> $eq1 := diff(x(t), t\$1) + x(t) = \frac{2}{\mathrm{sqrt}(\mathrm{Pi})} \cdot \exp(-t \cdot \cdot 2 - t);$

$$eq1 := \frac{d}{dt}\, x(t) + x(t) = \frac{2\, e^{-t^2 - t}}{\sqrt{\pi}} \qquad (1)$$

> $dsolve(eq1, x(t));$

$$x(t) = (\mathrm{erf}(t) + \_C1)\, e^{-t} \qquad (2)$$

> ?erf

> #exercise 2

> $eq2 := diff(x(t), t\$2) + 3 \cdot diff(x(t), t\$1) + x(t) = 1;$

$$eq2 := \frac{d^2}{dt^2}\, x(t) + 3\, \frac{d}{dt}\, x(t) + x(t) = 1 \qquad (3)$$

> $dsolve(eq2, x(t));$

$$x(t) = e^{\frac{(\sqrt{5} - 3)\, t}{2}}\, \_C2 + e^{-\frac{(3 + \sqrt{5})\, t}{2}}\, \_C1 + 1 \qquad (4)$$

> $h := x(t) = e^{\frac{(\sqrt{5} - 3)\, t}{2}} + e^{-\frac{(3 + \sqrt{5})\, t}{2}} + 1;$

$$h := x(t) = e^{\frac{(\sqrt{5} - 3)\, t}{2}} + e^{-\frac{(3 + \sqrt{5})\, t}{2}} + 1 \qquad (5)$$

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

$$\lim_{t \to \infty} x(t) = 1 \qquad (6)$$

> #exercise 2 is true

> #exercise 3

> $eq3 := diff(x(t), t\$2) + 4 \cdot x(t) = 1;$

$$eq3 := \frac{d^2}{dt^2}\, x(t) + 4\, x(t) = 1 \qquad (7)$$

> $ic1 := x(0) = \frac{5}{4}$

$$ic1 := x(0) = \frac{5}{4} \qquad (8)$$

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

$$ic2 := \mathrm{D}(x)(0) = 0 \qquad (9)$$

> $dsolve(\{eq3, ic1, ic2\}, x(t));$

$$x(t) = \frac{1}{4} + \cos(2\, t) \qquad (10)$$

> $\frac{1}{4} + \cos(2 \cdot \mathrm{Pi})$

$$\frac{5}{4} \qquad (11)$$

> #exercise 3 is true

> #exercise 4

> $eq4 := diff(x(t), t\$1) - x(t) - t^3;$

$$eq4 := \frac{\mathrm{d}}{\mathrm{d}t}\, x(t) - x(t) - t^3 \tag{12}$$

> $dsolve(eq4, x(t));$

$$x(t) = -t^3 - 3\,t^2 - 6\,t - 6 + \mathrm{e}^{t}\,\_C1 \tag{13}$$

> #exercise 4 is true when C1=0

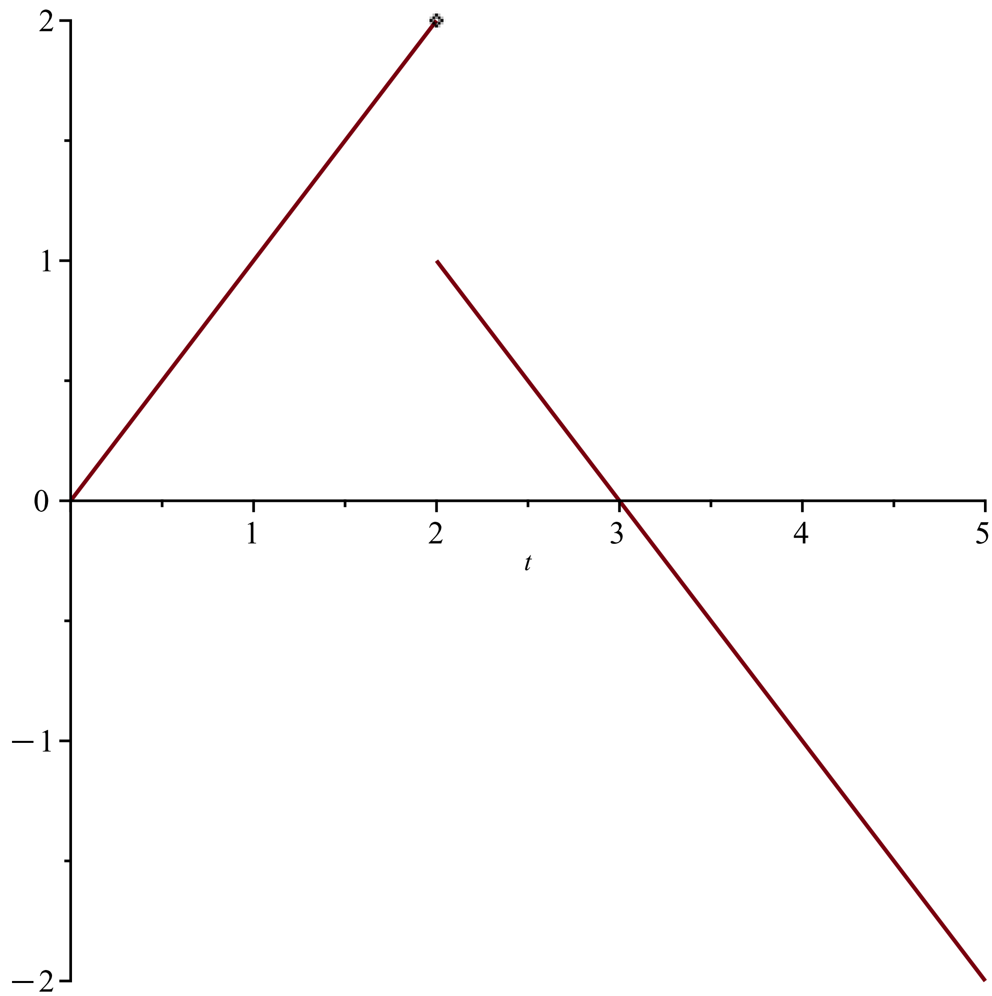
> #exercice 5

> #yeyeye

> $eq5 := piecewise(t \le 2, t, t > 2, 3 - t);$

$$eq5 := \begin{cases} t & t \le 2 \\ -t + 3 & 2 < t \end{cases} \tag{14}$$

> $plot(eq5, t = 0\,..5, discont = true);$



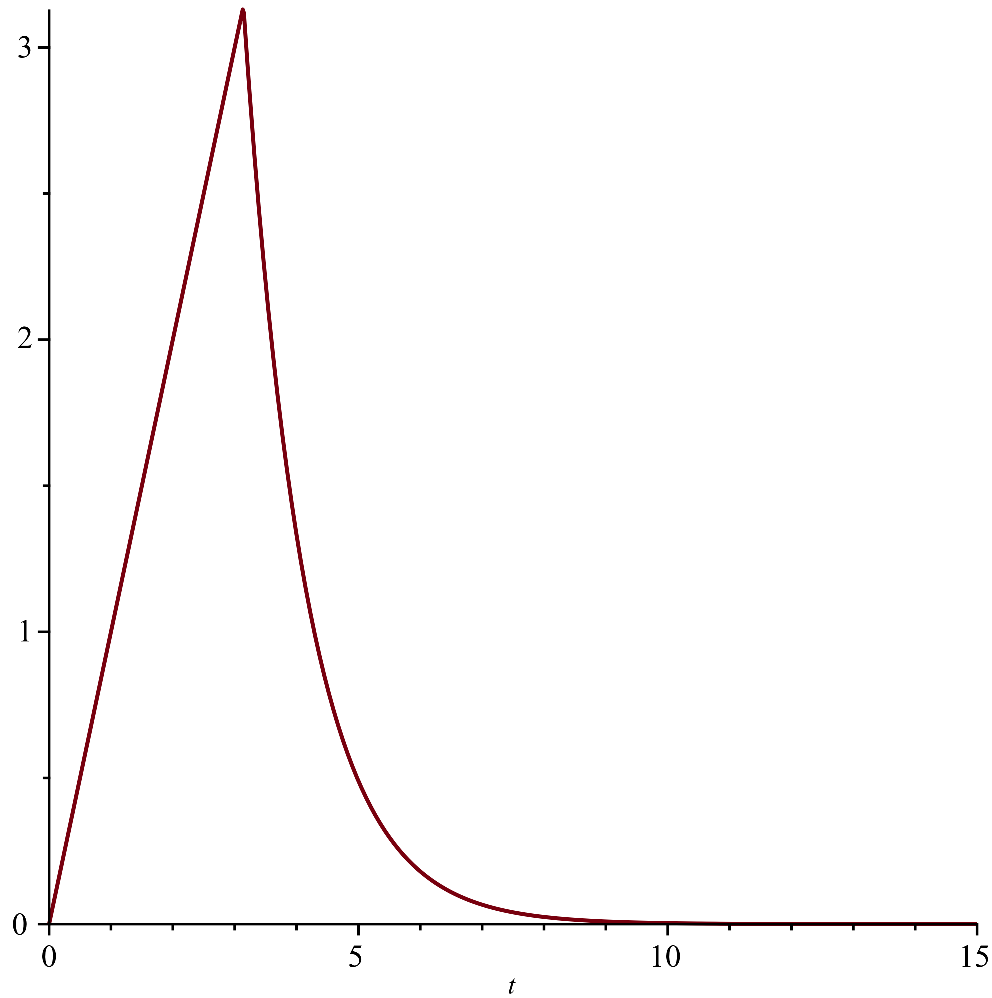
> #

> #exercise 6

> $eq6 := piecewise(0 \le t \le \mathrm{Pi}, t, t > \mathrm{Pi}, \mathrm{Pi}\cdot\exp(\mathrm{Pi} - t));$

$$eq6 := \begin{cases} t & 0 \le t \le \pi \\ \pi\, e^{\pi - t} & \pi < t \end{cases} \quad (15)$$

> $plot(eq6, t = 0 ..15, discont = true);$



> #

> #exercise 7

> $eq7 := diff(x(t), t\$2) + x(t) = eq6;$

$$eq7 := \frac{d^2}{dt^2}\, x(t) + x(t) = \begin{cases} t & 0 \le t \le \pi \\ \pi\, e^{\pi - t} & \pi < t \end{cases} \quad (16)$$

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

$$ic1 := x(0) = 0 \quad (17)$$

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

$$ic2 := D(x)(0) = 1 \quad (18)$$

> $assume(t \ge 0);$

> $sol := dsolve(\{eq7, ic1, ic2\}, x(t));$

(19)

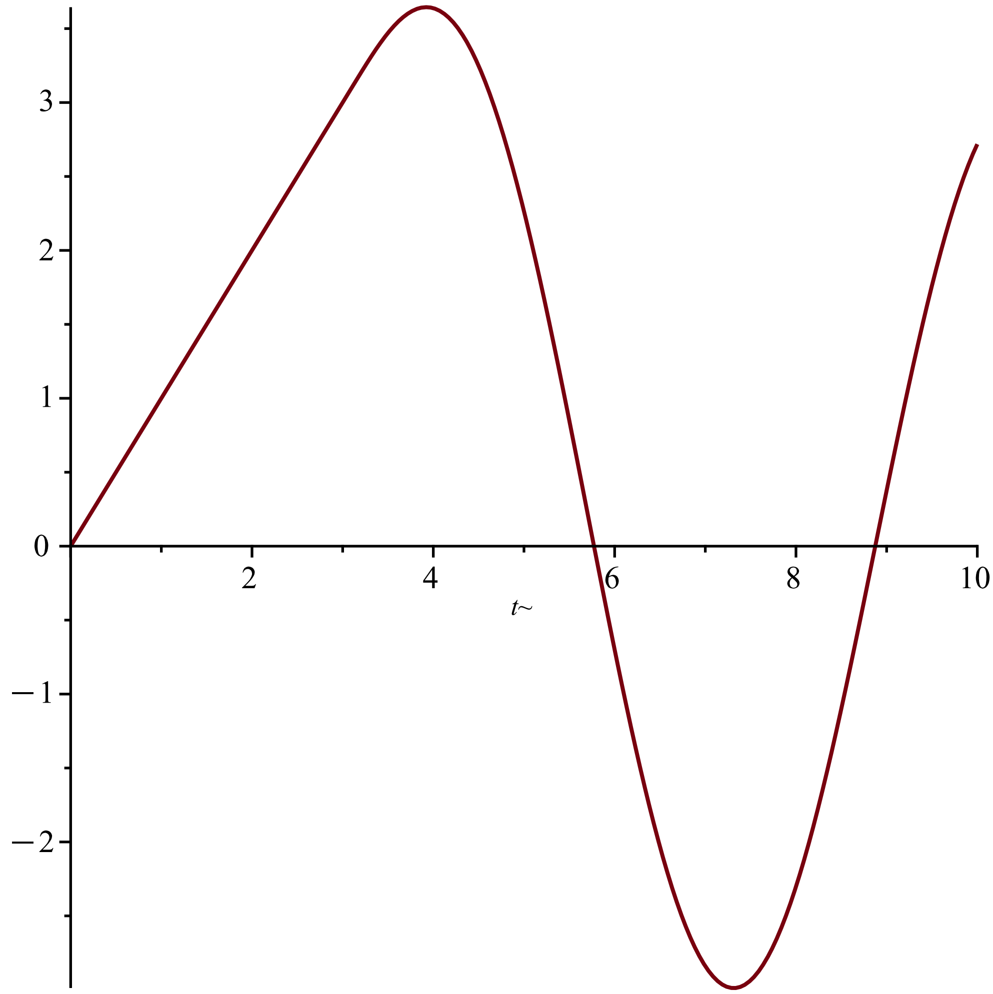
$$sol := x(t\sim) = \begin{cases} t\sim & t\sim < \pi \\ \frac{\pi\, e^{\pi - t\sim}}{2} - \frac{\sin(t\sim)\,\pi}{2} - \frac{\cos(t\sim)\,\pi}{2} - \sin(t\sim) & \pi \le t\sim \end{cases} \quad (19)$$

> #

> $y := unapply(rhs(sol), t);$

$$y := t\sim \mapsto \begin{cases} t\sim & t\sim < \pi \\ \frac{\pi \cdot e^{\pi - t\sim}}{2} - \frac{\sin(t\sim)\cdot\pi}{2} - \frac{\cos(t\sim)\cdot\pi}{2} - \sin(t\sim) & \pi \le t\sim \end{cases} \quad (20)$$

> $plot(y(t), t=0..10);$



> $t='t';$

$$t\sim = t \quad (21)$$

> #exercise 8
$t='t'$

$$t\sim = t \quad (22)$$

> $t :='t';$

$$t := t \quad (23)$$

> $eq8 := diff(x(t), t\$2) + x(t) = \cos(a \cdot t);$

$$eq8 := \frac{d^2}{dt^2}\, x(t) + x(t) = \cos(a\, t) \tag{24}$$

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

$$ic1 := x(0) = 0 \tag{25}$$

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

$$ic2 := D(x)(0) = 0 \tag{26}$$

> $sol := dsolve(\{eq8, ic1, ic2\},\ x(t));$

$$sol := x(t) = \frac{\cos(t)}{a^2 - 1} - \frac{\cos(a\, t)}{a^2 - 1} \tag{27}$$

> $y := unapply(rhs(sol), t, a);$

$$y := (t, a) \mapsto \frac{\cos(t)}{a^2 - 1} - \frac{\cos(a \cdot t)}{a^2 - 1} \tag{28}$$

> $assume(a \neq 1);$

> $limit(y(t, a), a = 1)$

$$\frac{\sin(t)\, t}{2} \tag{29}$$

> $eq8copy := diff(x(t), t\$2) + x(t) = \cos(t)$

$$eq8copy := \frac{d^2}{dt^2}\, x(t) + x(t) = \cos(t) \tag{30}$$

> $sol8copy := dsolve(\{eq8copy, ic1, ic2\},\ x(t))$

$$sol8copy := x(t) = \frac{\sin(t)\, t}{2} \tag{31}$$

>

>