

$$\begin{aligned} &> \text{restart} \\ &> \text{EcuaUno} := \text{diff}(x[1](t), t) = 2 \cdot x[1](t) + 3 \cdot x[2](t) \\ &\qquad \text{EcuaUno} := \frac{d}{dt} x_1(t) = 2 x_1(t) + 3 x_2(t) \end{aligned} \quad (1)$$

$$\begin{aligned} &> \text{EcuaDos} := \text{diff}(x[2](t), t) = -x[1](t) + 2 \cdot x[2](t) \\ &\qquad \text{EcuaDos} := \frac{d}{dt} x_2(t) = -x_1(t) + 2 x_2(t) \end{aligned} \quad (2)$$

$$\begin{aligned} &> \text{SolGral} := \text{expand}(\text{dsolve}(\{\text{EcuaUno}, \text{EcuaDos}\})) \\ \text{SolGral} &:= \left\{ x_1(t) = (e^t)^2 \_C1 \sin(\sqrt{3} t) + (e^t)^2 \_C2 \cos(\sqrt{3} t), x_2(t) = \right. \\ &\quad \left. -\frac{1}{3} (e^t)^2 \sqrt{3} \sin(\sqrt{3} t) \_C2 + \frac{1}{3} (e^t)^2 \sqrt{3} \cos(\sqrt{3} t) \_C1 \right\} \end{aligned} \quad (3)$$

$$\begin{aligned} &> \text{SolGral}[1] \\ &\qquad x_1(t) = (e^t)^2 \_C1 \sin(\sqrt{3} t) + (e^t)^2 \_C2 \cos(\sqrt{3} t) \end{aligned} \quad (4)$$

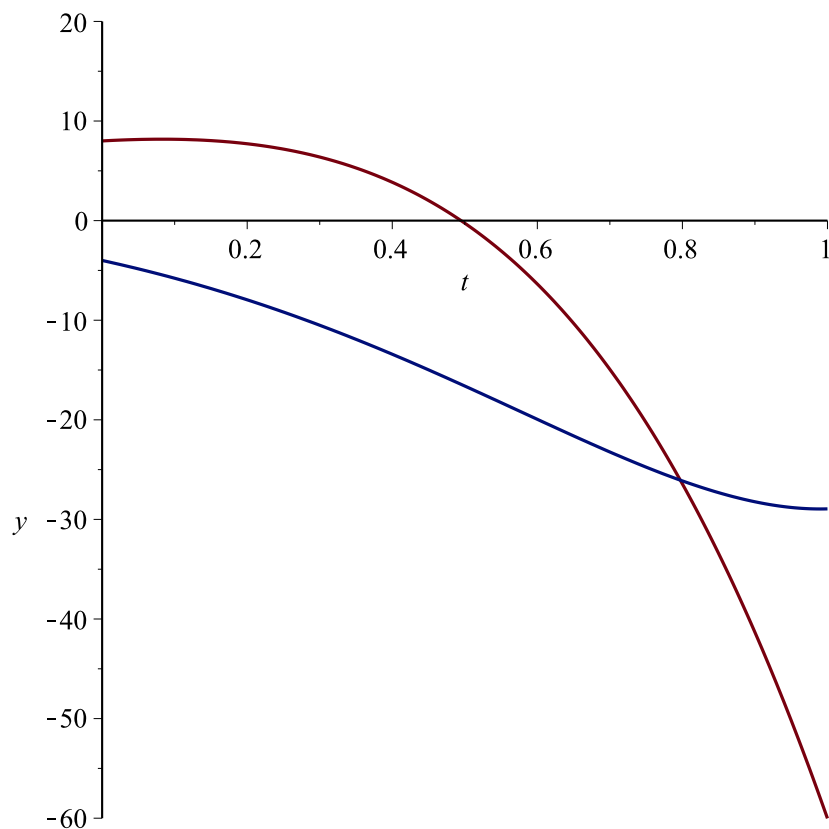
$$\begin{aligned} &> \text{SolGral}[2] \\ &\qquad x_2(t) = -\frac{1}{3} (e^t)^2 \sqrt{3} \sin(\sqrt{3} t) \_C2 + \frac{1}{3} (e^t)^2 \sqrt{3} \cos(\sqrt{3} t) \_C1 \end{aligned} \quad (5)$$

$$\begin{aligned} &> \text{Cond} := x[1](0) = 8, x[2](0) = -4 \\ &\qquad \text{Cond} := x_1(0) = 8, x_2(0) = -4 \end{aligned} \quad (6)$$

$$\begin{aligned} &> \text{SolPart} := \text{expand}(\text{dsolve}(\{\text{EcuaUno}, \text{EcuaDos}, \text{Cond}\})) \\ \text{SolPart} &:= \left\{ x_1(t) = -4 (e^t)^2 \sin(\sqrt{3} t) \sqrt{3} + 8 (e^t)^2 \cos(\sqrt{3} t), x_2(t) = \right. \\ &\quad \left. -\frac{8}{3} (e^t)^2 \sin(\sqrt{3} t) \sqrt{3} - 4 (e^t)^2 \cos(\sqrt{3} t) \right\} \end{aligned} \quad (7)$$

$$\begin{aligned} &> \text{SolPart}[1]; \text{SolPart}[2] \\ &\qquad x_1(t) = -4 (e^t)^2 \sin(\sqrt{3} t) \sqrt{3} + 8 (e^t)^2 \cos(\sqrt{3} t) \\ &\qquad x_2(t) = -\frac{8}{3} (e^t)^2 \sin(\sqrt{3} t) \sqrt{3} - 4 (e^t)^2 \cos(\sqrt{3} t) \end{aligned} \quad (8)$$

$$> \text{plot}([\text{rhs}(\text{SolPart}[1]), \text{rhs}(\text{SolPart}[2])], t=0..1, y=-60..20)$$



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> A := array([ [2, 3], [-1, 2] ])
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$$A := \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$$

(9)

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> with(linalg)
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[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, 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,

(10)

*vectdim, vector, wronskian]*

> *MatExp* := *exponential*(*A*, *t*)

$$MatExp := \begin{bmatrix} e^{2t} \cos(\sqrt{3} t) & \sqrt{3} e^{2t} \sin(\sqrt{3} t) \\ -\frac{1}{3} \sqrt{3} e^{2t} \sin(\sqrt{3} t) & e^{2t} \cos(\sqrt{3} t) \end{bmatrix} \quad (11)$$

> *DerMatExp* := *map*(*diff*, *MatExp*, *t*)

*DerMatExp* := (12)

$$\begin{bmatrix} 2 e^{2t} \cos(\sqrt{3} t) - \sqrt{3} e^{2t} \sin(\sqrt{3} t) & 2 \sqrt{3} e^{2t} \sin(\sqrt{3} t) + 3 e^{2t} \cos(\sqrt{3} t) \\ -\frac{2}{3} \sqrt{3} e^{2t} \sin(\sqrt{3} t) - e^{2t} \cos(\sqrt{3} t) & 2 e^{2t} \cos(\sqrt{3} t) - \sqrt{3} e^{2t} \sin(\sqrt{3} t) \end{bmatrix}$$

> *ProdAmatExp* := *evalm*(*A* &\* *MatExp*)

*ProdAmatExp* := (13)

$$\begin{bmatrix} 2 e^{2t} \cos(\sqrt{3} t) - \sqrt{3} e^{2t} \sin(\sqrt{3} t) & 2 \sqrt{3} e^{2t} \sin(\sqrt{3} t) + 3 e^{2t} \cos(\sqrt{3} t) \\ -\frac{2}{3} \sqrt{3} e^{2t} \sin(\sqrt{3} t) - e^{2t} \cos(\sqrt{3} t) & 2 e^{2t} \cos(\sqrt{3} t) - \sqrt{3} e^{2t} \sin(\sqrt{3} t) \end{bmatrix}$$

> *Comprob* := *evalm*(*DerMatExp* - *ProdAmatExp*)

$$Comprob := \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \quad (14)$$

> *CondIni* := *array*( [*x*[1](0), *x*[2](0)] ) = *array*( [8, -4] )

$$CondIni := \begin{bmatrix} x_1(0) & x_2(0) \end{bmatrix} = \begin{bmatrix} 8 & -4 \end{bmatrix} \quad (15)$$

> *SolPartMat* := *evalm*( *MatExp* &\* *rhs*(*CondIni*) )

*SolPartMat* := (16)

$$\begin{bmatrix} 8 e^{2t} \cos(\sqrt{3} t) - 4 \sqrt{3} e^{2t} \sin(\sqrt{3} t) & -\frac{8}{3} \sqrt{3} e^{2t} \sin(\sqrt{3} t) - 4 e^{2t} \cos(\sqrt{3} t) \end{bmatrix}$$

> *SolPartMat*[1]; *SolPartMat*[2]

$$\begin{aligned} & 8 e^{2t} \cos(\sqrt{3} t) - 4 \sqrt{3} e^{2t} \sin(\sqrt{3} t) \\ & -\frac{8}{3} \sqrt{3} e^{2t} \sin(\sqrt{3} t) - 4 e^{2t} \cos(\sqrt{3} t) \end{aligned} \quad (17)$$

> *SolPart*[1]; *SolPart*[2]

$$\begin{aligned} x_1(t) &= -4 (e^t)^2 \sin(\sqrt{3} t) \sqrt{3} + 8 (e^t)^2 \cos(\sqrt{3} t) \\ x_2(t) &= -\frac{8}{3} (e^t)^2 \sin(\sqrt{3} t) \sqrt{3} - 4 (e^t)^2 \cos(\sqrt{3} t) \end{aligned} \quad (18)$$

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