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> restart :
> AA := array([ [2, 3], [1, 4] ]);
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$$AA := \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \quad (1)$$

```
> with(linalg) :
> MatrizExponencial := exponential(AA, t);
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$$MatrizExponencial := \begin{bmatrix} \frac{3}{4} e^t + \frac{1}{4} e^{5t} & \frac{3}{4} e^{5t} - \frac{3}{4} e^t \\ \frac{1}{4} e^{5t} - \frac{1}{4} e^t & \frac{1}{4} e^t + \frac{3}{4} e^{5t} \end{bmatrix} \quad (2)$$

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> Inversa := exponential(AA, -t);
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$$Inversa := \begin{bmatrix} \frac{3}{4} e^{-t} + \frac{1}{4} e^{-5t} & \frac{3}{4} e^{-5t} - \frac{3}{4} e^{-t} \\ \frac{1}{4} e^{-5t} - \frac{1}{4} e^{-t} & \frac{1}{4} e^{-t} + \frac{3}{4} e^{-5t} \end{bmatrix} \quad (3)$$

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> Identidad := simplify(evalm( MatrizExponencial &* Inversa ));
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$$Identidad := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad (4)$$

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> Identidad2 := map(rcurry(eval, t='0'), MatrizExponencial);
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$$Identidad2 := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad (5)$$

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> Derivada := map(diff, MatrizExponencial, t);
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$$Derivada := \begin{bmatrix} \frac{3}{4} e^t + \frac{5}{4} e^{5t} & \frac{15}{4} e^{5t} - \frac{3}{4} e^t \\ \frac{5}{4} e^{5t} - \frac{1}{4} e^t & \frac{1}{4} e^t + \frac{15}{4} e^{5t} \end{bmatrix} \quad (6)$$

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> Producto := evalm( AA &* MatrizExponencial );
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$$Producto := \begin{bmatrix} \frac{3}{4} e^t + \frac{5}{4} e^{5t} & \frac{15}{4} e^{5t} - \frac{3}{4} e^t \\ \frac{5}{4} e^{5t} - \frac{1}{4} e^t & \frac{1}{4} e^t + \frac{15}{4} e^{5t} \end{bmatrix} \quad (7)$$

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> Comprobacion := evalm( Derivada - Producto )
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$$Comprobacion := \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \quad (8)$$

```
> MatrizOriginal := map(rcurry(eval, t='0'), Derivada);
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$$MatrizOriginal := \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \quad (9)$$

$$\begin{aligned} &> Xcero := array([C1, C2]); \\ &Xcero := \begin{bmatrix} C1 & C2 \end{bmatrix} \end{aligned} \quad (10)$$

$$\begin{aligned} &> SolucionGeneral := evalm(MatrizExponencial \&* Xcero) : Solucion_1 := x_1(t) \\ &= SolucionGeneral_1; \\ &Solucion_1 := x_1(t) = \left(\frac{3}{4} e^t + \frac{1}{4} e^{5t} \right) C1 + \left(\frac{3}{4} e^{5t} - \frac{3}{4} e^t \right) C2 \end{aligned} \quad (11)$$

$$\begin{aligned} &> Solucion_2 := x_2(t) = SolucionGeneral_2; \\ &Solucion_2 := x_2(t) = \left(\frac{1}{4} e^{5t} - \frac{1}{4} e^t \right) C1 + \left(\frac{1}{4} e^t + \frac{3}{4} e^{5t} \right) C2 \end{aligned} \quad (12)$$

$$\begin{aligned} &> sistema := diff(x_1(t), t) = 2 \cdot x_1(t) + 3 \cdot x_2(t), diff(x_2(t), t) = x_1(t) + 4 \cdot x_2(t) : sistema_1; \\ &sistema_2; \\ &\frac{d}{dt} x_1(t) = 2 x_1(t) + 3 x_2(t) \\ &\frac{d}{dt} x_2(t) = x_1(t) + 4 x_2(t) \end{aligned} \quad (13)$$

$$\begin{aligned} &> SolGral := dsolve(\{sistema\}) : SolGral_1; SolGral_2; \\ &x_1(t) = _C1 e^t + _C2 e^{5t} \\ &x_2(t) = -\frac{1}{3} _C1 e^t + _C2 e^{5t} \end{aligned} \quad (14)$$

$$\begin{aligned} &> Xinicial := array([4, -5]); \\ &Xinicial := \begin{bmatrix} 4 & -5 \end{bmatrix} \end{aligned} \quad (15)$$

$$\begin{aligned} &> SolucionParticular := evalm(MatrizExponencial \&* Xinicial) : Sol_1 := x_1(t) \\ &= SolucionParticular_1; Sol_2 := x_2(t) = SolucionParticular_2; \\ &Sol_1 := x_1(t) = \frac{27}{4} e^t - \frac{11}{4} e^{5t} \\ &Sol_2 := x_2(t) = -\frac{11}{4} e^{5t} - \frac{9}{4} e^t \end{aligned} \quad (16)$$

$$\begin{aligned} &> CondicionesIniciales := x_1(0) = 4, x_2(0) = -5; \\ &CondicionesIniciales := x_1(0) = 4, x_2(0) = -5 \end{aligned} \quad (17)$$

$$\begin{aligned} &> SolPart := dsolve(\{sistema, CondicionesIniciales\}) : SolPart_1; SolPart_2; \\ &x_1(t) = \frac{27}{4} e^t - \frac{11}{4} e^{5t} \\ &x_2(t) = -\frac{11}{4} e^{5t} - \frac{9}{4} e^t \end{aligned} \quad (18)$$

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