

```

> ec:=x*diff(y(x),x)=m*x^2+y(x)

$$ec := x \left( \frac{d}{dx} y(x) \right) = m x^2 + y(x) \quad (1)$$

=
> sol:=dsolve(ec,y(x))

$$sol := y(x) = (m x + c_1) x \quad (2)$$

=
> f:=unapply(rhs(sol),x,m,c__1)

$$f := (x, m, c_1) \mapsto (m \cdot x + c_1) \cdot x \quad (3)$$

=
> solve(f(1,m,c__1)=2,m)

$$2 - c_1 \quad (4)$$

=
> solve(f(3,2-c__1,c__1)=1,c__1)

$$\frac{17}{6} \quad (5)$$

=
> f(x,-5/6,17/6)

$$\left( -\frac{5x}{6} + \frac{17}{6} \right) x \quad (6)$$

=
> restart
> with(plots)
[animate, animate3d, animatecurve, arrow, changecoords, complexplot, complexplot3d, conformal, (7)
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]
=
> ec:=x^2*diff(y(x),x$2)-2*x*diff(y(x),x)+2*y(x)=0

$$ec := x^2 \left( \frac{d^2}{dx^2} y(x) \right) - 2x \left( \frac{d}{dx} y(x) \right) + 2y(x) = 0 \quad (8)$$

=
> dsolve(ec,y(x))

$$y(x) = c_1 x^2 + c_2 x \quad (9)$$

=
> cond:=y(1)=2,D(y)(1)=3

$$cond := y(1) = 2, D(y)(1) = 3 \quad (10)$$

=
> sol2:=dsolve({ec,cond},y(x))

$$sol2 := y(x) = x^2 + x \quad (11)$$

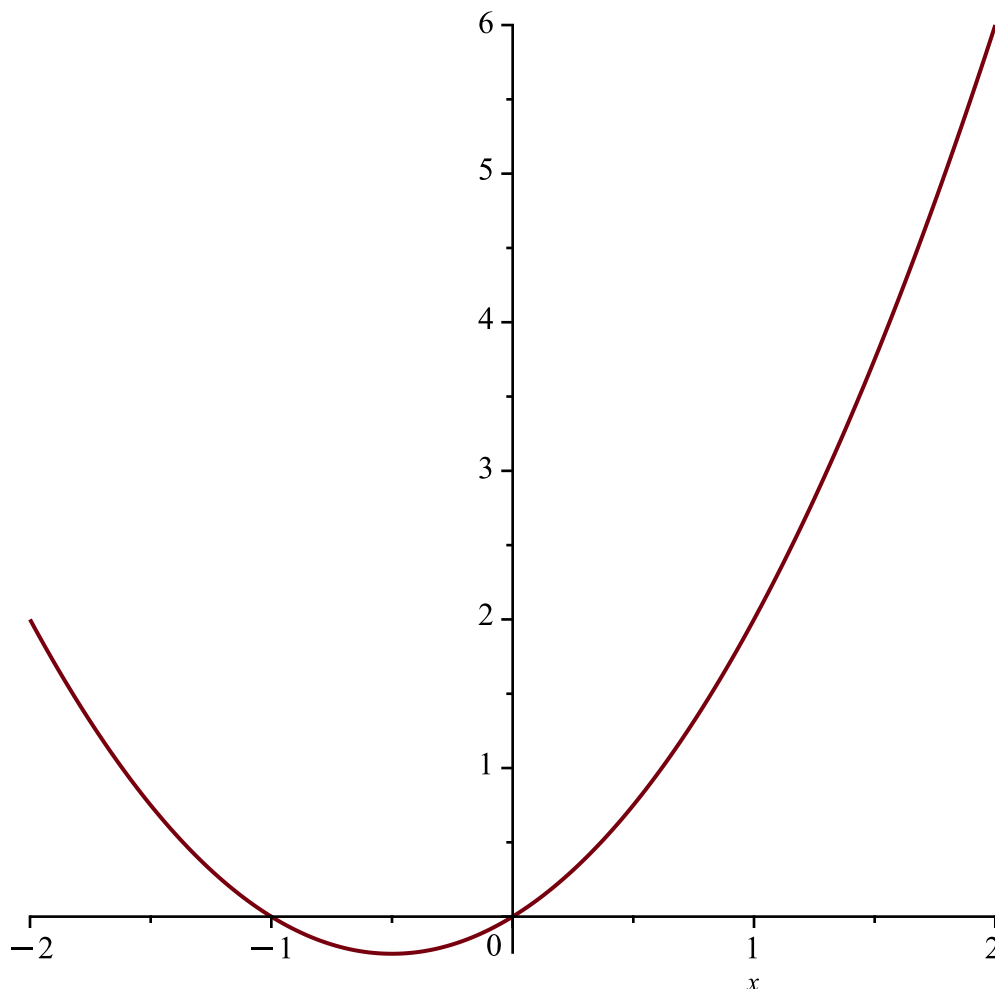

```

```
> f:=unapply(rhs(sol2),x)
```

$$f := x \mapsto x^2 + x$$

(12)

```
> plot([f(x)],x=-2..2)
```



```
> restart
```

```
> with(DEtools)
```

[AreSimilar, Closure, DENormal, DEplot, DEplot3d, DEplot\_polygon, DFactor, DFactorLCLM, (13)  
 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]*

**> f:=x->-x^3+x^2+2\*x**

$$f := x \mapsto -x^3 + x^2 + 2 \cdot x \quad (14)$$

**> ec:=diff(x(t),t)=f(x(t))**

$$ec := \frac{d}{dt} x(t) = -x(t)^3 + x(t)^2 + 2x(t) \quad (15)$$

**> sol:=solve(f(x)=0)**

$$sol := 0, 2, -1 \quad (16)$$

**> D(f)(sol[1])**

$$2 \quad (17)$$

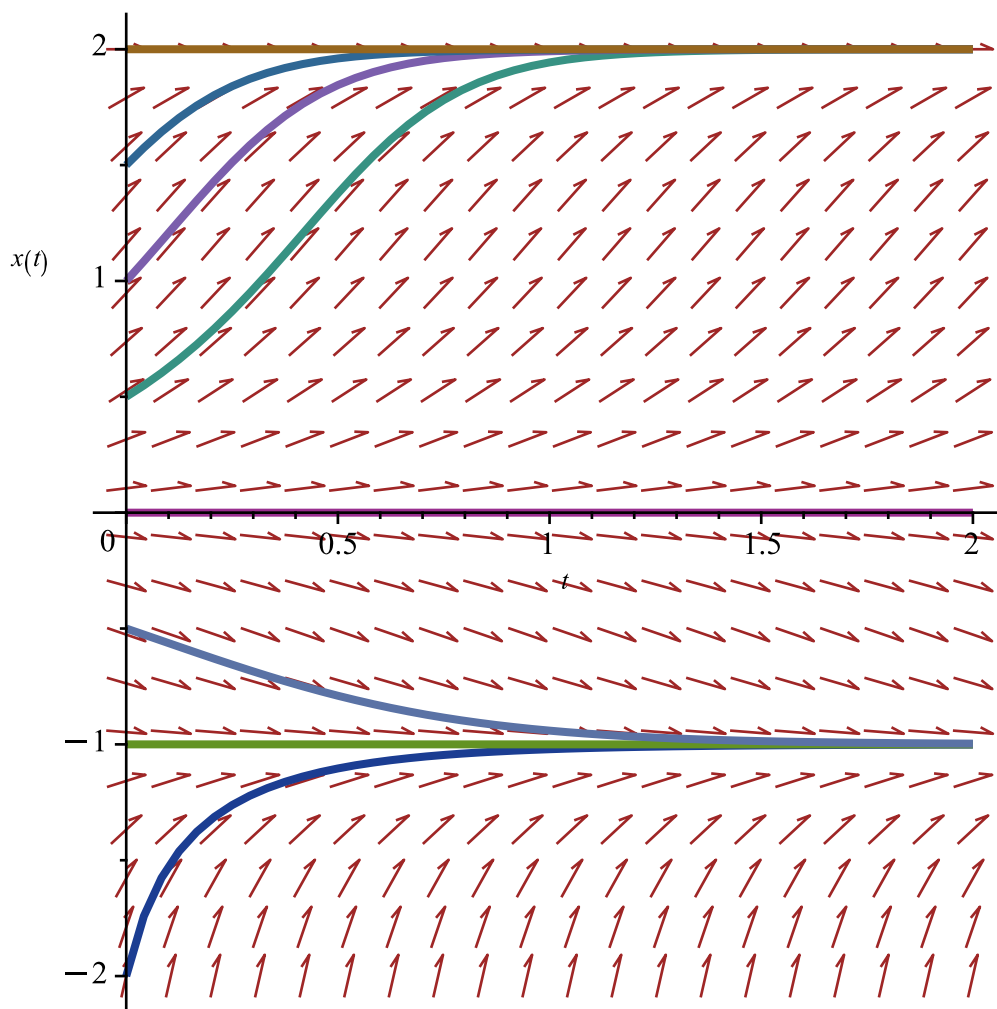
**> D(f)(sol[2])**

$$-6 \quad (18)$$

**> D(f)(sol[3])**

$$-3 \quad (19)$$

**> DEplot(ec,x(t),t=0..2,[[x(0)=-2],[x(0)=-1],[x(0)=-1/2],[x(0)=0],[x(0)=1/2],[x(0)=1],[x(0)=3/2],[x(0)=2]])**



```
> restart
```

```
> ec1:=diff(y1(x),x)=9*y1(x)+21*y2(x)
```

$$ec1 := \frac{d}{dx} y1(x) = 9 y1(x) + 21 y2(x) \quad (20)$$

```
> ec2:=diff(y2(x),x)=-2*y1(x)-4*y2(x)
```

$$ec2 := \frac{d}{dx} y2(x) = -2 y1(x) - 4 y2(x) \quad (21)$$

```
> sist:=ec1,ec2
```

$$sist := \frac{d}{dx} y1(x) = 9 y1(x) + 21 y2(x), \frac{d}{dx} y2(x) = -2 y1(x) - 4 y2(x) \quad (22)$$

```
> dsolve({sist},{y1(x),y2(x)})
```

$$\left\{ y1(x) = c_1 e^{3x} + c_2 e^{2x}, y2(x) = -\frac{2 c_1 e^{3x}}{7} - \frac{c_2 e^{2x}}{3} \right\} \quad (23)$$

```
> cond:=y1(0)=2,y2(0)=5
```

$$cond := y1(0) = 2, y2(0) = 5 \quad (24)$$

```
> dsolve({sist,cond},{y1(x),y2(x)})
```

$$\left\{ y_1(x) = 119 e^{3x} - 117 e^{2x}, y_2(x) = -34 e^{3x} + 39 e^{2x} \right\} \quad (25)$$