```
> restart
> Sist := 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) :
    Sist[1]; Sist[2]
```

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

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

```
> SolGral := dsolve({Sist}) : SolGral[1]; SolGral[2]
```

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

$$x_2(t) = -\frac{1}{3}\,\_C1\, e^{t} + \_C2\, e^{5t} \tag{2}$$

```
> CondIni := x[1](0) = 4, x[2](0) = -3
```

$$CondIni := x_1(0) = 4,\ x_2(0) = -3 \tag{3}$$

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

$$x_1(t) = \frac{21}{4} e^{t} - \frac{5}{4} e^{5t}$$

$$x_2(t) = -\frac{7}{4} e^{t} - \frac{5}{4} e^{5t} \tag{4}$$

```
> restart
> AA := array([[2, 3], [1, 4]])
```

$$AA := \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \tag{5}$$

```
> with(linalg) :
> MatExp := exponential(AA, t)
```

$$MatExp := \begin{bmatrix} \frac{3}{4} e^{t} + \frac{1}{4} e^{5t} & \frac{3}{4} e^{5t} - \frac{3}{4} e^{t} \\ \frac{1}{4} e^{5t} - \frac{1}{4} e^{t} & \frac{1}{4} e^{t} + \frac{3}{4} e^{5t} \end{bmatrix} \tag{6}$$

```
> BB := array([4, -3])
```

$$BB := \begin{bmatrix} 4 & -3 \end{bmatrix} \tag{7}$$

```
> XX := array([x[1](t), x[2](t)])
```

$$XX := \begin{bmatrix} x_1(t) & x_2(t) \end{bmatrix} \tag{8}$$

```
> SolPart := evalm(MatExp &* BB) : x[1](t) = Sol[1]; x[2](t) = Sol[2];
```

$$x_1(t) = \frac{21}{4} e^{t} - \frac{5}{4} e^{5t}$$

$$x_2(t) = -\frac{5}{4} e^{5t} - \frac{7}{4} e^{t} \tag{9}$$

```
> BBB := array([_C1, _C2])
```

$$BBB := \begin{bmatrix} \_C1 & \_C2 \end{bmatrix} \tag{10}$$

```
> SolGral := evalm(MatExp &* BBB) : x[1](t) = SolGral[1]; x[2](t) = SolGral[2]
```

$$x_1(t) = \left(\frac{3}{4}\,e^{t} + \frac{1}{4}\,e^{5t}\right)\_C1 + \left(\frac{3}{4}\,e^{5t} - \frac{3}{4}\,e^{t}\right)\_C2$$

$$x_2(t) = \left(\frac{1}{4}\,e^{5t} - \frac{1}{4}\,e^{t}\right)\_C1 + \left(\frac{1}{4}\,e^{t} + \frac{3}{4}\,e^{5t}\right)\_C2 \quad (11)$$

> evalm(MatExp)

$$\begin{bmatrix} \frac{3}{4}\,e^{t} + \frac{1}{4}\,e^{5t} & \frac{3}{4}\,e^{5t} - \frac{3}{4}\,e^{t} \\ \frac{1}{4}\,e^{5t} - \frac{1}{4}\,e^{t} & \frac{1}{4}\,e^{t} + \frac{3}{4}\,e^{5t} \end{bmatrix} \quad (12)$$

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

$$Identidad := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad (13)$$

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

$$DerMatExp := \begin{bmatrix} \frac{3}{4}\,e^{t} + \frac{5}{4}\,e^{5t} & \frac{15}{4}\,e^{5t} - \frac{3}{4}\,e^{t} \\ \frac{5}{4}\,e^{5t} - \frac{1}{4}\,e^{t} & \frac{1}{4}\,e^{t} + \frac{15}{4}\,e^{5t} \end{bmatrix} \quad (14)$$

> AAporMatExp := evalm(AA &* MatExp)

$$AAporMatExp := \begin{bmatrix} \frac{3}{4}\,e^{t} + \frac{5}{4}\,e^{5t} & \frac{15}{4}\,e^{5t} - \frac{3}{4}\,e^{t} \\ \frac{5}{4}\,e^{5t} - \frac{1}{4}\,e^{t} & \frac{1}{4}\,e^{t} + \frac{15}{4}\,e^{5t} \end{bmatrix} \quad (15)$$

> Comprobar := evalm(DerMatExp - AAporMatExp)

$$Comprobar := \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \quad (16)$$

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

$$InvMatExp := \begin{bmatrix} \frac{3}{4}\,e^{-t} + \frac{1}{4}\,e^{-5t} & \frac{3}{4}\,e^{-5t} - \frac{3}{4}\,e^{-t} \\ \frac{1}{4}\,e^{-5t} - \frac{1}{4}\,e^{-t} & \frac{1}{4}\,e^{-t} + \frac{3}{4}\,e^{-5t} \end{bmatrix} \quad (17)$$

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

$$Ident := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad (18)$$

>

>

> restart

> AA := array([[0, 1, 0], [0, 0, 1], [6, -3, 4]])

$$AA := \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 6 & -3 & 4 \end{bmatrix} \quad (19)$$

```
> BB := array([1,-2,3])
```

$$BB := \begin{bmatrix} 1 & -2 & 3 \end{bmatrix} \quad (20)$$

```
> with(linalg):
> MatExp := exponential(AA, t): evalf(MatExp[1, 1], 2)
```

$$0.12\,e^{3.6\,t} + 0.45\,e^{0.13\,t}\cos(1.3\,t) + 0.39\,e^{0.13\,t}\cos(-1.3\,t) + 0.24\,e^{0.13\,t}\sin(-1.3\,t) - 0.23\,e^{0.13\,t}\sin(1.3\,t) + 1.\,I\,(0.49\,e^{0.13\,t}\sin(1.3\,t) + 0.46\,e^{0.13\,t}\sin(-1.3\,t) - 0.23\,e^{0.13\,t}\cos(-1.3\,t) + 0.21\,e^{0.13\,t}\cos(1.3\,t) - 0.002\,e^{3.6\,t}) \quad (21)$$

```
> Sol := evalm(MatExp &* BB): evalf(expand(subs(t=0, Sol[1])), 2); evalf(expand(subs(t
    =0, Sol[2])), 2); evalf(expand(subs(t=0, Sol[3])), 2)
```

$$\begin{bmatrix} 0.90 \\ -1.8 \\ 2.6 \end{bmatrix} \quad (22)$$

```
>
>
>
>
```