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> restart
> Sistema := diff(x(t), t) = 3·x(t) + 4·y(t), diff(y(t), t) = 2·x(t) + 5·y(t) : Sistema1; Sistema2

$$\begin{aligned}\frac{d}{dt} x(t) &= 3 x(t) + 4 y(t) \\ \frac{d}{dt} y(t) &= 2 x(t) + 5 y(t)\end{aligned}\tag{1}$$

> Var := isolate(Sistema1, y(t))

$$Var := y(t) = \frac{1}{4} \frac{d}{dt} x(t) - \frac{3}{4} x(t)\tag{2}$$

> Ecua := eval(subs(y(t) = rhs(Var), Sistema2))

$$Ecua := \frac{1}{4} \frac{d^2}{dt^2} x(t) - \frac{3}{4} \frac{d}{dt} x(t) = -\frac{7}{4} x(t) + \frac{5}{4} \frac{d}{dt} x(t)\tag{3}$$

> Ecuacion := lhs(Ecua)·4 - rhs(Ecua)·4 = 0

$$Ecuacion := \frac{d^2}{dt^2} x(t) - 8 \left( \frac{d}{dt} x(t) \right) + 7 x(t) = 0\tag{4}$$

> EcuaCarac := m·2 - 8·m + 7 = 0

$$EcuaCarac := m^2 - 8 m + 7 = 0\tag{5}$$

> Raiz := solve(EcuaCarac)

$$Raiz := 7, 1\tag{6}$$

> SolucionX := x(t) = C1·exp(Raiz1·t) + C2·exp(Raiz2·t)

$$SolucionX := x(t) = C_1 e^{7t} + C_2 e^t\tag{7}$$

> SolucionY := eval(subs(x(t) = rhs(SolucionX), Var))

$$SolucionY := y(t) = C_1 e^{7t} - \frac{1}{2} C_2 e^t\tag{8}$$

> Comprobacion1 := eval(subs(x(t) = rhs(SolucionX), y(t) = rhs(SolucionY), lhs(Sistema1) - rhs(Sistema1) = 0))

$$Comprobacion_1 := 0 = 0\tag{9}$$

> Comprobacion2 := eval(subs(x(t) = rhs(SolucionX), y(t) = rhs(SolucionY), lhs(Sistema2) - rhs(Sistema2) = 0))

$$Comprobacion_2 := 0 = 0\tag{10}$$

> SolucionGeneral := dsolve({Sistema}) : SolucionGeneral1; SolucionGeneral2

$$\begin{aligned}x(t) &= \_C1 e^{7t} + \_C2 e^t \\ y(t) &= \_C1 e^{7t} - \frac{1}{2} \_C2 e^t\end{aligned}\tag{11}$$

> Condiciones := x(0) = 4, y(0) = -5

$$Condiciones := x(0) = 4, y(0) = -5\tag{12}$$

> SolucionParticular := dsolve({Sistema, Condiciones}) : SolucionParticular1;
SolucionParticular2

$$x(t) = -2 e^{7t} + 6 e^t$$


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$$y(t) = -2 e^{7t} - 3 e^t \quad (13)$$

> restart

> AA := array([[3, 4], [2, 5]])

$$AA := \begin{bmatrix} 3 & 4 \\ 2 & 5 \end{bmatrix} \quad (14)$$

> Xcero := array([4, -5])

$$Xcero := \begin{bmatrix} 4 & -5 \end{bmatrix} \quad (15)$$

> with(linalg) :

> MatExp := exponential(AA, t)

$$MatExp := \begin{bmatrix} \frac{2}{3} e^t + \frac{1}{3} e^{7t} & \frac{2}{3} e^{7t} - \frac{2}{3} e^t \\ \frac{1}{3} e^{7t} - \frac{1}{3} e^t & \frac{1}{3} e^t + \frac{2}{3} e^{7t} \end{bmatrix} \quad (16)$$

> Solucion := evalm(MatExp &* Xcero)

$$Solucion := \begin{bmatrix} 6 e^t - 2 e^{7t} & -2 e^{7t} - 3 e^t \end{bmatrix} \quad (17)$$

> SolucionX := x(t) = Solucion₁; SolucionY := y(t) = Solucion₂

$$SolucionX := x(t) = 6 e^t - 2 e^{7t}$$

$$SolucionY := y(t) = -2 e^{7t} - 3 e^t \quad (18)$$

> evalm(MatExp)

$$\begin{bmatrix} \frac{2}{3} e^t + \frac{1}{3} e^{7t} & \frac{2}{3} e^{7t} - \frac{2}{3} e^t \\ \frac{1}{3} e^{7t} - \frac{1}{3} e^t & \frac{1}{3} e^t + \frac{2}{3} e^{7t} \end{bmatrix} \quad (19)$$

> MatExpInv := exponential(AA, -t)

$$MatExpInv := \begin{bmatrix} \frac{2}{3} e^{-t} + \frac{1}{3} e^{-7t} & \frac{2}{3} e^{-7t} - \frac{2}{3} e^{-t} \\ \frac{1}{3} e^{-7t} - \frac{1}{3} e^{-t} & \frac{1}{3} e^{-t} + \frac{2}{3} e^{-7t} \end{bmatrix} \quad (20)$$

> Ident := simplify(evalm(MatExp &* MatExpInv))

$$Ident := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad (21)$$

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

$$DerMatExp := \begin{bmatrix} \frac{2}{3} e^t + \frac{7}{3} e^{7t} & \frac{14}{3} e^{7t} - \frac{2}{3} e^t \\ \frac{7}{3} e^{7t} - \frac{1}{3} e^t & \frac{1}{3} e^t + \frac{14}{3} e^{7t} \end{bmatrix} \quad (22)$$

> ProdAA := evalm(AA &* MatExp)

$$ProdAA := \begin{bmatrix} \frac{2}{3} e^t + \frac{7}{3} e^{7t} & \frac{14}{3} e^{7t} - \frac{2}{3} e^t \\ \frac{7}{3} e^{7t} - \frac{1}{3} e^t & \frac{1}{3} e^t + \frac{14}{3} e^{7t} \end{bmatrix} \quad (23)$$

> *Cero* := evalm(*ProdAA* - *DerMatExp*)

$$Cero := \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \quad (24)$$

> *Identidad* := map(rcurry(eval, t=0'), *MatExp*)

$$Identidad := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad (25)$$

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