```
> #ex1:
```

```
> e1 := diff(x(t), t) + x(t) = 2/sqrt(Pi) · exp(-t^2 - t);
```

$$e1 := \frac{d}{dt}\, x(t) + x(t) = \frac{2\,e^{-t2-t}}{\sqrt{\pi}} \tag{1}$$

```
> solution1 := dsolve(e1, x(t));
```

$$solution1 := x(t) = \left(\operatorname{erf}(t) + c_1\right) e^{-t} \tag{2}$$

```
> Sol1 := unapply(rhs(solution1), t, _C1);
```

$$Sol1 := (t, c_1) \mapsto \left(\operatorname{erf}(t) + c_1\right)\cdot e^{-t} \tag{3}$$

```
>
```

```
> int(exp(t^2), t);
```

$$\frac{\sqrt{\pi}\,\operatorname{erfi}(t)}{2} \tag{4}$$

```
>
```

```
> int( 2/sqrt(Pi) · exp(-t^2), t);
```

$$\operatorname{erf}(t) \tag{5}$$

```
> erf(t) + C;
```

$$\operatorname{erf}(t) + C \tag{6}$$

```
>
```

```
> #ex2:
```

```
>
```

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

$$eq2 := \frac{d^2}{dt^2}\, x(t) + 3\,\frac{d}{dt}\, x(t) + x(t) = 1 \tag{7}$$

```
> solution2 := dsolve(eq2, x(t));
```

$$solution2 := x(t) = e^{\frac{(\sqrt{5}-3)\,t}{2}} c_2 + e^{-\frac{(3+\sqrt{5})\,t}{2}} c_1 + 1 \tag{8}$$

```
> Sol2 := unapply(rhs(solution2), t, _C1, _C2);
```

$$Sol2 := (t, c_1, c_2) \mapsto e^{\frac{(\sqrt{5}-3)\cdot t}{2}}\cdot c_2 + e^{-\frac{(3+\sqrt{5})\cdot t}{2}}\cdot c_1 + 1 \tag{9}$$

```
> limit(Sol2(t, C1, C2), t = infinity);
```

$$1 \tag{10}$$

```
> #ex3:
```

```
>
```

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

$$eq3 := \frac{d^2}{dt^2}\, x(t) + 4\,x(t) = 1 \tag{11}$$

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

$$icl := \mathrm{D}(x)(0) = 0, x(0) = \dfrac{5}{4} \tag{12}$$

> **dsolve({eq3,icl},x(t));**

$$x(t) = \dfrac{1}{4} + \cos(2\,t) \tag{13}$$

>

> *#ex4:*
> $eq4 := diff(x(t), t) = 3{\cdot}x(t) + t^3;$

$$eq3 := \dfrac{\mathrm{d}}{\mathrm{d}t}\,x(t) = 3\,x(t) + t^3 \tag{14}$$

> *#EX5:*
> $f5 := piecewise(t \le 2\,, t, 3 - t);$

$$f5 := \begin{cases} t & t \le 2 \\ 3 - t & otherwise \end{cases} \tag{15}$$

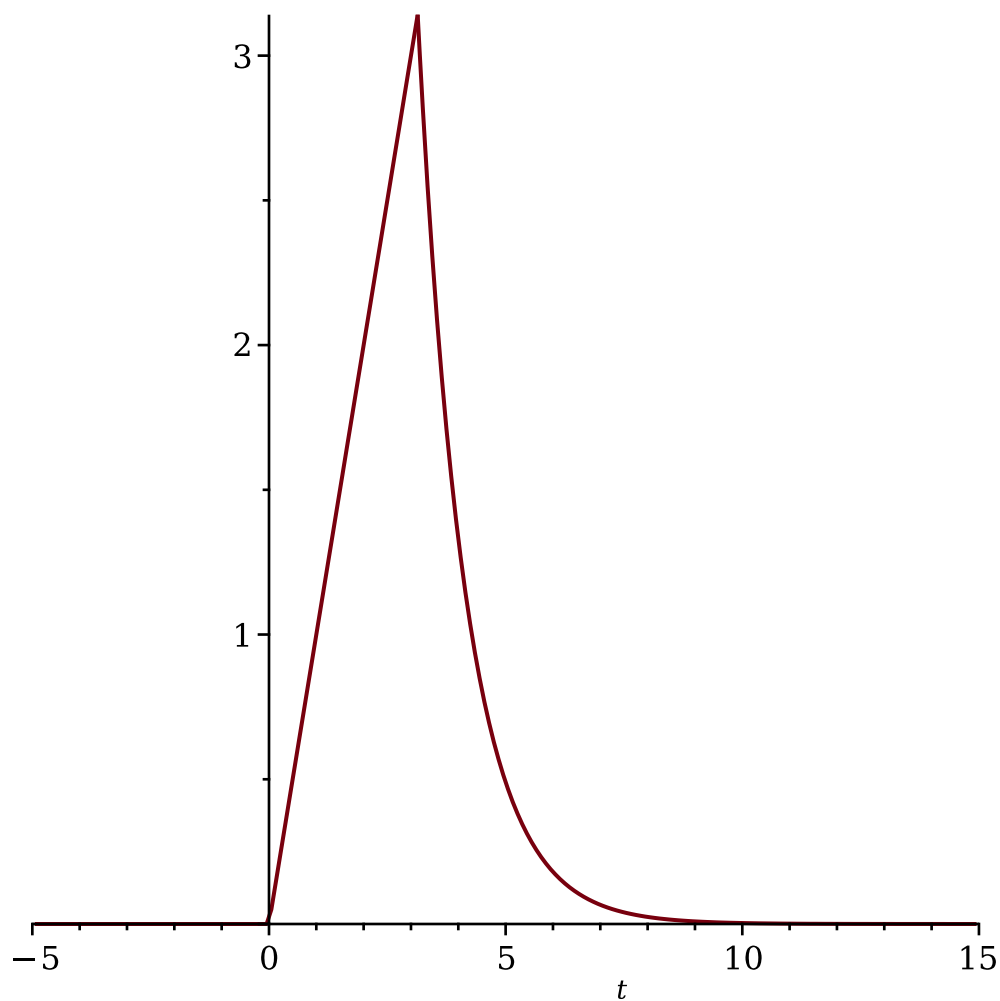> $plot(f5, discont = true);$
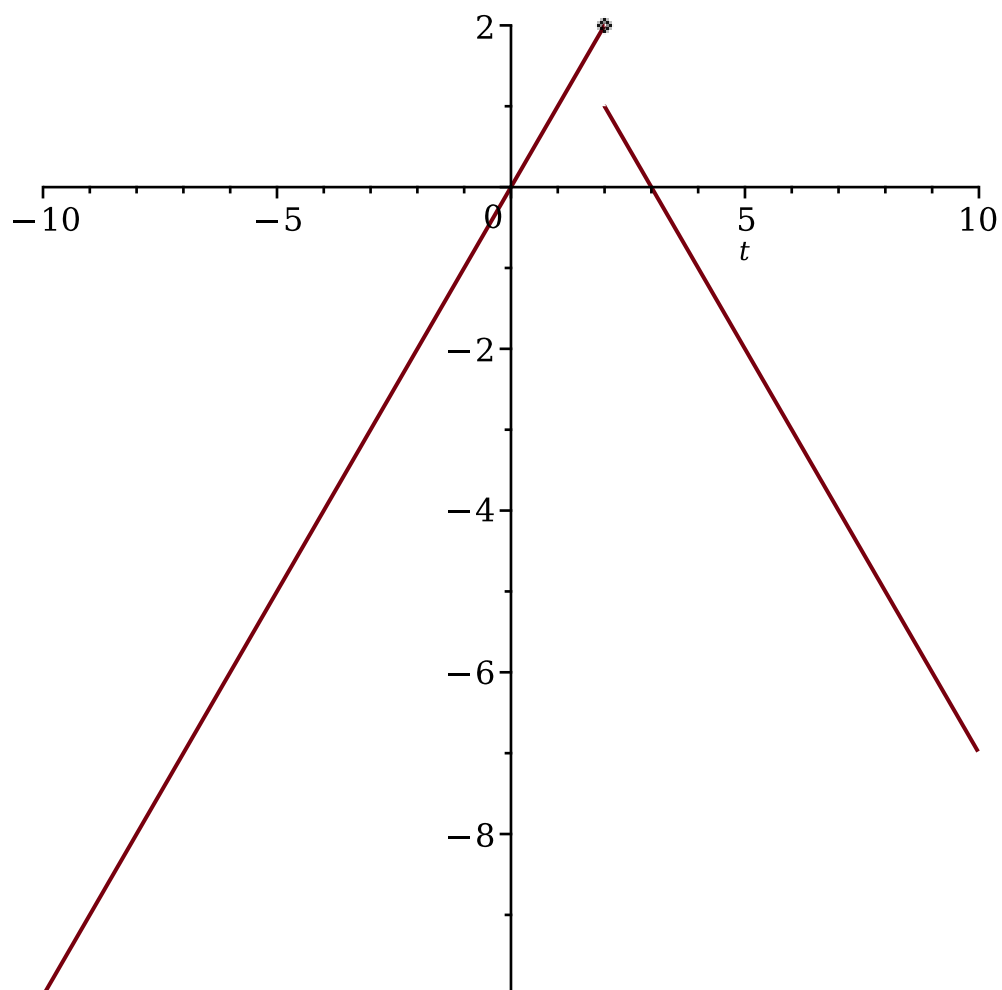
> 
> #EX6:
> $f6 := piecewise(0 \leq t \leq Pi, t, t > Pi, Pi\,exp(Pi - t));$

$$f6 := \begin{cases} t & 0 \leq t \leq \pi \\ \pi\,e^{\pi - t} & \pi < t \end{cases}$$

(16)

> $plot(f6);$

> 

> *Ex7* :

> *ode* := *diff*(*x*(*t*), *t*$2) + *x*(*t*) = *f6*;

$$ode := \frac{d^2}{dt^2}\, x(t) + x(t) = \begin{cases} t & 0 \le t \le \pi \\ \pi\, e^{\pi - t} & \pi < t \end{cases} \tag{17}$$

> *ic1* := *x*(0) = 0, D(*x*)(0) = 1;

$$ic1 := x(0) = 0,\ D(x)(0) = 1 \tag{18}$$

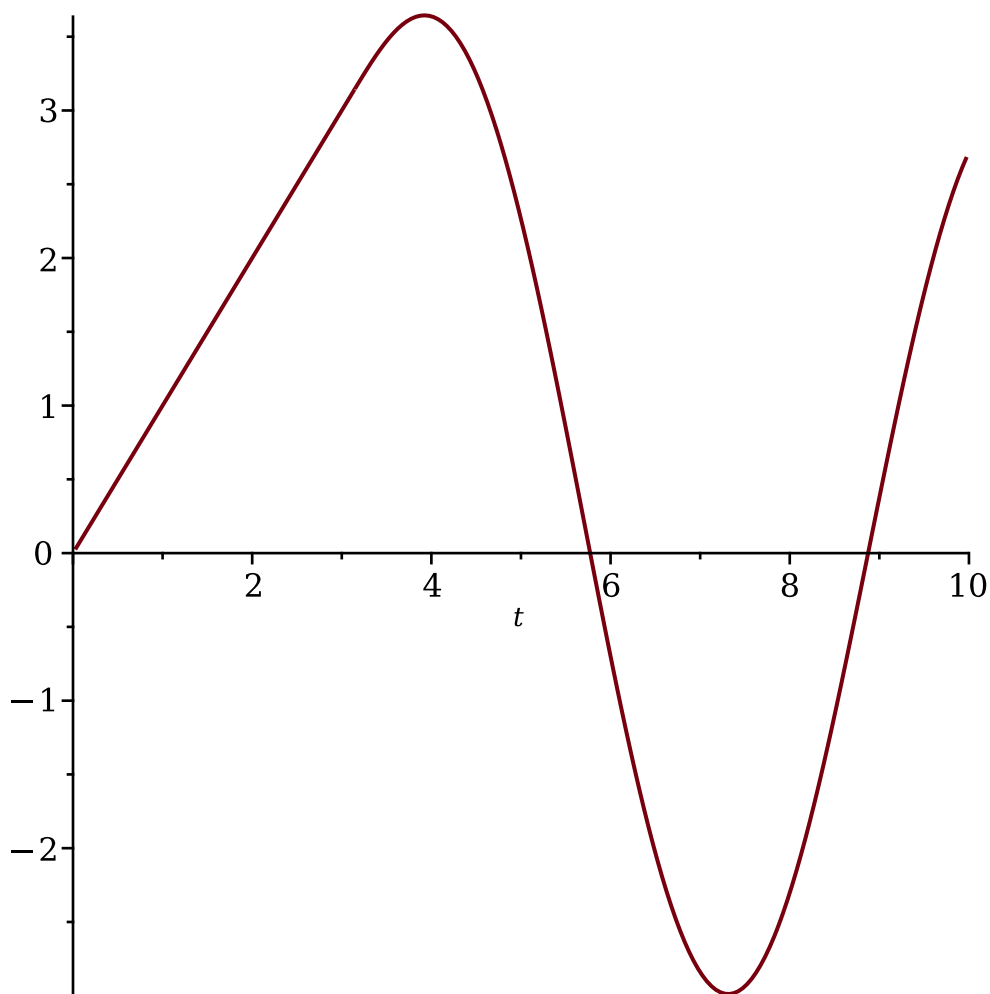> *sol7* := *dsolve*({*ode*, *icl*}, *x*(*t*));

$$sol7 := x(t) = \begin{cases} \sin(t) & t < 0 \\ t & t < \pi \\ -\sin(t) - \dfrac{\sin(t)\,\pi}{2} - \dfrac{\cos(t)\,\pi}{2} + \dfrac{\pi\, e^{\pi - t}}{2} & \pi \le t \end{cases} \tag{19}$$

> *Sol7* := *unapply*(*rhs*(*sol7*), *t*);

$$\tag{20}$$

$$Sol7 := t \mapsto \begin{cases} \sin(t) & t < 0 \\ t & t < \pi \\ -\sin(t) - \dfrac{\sin(t)\cdot\pi}{2} - \dfrac{\cos(t)\cdot\pi}{2} + \dfrac{\pi\cdot e^{\pi - t}}{2} & \pi \le t \end{cases}$$  (20)

`plot(Sol7(t), t = 0..10);`



```
> #EX11:
> restart;
> ode1x := diff(x(t), t) = -2·x(t);
```

$$ode1x := \frac{d}{dt}\, x(t) = -2\, x(t)$$  (21)

```
> ode1y := diff(y(t), t) = -3·y(t);
```

$$ode1y := \frac{d}{dt}\, y(t) = -3\, y(t)$$  (22)

```
> syst1 := ode1x, ode1y;
```

$$syst1 := \frac{d}{dt}\, x(t) = -2\, x(t), \frac{d}{dt}\, y(t) = -3\, y(t)$$  (23)

> $a := x(0) = 1, y(0) = 1;$
$$a := x(0) = 1, y(0) = 1 \tag{24}$$

> $sol := dsolve(\{syst1, a\}, \{x(t), y(t)\});$
$$sol := \{x(t) = e^{-2t}, y(t) = e^{-3t}\} \tag{25}$$

> $Sol1x := unapply(rhs(sol[1]), t);$
$$Sol1x := t \mapsto e^{-2 \cdot t} \tag{26}$$

> $Sol1y := unapply(rhs(sol[2]), t);$
$$Sol1y := t \mapsto e^{-3 \cdot t} \tag{27}$$

> $plot([Sol1x(t), Sol1y(t)], t = 0..10);$
Warning, expecting only range variable t in expression Sol1x(t) to be plotted but found name Sol1x
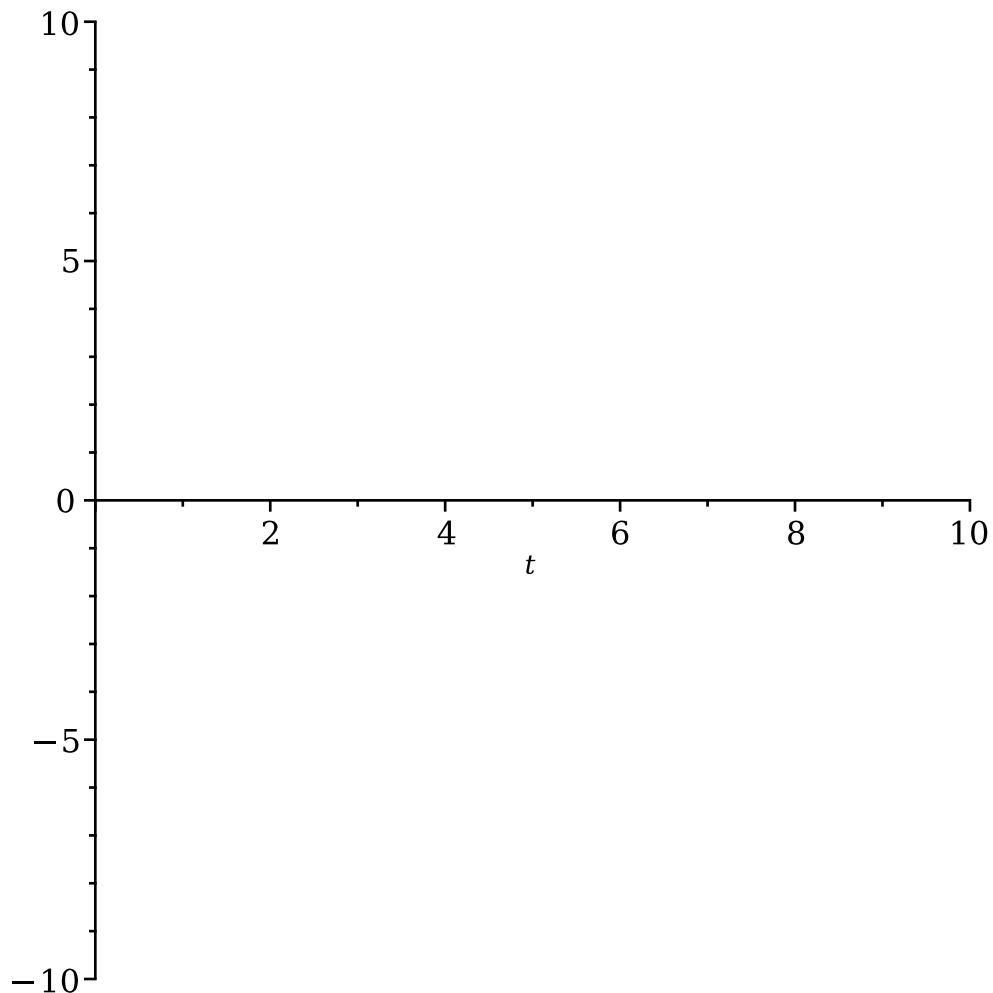


>
> #EX12:
> restart;
> $ode1x := diff(x(t), t) = -2 \cdot x(t);$

$$ode1x := \frac{\mathrm{d}}{\mathrm{d}t}\,x(t) = -2\,x(t) \tag{28}$$

> $ode1y := diff(y(t), t) = 3 \cdot y(t);$

$$ode1y := \frac{\mathrm{d}}{\mathrm{d}t}\,y(t) = 3\,y(t) \tag{29}$$

> $syst1 := ode1x, ode1y;$

$$syst1 := \frac{\mathrm{d}}{\mathrm{d}t}\,x(t) = -2\,x(t), \ \frac{\mathrm{d}}{\mathrm{d}t}\,y(t) = 3\,y(t) \tag{30}$$

> $a := x(0) = 1, y(0) = 1;$

$$a := x(0) = 1, y(0) = 1 \tag{31}$$

> $sol := dsolve(\{syst1, a\}, \{x(t), y(t)\});$

$$sol := \{x(t) = \mathrm{e}^{-2\,t}, y(t) = \mathrm{e}^{3\,t}\} \tag{32}$$
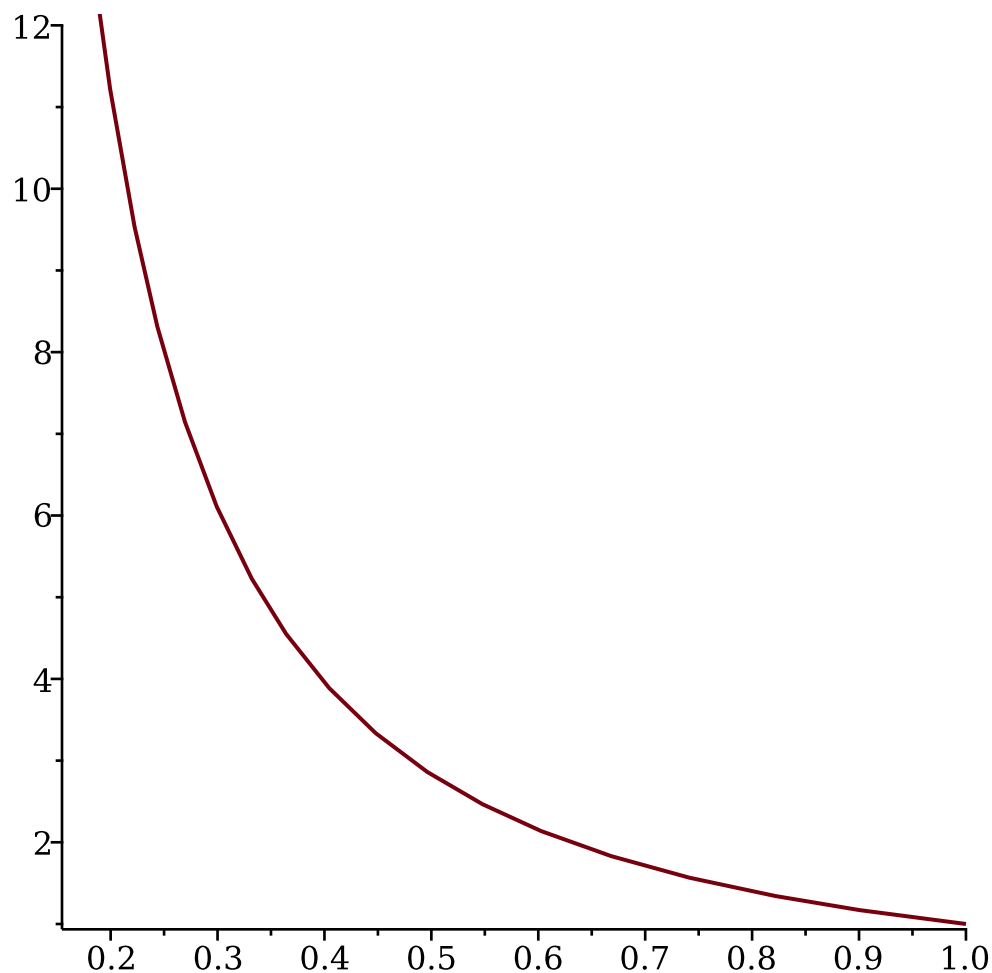
> $Sol1x := unapply(rhs(sol[1]), t);$

$$Sol1x := t \mapsto \mathrm{e}^{-2 \cdot t} \tag{33}$$

> $Sol1y := unapply(rhs(sol[2]), t);$

$$Sol1y := t \mapsto \mathrm{e}^{3 \cdot t} \tag{34}$$

> $plot([Sol1x(t), Sol1y(t), t = 0..10]);$

> 

> *#EX13:*

> *restart;*

> *ode1x := diff(x(t), t) = −y( t);*

$$ode1x := \frac{\mathrm{d}}{\mathrm{d}t}\, x(t) = -y(t) \tag{35}$$

> *ode1y := diff(y(t), t) = 4·x(t);*

$$ode1y := \frac{\mathrm{d}}{\mathrm{d}t}\, y(t) = 4\, x(t) \tag{36}$$

> *syst1 := ode1x, ode1y;*

$$syst1 := \frac{\mathrm{d}}{\mathrm{d}t}\, x(t) = -y(t),\ \frac{\mathrm{d}}{\mathrm{d}t}\, y(t) = 4\, x(t) \tag{37}$$

> *a := x(0) = 1, y(0) = 1;*

$$a := x(0) = 1,\, y(0) = 1 \tag{38}$$

> *sol := dsolve({syst1, a}, {x(t), y(t)});*

$$sol := \left\{ x(t) = -\frac{\sin(2\,t)}{2} + \cos(2\,t),\, y(t) = \cos(2\,t) + 2\sin(2\,t) \right\} \tag{39}$$

> $Sol1x := unapply(rhs(sol[1]), t);$
$$Sol1x := t \mapsto -\frac{\sin(2 \cdot t)}{2} + \cos(2 \cdot t) \tag{40}$$

> $Sol1y := unapply(rhs(sol[2]), t);$
$$Sol1y := t \mapsto \cos(2 \cdot t) + 2 \cdot \sin(2 \cdot t) \tag{41}$$

> $plot([Sol1x(t), Sol1y(t), t = 0 .. 10]);$



>
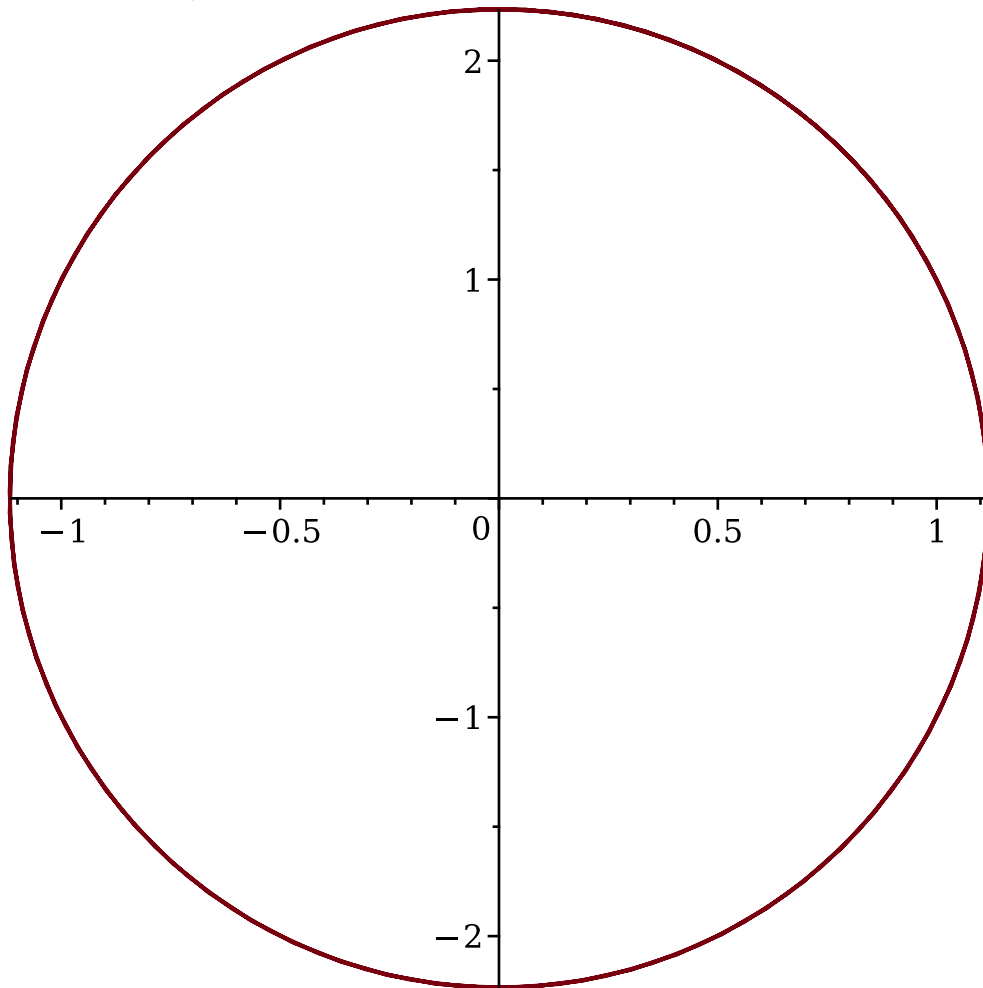
> #EX14:

> $restart;$

> $ode1x := diff(x(t), t) = -2 \cdot x(t);$
$$ode1x := \frac{\mathrm{d}}{\mathrm{d}t}\, x(t) = -2\, x(t) \tag{42}$$

> $ode1y := diff(y(t), t) = -3 \cdot y(t);$
$$ode1y := \frac{\mathrm{d}}{\mathrm{d}t}\, y(t) = -3\, y(t) \tag{43}$$

> $syst1 := ode1x, ode1y;$

$$\tag{44}$$

$$syst1 := \frac{d}{dt}\,x(t) = -2\,x(t),\ \frac{d}{dt}\,y(t) = -3\,y(t) \tag{44}$$

> $a := x(0) = 1, y(0) = 1;$
$$a := x(0) = 1, y(0) = 1 \tag{45}$$

> $sol := dsolve(\{syst1, a\}, \{x(t), y(t)\});$
$$sol := \{x(t) = e^{-2\,t},\ y(t) = e^{-3\,t}\} \tag{46}$$

> $Sol1x := unapply(rhs(sol[1]), t);$
$$Sol1x := t \mapsto e^{-2 \cdot t} \tag{47}$$

> $Sol1y := unapply(rhs(sol[2]), t);$
$$Sol1y := t \mapsto e^{-3 \cdot t} \tag{48}$$

> $plot([Sol1x(t), Sol1y(t), t = 0..10]);$
>
>
>
>