

> restart

> Ecua := y'' + y' + y = 0

$$Ecua := \frac{d^2}{dx^2} y(x) + \frac{d}{dx} y(x) + y(x) = 0 \quad (1)$$

> EcuaCarac := m<sup>2</sup> + m + 1 = 0

$$EcuaCarac := m^2 + m + 1 = 0 \quad (2)$$

> Raiz := solve(EcuaCarac)

$$Raiz := -\frac{1}{2} + \frac{i\sqrt{3}}{2}, -\frac{1}{2} - \frac{i\sqrt{3}}{2} \quad (3)$$

> SolGralUno := y(x) = \_C1·exp(Raiz[1]·x) + \_C2·exp(Raiz[2]·x)

$$SolGralUno := y(x) = _C1 e^{\left(-\frac{1}{2} + \frac{i\sqrt{3}}{2}\right)x} + _C2 e^{\left(-\frac{1}{2} - \frac{i\sqrt{3}}{2}\right)x} \quad (4)$$

> with(linalg)

[BlockDiagonal, GramSchmidt, JordanBlock, LUdecomp, QRdecomp, Wronskian, addcol, addrow, (5)

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, vectdim, vector, wronskian]

> WW := wronskian([exp(Raiz[1]·x), exp(Raiz[2]·x)], x)

$$WW := \begin{vmatrix} e^{\left(-\frac{1}{2} + \frac{i\sqrt{3}}{2}\right)x} & e^{\left(-\frac{1}{2} - \frac{i\sqrt{3}}{2}\right)x} \\ \left(-\frac{1}{2} + \frac{i\sqrt{3}}{2}\right) e^{\left(-\frac{1}{2} + \frac{i\sqrt{3}}{2}\right)x} & \left(-\frac{1}{2} - \frac{i\sqrt{3}}{2}\right) e^{\left(-\frac{1}{2} - \frac{i\sqrt{3}}{2}\right)x} \end{vmatrix} \quad (6)$$

> Comprobar := evalf(det(WW, 3)) ≠ 0

$$Comprobar := -1.732050808 i e^{(-0.5000000000 + 0.8660254040 i) x} e^{(-0.5000000000 - 0.8660254040 i) x} \neq 0 \quad (7)$$

> yy[1] := exp(Re(Raiz[1])·x)

$$yy_1 := e^{-\frac{x}{2}} \quad (8)$$

> yy[2] := cos(Im(Raiz[1])·x)

$$yy_2 := \cos\left(\frac{\sqrt{3} x}{2}\right) \quad (9)$$

$$\begin{aligned} &> yy[3] := \sin(\operatorname{Im}(Raiz[1]) \cdot x) \\ &yy_3 := \sin\left(\frac{\sqrt{3} x}{2}\right) \end{aligned} \quad (10)$$

$$\begin{aligned} &> SolGralDos := y(x) = \_C1 \cdot yy[1] \cdot yy[2] + \_C2 \cdot yy[1] \cdot yy[3] \\ &SolGralDos := y(x) = \_C1 e^{-\frac{x}{2}} \cos\left(\frac{\sqrt{3} x}{2}\right) + \_C2 e^{-\frac{x}{2}} \sin\left(\frac{\sqrt{3} x}{2}\right) \end{aligned} \quad (11)$$

$$\begin{aligned} &> Ecua \\ &\frac{d^2}{dx^2} y(x) + \frac{d}{dx} y(x) + y(x) = 0 \end{aligned} \quad (12)$$

$$\begin{aligned} &> ComprobarDos := simplify(eval(subs(y(x) = rhs(SolGralDos), Ecua))) \\ &ComprobarDos := 0 = 0 \end{aligned} \quad (13)$$

> restart

$$\begin{aligned} &> Ecua := y'' + 9 \cdot y = 0 \\ &Ecua := \frac{d^2}{dx^2} y(x) + 9 y(x) = 0 \end{aligned} \quad (14)$$

$$\begin{aligned} &> EcuaCarac := m^2 + 9 = 0 \\ &EcuaCarac := m^2 + 9 = 0 \end{aligned} \quad (15)$$

$$\begin{aligned} &> Raiz := solve(EcuaCarac) \\ &Raiz := 3 I, -3 I \end{aligned} \quad (16)$$

$$\begin{aligned} &> yy[1] := \exp(\operatorname{Re}(Raiz[1]) \cdot x) \\ &yy_1 := 1 \end{aligned} \quad (17)$$

$$\begin{aligned} &> yy[2] := \cos(\operatorname{Im}(Raiz[1]) \cdot x) \\ &yy_2 := \cos(3 x) \end{aligned} \quad (18)$$

$$\begin{aligned} &> yy[3] := \sin(\operatorname{Im}(Raiz[1]) \cdot x) \\ &yy_3 := \sin(3 x) \end{aligned} \quad (19)$$

$$\begin{aligned} &> SolGral := y(x) = \_C1 \cdot yy[1] \cdot yy[2] + \_C2 \cdot yy[1] \cdot yy[3] \\ &SolGral := y(x) = \_C1 \cos(3 x) + \_C2 \sin(3 x) \end{aligned} \quad (20)$$

$$\begin{aligned} &> ComprobarUno := simplify(eval(subs(y(x) = rhs(SolGral), Ecua))) \\ &ComprobarUno := 0 = 0 \end{aligned} \quad (21)$$

> with(linalg) :

$$\begin{aligned} &> WW := wronskian([yy[2], yy[3]], x) \\ &WW := \begin{bmatrix} \cos(3 x) & \sin(3 x) \\ -3 \sin(3 x) & 3 \cos(3 x) \end{bmatrix} \end{aligned} \quad (22)$$

$$\begin{aligned} &> ComprobarDos := simplify(det(WW)) \neq 0 \\ &ComprobarDos := 3 \neq 0 \end{aligned} \quad (23)$$

> restart

$$\begin{aligned} &> Ecua := y'' - 4 \cdot y' + 4 y = 0 \end{aligned} \quad (24)$$

$$Ecua := \frac{d^2}{dx^2} y(x) - 4 \frac{d}{dx} y(x) + 4 y(x) = 0 \quad (24)$$

$$> EcuaCarac := m^2 - 4 \cdot m + 4 = 0$$

$$EcuaCarac := m^2 - 4 m + 4 = 0 \quad (25)$$

$$> Raiz := solve(EcuaCarac)$$

$$Raiz := 2, 2 \quad (26)$$

$$> yy[1] := \exp(Raiz[1] \cdot x)$$

$$yy_1 := e^{2x} \quad (27)$$

$$> yy[2] := x \cdot \exp(Raiz[1] \cdot x)$$

$$yy_2 := x e^{2x} \quad (28)$$

$$> with(linalg) :$$

$$> WW := wronskian([yy[1], yy[2]], x)$$

$$WW := \begin{bmatrix} e^{2x} & x e^{2x} \\ 2 e^{2x} & e^{2x} + 2 x e^{2x} \end{bmatrix} \quad (29)$$

$$> ComprobarUno := simplify(det(WW)) \neq 0$$

$$ComprobarUno := e^{4x} \neq 0 \quad (30)$$

$$> SolGral := y(x) = \_C1 \cdot yy[1] + \_C2 \cdot yy[2]$$

$$SolGral := y(x) = \_C1 e^{2x} + \_C2 x e^{2x} \quad (31)$$

$$> Ecua$$

$$\frac{d^2}{dx^2} y(x) - 4 \frac{d}{dx} y(x) + 4 y(x) = 0 \quad (32)$$

$$> comprobarDos := simplify(eval(subs(y(x) = rhs(SolGral), Ecua)))$$

$$comprobarDos := 0 = 0 \quad (33)$$

$$> restart$$

$$> Ecua := y'''' - 12 \cdot y''' + 54 \cdot y'' - 108 \cdot y' + 81 \cdot y = 0$$

$$Ecua := \frac{d^4}{dx^4} y(x) - 12 \frac{d^3}{dx^3} y(x) + 54 \frac{d^2}{dx^2} y(x) - 108 \frac{d}{dx} y(x) + 81 y(x) = 0 \quad (34)$$

$$> SolGral := y(x) = \exp(3 \cdot x) \cdot (\_C1 + \_C2 \cdot x + \_C3 \cdot x^2 + \_C4 \cdot x^3)$$

$$SolGral := y(x) = e^{3x} (\_C4 x^3 + \_C3 x^2 + \_C2 x + \_C1) \quad (35)$$

$$> Comprobar := simplify(eval(subs(y(x) = rhs(SolGral), Ecua)))$$

$$Comprobar := 0 = 0 \quad (36)$$

$$>$$

$$> restart$$

$$> Ecua := 4 \cdot y' = 4 + \sec(x - y)$$

$$Ecua := 4 \frac{d}{dx} y(x) = 4 + \sec(x - y(x)) \quad (37)$$

$$> EcuaDos := isolate(eval(subs(y(x) = x - v(x), Ecua)), diff(v(x), x))$$

$$EcuaDos := \frac{d}{dx} v(x) = -\frac{\sec(v(x))}{4} \quad (38)$$

> N := 4

$$N := 4 \quad (39)$$

> M := sec(v)

$$M := \sec(v) \quad (40)$$

> P := 1; Q := sec(v); R := 4; S := 1

$$P := 1$$

$$Q := \sec(v)$$

$$R := 4$$

$$S := 1$$

(41)

> Sol := int( $\frac{P}{R}, x$ ) + int( $\frac{S}{Q}, v$ ) = \_CI

$$Sol := \frac{x}{4} + \sin(v) = \_CI \quad (42)$$

> SolGral := subs(v = x - y(x), Sol)

$$SolGral := \frac{x}{4} + \sin(x - y(x)) = \_CI \quad (43)$$

> DerSolGral := simplify(isolate(diff(SolGral, x), diff(y(x), x)))

$$DerSolGral := \frac{d}{dx} y(x) = 1 + \frac{\sec(x - y(x))}{4} \quad (44)$$

> DerEcua := isolate(Ecua, diff(y(x), x))

$$DerEcua := \frac{d}{dx} y(x) = 1 + \frac{\sec(x - y(x))}{4} \quad (45)$$

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