

> restart

PROBAR LA INDEPENDENCIA LINEAL DE LAS SOLUCIONES PARTICULARES FUNDAMENTALES

> EcuacionDiferencial := diff(y(x), x\$3) - 9*y(x) = 0

$$\text{EcuacionDiferencial} := \frac{d^3}{dx^3} y(x) - 9 y(x) = 0 \quad (1)$$

Ecuación Diferencial Ordinaria Lineal (orden 3) Coeficientes Constantes Homogenea

> SolucionGeneral := dsolve(EcuacionDiferencial)

$$\text{SolucionGeneral} := y(x) = _C1 e^{3^{2/3}x} - _C2 e^{-\frac{1}{2} 3^{2/3}x} \sin\left(\frac{3}{2} 3^{1/6}x\right) + _C3 e^{-\frac{1}{2} 3^{2/3}x} \cos\left(\frac{3}{2} 3^{1/6}x\right) \quad (2)$$

> evalf(%)

$$y(x) = _C1 e^{2.080083823x} - 1. _C2 e^{-1.040041912x} \sin(1.801405432x) + _C3 e^{-1.040041912x} \cos(1.801405432x) \quad (3)$$

> Solucion1 := y(x) = e^{3^{2/3}x}

$$\text{Solucion1} := y(x) = e^{3^{2/3}x} \quad (4)$$

> evalf(%, 4)

$$y(x) = e^{2.080x} \quad (5)$$

> Solucion2 := y(x) = -e^{-\frac{1}{2} 3^{2/3}x} \sin\left(\frac{3}{2} 3^{1/6}x\right)

$$\text{Solucion2} := y(x) = -e^{-\frac{1}{2} 3^{2/3}x} \sin\left(\frac{3}{2} 3^{1/6}x\right) \quad (6)$$

> evalf(%, 4)

$$y(x) = -1. e^{-1.040x} \sin(1.802x) \quad (7)$$

> Solucion3 := y(x) = e^{-\frac{1}{2} 3^{2/3}x} \cos\left(\frac{3}{2} 3^{1/6}x\right)

$$\text{Solucion3} := y(x) = e^{-\frac{1}{2} 3^{2/3}x} \cos\left(\frac{3}{2} 3^{1/6}x\right) \quad (8)$$

> evalf(%, 4)

$$y(x) = e^{-1.040x} \cos(1.802x) \quad (9)$$

> 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, (10)

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, sylveste, toeplitz, trace, transpose, vandermonde, vecpotent, vectdim, vector, wronskian]

> $WW := \text{wronskian}([\text{rhs}(\text{Solucion1}), \text{rhs}(\text{Solucion2}), \text{rhs}(\text{Solucion3})], x)$

$$WW := \left[\left[e^{3^{2/3}x}, -e^{-\frac{1}{2}3^{2/3}x} \sin\left(\frac{3}{2}3^{1/6}x\right), e^{-\frac{1}{2}3^{2/3}x} \cos\left(\frac{3}{2}3^{1/6}x\right) \right], \right. \\ \left[3^{2/3}e^{3^{2/3}x}, \frac{1}{2}3^{2/3}e^{-\frac{1}{2}3^{2/3}x} \sin\left(\frac{3}{2}3^{1/6}x\right) - \frac{3}{2}e^{-\frac{1}{2}3^{2/3}x} \cos\left(\frac{3}{2}3^{1/6}x\right)3^{1/6}, \right. \\ \left. -\frac{1}{2}3^{2/3}e^{-\frac{1}{2}3^{2/3}x} \cos\left(\frac{3}{2}3^{1/6}x\right) - \frac{3}{2}e^{-\frac{1}{2}3^{2/3}x} \sin\left(\frac{3}{2}3^{1/6}x\right)3^{1/6} \right], \\ \left. \left[33^{1/3}e^{3^{2/3}x}, \frac{3}{2}3^{1/3}e^{-\frac{1}{2}3^{2/3}x} \sin\left(\frac{3}{2}3^{1/6}x\right) + \frac{3}{2}3^{5/6}e^{-\frac{1}{2}3^{2/3}x} \cos\left(\frac{3}{2}3^{1/6}x\right), \right. \right. \\ \left. \left. -\frac{3}{2}3^{1/3}e^{-\frac{1}{2}3^{2/3}x} \cos\left(\frac{3}{2}3^{1/6}x\right) + \frac{3}{2}3^{5/6}e^{-\frac{1}{2}3^{2/3}x} \sin\left(\frac{3}{2}3^{1/6}x\right) \right] \right] \quad (11)$$

> $\text{evalf}(\%, 2)$

$$\left[\left[e^{2.1x}, -1.0e^{-1.0x} \sin(1.8x), e^{-1.0x} \cos(1.8x) \right], \right. \\ \left[2.1e^{2.1x}, 1.0e^{-1.0x} \sin(1.8x) - 1.8e^{-1.0x} \cos(1.8x), -1.0e^{-1.0x} \cos(1.8x) \right. \\ \left. - 1.8e^{-1.0x} \sin(1.8x) \right], \\ \left. \left[4.2e^{2.1x}, 2.1e^{-1.0x} \sin(1.8x) + 3.8e^{-1.0x} \cos(1.8x), -2.1e^{-1.0x} \cos(1.8x) \right. \right. \\ \left. \left. + 3.8e^{-1.0x} \sin(1.8x) \right] \right] \quad (12)$$

> $\text{DetWW} := \text{simplify}(\det(WW)) \neq 0$

$$\text{DetWW} := \frac{27}{2} \sqrt{3} \neq 0 \quad (13)$$

> *restart*

LA SOLUCIÓN SINGULAR

> $\text{EcuacionNoLineal} := x \cdot (\text{diff}(y(x), x)) \cdot 2 - 2 \cdot (y(x)) \cdot (\text{diff}(y(x), x)) + 4 \cdot x = 0$

$$\text{EcuacionNoLineal} := x \left(\frac{d}{dx} y(x) \right)^2 - 2 y(x) \left(\frac{d}{dx} y(x) \right) + 4 x = 0 \quad (14)$$

> $\text{Solucion} := \text{dsolve}(\text{EcuacionNoLineal})$

$$\text{Solucion} := y(x) = -2x, y(x) = 2x, y(x) = -\frac{1}{2} \left(-\frac{x^2}{-CI^2} - 4 \right) - CI \quad (15)$$

> $\text{evalf}(\%, 4)$

(16)

$$y(x) = -2 \cdot x, y(x) = 2 \cdot x, y(x) = -0.5000 \left(-\frac{1 \cdot x^2}{_CI^2} - 4 \right) _CI \quad (16)$$

> *SolucionSingular1* := *Solucion*[1]

$$\textcolor{blue}{SolucionSingular1} := y(x) = -2 \cdot x \quad (17)$$

> *SolucionSingular2* := *Solucion*[2]

$$\textcolor{blue}{SolucionSingular2} := y(x) = 2 \cdot x \quad (18)$$

> *SolucionGeneral* := *Solucion*[3]

$$\textcolor{blue}{SolucionGeneral} := y(x) = -\frac{1}{2} \left(-\frac{x^2}{_CI^2} - 4 \right) _CI \quad (19)$$

> *Prueba1* := *simplify*(*subs*(*y*(*x*) = *rhs*(*SolucionSingular1*), *rhs*(*EcuacionNoLineal*) = 0))

$$\textcolor{blue}{Prueba1} := 0 = 0 \quad (20)$$

> *Prueba2* := *simplify*(*subs*(*y*(*x*) = *rhs*(*SolucionSingular2*), *rhs*(*EcuacionNoLineal*) = 0))

$$\textcolor{blue}{Prueba2} := 0 = 0 \quad (21)$$

> *Prueba3* := *simplify*(*subs*(*y*(*x*) = *rhs*(*SolucionGeneral*), *rhs*(*EcuacionNoLineal*) = 0))

$$\textcolor{blue}{Prueba3} := 0 = 0 \quad (22)$$

>