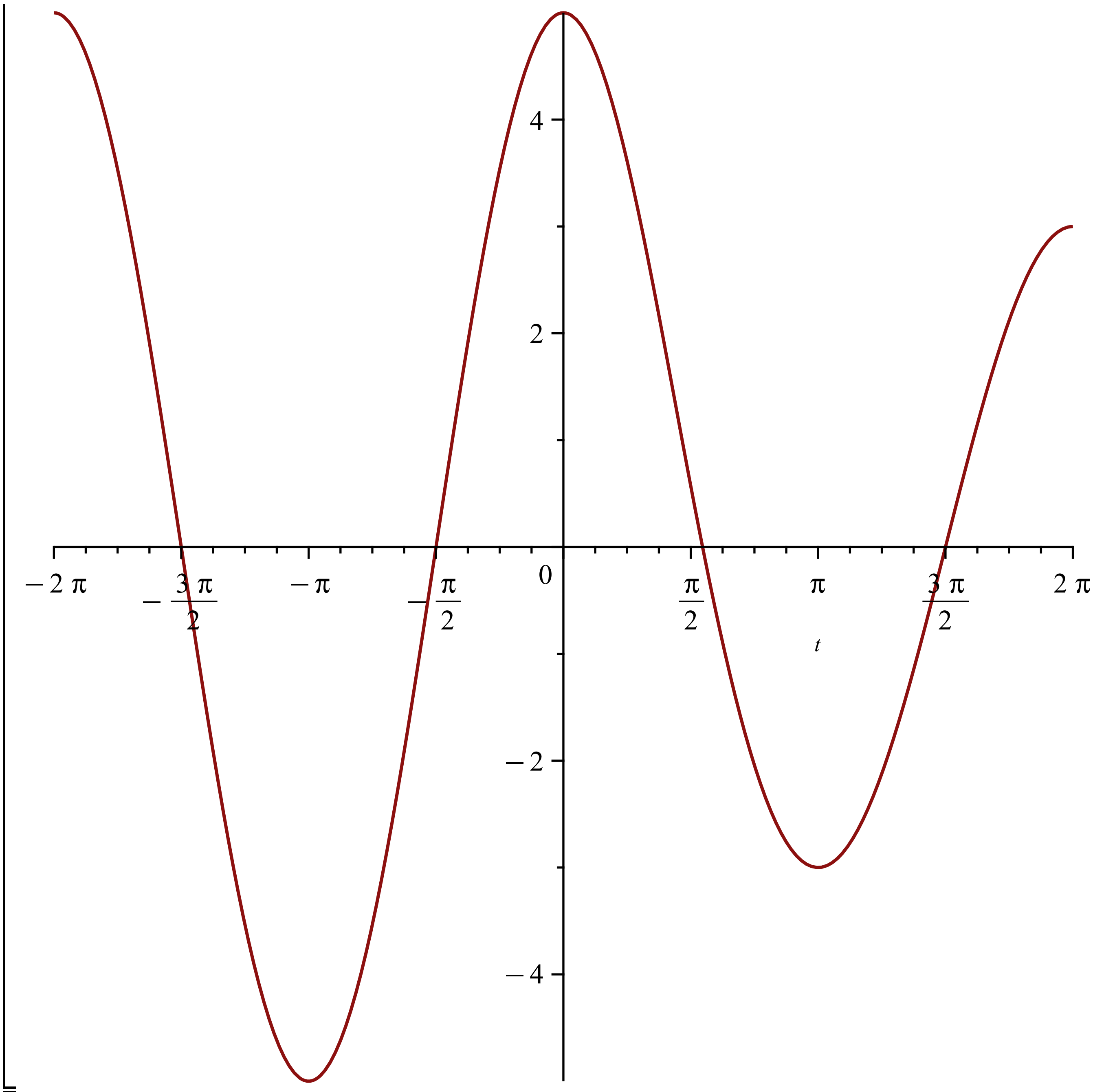
> $spring := dsolve(\{expr, ic\}, x(t))$

$$spring := x(t) = \begin{cases} 5\cos(t) & t < 0 \\ 5\cos(t) + t - \sin(t) & t < \frac{\pi}{2} \\ 3\cos(t) - \sin(t) + \pi - t & t < \pi \\ 3\cos(t) & \pi \le t \end{cases} \tag{30}$$

> $spring := rhs(spring)$

$$spring := \begin{cases} 5\cos(t) & t < 0 \\ 5\cos(t) + t - \sin(t) & t < \frac{\pi}{2} \\ 3\cos(t) - \sin(t) + \pi - t & t < \pi \\ 3\cos(t) & \pi \le t \end{cases} \tag{31}$$

> $plot(spring)$



> $eq1 := diff(x(t), t) = -2 \cdot x(t)$

$$eq1 := \frac{\mathrm{d}}{\mathrm{d}t}\, x(t) = -2\, x(t) \tag{32}$$

> $ic1 := x(0) = 1$

$$ic1 := x(0) = 1 \tag{33}$$

> $eq2 := diff(y(t), t) = -3 \cdot y(t)$

$$eq2 := \frac{\mathrm{d}}{\mathrm{d}t}\, y(t) = -3\, y(t) \tag{34}$$

> $ic2 := y(0) = 1$

$$ic2 := y(0) = 1 \tag{35}$$

> $sol := dsolve(\{eq1, eq2, ic1, ic2\}, \{x(t), y(t)\})$

$$sol := \{x(t) = e^{-2t}, y(t) = e^{-3t}\} \quad \textbf{(36)}$$

> $sol[1]$

$$x(t) = e^{-2t} \quad \textbf{(37)}$$

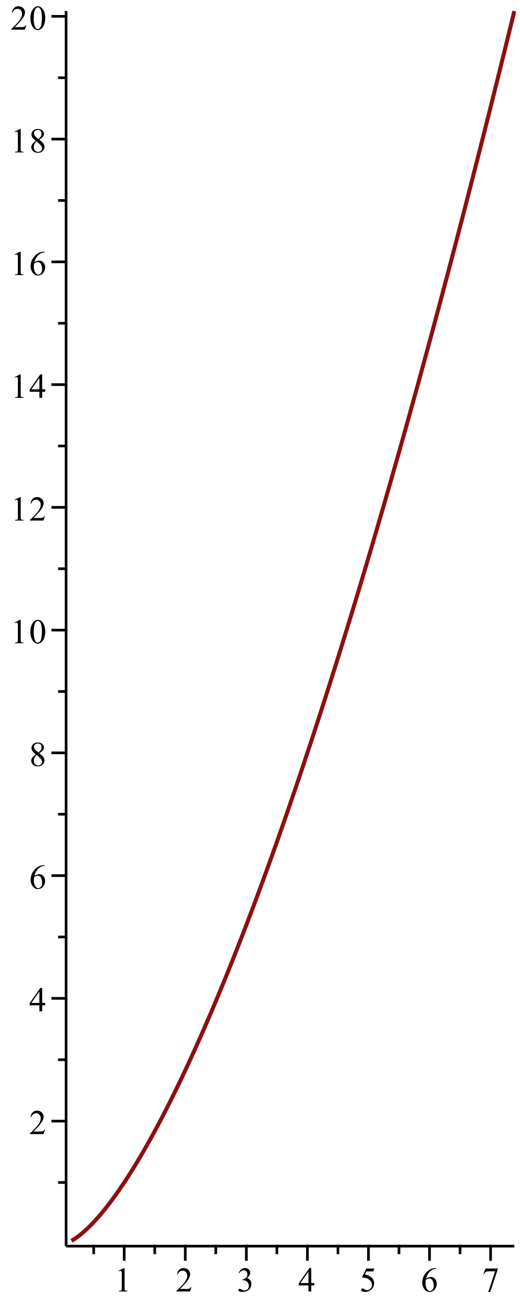
> $sol[2]$

$$y(t) = e^{-3t} \quad \textbf{(38)}$$

> $rhs(sol[1])$

$$e^{-2t} \quad \textbf{(39)}$$

> $plot([rhs(sol[1]), rhs(sol[2]), t = -1..1], scaling = constrained)$



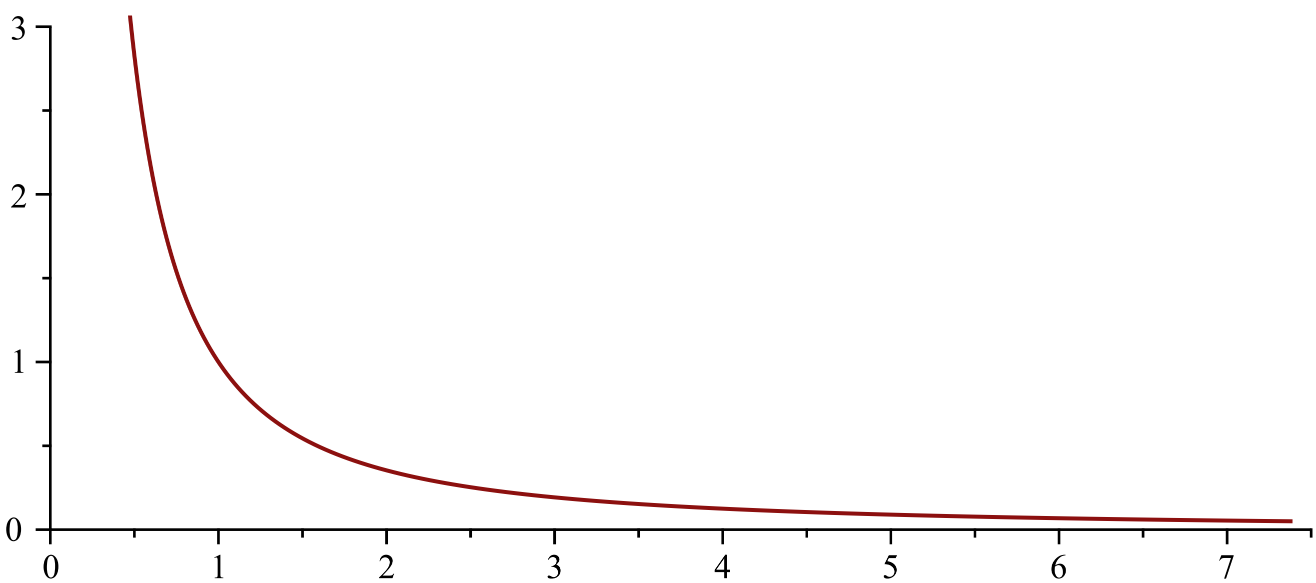
> $eq2 := diff(y(t), t) = 3 \cdot y(t)$

$$eq2 := \frac{d}{dt}\, y(t) = 3\, y(t) \tag{40}$$

> $sol := dsolve(\{eq1, eq2, ic1, ic2\}, \{x(t), y(t)\})$

$$sol := \{x(t) = e^{-2\,t}, y(t) = e^{3\,t}\} \tag{41}$$

> $plot([rhs(sol[1]), rhs(sol[2]), t = -1 ..1], scaling = constrained)$



> $eq1 := diff(x(t), t) = -y(t)$

$$eq1 := \frac{d}{dt}\, x(t) = -y(t) \tag{42}$$

> $eq2 := diff(y(t), t) = 4 \cdot x(t)$

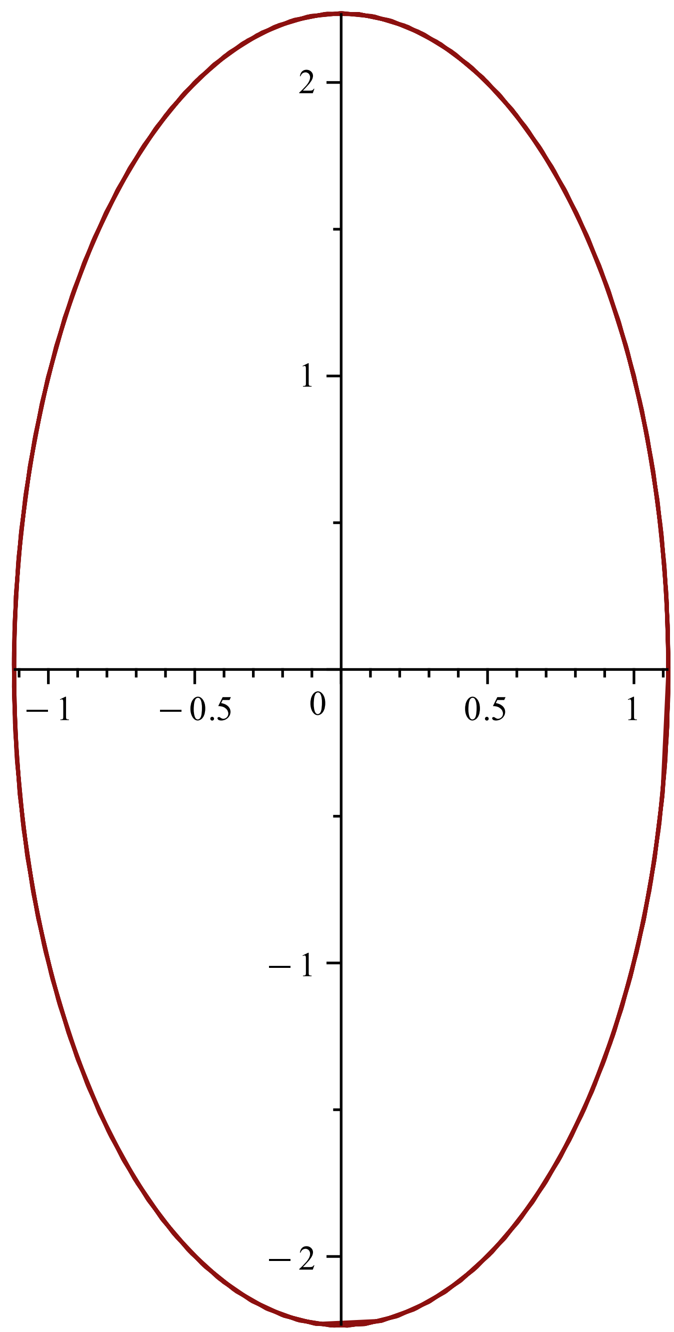
(43)

$$eq2 := \frac{d}{dt}\, y(t) = 4\, x(t) \tag{43}$$

> $sol := dsolve(\{eq1, eq2, ic1, ic2\}, \{x(t), y(t)\})$

$$sol := \left\{x(t) = -\frac{\sin(2\,t)}{2} + \cos(2\,t), y(t) = \cos(2\,t) + 2\,\sin(2\,t)\right\} \tag{44}$$

> $plot([rhs(sol[1]), rhs(sol[2]), t=-10\,..10], scaling = constrained)$



> $eq1 := diff(x(t), t) = -x(t) + 3\cdot y(t)$

$$eq1 := \frac{d}{dt}\, x(t) = -x(t) + 3\, y(t) \tag{45}$$

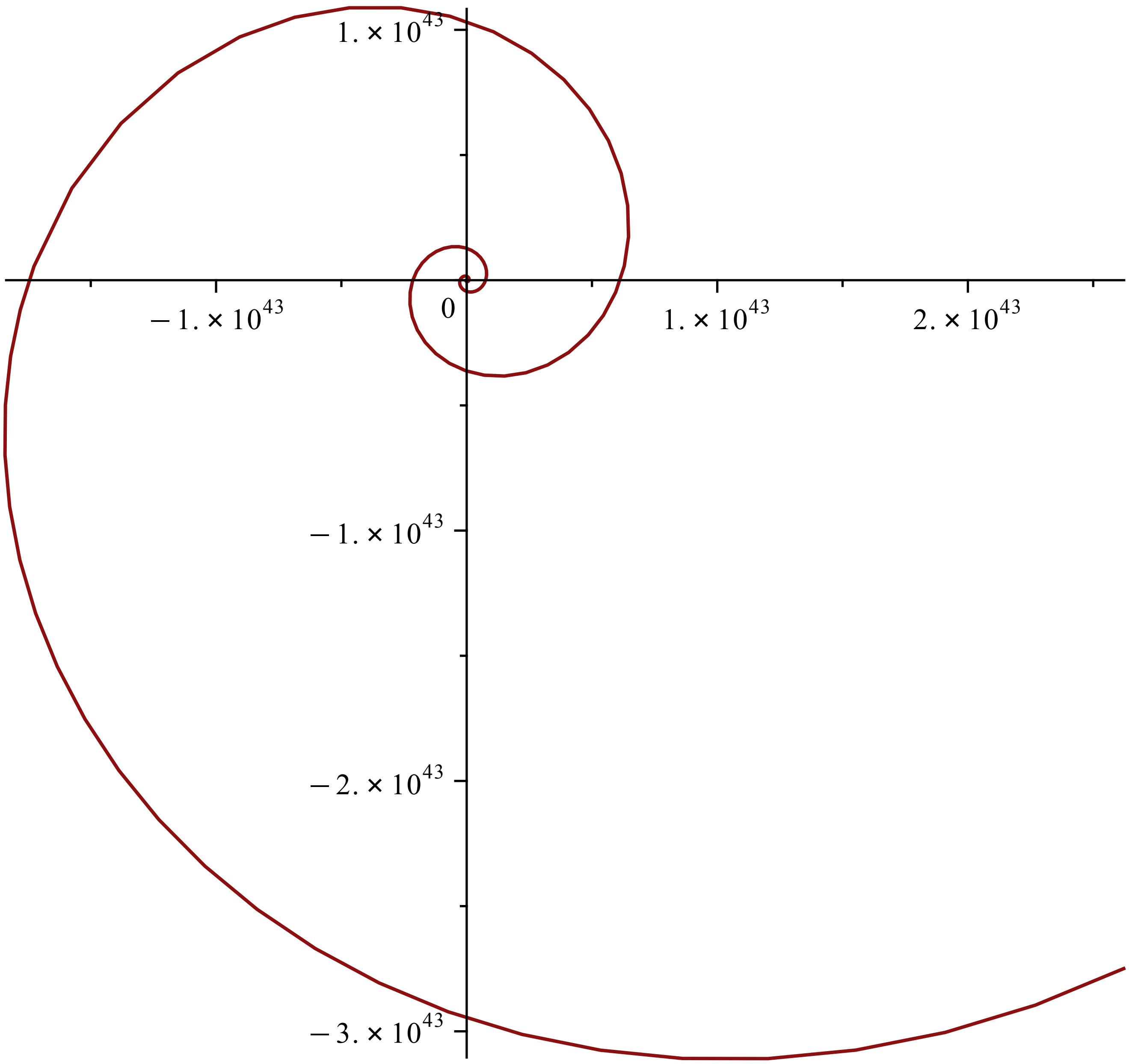
> $eq2 := diff(y(t), t) = -3\cdot x(t) - y(t)$

$$eq2 := \frac{d}{dt}\, y(t) = -3\, x(t) - y(t) \tag{46}$$

> $sol := dsolve(\{eq1, eq2, ic1, ic2\}, \{x(t), y(t)\})$

$$sol := \{x(t) = e^{-t}\,(\cos(3\,t) + \sin(3\,t)), y(t) = e^{-t}\,(\cos(3\,t) - \sin(3\,t))\} \tag{47}$$

> $plot([rhs(sol[1]), rhs(sol[2]), t = -100..100], scaling = constrained)$



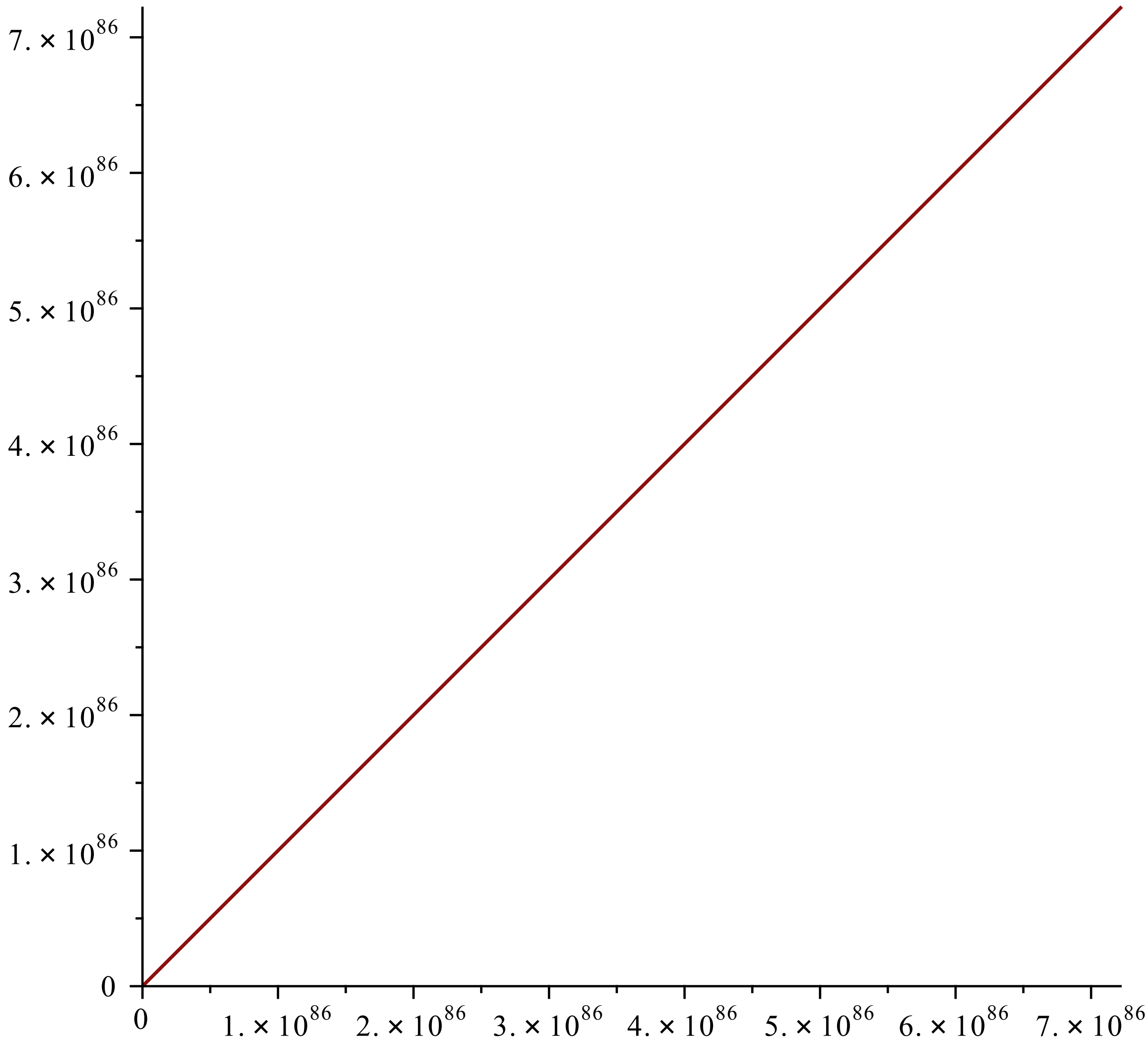
> $eq2 := diff(y(t), t) = 3 \cdot x(t) - y(t)$

$$eq2 := \frac{d}{dt}\, y(t) = 3\, x(t) - y(t) \tag{48}$$

> $sol := dsolve(\{eq1, eq2, ic1, ic2\}, \{x(t), y(t)\})$

$$sol := \{x(t) = e^{2\,t}, y(t) = e^{2\,t}\} \tag{49}$$

> $plot([rhs(sol[1]), rhs(sol[2]), t = -100..100], scaling = constrained)$



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