

```

> restart
> Ecua := x^2 + 4·x + 5 = 0 :
> Ecua

$$x^2 + 4x + 5 = 0 \quad (1)$$

> LadoDerecho := rhs(Ecua)

$$LadoDerecho := 0 \quad (2)$$

> LadoIzquierdo := lhs(Ecua)

$$LadoIzquierdo := x^2 + 4x + 5 \quad (3)$$

> restart
> Ecua := x^2 + 4·x + 6 = 0; Raiz := solve(Ecua)

$$Ecua := x^2 + 4x + 6 = 0$$


$$Raiz := -2 + I\sqrt{2}, -2 - I\sqrt{2} \quad (4)$$

> evalf(Raiz[1]); evalf(Raiz[2])

$$-2. + 1.414213562 I$$


$$-2. - 1.414213562 I \quad (5)$$

> Sol := expand((x - Raiz[1])·(x - Raiz[2])) = 0

$$Sol := x^2 + 4x + 6 = 0 \quad (6)$$

> ComprobarUno := simplify(subs(x = Raiz[1], Ecua))

$$ComprobarUno := 0 = 0 \quad (7)$$

> ComprobarDos := simplify(subs(x = Raiz[2], Ecua))

$$ComprobarDos := 0 = 0 \quad (8)$$

>
> restart
> alpha

$$\alpha \quad (9)$$

> pi

$$\pi \quad (10)$$

> PI

$$\Pi \quad (11)$$

> evalf(Pi)

$$3.141592654 \quad (12)$$

> evalf(Pi, 100)
3.141592653589793238462643383279502884197169399375105820974944592307816406286208\
998628034825342117068 (13)
> evalf(Pi, 1000);
3.141592653589793238462643383279502884197169399375105820974944592307816406286208\
9986280348253421170679821480865132823066470938446095505822317253594081284811\
1745028410270193852110555964462294895493038196442881097566593344612847564823\
3786783165271201909145648566923460348610454326648213393607260249141273724587\

```

```
0066063155881748815209209628292540917153643678925903600113305305488204665213\
8414695194151160943305727036575959195309218611738193261179310511854807446237\
9962749567351885752724891227938183011949129833673362440656643086021394946395\
2247371907021798609437027705392171762931767523846748184676694051320005681271\
4526356082778577134275778960917363717872146844090122495343014654958537105079\
2279689258923542019956112129021960864034418159813629774771309960518707211349\
9999983729780499510597317328160963185950244594553469083026425223082533446850\
3526193118817101000313783875288658753320838142061717766914730359825349042875\
5468731159562863882353787593751957781857780532171226806613001927876611195909\
216420199
```

```
> evalf(Pi, 10000) :
> evalf(Pi, 25000) :
> evalf(exp(1))
2.718281828 (15)
```

```
> restart
> Expression := eval(exp(Pi·I))
Expression := -1 (16)
```

```
> restart
> ExpressionIntegral := Int(cos(5·x) + exp(2·x) + x3, x) = int(cos(5·x) + exp(2·x) + x3, x)
ExpressionIntegral := ∫ (cos(5 x) + e2x + x3) dx =  $\frac{x^4}{4} + \frac{\sin(5 x)}{5} + \frac{e^{2x}}{2}$  (17)
```

```
> ExpressionDerivada := Diff(rhs(ExpressionIntegral), x) = diff(rhs(ExpressionIntegral), x)
ExpressionDerivada :=  $\frac{d}{dx} \left( \frac{x^4}{4} + \frac{\sin(5 x)}{5} + \frac{e^{2x}}{2} \right) = \cos(5 x) + e^{2x} + x^3$  (18)
```

```
> restart
> Dia := [lunes, martes, miércoles, jueves, viernes, sábado, domingo]
Dia := [lunes, martes, miércoles, jueves, viernes, sábado, domingo] (19)
```

```
> Dia[1]
lunes (20)
```

```
> Dia[5]
viernes (21)
```

```
> DiaHabil := [Dia[1]..Dia[5]]
DiaHabil := [lunes..viernes] (22)
```

```
> DiaFestivo := [Dia[6]..Dia[7]]
DiaFestivo := [sábado..domingo] (23)
```

```
> restart
> with(linalg)
[BlockDiagonal, GramSchmidt, JordanBlock, LUdecomp, QRdecomp, Wronskian, addcol,
addrow, adj, adjoint, angle, augment, backsub, band, basis, bezout, blockmatrix, charmat, (24)
```

charpoly, cholesky, col, coldim, colspace, colspan, companion, concat, cond, copyinto, crossprod, curl, definite, delcols, delrows, det, diag, diverge, dotprod, eigenvals, eigenvalues, eigenvectors, eigenvects, entermatrix, equal, exponential, extend, ffgausselim, fibonacci, forwardsub, frobenius, gausselim, gaussjord, geneqns, genmatrix, grad, hadamard, hermite, hessian, hilbert, htranspose, ihermite, indexfunc, innerprod, intbasis, inverse, ismith, issimilar, iszero, jacobian, jordan, kernel, laplacian, leastsqrs, linsolve, matadd, matrix, minor, minpoly, mulcol, mulrow, multiply, norm, normalize, nullspace, orthog, permanent, pivot, potential, randmatrix, randvector, rank, ratform, row, rowdim, rowspace, rowspan, rref, scalarmul, singularvals, smith, stackmatrix, submatrix, subvector, sumbasis, swapcol, swaprow, sylvester, toeplitz, trace, transpose, vandermonde, vecpotent, vectdim, vector, wronskian]

> *AA := matrix([[1, 2, 3], [4, -5, 6], [7, 8, 9]])*

$$AA := \begin{bmatrix} 1 & 2 & 3 \\ 4 & -5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad (25)$$

> *det(AA)*

$$120 \quad (26)$$

> *InvAA := inverse(AA)*

$$InvAA := \begin{bmatrix} -\frac{31}{40} & \frac{1}{20} & \frac{9}{40} \\ \frac{1}{20} & -\frac{1}{10} & \frac{1}{20} \\ \frac{67}{120} & \frac{1}{20} & -\frac{13}{120} \end{bmatrix} \quad (27)$$

> *Ident := evalm(AA &* InvAA)*

$$Ident := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad (28)$$

> *restart*

> *with(DEtools)*

[*AreSimilar, Closure, DENormal, DEplot, DEplot3d, DEplot_polygon, DFactor, DFactorLCLM, (29)*

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, infactor, 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(PDEtools)*

[CanonicalCoordinates, ChangeSymmetry, CharacteristicQ, CharacteristicQInvariants, ConservedCurrentTest, ConservedCurrents, ConsistencyTest, D_Dx, DeterminingPDE, Eta_k, Euler, FirstIntegralSolver, FromJet, FunctionFieldSolutions, InfinitesimalGenerator, Infinitesimals, IntegratingFactorTest, IntegratingFactors, InvariantEquation, InvariantSolutions, InvariantTransformation, Invariants, Laplace, Library, PDEplot, PolynomialSolutions, ReducedForm, SimilaritySolutions, SimilarityTransformation, Solve, SymmetryCommutator, SymmetryGauge, SymmetrySolutions, SymmetryTest, SymmetryTransformation, TWSolutions, ToJet, ToMissingDependentVariable, build, casesplit, charstrip, dchange, dcoeffs, declare, diff_table, difforder, dpolyform, dsubs, mapde, separability, splitstrip, splitsys, undeclare]

(30)

> *with(plots)*

[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]

(31)

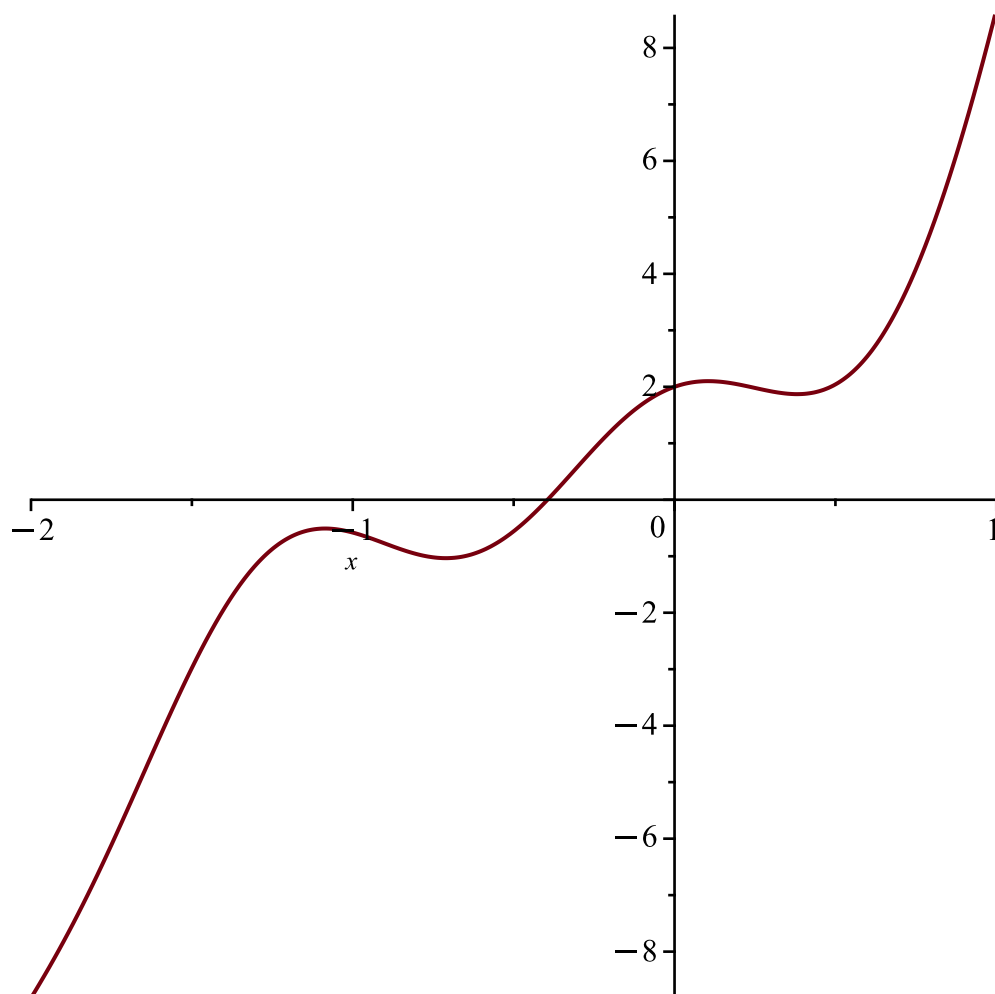
> *restart*

> $Ecua := \cos(5 \cdot x) + \exp(2 \cdot x) + x^3$

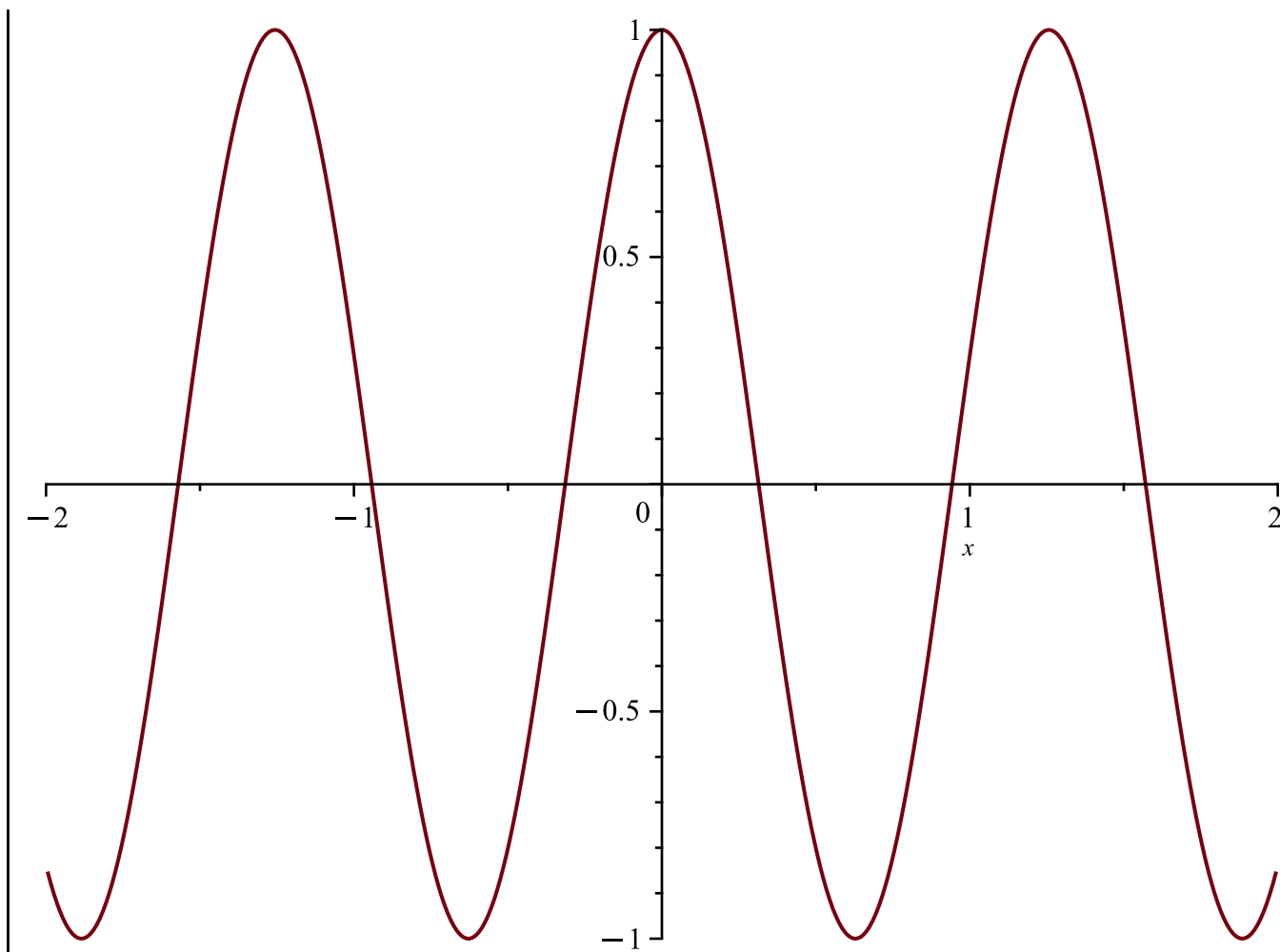
$Ecua := \cos(5 x) + e^{2 x} + x^3$

(32)

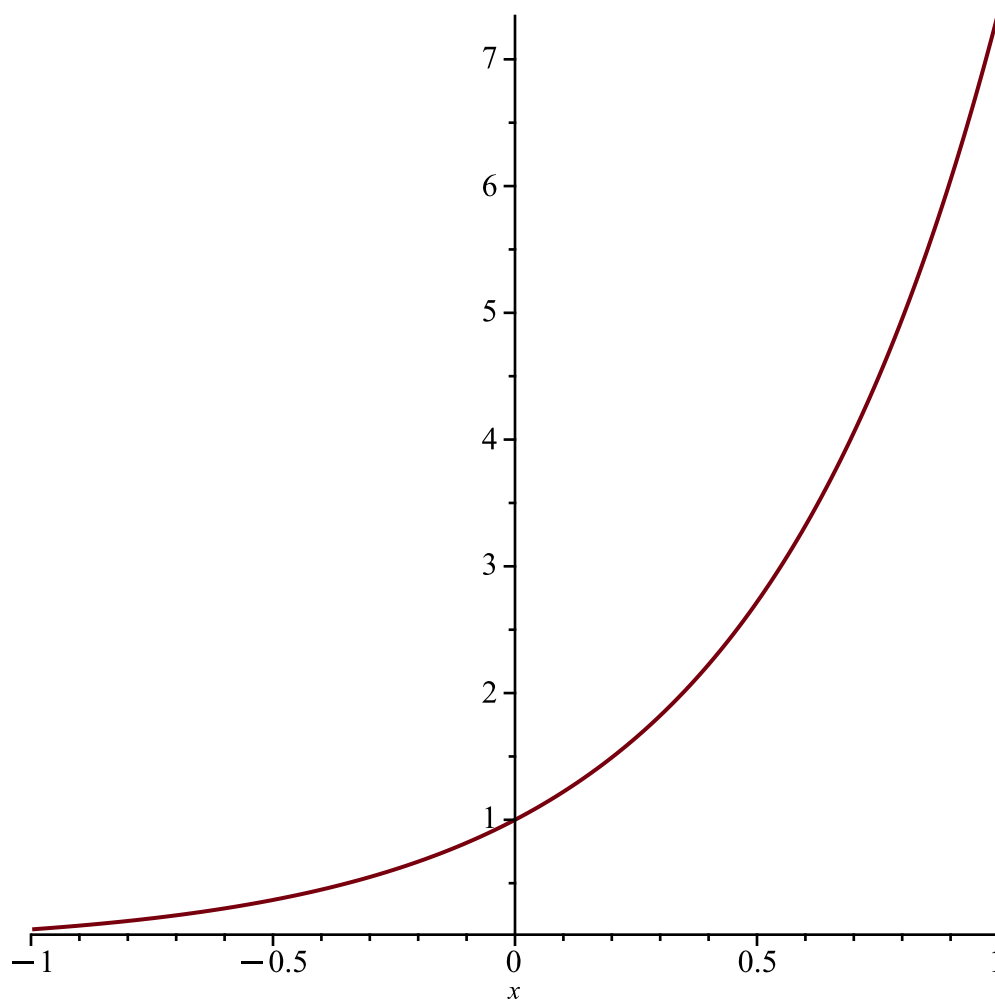
> *plot(Ecua, x=-2..1)*



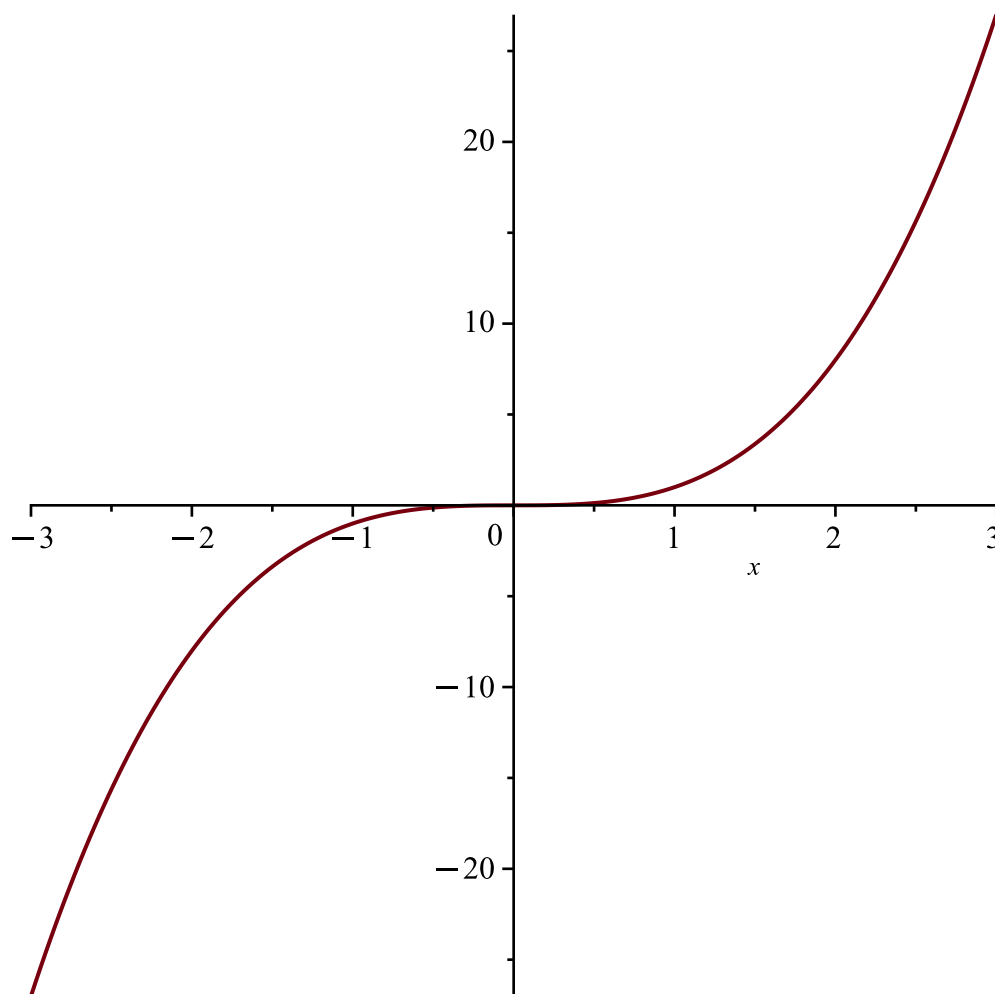
```
> plot(cos(5 x), x=-2..2)
```



```
> plot(exp(2 x), x=-1 ..1)
```



```
> plot(x^3, x=-1..1)
```



> restart

> EcuacionDiferencial := $y'' - 4 \cdot y' + 6 + y = 3 \cdot \exp(5x)$

$$\text{EcuacionDiferencial} := \frac{d^2}{dx^2} y(x) - 4 \frac{d}{dx} y(x) + 6 + y(x) = 3 e^{5x} \quad (33)$$

E_D_O_(2)_L_cc_NH

> SolucionGeneral := dsolve(EcuacionDiferencial); evalf(%, 3)

$$\text{SolucionGeneral} := y(x) = e^{(2+\sqrt{3})x} c_2 + e^{(-2+\sqrt{3})x} c_1 + \frac{e^{5x}}{2} - 6$$

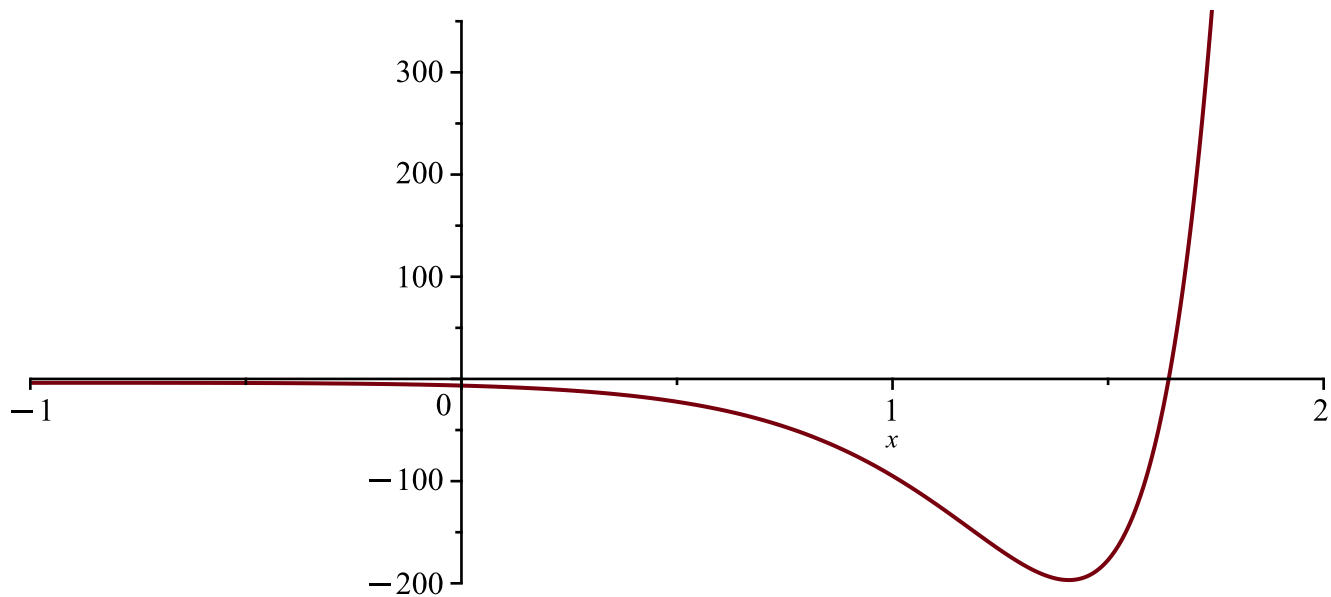
$$y(x) = e^{3.73x} c_2 + e^{0.27x} c_1 + 0.500 e^{5x} - 6. \quad (34)$$

> SolucionParticular := $y(x) = \text{subs}(c_1 = 3, c_2 = -4, \text{rhs}(\text{SolucionGeneral}))$; evalf(%, 3)

$$\text{SolucionParticular} := y(x) = -4 e^{(2+\sqrt{3})x} + 3 e^{(-2+\sqrt{3})x} + \frac{e^{5x}}{2} - 6$$

$$y(x) = -4 \cdot e^{3.73x} + 3 \cdot e^{0.27x} + 0.500 e^{5x} - 6. \quad (35)$$

> plot(rhs(SolucionParticular), x = -1 .. 2.4)



```
> ComprobacionGeneral := simplify(eval(subs(y(x) = rhs(SolucionGeneral),
    lhs(EcuacionDiferencial) - rhs(EcuacionDiferencial) = 0)))
    ComprobacionGeneral := 0 = 0 (36)
```

```
> ComprobacionParticular := simplify(eval(subs(y(x) = rhs(SolucionParticular),
    lhs(EcuacionDiferencial) - rhs(EcuacionDiferencial) = 0)))
    ComprobacionParticular := 0 = 0 (37)
```

```
> with(DEtools) :
> odeadvisor(EcuacionDiferencial)
    [[_2nd_order, _with_linear_symmetries]] (38)
```

```
> restart
> alpha, beta, gamma
    α, β, γ (39)
```

```
> Alpha, Beta, Gamma
    A, B, Γ (40)
```

```
>
>
>
>
>
```