

> **with (DEtools)**

[*AreSimilar, Closure, DEnormal, DEplot, DEplot3d, DEplot\_polygon, DFactor, (1)  
DFactorLCLM, DFactorsols, Dchangevar, Desingularize, FindODE,  
FunctionDecomposition, GCRD, Gosper, Heunsols, Homomorphisms,  
IVPsol, IsHyperexponential, LCLM, MeijerGsols,  
MultiplicativeDecomposition, ODEInvariants, PDEchangecoords,  
PolynomialNormalForm, RationalCanonicalForm, ReduceHyperexp,  
RiemannPsols, Xchange, Xcommutator, Xgauge, Zeilberger, abelsol,  
adjoint, autonomous, bernoullisol, buildsol, buildsym, canoni, caseplot,  
casesplit, checkrank, chinisol, clairautsol, constcoeffsols, convertAlg,  
convertsys, dalembertsol, dcoeffs, de2diffop, dfieldplot, diff\_table,  
diffop2de, dperiodic\_sols, dpolyform, dsubs, eigenring,  
endomorphism\_charpoly, equinv, eta\_k, eulersols, exactsol, expsols,  
exterior\_power, firint, firtest, formal\_sol, gen\_exp, generate\_ic,  
genhomosol, gensys, hamilton\_eqs, hypergeometricsols, hypergeomsols,  
hyperode, indicialeq, infgen, initialdata, integrate\_sols, intfactor,  
invariants, kovacicsols, leftdivision, liesol, line\_int, linearsol, matrixDE,  
matrix\_riccati, maxdimsystems, moser\_reduce, muchange, mult, mutest,  
newton\_polygon, normalG2, ode\_int\_y, ode\_y1, odeadvisor, odepde,  
parametricsol, particularsol, phaseportrait, poincare, polysols,  
power\_equivalent, rational\_equivalent, ratsols, redode, reduceOrder,  
reduce\_order, regular\_parts, regularsp, remove\_RootOf, riccati\_system,  
riccatisol, rifread, rifsimp, rightdivision, rtaylor, separablesol, singularities,  
solve\_group, super\_reduce, symgen, symmetric\_power,  
symmetric\_product, symtest, transinv, translate, untranslate, varparam,  
zoom]*]

> **with (plots)**

[*animate, animate3d, animatecurve, arrow, changecoords, complexplot, (2)  
complexplot3d, conformal, conformal3d, contourplot, contourplot3d,  
coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot,  
fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal,  
interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d,  
listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple,  
odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot,  
polygonplot, polygonplot3d, polyhedra\_supported, polyhedraplot,  
rootlocus, semilogplot, setcolors, setoptions, setoptions3d, shadebetween,  
spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot*]

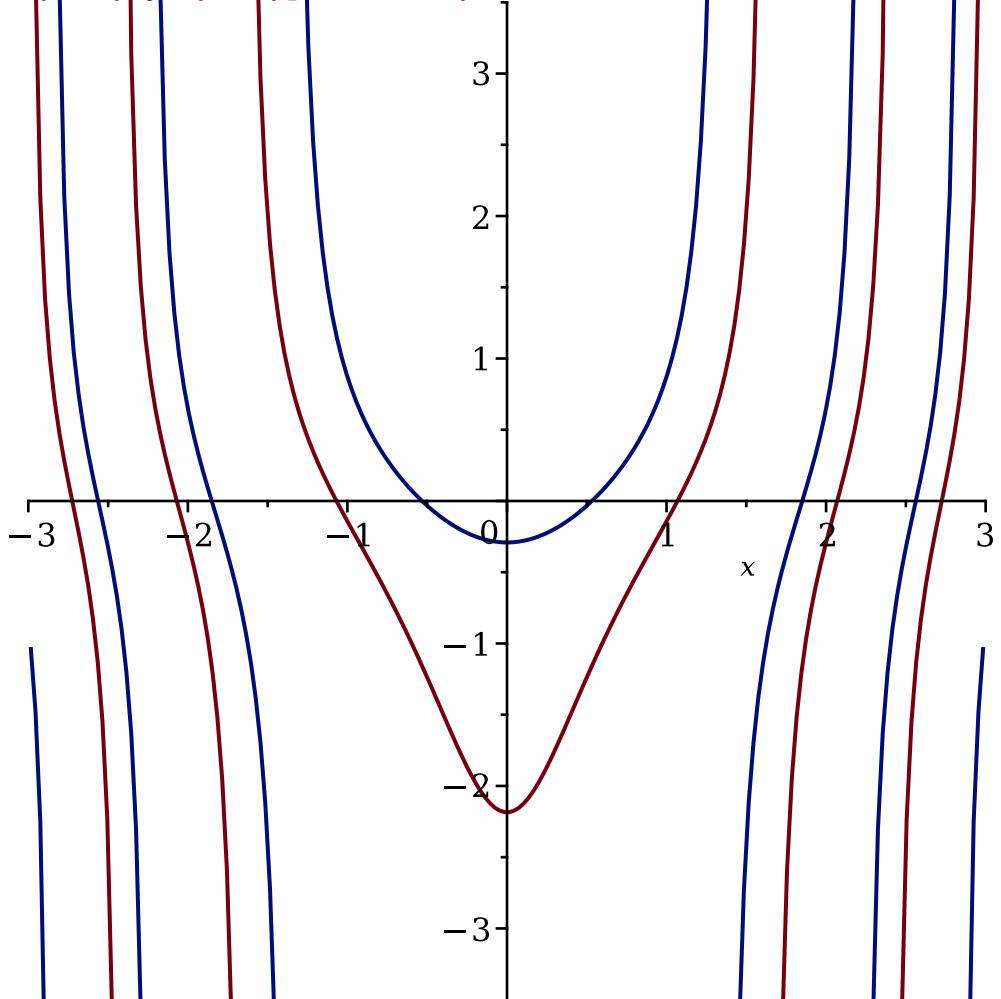
> **ecdif1:=diff(y(x),x) = 2\*x\*(1+y(x)^2)**

$$ecdif1 := \frac{d}{dx} y(x) = 2x(1 + y(x)^2) \quad (3)$$

$$> \text{sol1} := \text{dsolve}(ecdif1, y(x)); \\ sol1 := y(x) = \tan(x^2 + 2c_1) \quad (4)$$

$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}), x, c_{\_1}) \\ y1 := (x, c_1) \mapsto \tan(x^2 + 2 \cdot c_1) \quad (5)$$

>  $\text{plot}([\text{y1}(x, 1), \text{y1}(x, 3)], x = -3..3)$

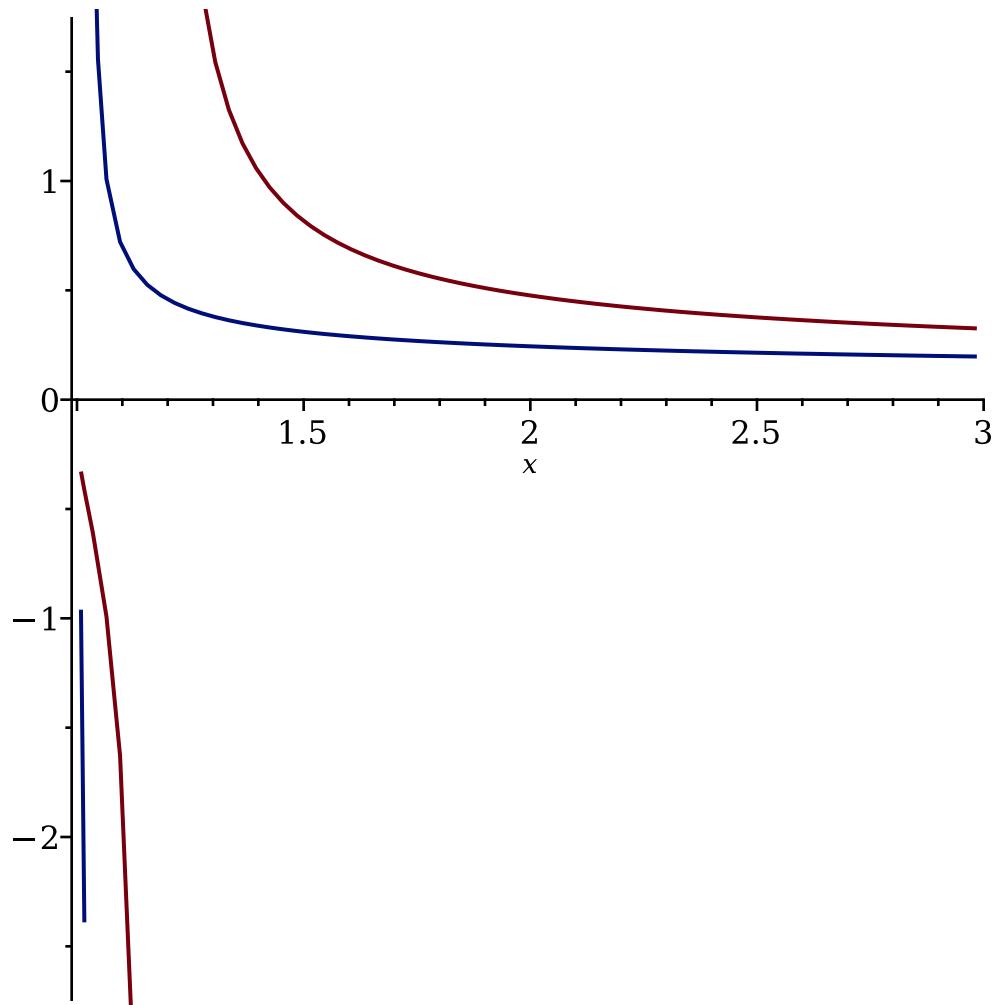


$$> \text{ecdif1} := (x^2 - 1) \cdot \text{diff}(y(x), x) + 2x \cdot (y(x))^2 = 0 \\ ecdif1 := (x^2 - 1) \left( \frac{d}{dx} y(x) \right) + 2y(x)^2 x = 0 \quad (6)$$

$$> \text{sol1} := \text{dsolve}(ecdif1, y(x)); \\ sol1 := y(x) = \frac{1}{\ln(x - 1) + \ln(x + 1) + c_1} \quad (7)$$

$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}), x, c_{\_1}) \\ y1 := (x, c_1) \mapsto \frac{1}{\ln(x - 1) + \ln(x + 1) + c_1} \quad (8)$$

>  $\text{plot}([\text{y1}(x, 1), \text{y1}(x, 3)], x = -3..3)$

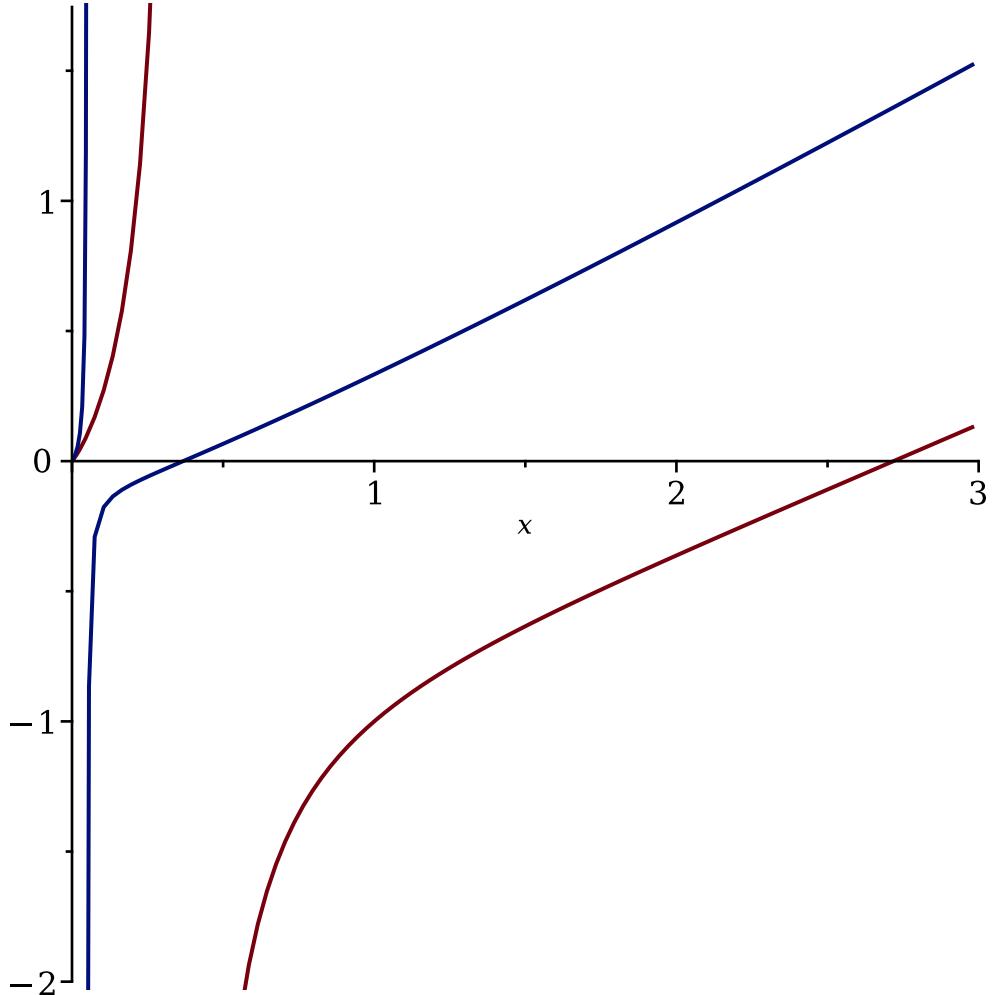


```
> ecdif1:=2*x^2*diff(y(x),x) = x^2+(y(x))^2
       $ecdif1 := 2 \left( \frac{d}{dx} y(x) \right) x^2 = x^2 + y(x)^2$  (9)
```

```
> sol1:=dsolve(ecdif1,y(x));
       $sol1 := y(x) = \frac{x (\ln(x) + c_1 - 2)}{\ln(x) + c_1}$  (10)
```

```
> y1:=unapply(rhs(sol1),x,c__1)
       $y1 := (x, c_1) \mapsto \frac{x \cdot (\ln(x) + c_1 - 2)}{\ln(x) + c_1}$  (11)
```

```
> plot([y1(x,1),y1(x,3)],x=-3..3)
```



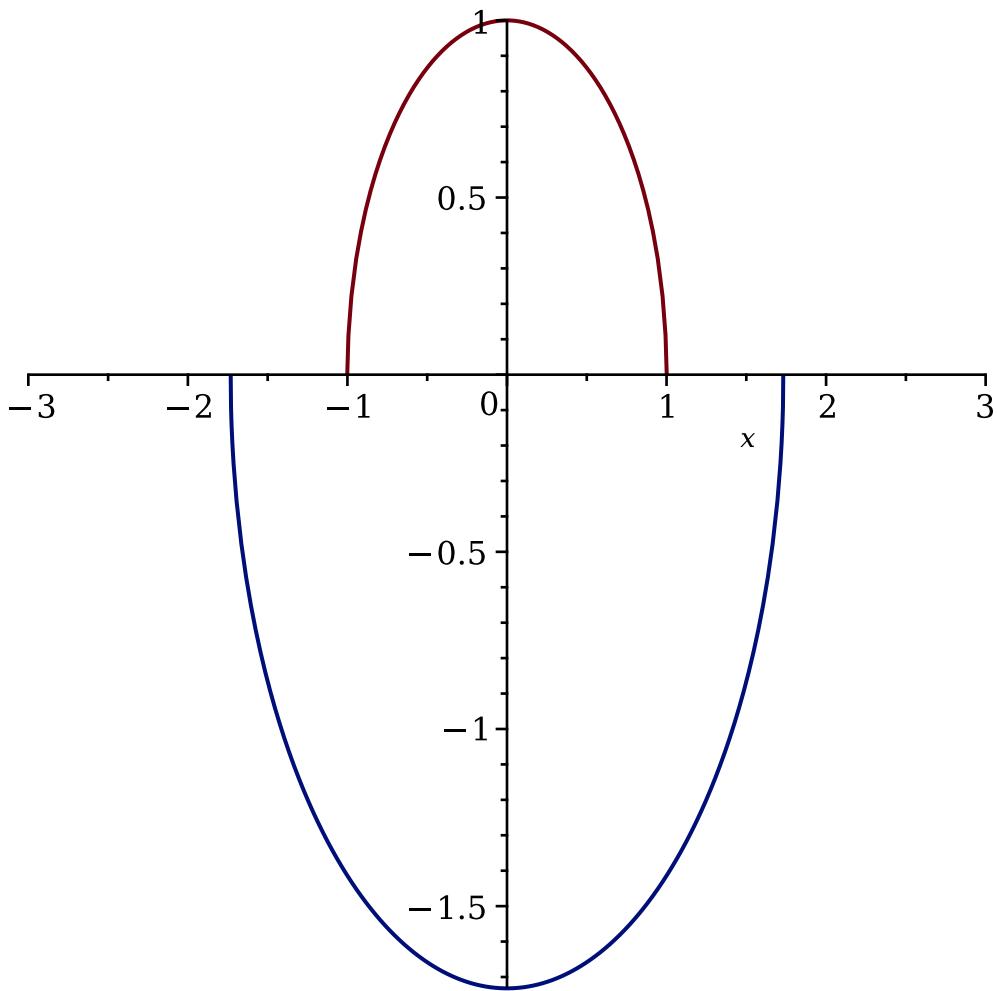
$$> \text{ecdif1} := \text{diff}(y(x), x) = -x/y(x) \quad (12)$$

$$> \text{sol1} := \text{dsolve}(\text{ecdif1}, y(x)); \quad \text{sol1} := y(x) = \sqrt{-x^2 + c_1}, y(x) = -\sqrt{-x^2 + c_1} \quad (13)$$

$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}[1]), x, c\_1); \quad \text{y1} := (x, c_1) \mapsto \sqrt{-x^2 + c_1} \quad (14)$$

$$> \text{y2} := \text{unapply}(\text{rhs}(\text{sol1}[2]), x, c\_1); \quad \text{y2} := (x, c_1) \mapsto -\sqrt{-x^2 + c_1} \quad (15)$$

> `plot([y1(x,1),y2(x,3)],x=-3..3)`



```

> ecdf1:=diff(y(x),x)=-x/(y(x))^3
      
$$ecdf1 := \frac{d}{dx} y(x) = -\frac{x}{y(x)^3}$$
 (16)

> sol1:=dsolve(ecdf1,y(x));
      
$$sol1 := y(x) = (-2x^2 + c_1)^{1/4}, y(x) = -(-2x^2 + c_1)^{1/4}, y(x) = -I(-2x^2 + c_1)^{1/4}$$
 (17)
      
$$+ c_1)^{1/4}, y(x) = I(-2x^2 + c_1)^{1/4}$$


> y1:=unapply(rhs(sol1[1]),x,c__1)
      
$$y1 := (x, c_1) \mapsto (-2 \cdot x^2 + c_1)^{1/4}$$
 (18)

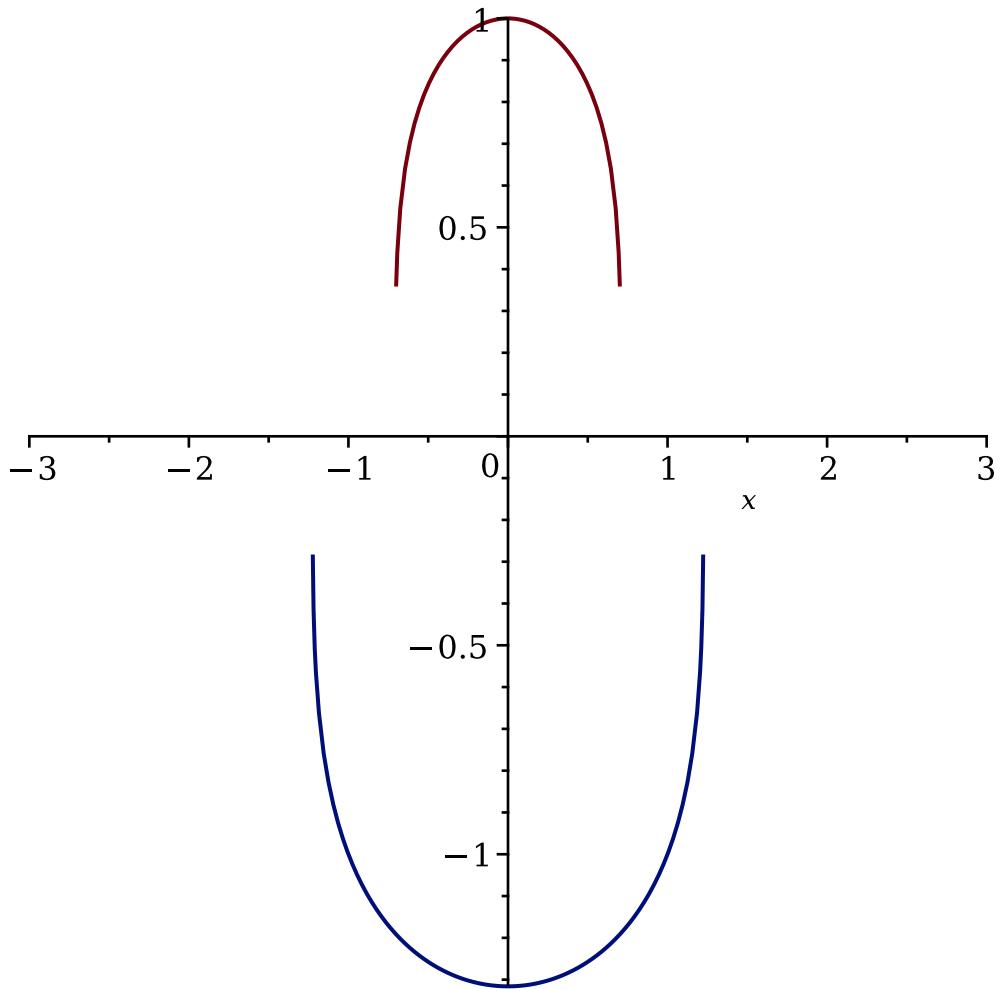
> y2:=unapply(rhs(sol1[2]),x,c__1)
      
$$y2 := (x, c_1) \mapsto -(-2 \cdot x^2 + c_1)^{1/4}$$
 (19)

> y3:=unapply(rhs(sol1[3]),x,c__1)
      
$$y3 := (x, c_1) \mapsto -I \cdot (-2 \cdot x^2 + c_1)^{1/4}$$
 (20)

> y4:=unapply(rhs(sol1[4]),x,c__1)
      
$$y4 := (x, c_1) \mapsto I \cdot (-2 \cdot x^2 + c_1)^{1/4}$$
 (21)

> plot([y1(x,1),y2(x,3)],x=-3..3)

```



$$> \text{ecdif1} := \text{diff}(y(x), x) = -(x + y(x))/y(x) \quad (22)$$

$$ecdif1 := \frac{d}{dx} y(x) = -\frac{x + y(x)}{y(x)}$$

$$> \text{sol1} := \text{dsolve}(\text{ecdif1}, y(x)); \quad (23)$$

$$\text{sol1} := y(x)$$

$$= \frac{\sqrt{3} x \tan\left(\text{RootOf}\left(\sqrt{3} \ln\left(\frac{3 x^2}{4} + \frac{3 x^2 \tan(Z)^2}{4}\right) + 2 \sqrt{3} c_1 - 2 Z\right)\right)}{2}$$

$$- \frac{x}{2}$$

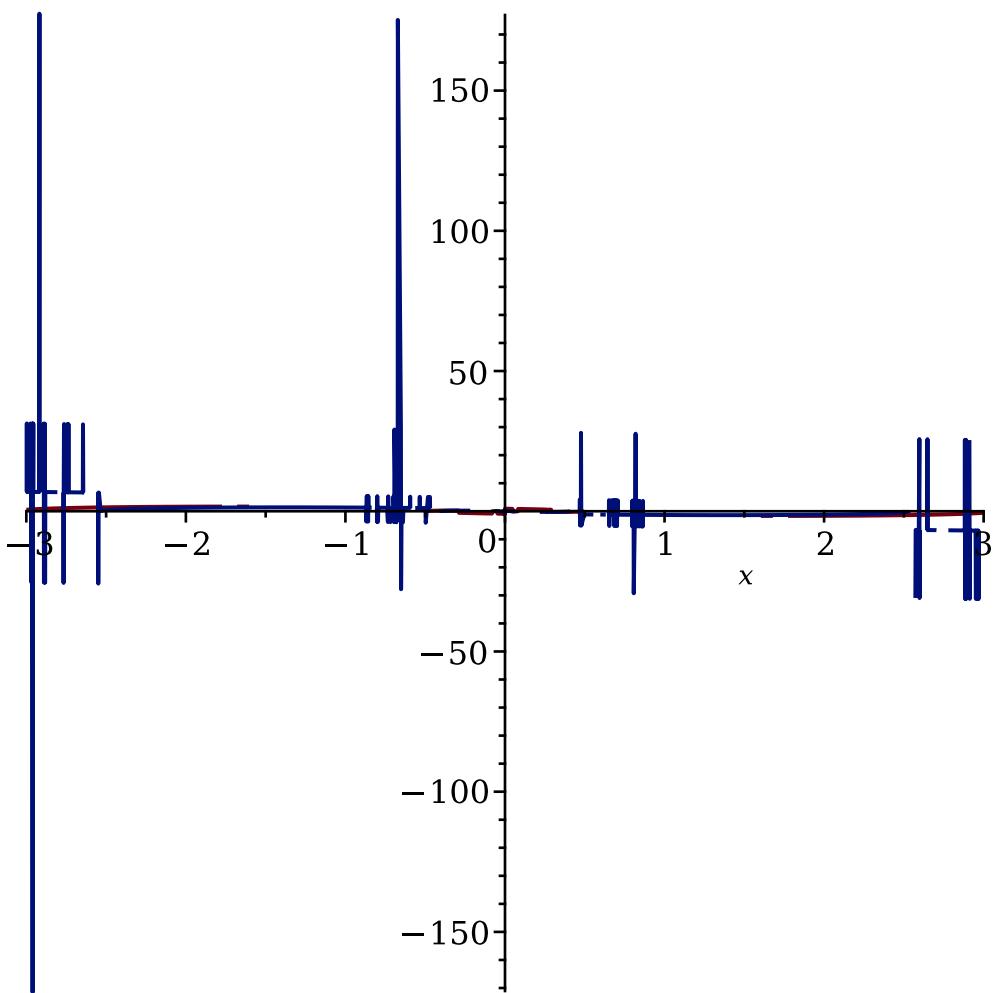
$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}), x, c\_1) \quad (24)$$

$$\text{y1} := (x, c_1)$$

$$\mapsto \frac{\sqrt{3} \cdot x \cdot \tan\left(\text{RootOf}\left(\sqrt{3} \cdot \ln\left(\frac{3 \cdot x^2}{4} + \frac{3 \cdot x^2 \cdot \tan(Z)^2}{4}\right) + 2 \cdot \sqrt{3} \cdot c_1 - 2 \cdot Z\right)\right)}{2}$$

$$- \frac{x}{2}$$

> `plot([y1(x,1),y1(x,3)],x=-3..3)`



$$> \text{ecdif1} := \text{diff}(y(x), x) + y(x) * \tan(x) = 1 / \cos(x) \quad (25)$$

$$\quad \quad \quad \text{ecdif1} := \frac{d}{dx} y(x) + y(x) \tan(x) = \frac{1}{\cos(x)}$$

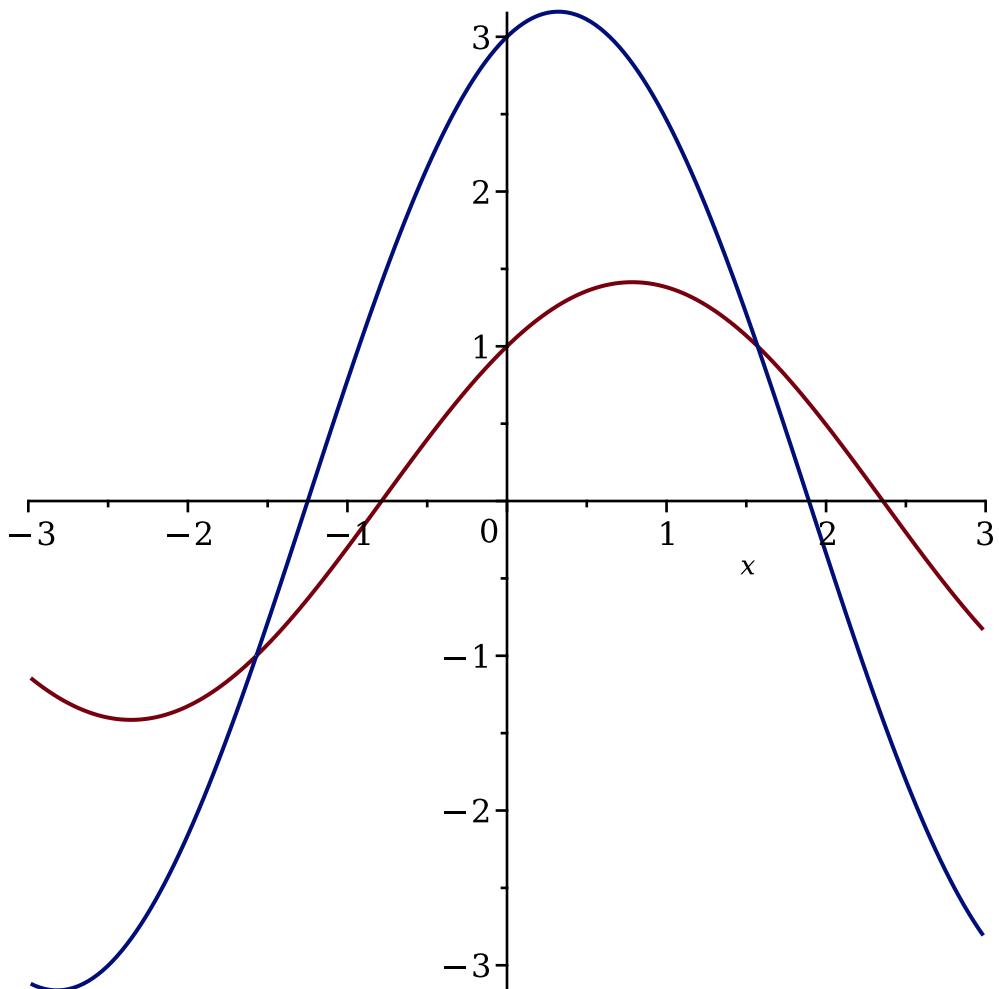
$$> \text{sol1} := \text{dsolve}(\text{ecdif1}, y(x)); \quad (26)$$

$$\quad \quad \quad \text{sol1} := y(x) = (\tan(x) + c_1) \cos(x)$$

$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}), x, c\_1); \quad (27)$$

$$\quad \quad \quad \text{y1} := (x, c_1) \mapsto (\tan(x) + c_1) \cdot \cos(x)$$

> `plot([y1(x,1),y1(x,3)],x=-3..3)`



$$> \text{ecdif1} := \text{diff}(y(x), x) + 2 * y(x) / x = x^2 \quad (28)$$

$$\quad \quad \quad \text{ecdif1} := \frac{d}{dx} y(x) + \frac{2 y(x)}{x} = x^2$$

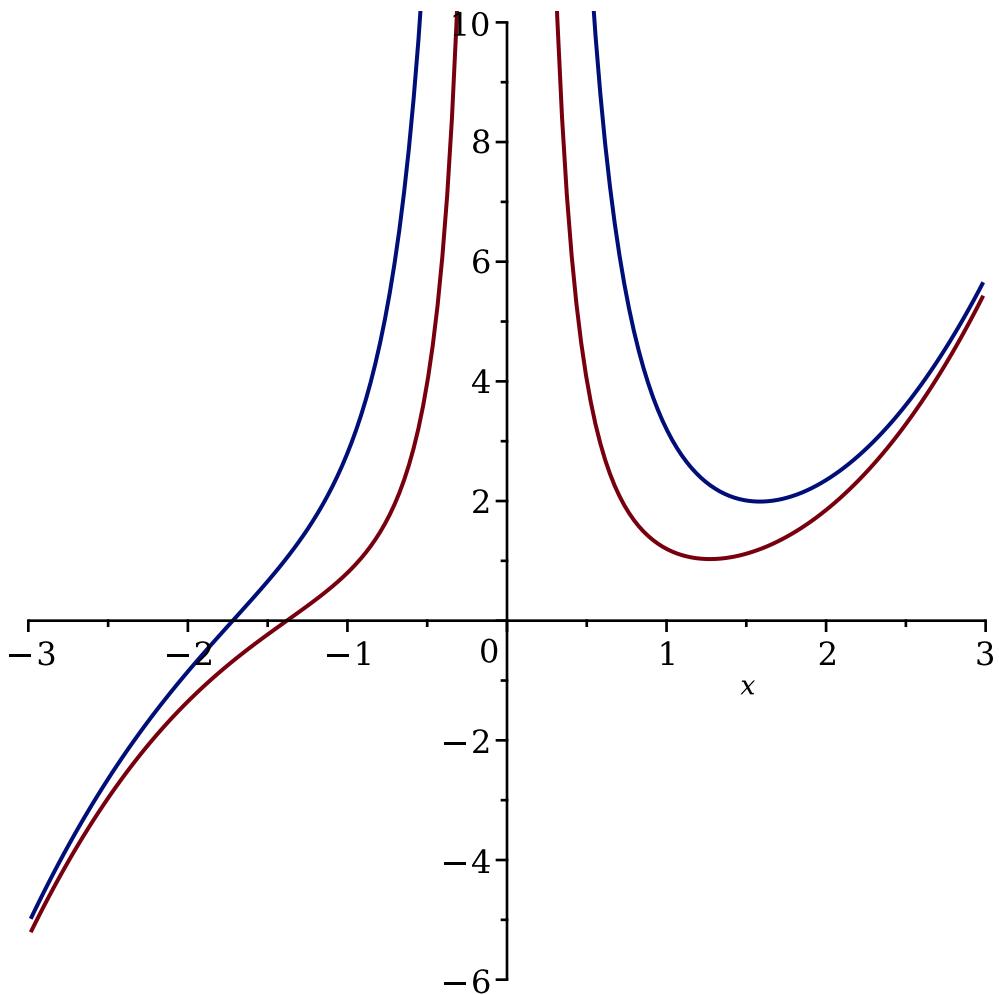
$$> \text{sol1} := \text{dsolve}(\text{ecdif1}, y(x)); \quad (29)$$

$$\quad \quad \quad \text{sol1} := y(x) = \frac{\frac{x^5}{5} + c_1}{x^2}$$

$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}), x, c\_1) \quad (30)$$

$$\quad \quad \quad \text{y1} := (x, c_1) \mapsto \frac{\frac{x^5}{5} + c_1}{x^2}$$

> `plot([y1(x,1),y1(x,3)],x=-3..3)`



```

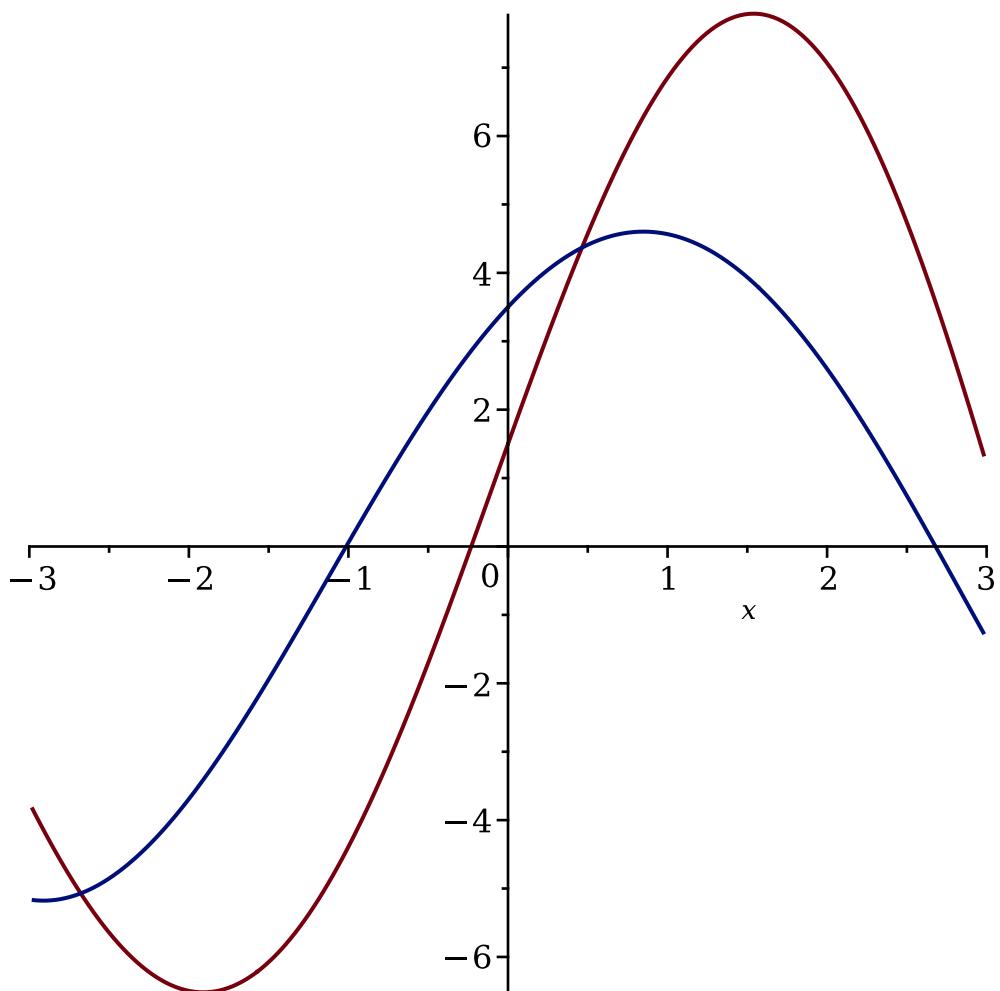
> ecdf1:=diff(y(x),x,x)+y(x)=sin(x)+cos(x)
      
$$ecdf1 := \frac{d^2}{dx^2} y(x) + y(x) = \sin(x) + \cos(x)$$
 (31)

> sol1:=dsolve(ecdf1,y(x));
      
$$sol1 := y(x) = \sin(x) c_2 + \cos(x) c_1 + \frac{(1-x)\cos(x)}{2} + \frac{\sin(x)x}{2}$$
 (32)

> y1:=unapply(rhs(sol1),x,c__1,c__2)
      
$$y1 := (x, c_1, c_2) \mapsto \sin(x) \cdot c_2 + \cos(x) \cdot c_1 + \frac{(1-x) \cdot \cos(x)}{2} + \frac{\sin(x) \cdot x}{2}$$
 (33)

> plot([y1(x,1,7),y1(x,3,3)],x=-3..3)

```

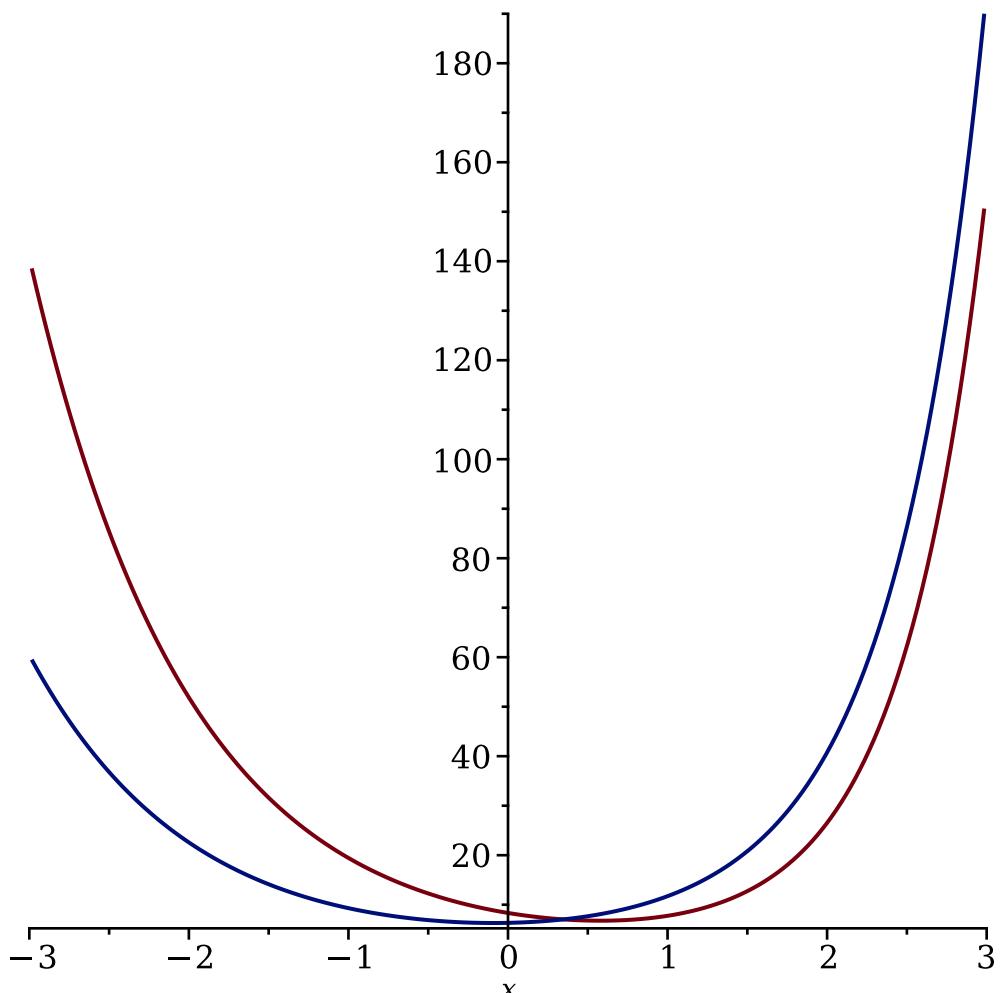


```
> ecdf1:=diff(y(x),x$2)-y(x)=exp(2*x)
      
$$ecdf1 := \frac{d^2}{dx^2} y(x) - y(x) = e^{2x}$$
 (34)
```

```
> sol1:=dsolve(ecdf1,y(x));
      
$$sol1 := y(x) = e^{-x} c_2 + e^x c_1 + \frac{e^{2x}}{3}$$
 (35)
```

```
> y1:=unapply(rhs(sol1),x,c__1,c__2)
      
$$y1 := (x, c_1, c_2) \mapsto e^{-x} \cdot c_2 + e^x \cdot c_1 + \frac{e^{2x}}{3}$$
 (36)
```

```
> plot([y1(x,1,7),y1(x,3,3)],x=-3..3)
```

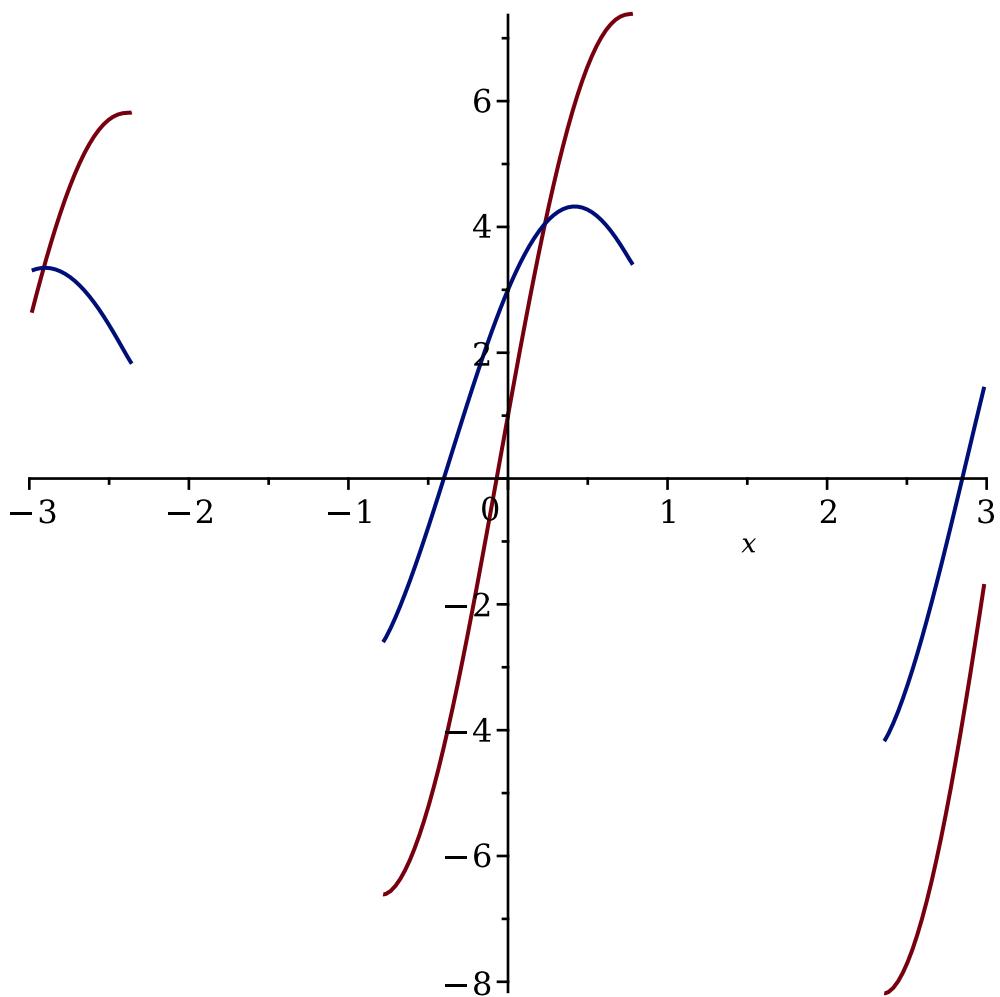


$$> \text{ecdif1} := \text{diff}(y(x), x, x) + 4 * y(x) = 1 / \cos(2 * x) \\ ecdif1 := \frac{d^2}{dx^2} y(x) + 4 y(x) = \frac{1}{\cos(2x)} \quad (37)$$

$$> \text{sol1} := \text{dsolve}(\text{ecdif1}, y(x)); \\ \text{sol1} := y(x) = \sin(2x) c_2 + \cos(2x) c_1 + \frac{x \sin(2x)}{2} + \frac{\ln(\cos(2x)) \cos(2x)}{4} \quad (38)$$

$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}), x, c\_1, c\_2) \\ \text{y1} := (x, c_1, c_2) \mapsto \sin(2 \cdot x) \cdot c_2 + \cos(2 \cdot x) \cdot c_1 + \frac{x \cdot \sin(2 \cdot x)}{2} \\ + \frac{\ln(\cos(2 \cdot x)) \cdot \cos(2 \cdot x)}{4} \quad (39)$$

> `plot([y1(x,1,7),y1(x,3,3)],x=-3..3)`

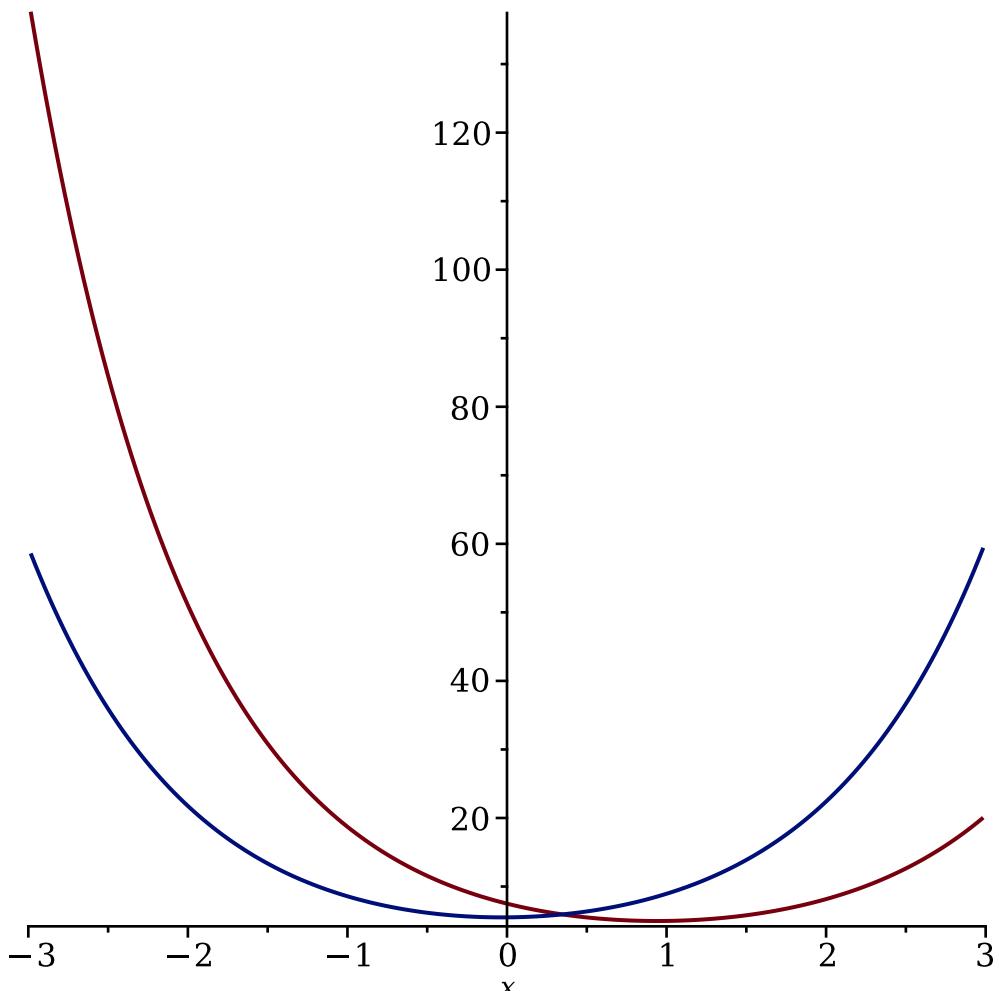


$$> \text{ecdif1} := \text{diff}(y(x), x\$2) - y(x) = 1/(1+\text{exp}(x)) \\ \text{ecdif1} := \frac{d^2}{dx^2} y(x) - y(x) = \frac{1}{1 + e^x} \quad (40)$$

$$> \text{sol1} := \text{dsolve}(\text{ecdif1}, y(x)); \\ \text{sol1} := y(x) = e^{-x} c_2 + e^x c_1 + \frac{(e^x - e^{-x}) \ln(1 + e^x)}{2} - \frac{\ln(e^x) e^x}{2} - \frac{1}{2} \quad (41)$$

$$> \text{y1} := \text{unapply}(\text{rhs}(\text{sol1}), x, c\_1, c\_2) \\ \text{y1} := (x, c_1, c_2) \mapsto e^{-x} \cdot c_2 + e^x \cdot c_1 + \frac{(e^x - e^{-x}) \cdot \ln(1 + e^x)}{2} - \frac{\ln(e^x) \cdot e^x}{2} - \frac{1}{2} \quad (42)$$

> `plot([y1(x,1,7),y1(x,3,3)],x=-3..3)`



>  $\text{ecdif2} := \text{diff}(y(x), x) = 1 + y(x)^2$

$$\text{ecdif2} := \frac{d}{dx} y(x) = 1 + y(x)^2 \quad (43)$$

>  $\text{con2} := y(0) = 1$

$$\text{con2} := y(0) = 1 \quad (44)$$

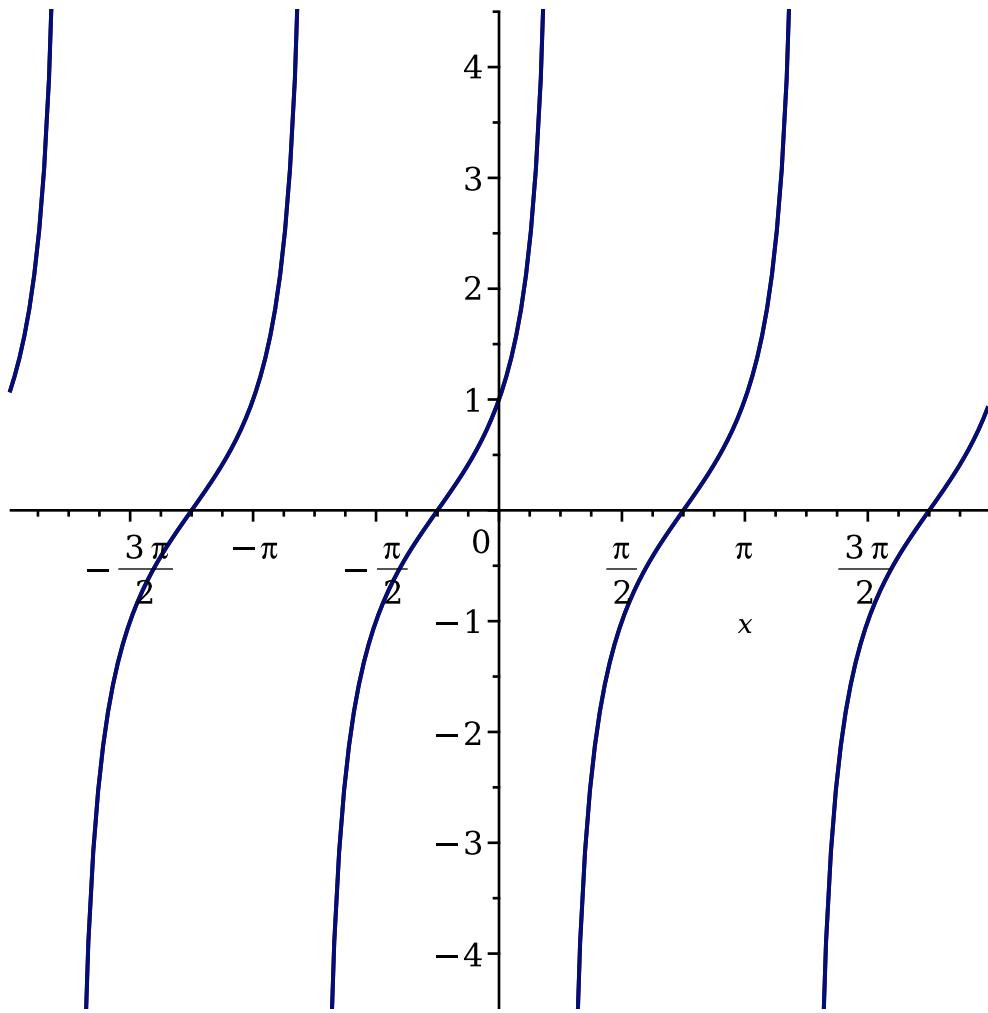
>  $\text{sol2} := \text{dsolve}(\{\text{ecdif2}, \text{con2}\}, y(x))$

$$\text{sol2} := y(x) = \tan\left(x + \frac{\pi}{4}\right) \quad (45)$$

>  $\text{y2} := \text{unapply}(\text{rhs}(\text{sol2}), x)$

$$y2 := x \mapsto \tan\left(x + \frac{\pi}{4}\right) \quad (46)$$

>  $\text{plot}([y2(x), y2(-x)])$



$$> \text{ecdif2} := \text{diff}(y(x), x) = y(x)/(1-x^2) + 1+x \quad (47)$$

$$\quad \quad \quad ecdif2 := \frac{d}{dx} y(x) = \frac{y(x)}{-x^2 + 1} + 1 + x$$

$$> \text{con2} := y(0) = 0 \quad (48)$$

$$\quad \quad \quad con2 := y(0) = 0$$

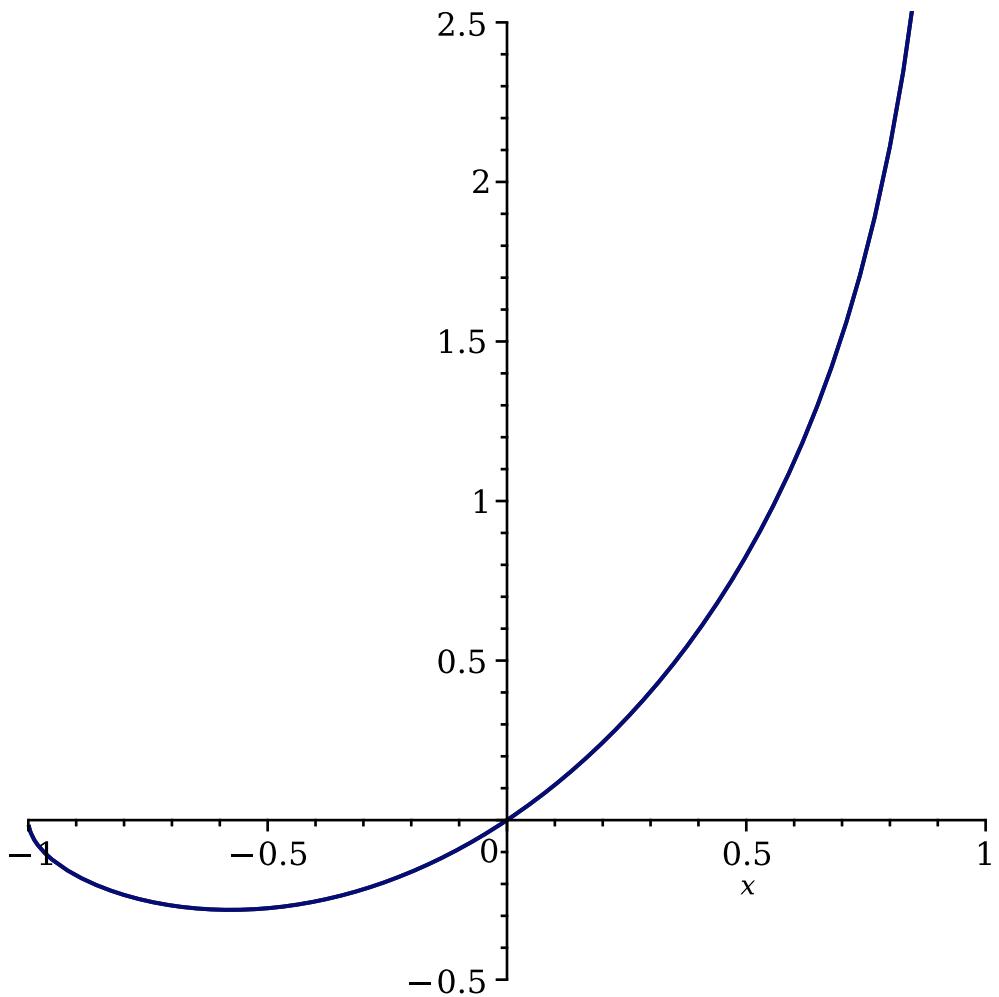
$$> \text{sol2} := \text{dsolve}(\{\text{ecdif2}, \text{con2}\}, y(x)) \quad (49)$$

$$\quad \quad \quad sol2 := y(x) = \frac{(x\sqrt{-x^2 + 1} + \arcsin(x))(x + 1)}{2\sqrt{-x^2 + 1}}$$

$$> \text{y2} := \text{unapply}(\text{rhs}(\text{sol2}), x) \quad (50)$$

$$\quad \quad \quad y2 := x \mapsto \frac{(x\sqrt{-x^2 + 1} + \arcsin(x)) \cdot (x + 1)}{2\sqrt{-x^2 + 1}}$$

> `plot([y2(x), y2(x)], x=-3..3)`



```

> ecdif2:=diff(y(x),x)-2*y(x)=-x^2
       $ecdif2 := \frac{d}{dx} y(x) - 2 y(x) = -x^2$  (51)

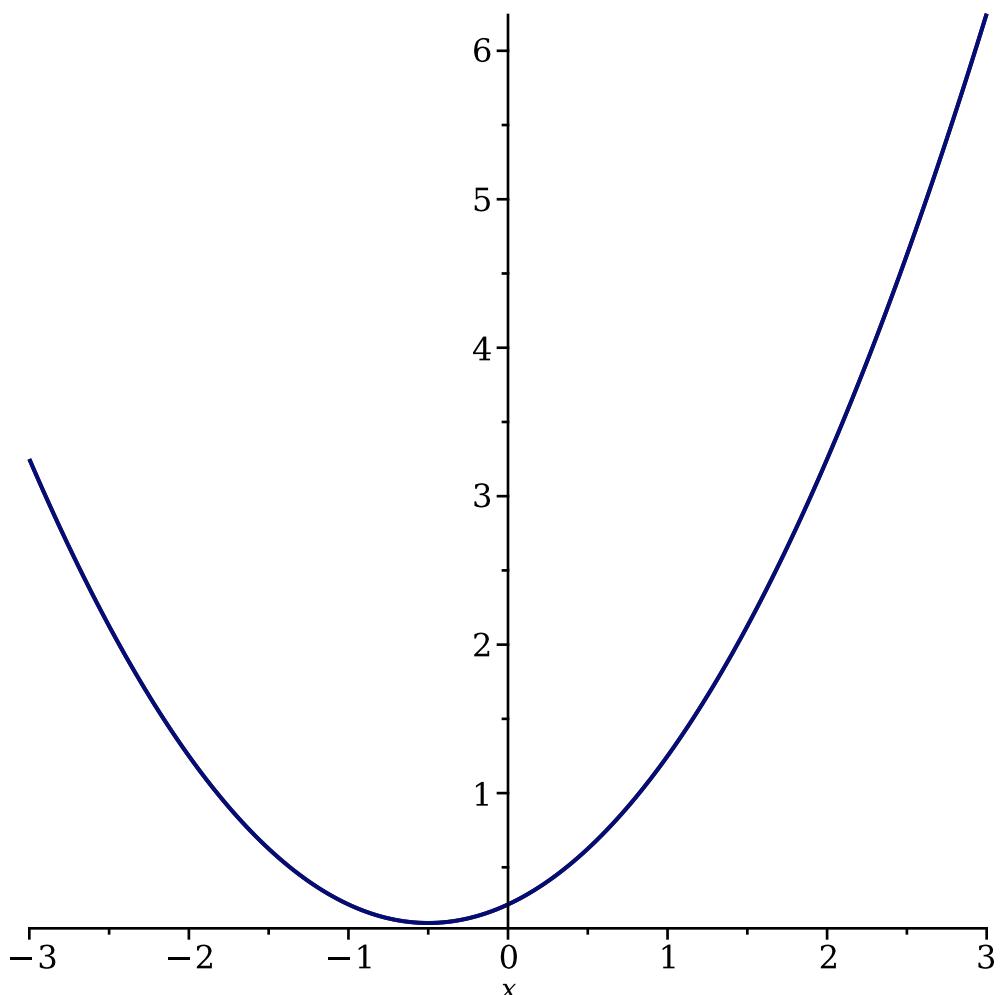
> con2:=y(0)=1/4
       $con2 := y(0) = \frac{1}{4}$  (52)

> sol2:=dsolve({ecdif2,con2},y(x))
       $sol2 := y(x) = \frac{1}{2} x^2 + \frac{1}{2} x + \frac{1}{4}$  (53)

> y2:=unapply(rhs(sol2),x)
       $y2 := x \mapsto \frac{1}{2} \cdot x^2 + \frac{1}{2} \cdot x + \frac{1}{4}$  (54)

> plot([y2(x),y2(x)],x=-3..3)

```



```

> ecdif2:=diff(y(x),x$2)-5*diff(y(x),x)+4*y(x)=0
       $ecdif2 := \frac{d^2}{dx^2} y(x) - 5 \frac{d}{dx} y(x) + 4 y(x) = 0$  (55)

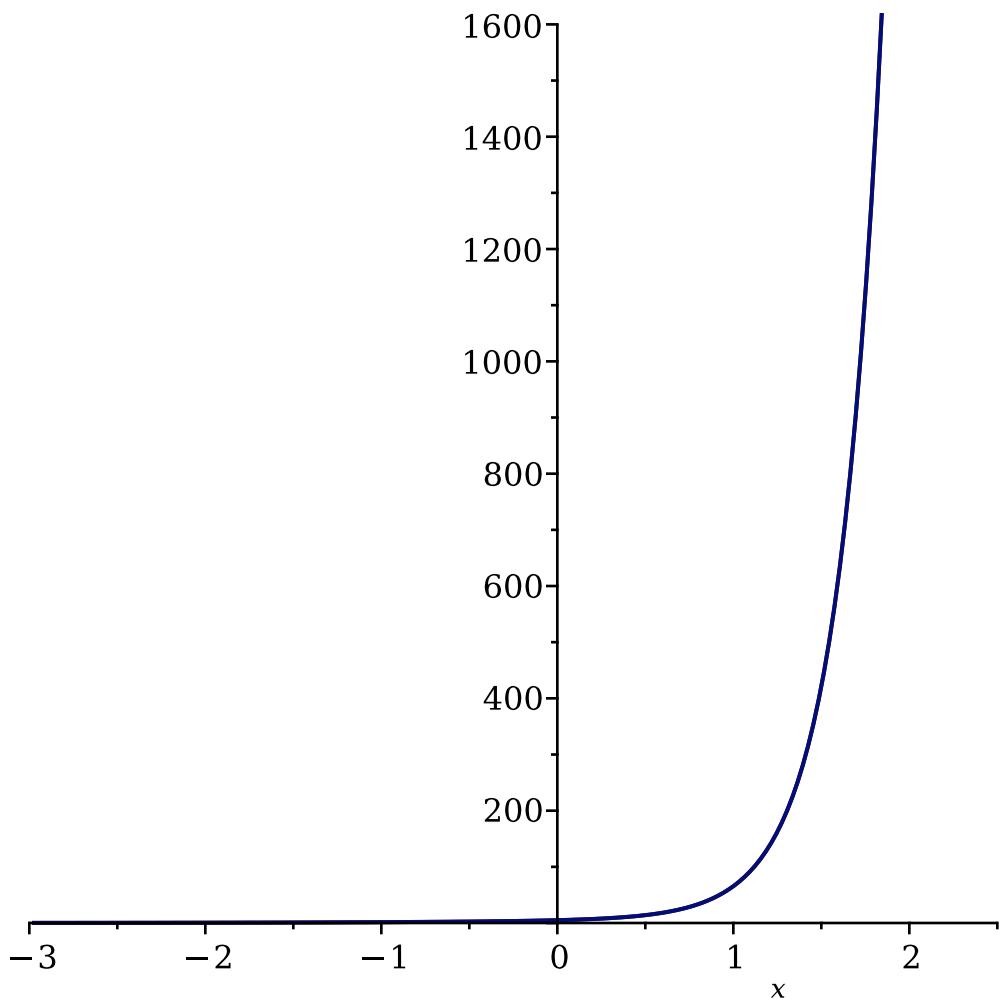
> con2:=(y(0)=5,D(y)(0)=8)
       $con2 := y(0) = 5, D(y)(0) = 8$  (56)

> sol2:=dsolve({ecdif2,con2},y(x))
       $sol2 := y(x) = e^{4x} + 4e^x$  (57)

> y2:=unapply(rhs(sol2),x)
       $y2 := x \mapsto e^{4x} + 4 \cdot e^x$  (58)

> plot([y2(x),y2(x)],x=-3..3)

```



```

> ecdif2:=diff(y(x),x$2)-4*diff(y(x),x)+5*y(x)=2*x^2*exp(x)
      
$$ecdif2 := \frac{d^2}{dx^2} y(x) - 4 \frac{d}{dx} y(x) + 5 y(x) = 2 x^2 e^x$$
 (59)

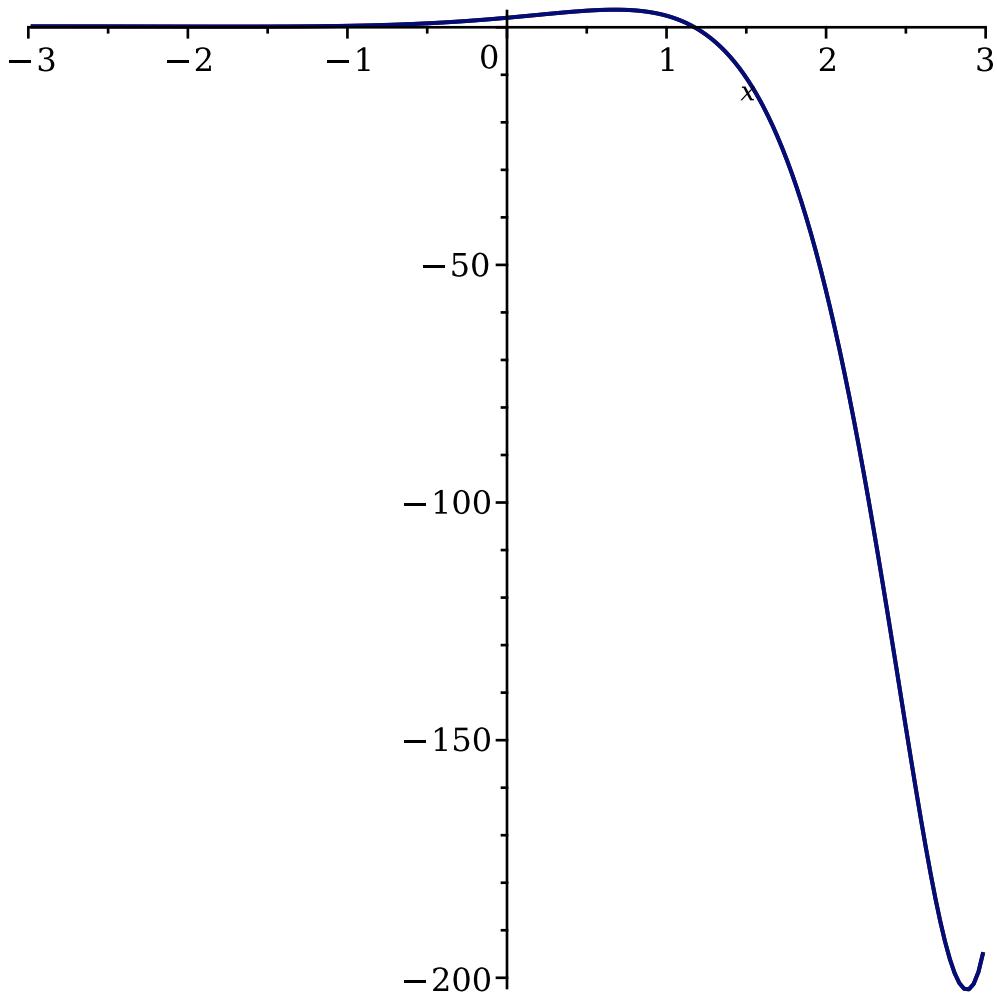
> con2:=(y(0)=2,D(y)(0)=3)
      
$$con2 := y(0) = 2, D(y)(0) = 3$$
 (60)

> sol2:=dsolve({ecdif2,con2},y(x))
      
$$sol2 := y(x) = (-2 \sin(x) + \cos(x)) e^{2x} + (x + 1)^2 e^x$$
 (61)

> y2:=unapply(rhs(sol2),x)
      
$$y2 := x \mapsto (-2 \cdot \sin(x) + \cos(x)) \cdot e^{2 \cdot x} + (x + 1)^2 \cdot e^x$$
 (62)

> plot([y2(x),y2(x)],x=-3..3)

```



```

> ecdif2:=diff(y(x),x$2)+4*y(x)=4*(sin(2*x)+cos(2*x))
      
$$ecdif2 := \frac{d^2}{dx^2} y(x) + 4 y(x) = 4 \sin(2x) + 4 \cos(2x)$$
 (63)

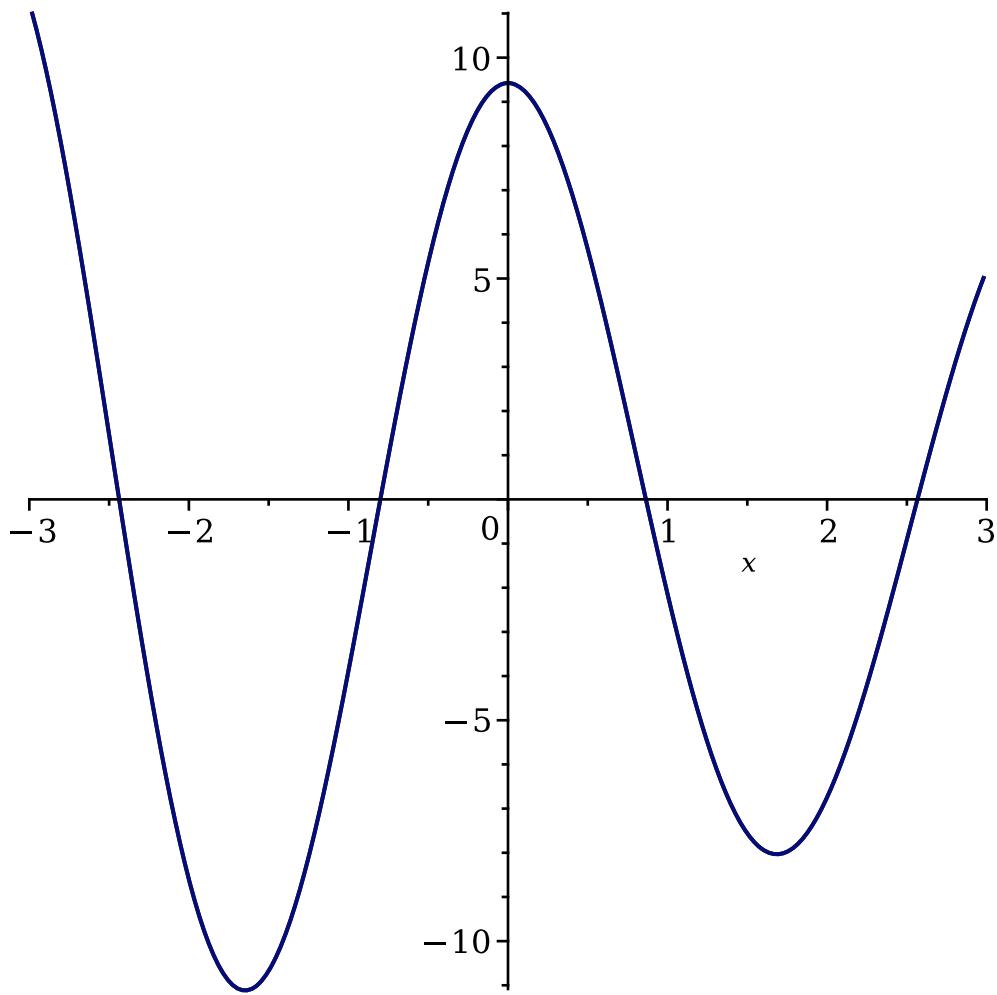
> con2:=(y(Pi)=2*Pi,D(y)(Pi)=2*Pi)
      
$$con2 := y(\pi) = 2\pi, D(y)(\pi) = 2\pi$$
 (64)

> sol2:=dsolve({ecdif2,con2},y(x))
      
$$sol2 := y(x) = (-x + 3\pi) \cos(2x) + \frac{\sin(2x)(2x + 1)}{2}$$
 (65)

> y2:=unapply(rhs(sol2),x)
      
$$y2 := x \mapsto (-x + 3\pi) \cdot \cos(2 \cdot x) + \frac{\sin(2 \cdot x) \cdot (2 \cdot x + 1)}{2}$$
 (66)

> plot([y2(x),y2(x)],x=-3..3)

```



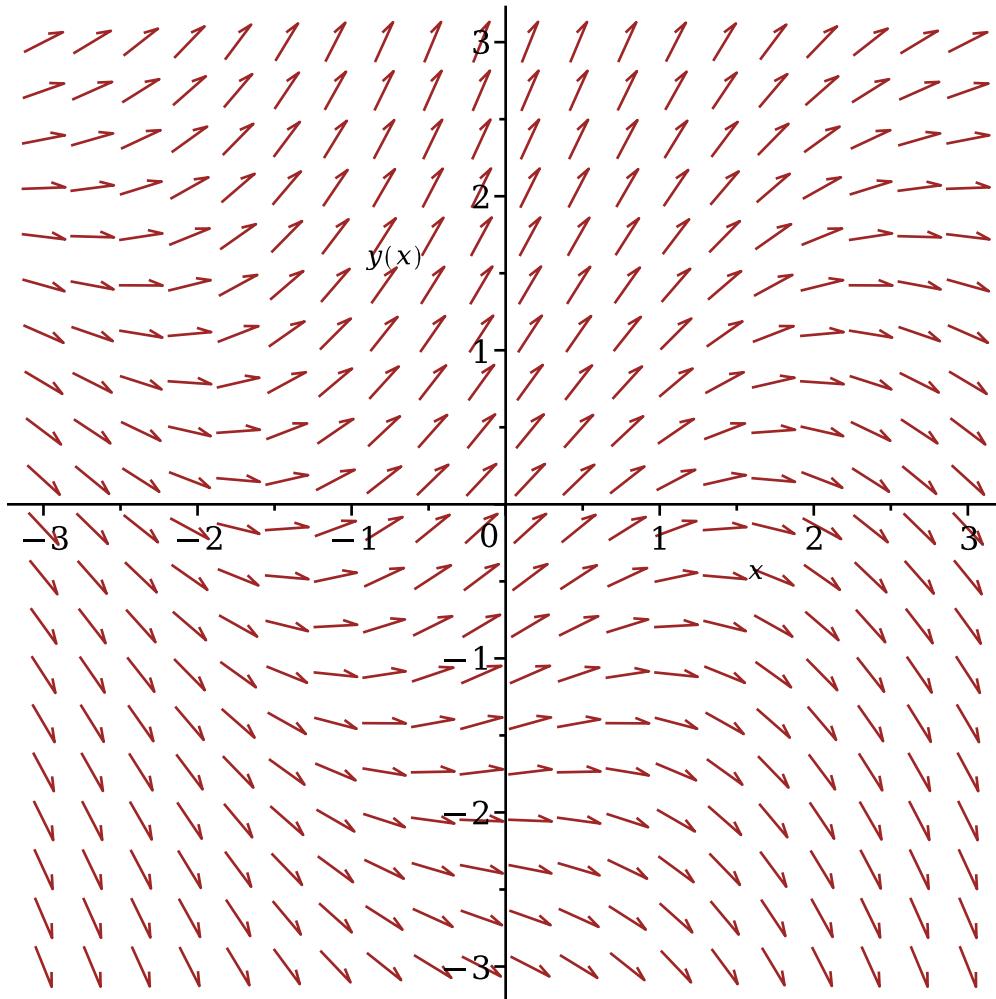
```

> restart:with(DEtools); with(plots)
[AreSimilar, Closure, DEnormal, DEplot, DEplot3d, DEplot_polygon,
DFactor, DFactorLCLM, DFactorsols, Dchangevar, Desingularize,
FindODE, FunctionDecomposition, GCRD, Gosper, Heunsols,
Homomorphisms, IVPsol, IsHyperexponential, LCLM, MeijerGsols,
MultiplicativeDecomposition, ODEInvariants, PDEchangecoords,
PolynomialNormalForm, RationalCanonicalForm, ReduceHyperexp,
RiemannPsols, Xchange, Xcommutator, Xgauge, Zeilberger, abelsol,
adjoint, autonomous, bernoullisols, buildsol, buildsym, canoni, caseplot,
casesplit, checkrank, chinisol, clairautsol, constcoeffsols, convertAlg,
convertsys, dalembertsols, dcoeffs, de2diffop, dfieldplot, diff_table,
diffop2de, dperiodic_sols, dpolyform, dsubs, eigenring,
endomorphism_charpoly, equinv, eta_k, eulersols, exactsol, expsols,
exterior_power, firint, firtest, formal_sol, gen_exp, generate_ic,
genhomosol, gensys, hamilton_eqs, hypergeometricsols, hypergeomsols,
hyperode, indicialeq, infgen, initialdata, integrate_sols, intfactor,
invariants, kovacicsols, leftdivision, liesol, line_int, linearsol, matrixDE,
```

`matrix_riccati, maxdimsystems, moser_reduce, muchange, mult, mutest,  
 newton_polygon, normalG2, ode_int_y, ode_y1, odeadvisor, odepde,  
 parametricsol, particularsol, phaseportrait, poincare, polysols,  
 power_equivalent, rational_equivalent, ratsols, redode, reduceOrder,  
 reduce_order, regular_parts, regularsp, remove_RootOf, riccati_system,  
 riccatisol, rifread, rifsimp, rightdivision, rtaylor, separablesol,  
 singularities, solve_group, super_reduce, symgen, symmetric_power,  
 symmetric_product, symtest, transinv, translate, untranslate, varparam,  
 zoom]` (67)  
`[animate, animate3d, animatecurve, arrow, changecoords, complexplot,  
 complexplot3d, conformal, conformal3d, contourplot, contourplot3d,  
 coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot,  
 fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal,  
 interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d,  
 listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot,  
 multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot,  
 polygonplot, polygonplot3d, polyhedra_supported, polyhedraplot,  
 rootlocus, semilogplot, setcolors, setoptions, setoptions3d,  
 shadebetween, spacecurve, sparsematrixplot, surfdata, textplot,  
 textplot3d, tubeplot]`

**> `ecdif3:=diff(y(x),x)-y(x)/2=cos(x)`**  

$$ecdif3 := \frac{d}{dx} y(x) - \frac{y(x)}{2} = \cos(x)$$
 (68)  
**> `DEplot(ecdif3,y(x),x=-3..3,y=-3..3)`**



> **con3:=y(0)=a**

$$con3 := y(0) = a$$

(69)

> **sol3:=dsolve({ecdif3,con3},y(x))**

$$sol3 := y(x) = -\frac{2 \cos(x)}{5} + \frac{4 \sin(x)}{5} + e^{\frac{x}{2}} \left(a + \frac{2}{5}\right)$$

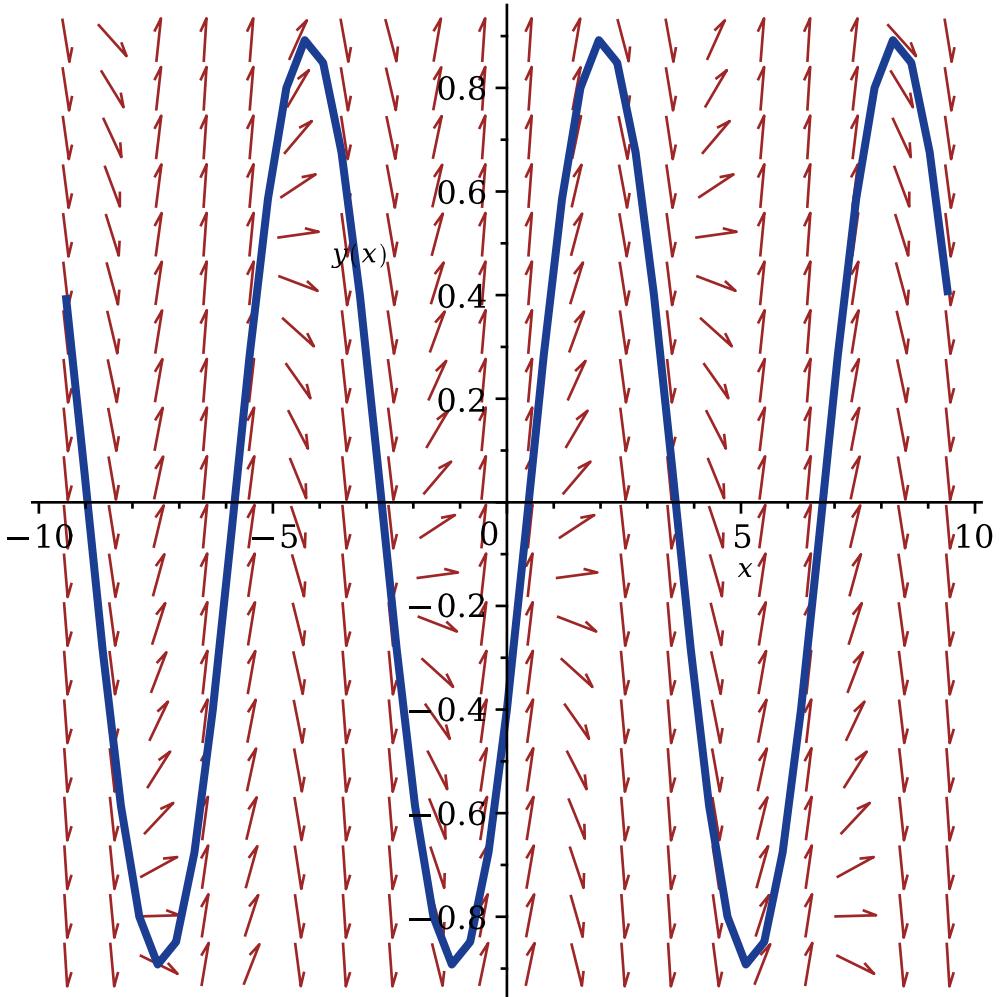
(70)

> **a:=-2/5**

$$a := -\frac{2}{5}$$

(71)

> **DEplot(ecdif3,y(x),x=-3\*Pi..3\*Pi,[[con3]])**



```

> restart:with(DEtools); with(plots)
[AreSimilar, Closure, DEnormal, DEplot, DEplot3d, DEplot_polygon,
DFactor, DFactorLCLM, DFactorsols, Dchangevar, Desingularize,
FindODE, FunctionDecomposition, GCRD, Gosper, Heunsols,
Homomorphisms, IVPsol, IsHyperexponential, LCLM, MeijerGsols,
MultiplicativeDecomposition, ODEInvariants, PDEchangecoords,
PolynomialNormalForm, RationalCanonicalForm, ReduceHyperexp,
RiemannPsols, Xchange, Xcommutator, Xgauge, Zeilberger, abelsol,
adjoint, autonomous, bernoullisols, buildsol, buildsym, canoni, caseplot,
casesplit, checkrank, chinisol, clairautsol, constcoeffsols, convertAlg,
convertsys, dalembertsols, dcoeffs, de2diffop, dfieldplot, diff_table,
diffop2de, dperiodic_sols, dpolyform, dsubs, eigenring,
endomorphism_charpoly, equinv, eta_k, eulersols, exactsol, expsols,
exterior_power, firint, firtest, formal_sol, gen_exp, generate_ic,
genhomosol, gensys, hamilton_eqs, hypergeometricsols, hypergeomsols,
hyperode, indicialeq, infgen, initialdata, integrate_sols, intfactor,
invariants, kovacicsols, leftdivision, liesol, line_int, linearsol, matrixDE,
```

`matrix_riccati, maxdimsystems, moser_reduce, muchange, mult, mutest,  
 newton_polygon, normalG2, ode_int_y, ode_y1, odeadvisor, odepde,  
 parametricsol, particularsol, phaseportrait, poincare, polysols,  
 power_equivalent, rational_equivalent, ratsols, redode, reduceOrder,  
 reduce_order, regular_parts, regularsp, remove_RootOf, riccati_system,  
 riccatisol, rifread, rifsimp, rightdivision, rtaylor, separablesol,  
 singularities, solve_group, super_reduce, symgen, symmetric_power,  
 symmetric_product, symtest, transinv, translate, untranslate, varparam,  
 zoom]` (72)  
`[animate, animate3d, animatecurve, arrow, changecoords, complexplot,  
 complexplot3d, conformal, conformal3d, contourplot, contourplot3d,  
 coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot,  
 fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal,  
 interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d,  
 listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot,  
 multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot,  
 polygonplot, polygonplot3d, polyhedra_supported, polyhedraplot,  
 rootlocus, semilogplot, setcolors, setoptions, setoptions3d,  
 shadebetween, spacecurve, sparsematrixplot, surfdata, textplot,  
 textplot3d, tubeplot]`  
`> ecdif4:=diff(y(x),x)=a*y(x)+b`  

$$ecdif4 := \frac{d}{dx} y(x) = a y(x) + b$$
 (73)  
`> sol4:=dsolve(ecdif4,y(x))`  

$$sol4 := y(x) = -\frac{b}{a} + e^{ax} c_1$$
 (74)  
`> con4:=(y(0)=m)`  

$$con4 := y(0) = m$$
 (75)  
`> sol4:=dsolve({ecdif4,con4},y(x))`  

$$sol4 := y(x) = \frac{(m a + b) e^{ax} - b}{a}$$
 (76)  
`> m=-b/a`  

$$m = -\frac{b}{a}$$
 (77)  
`> con4:=(y(0)=-b/a)`  

$$con4 := y(0) = -\frac{b}{a}$$
 (78)  
`> sol4:=dsolve({ecdif4,con4},y(x))`  

$$sol4 := y(x) = -\frac{b}{a} e^{ax}$$
 (79)

$$sol4 := y(x) = -\frac{b}{a} \quad (79)$$

```
> con4:=(y(0)=1)           con4 := y(0) = 1          (80)
```

```
> sol4:=dsolve({ecdif4,con4},y(x))      sol4 := y(x) =  $\frac{e^{ax}(a+b)-b}{a}$     (81)
```

```
> a=1                         a = 1                (82)
```

```
> b=1                         b = 1                (83)
```

```
> restart:with(DEtools); with(plots)
[AreSimilar, Closure, DEnormal, DEplot, DEplot3d, DEplot_polygon,
DFactor, DFactorLCLM, DFactorsols, Dchangevar, Desingularize,
FindODE, FunctionDecomposition, GCRD, Gosper, Heunsols,
Homomorphisms, IVPsol, IsHyperexponential, LCLM, MeijerGsols,
MultiplicativeDecomposition, ODEInvariants, PDEchangecoords,
PolynomialNormalForm, RationalCanonicalForm, ReduceHyperexp,
RiemannPsols, Xchange, Xcommutator, Xgauge, Zeilberger, abelsol,
adjoint, autonomous, bernoullisols, buildsol, buildsym, canoni, caseplot,
casesplit, checkrank, chinisol, clairautsol, constcoeffsols, convertAlg,
convertsys, dalembertsol, dcoeffs, de2diffop, dfieldplot, diff_table,
diffop2de, dperiodic_sols, dpolyform, dsups, eigenring,
endomorphism_charpoly, equinv, eta_k, eulersols, exactsol, expsols,
exterior_power, firint, firtest, formal_sol, gen_exp, generate_ic,
genhomosol, gensys, hamilton_eqs, hypergeometricsols, hypergeomsols,
hyperode, indicialeq, infgen, initialdata, integrate_sols, intfactor,
invariants, kovacsols, leftdivision, liesol, line_int, linearsols, matrixDE,
matrix_riccati, maxdimsystems, moser_reduce, muchange, mult, mutest,
newton_polygon, normalG2, ode_int_y, ode_y1, odeadvisor, odepde,
parametricsol, particularsols, phaseportrait, poincare, polysols,
power_equivalent, rational_equivalent, ratsols, redode, reduceOrder,
reduce_order, regular_parts, regularsp, remove_RootOf, riccati_system,
riccatisols, rifread, rifsimp, rightdivision, rtaylor, separablesol,
singularities, solve_group, super_reduce, symgen, symmetric_power,
symmetric_product, symtest, transinv, translate, untranslate, varparam,
zoom]
```

[animate, animate3d, animatecurve, arrow, changecoords, complexplot, (84)

*complexplot3d, conformal, conformal3d, contourplot, contourplot3d,  
 coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot,  
 fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal,  
 interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d,  
 listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot,  
 multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot,  
 polygonplot, polygonplot3d, polyhedra\_supported, polyhedraplot,  
 rootlocus, semilogplot, setcolors, setoptions, setoptions3d,  
 shadebetween, spacecurve, sparsematrixplot, surfdata, textplot,  
 textplot3d, tubeplot]*

$$> \text{ecdif5:=diff(y(x),x\$2)-diff(y(x),x)-2*y(x)=0} \\ ecdif5 := \frac{d^2}{dx^2} y(x) - \frac{d}{dx} y(x) - 2 y(x) = 0 \quad (85)$$

$$> \text{con5:=(D(y)(0)=2, y(0)=a)} \\ con5 := D(y)(0) = 2, y(0) = a \quad (86)$$

$$> \text{sol5:=dsolve(\{ecdif5,con5\},y(x))} \\ sol5 := y(x) = \frac{(-2 + 2 a) e^{-x}}{3} + \frac{e^{2 x} (a + 2)}{3} \quad (87)$$

$$> a=-2 \\ a = -2 \quad (88)$$