DEFINICAO DE SOMATÓRIO

$f := (x) \rightarrow (x - i)$

$$x \rightarrow x - i \tag{1}$$

$soma := (x) \rightarrow sum(f(x), i = 1..3)$

$$x \rightarrow \sum_{i=1}^{3} f(x) \tag{2}$$

$soma(x)$

$$3x - 6 \tag{3}$$

$soma(5)$

$$9 \tag{4}$$

DEFINIÇÃO DE PRODUTÓRIO

$Prod := (x) \rightarrow product(f(x), i = 1..3)$

$$x \rightarrow \prod_{i=1}^{3} f(x) \tag{5}$$

$Prod(x)$

$$(x - 1)(x - 2)(x - 3) \tag{6}$$

$expand(Prod(x))$

$$x^3 - 6x^2 + 11x - 6 \tag{7}$$

$Prod(5)$

$$24 \tag{8}$$

CÁLCULO DE INTEGRAIS

$int(x^2, x)$

$$\frac{1}{3} x^3 \tag{9}$$

$\int x^2 \, dx$

$$\frac{1}{3} x^3 \tag{10}$$

$int(x^2, x = a..b)$

$$\frac{1}{3} b^3 - \frac{1}{3} a^3 \tag{11}$$

$\int_a^b x^2 \, dx$

$$\frac{1}{3} b^3 - \frac{1}{3} a^3 \tag{12}$$

$g := int(x^2, [x = a..b, y = c..d])$

$$\frac{1}{3} b^3 (d - c) - \frac{1}{3} a^3 (d - c) \tag{13}$$

$\int_a^b \int_c^d x^2 \, dy \, dx$

$$\frac{1}{3}\,(d-c)\,(b^3-a^3) \quad \textbf{(14)}$$

CALCULO DE DERIVADAS

$f := x^2$

$$x^2 \quad \textbf{(15)}$$

$diff\,(\mathrm{f}, x)$

$$2\,x \quad \textbf{(16)}$$

$diff\,(f, x\$2)$

$$2 \quad \textbf{(17)}$$

$diff\,(f, x\$3)$

$$0 \quad \textbf{(18)}$$

$diff\,(x^2 \cdot y, [x, y])$

$$2\,x \quad \textbf{(19)}$$

$diff\,(f \cdot y, [x\$2, y])$

$$2 \quad \textbf{(20)}$$

$\frac{\mathrm{d}}{\mathrm{d}\,x} x^2$

$$2\,x \quad \textbf{(21)}$$

$\frac{\mathrm{d}}{\mathrm{d}\,x} (x^2 \cdot y)$

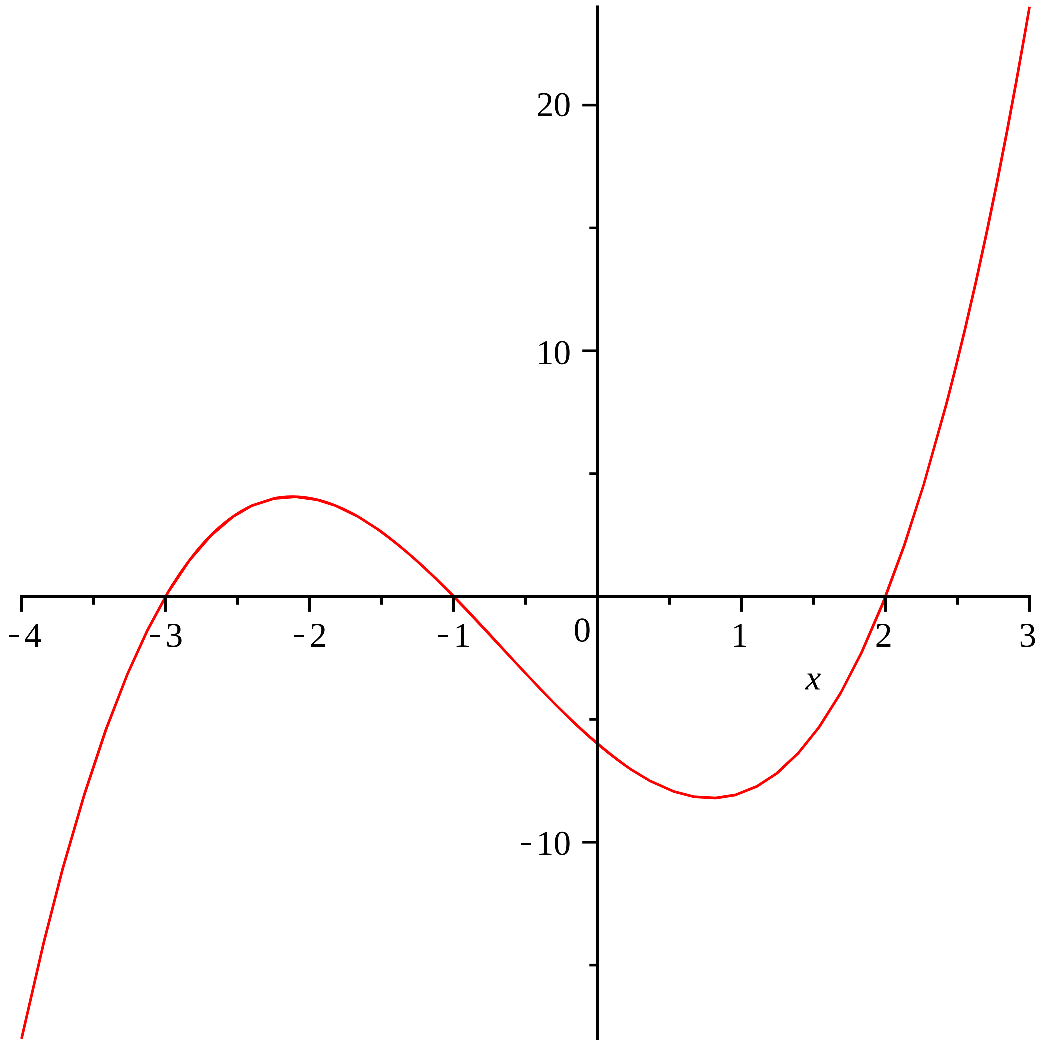
$$2\,x\,y \quad \textbf{(22)}$$

RESOLUÇÃO DE EQUAÇÕES

$f := x \rightarrow x^3 + 2\,x^2 - 5\,x - 6$

$$x \rightarrow x^3 + 2\,x^2 - 5\,x - 6 \quad \textbf{(23)}$$

$plot(\,f(x), x = -4\,..3)$



evalf(*solve*(*f*(*x*)))

$$2., -3., -1. \tag{24}$$

solve$(x \cdot y^2 - y = 5, x)$

$$\frac{y+5}{y^2} \tag{25}$$

solve$([x \cdot y^2 - y = 5, y = 3])$

$$\left\{x = \frac{8}{9}, y = 3\right\} \tag{26}$$

solve$([x \cdot y^2 - y = 5, y < 0])$

$$\left\{x = \frac{y+5}{y^2}, y < 0\right\} \tag{27}$$

Solução para multiplas equações

Desta forma é necessário informar quais são as variáveis

solve$([x^2 + x \cdot y = 3, x + y \cdot x = 1], [x, y])$

$$\left[[x = -1, y = -2], \left[x = 2, y = -\frac{1}{2}\right]\right] \tag{28}$$

Não é necessário informar quem são as variáveis

$fsolve([x^2+x\cdot y=3, x+y\cdot x=1])$

$$\{x=2.000000000, y=-0.5000000000\} \quad (29)$$

$fsolve(f(x))$

$$-3., -1., 2. \quad (30)$$

$sol := solve(q^2-r\cdot s+q=5, q)$

$$-\frac{1}{2}+\frac{1}{2}\sqrt{21+4\,r\,s}, -\frac{1}{2}-\frac{1}{2}\sqrt{21+4\,r\,s} \quad (31)$$

$f := unapply(sol[1], r, s)$

$$(r,s) \rightarrow -\frac{1}{2}+\frac{1}{2}\sqrt{21+4\,r\,s} \quad (32)$$

$f(a,b)$

$$-\frac{1}{2}+\frac{1}{2}\sqrt{21+4\,a\,b} \quad (33)$$

$f(1,2)$

$$-\frac{1}{2}+\frac{1}{2}\sqrt{29} \quad (34)$$

RESOLUCAO ANALÍTICA DE EDOs

restart

with(*DEtools*) :

(35)

$edo1 := diff(y(x), x\$2)+2\cdot y(x)-1$

$$\frac{d^2}{dx^2}y(x)+2\,y(x)-1 \quad (36)$$

$edo2 := D[1,1](y)(x)+2\cdot y(x)-1$

$$D^{(2)}(y)(x)+2\,y(x)-1 \quad (37)$$

$dsolve(\mathrm{edo1})$

$$y(x)=\sin(\sqrt{2}\,x)\,\_C2+\cos(\sqrt{2}\,x)\,\_C1+\frac{1}{2} \quad (38)$$

$dsolve(\mathrm{edo2})$

$$y(x)=\sin(\sqrt{2}\,x)\,\_C2+\cos(\sqrt{2}\,x)\,\_C1+\frac{1}{2} \quad (39)$$

$CI := y(0)=1, D(y)(0)=0$

$$y(0)=1, D(y)(0)=0 \quad (40)$$

$dsolve([edo1, CI])$

$$y(x)=\frac{1}{2}+\frac{1}{2}\cos(\sqrt{2}\,x) \quad (41)$$

SOLUÇÃO NUMERICA DE EDOs DE 1º ORDEM

restart

with(*DEtools*) :

$edo1 := \{diff(x(t),t)=y(t), diff(y(t),t)=x(t)+y(t), x(0)=2, y(0)=1\}$

$$\left\{x(0)=2, y(0)=1, \frac{d}{dt}x(t)=y(t), \frac{d}{dt}y(t)=x(t)+y(t)\right\} \quad (42)$$

$sol := dsolve(edo1, numeric)$

proc(*x_rkf45*) ... **end proc** (43) *sol*(2)

$$[t = 2., x(t) = 25.7240281916026740, y(t) = 40.9727198081363894] \quad \textbf{(44)}$$

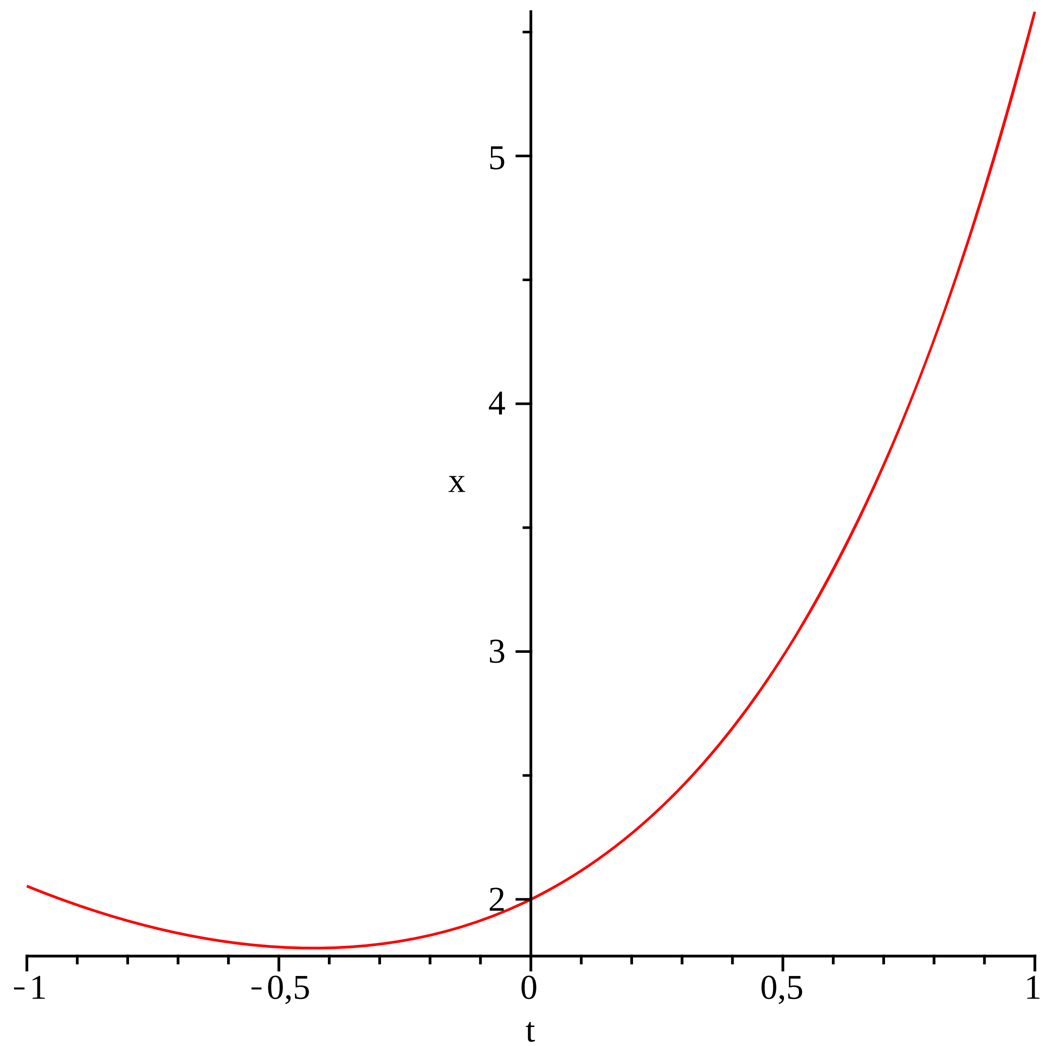
dsolve(*edo1*, *numeric*, *output* = *array*([0, 0.25, 0.5, 0.75, 1]))

(45)

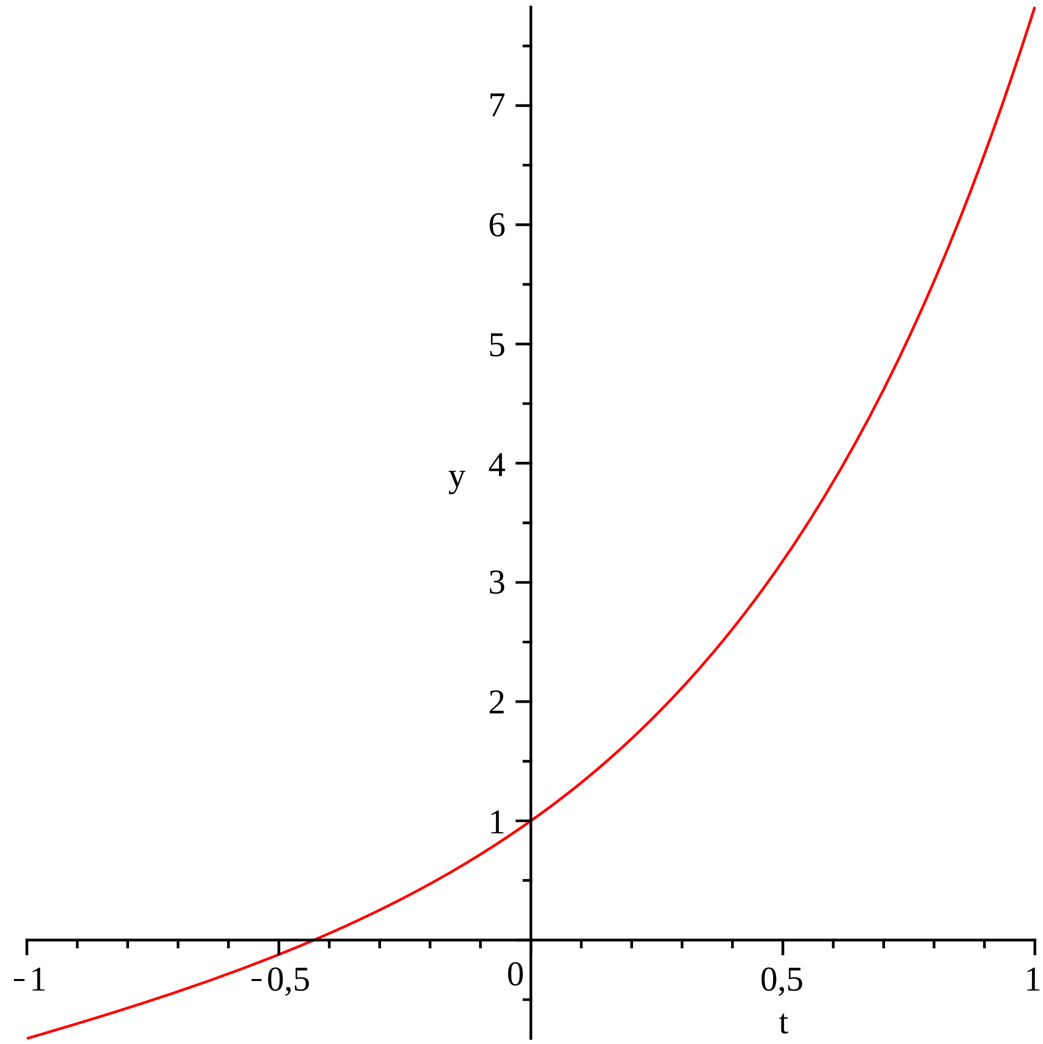
t	x(t)	y(t)
0.	2.	1.
0.250000000000000000	2.35540190364649460	1.89517632348434594
0.500000000000000000	2.97986745286469780	3.17987661172618540
0.750000000000000000	3.99438966474656842	5.05643289721047750
1.	5.58216755967155808	7.82688931187210280

with(*plots*) :

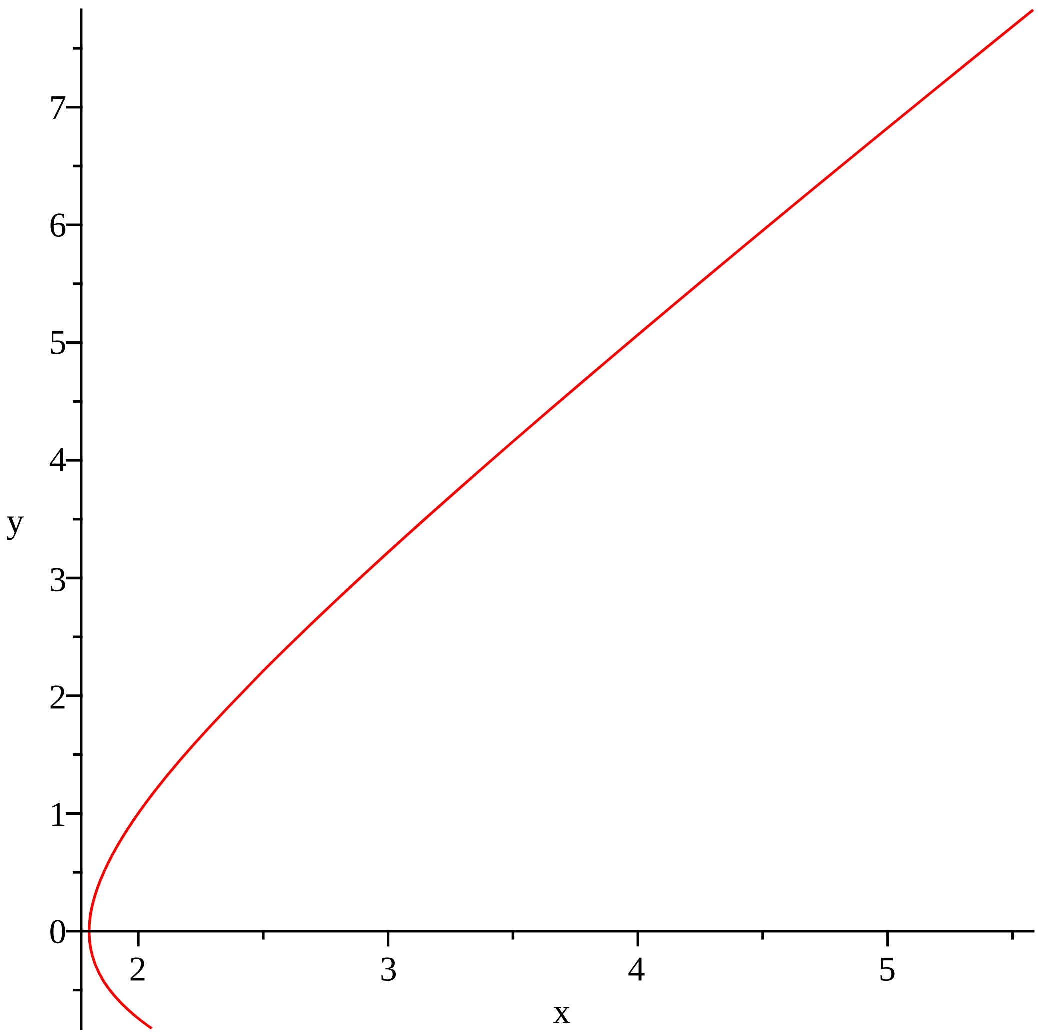
odeplot(*sol*, [*t*, *x*(*t*)], −1 ..1)



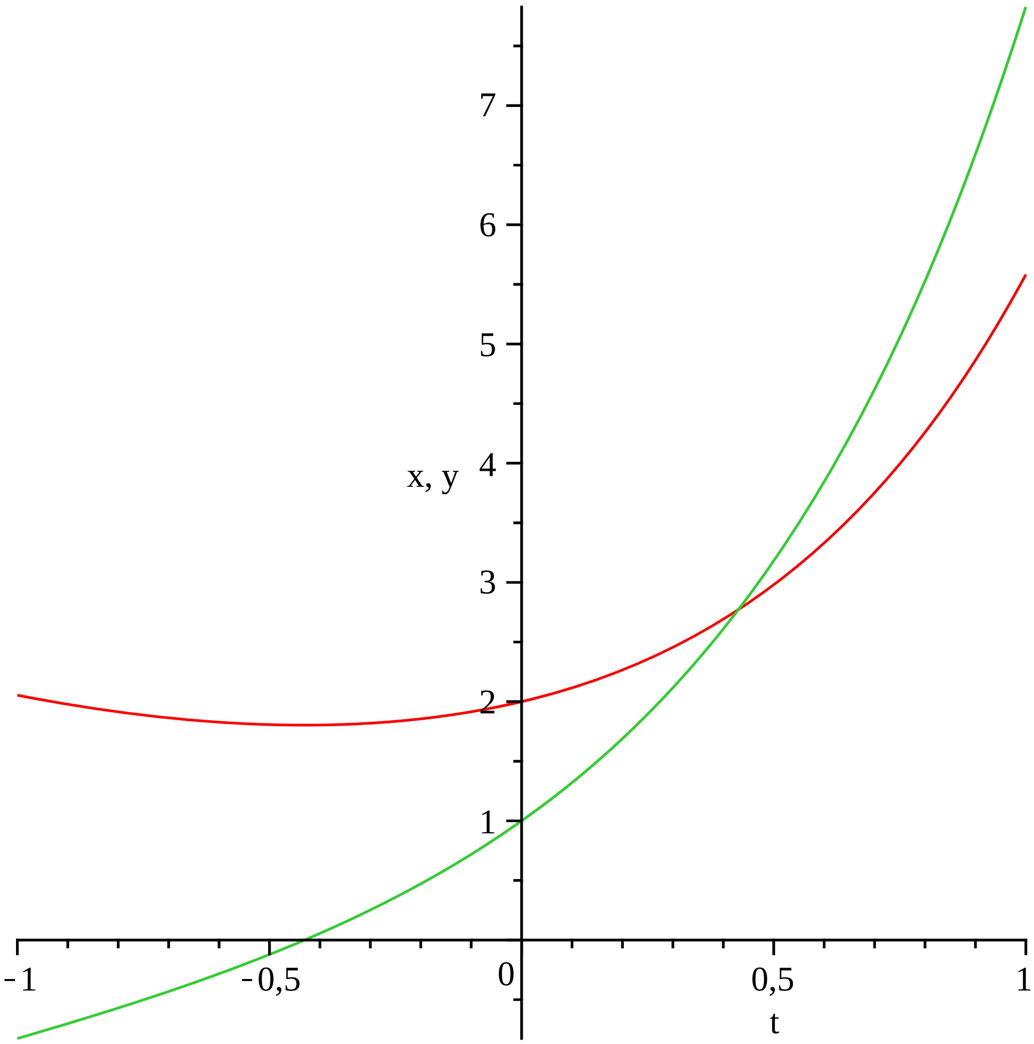
odeplot(*sol*, [*t*, *y*(*t*)], −1 ..1)



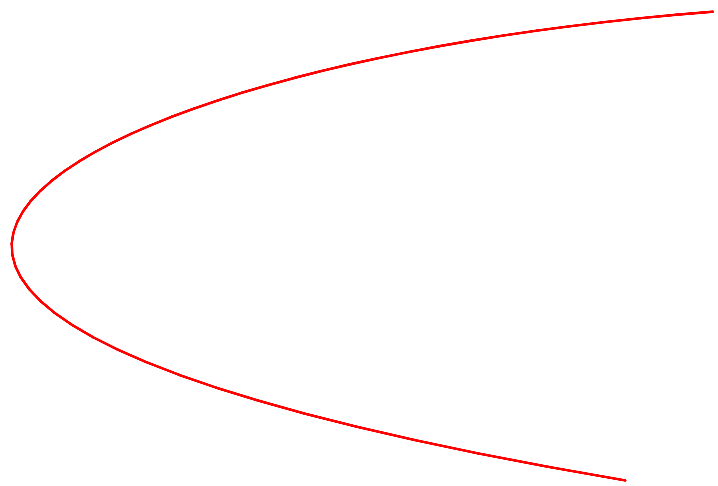
odeplot(*sol*, [*x*(*t*), *y*(*t*)], −1 ..1)



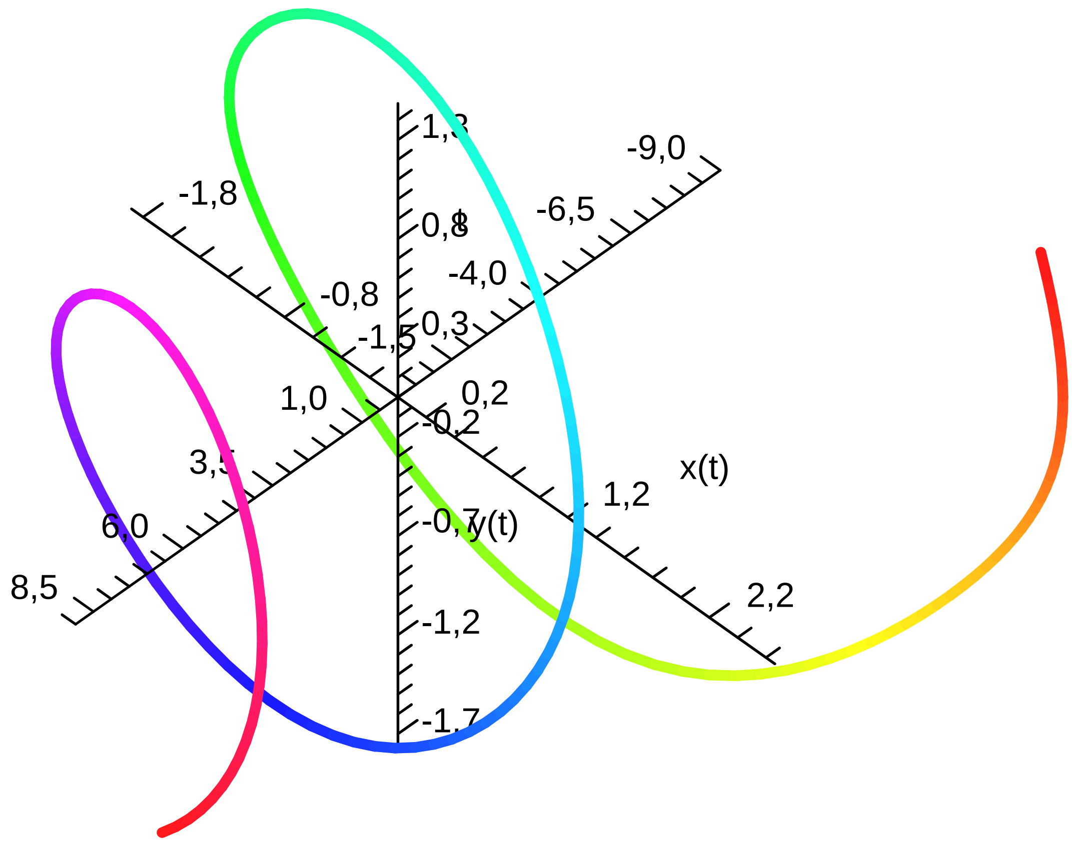
odeplot(*sol*, [[*t*, *x*(*t*)], [*t*, *y*(*t*)]], −1 ..1)



odeplot(*sol*, [*t*, *x*(*t*), *y*(*t*)], -1 ..1)



$$DEplot3d\left(\left\{\frac{d}{dt}\,x(t)=y(t),\ \frac{d}{dt}\,y(t)=-\sin(x(t))-\frac{y(t)}{10}\right\},\ \{x(t),y(t)\},\ t=-9..9,\ stepsize=0.1,\ [[x(0)=1,y(0)=1]],\ linecolor=t,\ axes=normal\right)$$



SOLUÇÃO NUMERICA DE EDOs DE ORDENS SUPERIORES

restart

with(*DEtools*) :

with(*plots*) :

edo := {*diff* (*y*(*t*), *t*$3) − 2·*diff* (*y*(*t*), *t*$2) + 2·*y*(*t*)}

$$\left\{ \frac{d^3}{dt^3} y(t) - 2 \left(\frac{d^2}{dt^2} y(t) \right) + 2\, y(t) \right\} \quad \textbf{(46)}$$

cond := {*y*(0) = 1, D(*y*)(0) = 1, D[1, 1](*y*)(0) = 1}

$$\{ y(0) = 1, D(y)(0) = 1, D^{(2)}(y)(0) = 1 \} \quad \textbf{(47)}$$

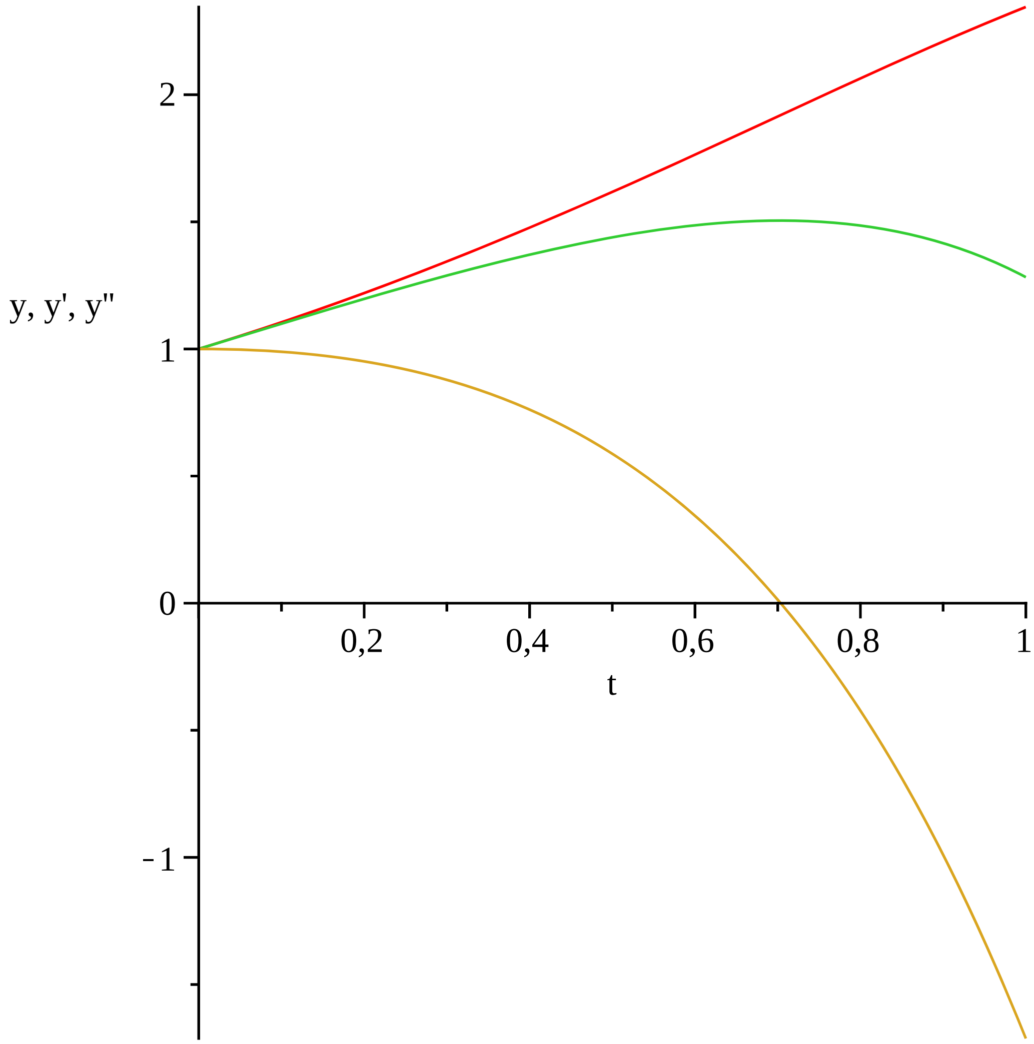
sol := *dsolve*(*edo* **union** *cond*, *numeric*)

proc(*x_rkf45*) ... **end proc** **(48)**

sol(1)

$$\left[t = 1., y(t) = 2.34524318556758394, \frac{d}{dt} y(t) = 1.28247861202400792, \frac{d^2}{dt^2} y(t) = -1.71244940665076606 \right] \quad \textbf{(49)}$$

odeplot(*sol*, [[*t*, *y*(*t*)], [*t*, *diff* (*y*(*t*), *t*)], [*t*, *diff* (*y*(*t*), *t*$2)]], 0 ..1)



SOLUÇÃO NUMERICA DE EQUAÇÕES ALGEBRICAS DIFERENCIAIS

restart

$with(DEtools):$

$with(plots):$

$sis := \{diff(x(t), t\$2) = -T(t)\cdot x(t), diff(y(t), t\$2) = -T(t)\cdot y(t) - 1, x(t)^2 + y(t)^2 = 1, x(0) = 1, D(x)(0) = 0, y(0) = 0, D(y)(0) = 0, T(0) = 0\}$

$$\left\{x(t)^2 + y(t)^2 = 1, T(0) = 0, x(0) = 1, y(0) = 0, \frac{d^2}{dt^2} x(t) = -T(t)\, x(t), \frac{d^2}{dt^2} y(t) = -T(t)\, y(t) - 1, D(x)(0) = 0, D(y)(0) = 0\right\} \quad (50)$$

$sol := dsolve(sis, numeric, output = operator)$

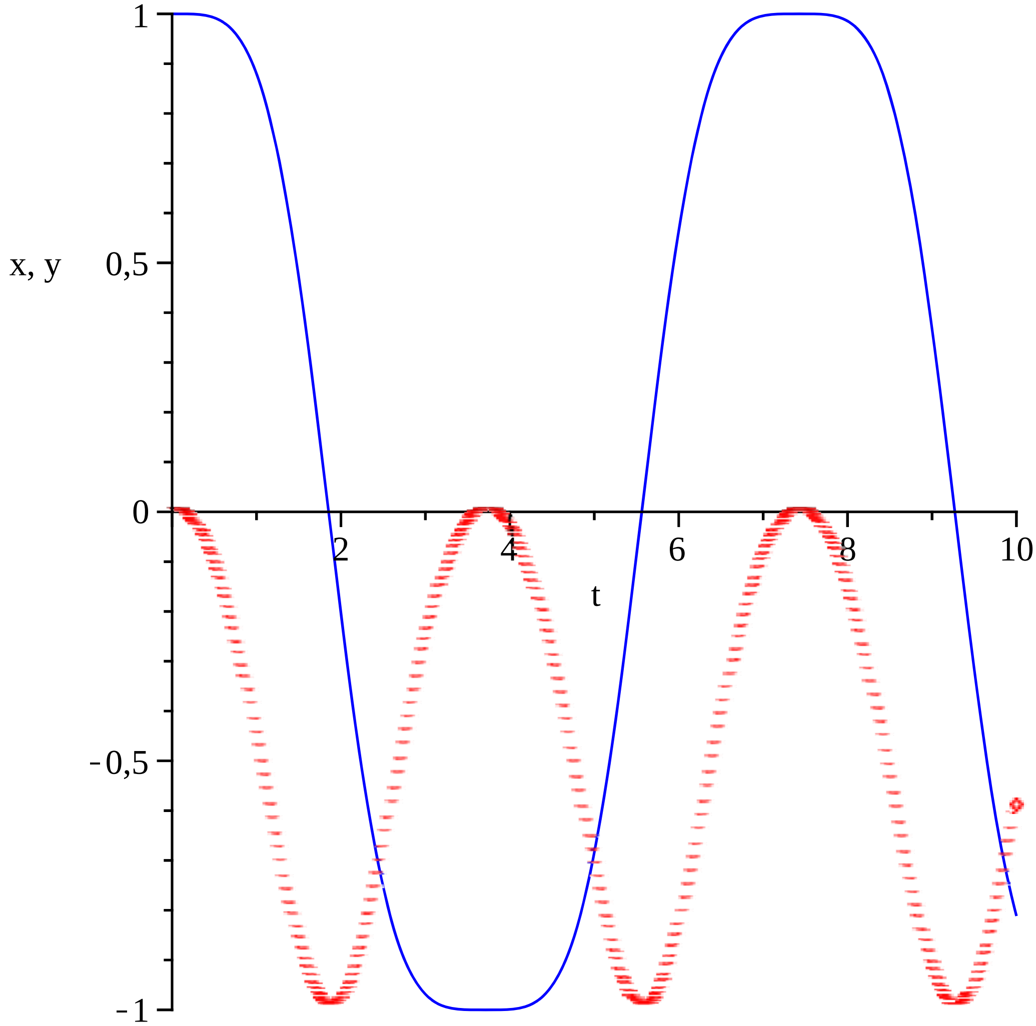
[t = **proc**(t) ... **end proc**, T = **proc**(t) ... **end proc**, x = **proc**(t) ... **end proc**, D(x) = **proc**(t) ... **end proc**, y = **proc**(t) ... **end proc**, D(y) = **proc**(t) ... **end proc**] **(51)**

$sol(2)$

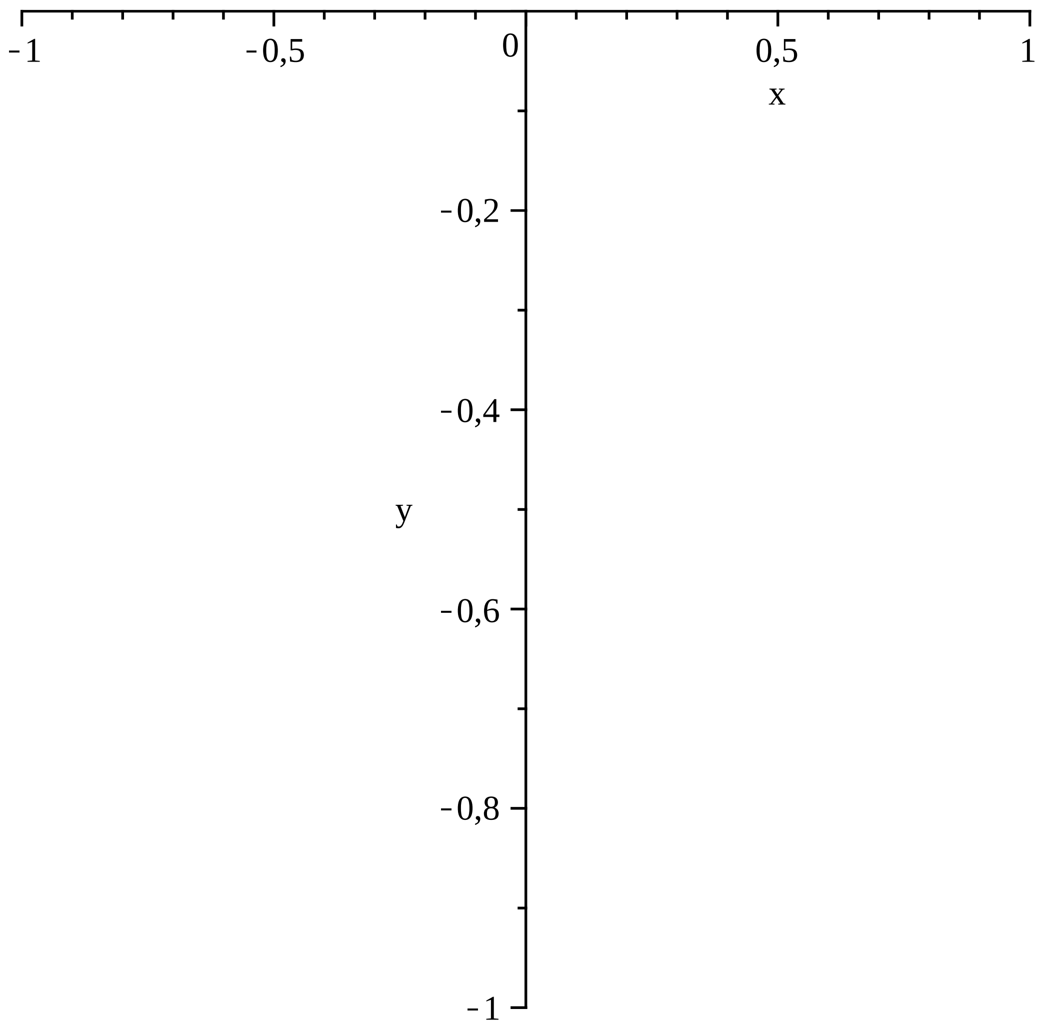
$[t = 2., T(2) = 2.93679181807691236, x(2) = -0.204193214767333708, D(x)(2) = -1.36975488521078192, y(2) = -0.978930605836405010, D(y)(2)$ **(52)**

= 0.285714484552269388]

odeplot(*sol*, [[*t*, *x*(*t*), *color* = *blue*,], [*t*, *y*(*t*), *color* = *red*, *style* = *point*]], 0 ..10, *numpoints* = 300)



odeplot(*sol*, [*x*(*t*), *y*(*t*), *color* = *blue*], 0 ..4, *numpoints* = 100, *frames* = 50)


-1
-0,5
0
0,5
1
x
-0,2
-0,4
y
-0,6
-0,8
-1