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> restart
> SistEcua := diff(x[1](t), t) = 2·x[1](t) + 3·x[2](t), diff(x[2](t), t) = x[1](t) + 4·x[2](t) :
    SistEcua[1]; SistEcua[2]

$$\frac{d}{dt} x_1(t) = 2 x_1(t) + 3 x_2(t)$$


$$\frac{d}{dt} x_2(t) = x_1(t) + 4 x_2(t) \quad (1)$$

> CondIni := x[1](0) = 5, x[2](0) = -3
    CondIni := x_1(0) = 5, x_2(0) = -3 \quad (2)
> SistSol := dsolve( {SistEcua}, {x[1](t), x[2](t)} ) : SistSol[1]; SistSol[2]

$$x_1(t) = \_C1 e^{5t} + \_C2 e^t$$


$$x_2(t) = \_C1 e^{5t} - \frac{1}{3} \_C2 e^t \quad (3)$$

> ComprobUno := eval(subs(x[1](t) = rhs(SistSol[1]), x[2](t) = rhs(SistSol[2]),
    lhs(SistEcua[1]) - rhs(SistEcua[1]) = 0))
    ComprobUno := 0 = 0 \quad (4)
> ComprobDos := eval(subs(x[1](t) = rhs(SistSol[1]), x[2](t) = rhs(SistSol[2]),
    lhs(SistEcua[2]) - rhs(SistEcua[2]) = 0))
    ComprobDos := 0 = 0 \quad (5)
> SistSolPart := dsolve( {SistEcua, CondIni}, {x[1](t), x[2](t)} ) : SistSolPart[1]; SistSolPart[2]

$$x_1(t) = -e^{5t} + 6 e^t$$


$$x_2(t) = -e^{5t} - 2 e^t \quad (6)$$

> restart
> Ecua := diff(y(t), t$3) - 6·diff(y(t), t$2) + 4·diff(y(t), t) - 3·y(t) = 0

$$Ecua := \frac{d^3}{dt^3} y(t) - 6 \left( \frac{d^2}{dt^2} y(t) \right) + 4 \left( \frac{d}{dt} y(t) \right) - 3 y(t) = 0 \quad (7)$$

> SolGral := dsolve(Ecua) : evalf(% , 2)

$$y(t) = \_C1 e^{5.4t} - 1. \_C2 e^{0.30t} \sin(0.67 t) + \_C3 e^{0.30t} \cos(0.67 t) \quad (8)$$

> SistEcua := diff(y[1](t), t) = y[2](t), diff(y[2](t), t) = y[3](t), diff(y[3](t), t) = 3·y[1](t)
    - 4·y[2](t) + 6·y[3](t) : SistEcua[1]; SistEcua[2]; SistEcua[3]

$$\frac{d}{dt} y_1(t) = y_2(t)$$


$$\frac{d}{dt} y_2(t) = y_3(t)$$


$$\frac{d}{dt} y_3(t) = 3 y_1(t) - 4 y_2(t) + 6 y_3(t) \quad (9)$$

> SistSolGral := dsolve( {SistEcua} ) :
>
> simplify(evalf(SistSolGral[1], 2)); simplify(evalf(SistSolGral[2], 2));
    simplify(evalf(SistSolGral[3], 2))

$$y_1(t) = 0.504 e^{0.30t} \_C3 \cos(0.70 t) + 1.152 e^{0.30t} \_C3 \sin(0.70 t) - 0.504 e^{0.30t} \_C2 \sin(0.70 t)$$


$$+ 1.152 e^{0.30t} \_C2 \cos(0.70 t) + 0.26 \_C1 e^{5.4t}$$


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$$\begin{aligned}
y_2(t) &= -\_C2 \sin(0.67 t) e^{0.30 t} + \_C3 \cos(0.67 t) e^{0.30 t} + \_C1 e^{5.4 t} \\
y_3(t) &= 5.2 \_C1 e^{5.4 t} - 0.30 \_C2 e^{0.30 t} \sin(0.63 t) - 0.67 \_C2 e^{0.30 t} \cos(0.63 t) \\
&\quad + 0.30 \_C3 e^{0.30 t} \cos(0.63 t) - 0.67 \_C3 e^{0.30 t} \sin(0.63 t)
\end{aligned} \tag{10}$$

> restart

> AA := array([ [1, 2], [-2, 1] ])

$$AA := \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix} \tag{11}$$

> with(linalg) :

> MatExp := exponential(AA, t)

$$MatExp := \begin{bmatrix} e^t \cos(2 t) & e^t \sin(2 t) \\ -e^t \sin(2 t) & e^t \cos(2 t) \end{bmatrix} \tag{12}$$

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

$$DerMatExp := \begin{bmatrix} e^t \cos(2 t) - 2 e^t \sin(2 t) & e^t \sin(2 t) + 2 e^t \cos(2 t) \\ -e^t \sin(2 t) - 2 e^t \cos(2 t) & e^t \cos(2 t) - 2 e^t \sin(2 t) \end{bmatrix} \tag{13}$$

> AAporMatExp := evalm(AA &\* MatExp)

$$AAporMatExp := \begin{bmatrix} e^t \cos(2 t) - 2 e^t \sin(2 t) & e^t \sin(2 t) + 2 e^t \cos(2 t) \\ -e^t \sin(2 t) - 2 e^t \cos(2 t) & e^t \cos(2 t) - 2 e^t \sin(2 t) \end{bmatrix} \tag{14}$$

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

$$Identidad := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \tag{15}$$

> InversaMatExp := map(rcurry(eval, t=-t'), MatExp)

$$InversaMatExp := \begin{bmatrix} e^{-t} \cos(2 t) & -e^{-t} \sin(2 t) \\ e^{-t} \sin(2 t) & e^{-t} \cos(2 t) \end{bmatrix} \tag{16}$$

> IdentidadDos := simplify(evalm(MatExp &\* InversaMatExp))

$$IdentidadDos := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \tag{17}$$

> Sist := diff(x[1](t), t) = x[1](t) + 2·x[2](t), diff(x[2](t), t) = -2·x[1](t) + x[2](t) :  
Sist[1]; Sist[2]

$$\begin{aligned}
\frac{d}{dt} x_1(t) &= x_1(t) + 2 x_2(t) \\
\frac{d}{dt} x_2(t) &= -2 x_1(t) + x_2(t)
\end{aligned} \tag{18}$$

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

$$CondIni := x_1(0) = 4, x_2(0) = -2 \tag{19}$$

> Sol := dsolve({Sist, CondIni}) : Sol[1]; Sol[2];

$$\begin{aligned} x_1(t) &= e^t (4 \cos(2t) - 2 \sin(2t)) \\ x_2(t) &= e^t (-2 \cos(2t) - 4 \sin(2t)) \end{aligned} \quad (20)$$

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> Xcero := array([4,-2])
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$$Xcero := \begin{bmatrix} 4 & -2 \end{bmatrix} \quad (21)$$

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> SolPart := evalm(MatExp &* Xcero) : SolPart[1]; SolPart[2]
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$$\begin{aligned} &4 e^t \cos(2t) - 2 e^t \sin(2t) \\ &-4 e^t \sin(2t) - 2 e^t \cos(2t) \end{aligned} \quad (22)$$

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>
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