

$$\begin{aligned} &> \text{restart} \\ &> f := x^2 - 6 \cdot x + 9 \\ &f := x^2 - 6x + 9 \end{aligned} \tag{1}$$

Vamos a realizar una operación matemática de ejemplo

$$\begin{aligned} &> \text{Integral} := \text{Int}(f, x) = \text{int}(f, x) \\ &\text{Integral} := \int (x^2 - 6x + 9) \, dx = \frac{(x - 3)^3}{3} \end{aligned} \tag{2}$$

$$\begin{aligned} &> \text{Derivada} := \text{Diff}(f, x) = \text{diff}(f, x) : \\ &> \text{Derivada} \\ &\frac{d}{dx} (x^2 - 6x + 9) = 2x - 6 \end{aligned} \tag{3}$$

$$\begin{aligned} &> \text{Raiz} := \text{solve}(f=0) \\ &\text{Raiz} := 3, 3 \end{aligned} \tag{4}$$

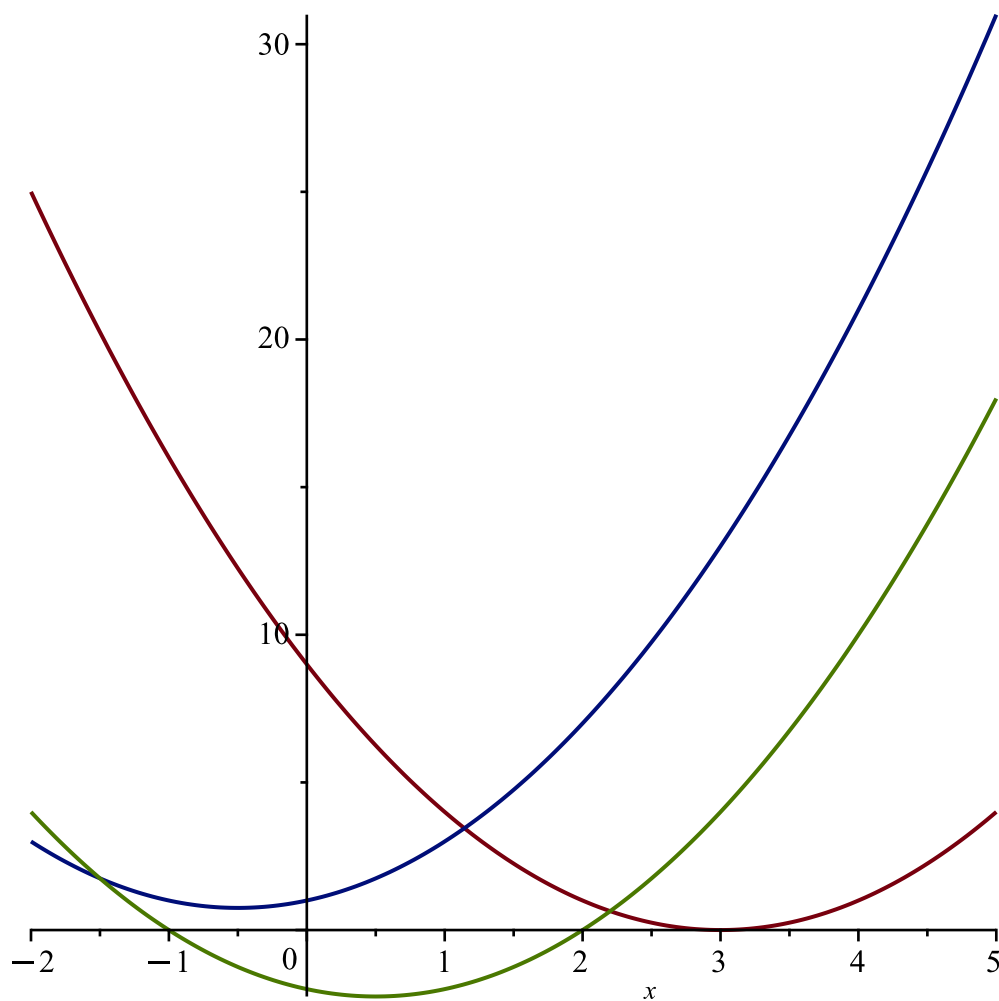
$$\begin{aligned} &> \text{EcuaOriginal} := \text{expand}((x - \text{Raiz}[1]) \cdot (x - \text{Raiz}[2])) = 0 \\ &\text{EcuaOriginal} := x^2 - 6x + 9 = 0 \end{aligned} \tag{5}$$

$$\begin{aligned} &> f = 0 \\ &x^2 - 6x + 9 = 0 \end{aligned} \tag{6}$$

$$\begin{aligned} &> g := x^2 + x + 1 \\ &g := x^2 + x + 1 \end{aligned} \tag{7}$$

$$\begin{aligned} &> h := (x + 1) \cdot (x - 2) \\ &h := (x + 1) (x - 2) \end{aligned} \tag{8}$$

$$> \text{plot}([f, g, h], x = -2 .. 5)$$



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> RaizDos := solve(g=0)
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$$RaizDos := -\frac{1}{2} + \frac{I\sqrt{3}}{2}, -\frac{1}{2} - \frac{I\sqrt{3}}{2} \quad (9)$$

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> RaizReal := evalf(%, 3)
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$$RaizReal := -0.500 + 0.865 I, -0.500 - 0.865 I \quad (10)$$

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> restart
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> evalf(pi)
```

$$\pi \quad (11)$$

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> evalf(Pi)
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$$\Pi \quad (12)$$

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> evalf(Pi, 100000) :
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> evalf(sqrt(3), 10000) :
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> Semana := [lunes, martes, miércoles, jueves, viernes, sábado, domingo]
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$$Semana := [lunes, martes, miércoles, jueves, viernes, sábado, domingo] \quad (13)$$

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> DiasHabiles := Semana[1..5]
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$$DiasHabiles := [lunes, martes, miércoles, jueves, viernes] \quad (14)$$

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> FinSemana := Semana[6..7]
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$$FinSemana := [sábado, domingo] \quad (15)$$

>  $AA := \text{array}([ [1, 2, 3], [4, -5, 6], [7, 8, 9] ])$

$$AA := \begin{bmatrix} 1 & 2 & 3 \\ 4 & -5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad (16)$$

> *with(linalg)*

[*BlockDiagonal, GramSchmidt, JordanBlock, LUdecomp, QRdecomp, Wronskian, addcol, addrow, adj, adjoint, angle, augment, backsub, band, basis, bezout, blockmatrix, charmat, 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, gaussjordan, 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*]

>  $Valor := \det(AA)$

$$Valor := 120 \quad (18)$$

>  $Inversa := \text{inverse}(AA)$

$$Inversa := \begin{bmatrix} -\frac{31}{40} & \frac{1}{20} & \frac{9}{40} \\ \frac{1}{20} & -\frac{1}{10} & \frac{1}{20} \\ \frac{67}{120} & \frac{1}{20} & -\frac{13}{120} \end{bmatrix} \quad (19)$$

>  $Identidad := \text{evalm}(AA \&* Inversa)$

$$Identidad := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad (20)$$

> *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]*

> *with(inttrans)*

*[addtable, fourier, fouriercos, fouriersin, hankel, hilbert, invfourier, invhilbert, invlaplace, invmellin, laplace, mellin, savetable, setup]*

(22)

> *with(DEtools)*

*[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, 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]*

(23)

> *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]*

(24)

> *restart*

$$\begin{aligned} > \text{EcuaDif} := y'' - 6y' + 4y = 2 \cdot \cos(2x) \\ & \text{EcuaDif} := \frac{d^2}{dx^2} y(x) - 6 \frac{d}{dx} y(x) + 4y(x) = 2 \cos(2x) \end{aligned} \quad (25)$$

$$\begin{aligned} > \text{EcuaDifDos} := \text{diff}(y(t), t, t) - 6 \cdot \text{diff}(y(t), t) + 4 \cdot y(t) = 2 \cdot \cos(2 - t) \\ & \text{EcuaDifDos} := \frac{d^2}{dt^2} y(t) - 6 \frac{d}{dt} y(t) + 4y(t) = 2 \cos(-2 + t) \end{aligned} \quad (26)$$

$$\begin{aligned} > \text{CondIni} := y(0) = 3, D(y)(0) = -4 \\ & \text{CondIni} := y(0) = 3, D(y)(0) = -4 \end{aligned} \quad (27)$$

$$\begin{aligned} > \text{SolGral} := \text{dsolve}(\text{EcuaDif}) \\ & \text{SolGral} := y(x) = e^{(3+\sqrt{5})x} c_2 + e^{-(\sqrt{5}-3)x} c_1 - \frac{\sin(2x)}{6} \end{aligned} \quad (28)$$

$$\begin{aligned} > \text{evalf}(\%, 3) \\ & y(x) = e^{5.24x} c_2 + e^{0.76x} c_1 - 0.167 \sin(2x) \end{aligned} \quad (29)$$

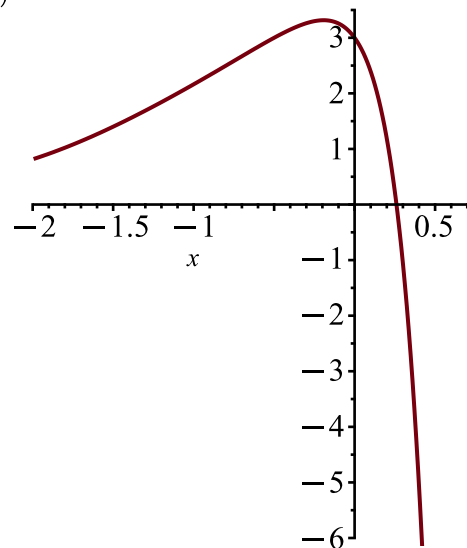
$$\begin{aligned} > \text{SolPart} := \text{dsolve}(\{\text{EcuaDif}, \text{CondIni}\}) \\ & \text{SolPart} := y(x) = e^{(3+\sqrt{5})x} \left( \frac{3}{2} - \frac{19\sqrt{5}}{15} \right) + e^{-(\sqrt{5}-3)x} \left( \frac{3}{2} + \frac{19\sqrt{5}}{15} \right) - \frac{\sin(2x)}{6} \end{aligned} \quad (30)$$

$$\begin{aligned} > \text{CondInicialIncognita} := y(0) = \text{simplify}(\text{eval}(\text{subs}(x=0, \text{rhs}(\text{SolPart})))) \\ & \text{CondInicialIncognita} := y(0) = 3 \end{aligned} \quad (31)$$

$$\begin{aligned} > \text{CondInicialDerivada} := D(y)(0) = \text{simplify}(\text{eval}(\text{subs}(x=0, \text{rhs}(\text{diff}(\text{SolPart}, x))))) \\ & \text{CondInicialDerivada} := D(y)(0) = -4 \end{aligned} \quad (32)$$

$$\begin{aligned} > \text{evalf}(\%, 3) \\ & y(x) = -1.34 e^{5.24x} + 4.34 e^{0.76x} - 0.167 \sin(2x) \end{aligned} \quad (33)$$

$$> \text{plot}(\text{rhs}(\text{SolPart}), x = -2..1)$$



$$\begin{aligned} > \text{restart} \\ > \text{yy}[1] := \exp(5x) \\ & \text{yy}_1 := e^{5x} \end{aligned} \quad (34)$$

$$\begin{aligned} & \text{yy}[2] := \cos(5x) \\ & \text{yy}_2 := \cos(5x) \end{aligned} \tag{35}$$

$$\begin{aligned} & \text{yy}[3] := \sin(5x) \\ & \text{yy}_3 := \sin(5x) \end{aligned} \tag{36}$$

$$\begin{aligned} & \text{with(linalg):} \\ & WW := \text{wronskian}([\text{yy}[1], \text{yy}[2], \text{yy}[3]], x) \\ & WW := \begin{bmatrix} e^{5x} & \cos(5x) & \sin(5x) \\ 5e^{5x} & -5\sin(5x) & 5\cos(5x) \\ 25e^{5x} & -25\cos(5x) & -25\sin(5x) \end{bmatrix} \end{aligned} \tag{37}$$

$$\begin{aligned} & \text{ComprobarIndependenciaLineal} := \text{simplify}(\det(WW)) \neq 0 \\ & \text{ComprobarIndependenciaLineal} := 250e^{5x} \neq 0 \end{aligned} \tag{38}$$

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