```
> restart
>
```

$$\frac{dx_1}{dt} = 4x_1 - 3x_2 + 8t^2 + 4\cos(3t)$$

$$\frac{dx_2}{dt} = 3x_1 + 5x_2 + 6e^{3t} + 4$$

```
> sistema := diff(x1(t), t) = 4·x1(t) − 3·x2(t) + 8·t··2 + 4·cos(3·t), diff(x2(t), t) = 3·x1(t)
      + 5·x2(t) + 6·exp(3·t) + 4 : sistema1; sistema2;
```

$$\frac{d}{dt}x_1(t) = 4\,x_1(t) - 3\,x_2(t) + 8\,t^2 + 4\cos(3\,t)$$

$$\frac{d}{dt}x_2(t) = 3\,x_1(t) + 5\,x_2(t) + 6\,e^{3\,t} + 4 \qquad \textbf{(1)}$$

```
> Condiciones := x1(0) = 8, x2(0) = -4;
```

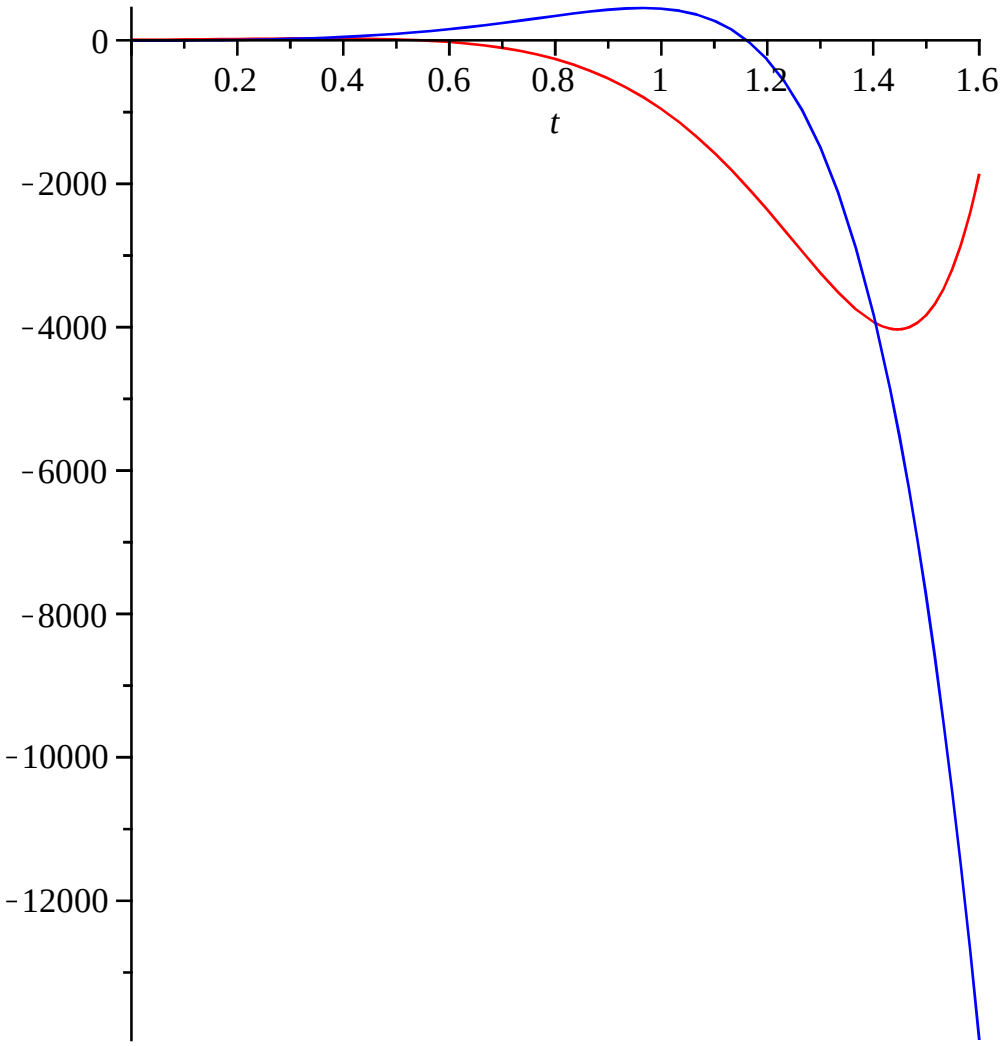
$$Condiciones := x_1(0) = 8,\ x_2(0) = -4 \qquad \textbf{(2)}$$

```
> Solucion := dsolve({sistema, Condiciones}) : evalf(Solucion1, 3); evalf(Solucion2, 3);
```

$$x_1(t) = 1.46\,e^{4.50\,t}\sin(2.96\,t) + 10.7\,e^{4.50\,t}\cos(2.96\,t) - 0.413 - 1.64\,e^{3.\,t} + 0.266\sin(3.\,t) - 0.641\cos(3.\,t) - 0.304\,t - 1.38\,t^2$$

$$x_2(t) = 10.3\,e^{4.50\,t}\sin(2.96\,t) - 3.22\,e^{4.50\,t}\cos(2.96\,t) - 0.545\,e^{3.\,t} + 0.213\cos(3.\,t) - 0.287\sin(3.\,t) - 0.449 + 0.514\,t + 0.828\,t^2 \qquad \textbf{(3)}$$

```
> plot([rhs(Solucion1), rhs(Solucion2)], t = 0..1.6, color = [red, blue])
```




```
> restart :
> AA := array( [ [4,-3], [3, 5] ])
```

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

```
> BB := array( [8·t··2 + 4·cos(3·t), 6·exp(3·t) + 4] ) : BB1; BB2;
```

$$8\,t^2 + 4\cos(3\,t)$$

$$6\,e^{3t} + 4 \quad \textbf{(5)}$$

```
> Xcero := array( [8,-4] )
```

$$Xcero := \begin{bmatrix} 8 & -4 \end{bmatrix} \quad \textbf{(6)}$$

```
> with(linalg) :
> MatrizExpo := exponential(AA, t) : MatrizExpo[1, 1];
```

$$e^{\frac{9}{2}t}\cos\left(\frac{1}{2}\,t\sqrt{35}\right) - \frac{1}{35}\sqrt{35}\,e^{\frac{9}{2}t}\sin\left(\frac{1}{2}\,t\sqrt{35}\right) \quad \textbf{(7)}$$

```
> BBtau := map(rcurry(eval, t ='tau'), BB)
```

$$BBtau := \begin{bmatrix} 8\,\tau^2 + 4\cos(3\,\tau) & 6\,e^{3\tau} + 4 \end{bmatrix} \quad \textbf{(8)}$$

```
> MatExpoTau := map(rcurry(eval, t='t - tau'), MatrizExpo):
> MatExpoTau[1, 1];
```

$$e^{\frac{9}{2}t-\frac{9}{2}\tau}\cos\left(\frac{1}{2}(t-\tau)\sqrt{35}\right)-\frac{1}{35}\sqrt{35}\,e^{\frac{9}{2}t-\frac{9}{2}\tau}\sin\left(\frac{1}{2}(t-\tau)\sqrt{35}\right) \quad (9)$$

```
> ProdMatBBtau := evalm( MatExpoTau &* BBtau):
> evalf (ProdMatBBtau[1], 2);
```

$$\left(e^{4.5t-4.5\tau}\cos(3.0t-3.0\tau)-0.17\,e^{4.5t-4.5\tau}\sin(3.0t-3.0\tau)\right)\left(8.\tau^2+4.\cos(3.\tau)\right) \quad (10)$$
$$-1.0\,e^{4.5t-4.5\tau}\sin(3.0t-3.0\tau)\left(6.e^{3.\tau}+4.\right)$$

```
> IntMatBBtau := map(int, ProdMatBBtau, tau = 0..t):
> evalf (IntMatBBtau[1], 2);
```

$$2.7\,e^{4.5t}\cos(3.0t)-1.2\,e^{4.5t}\sin(3.0t)-0.41+1.1\sin(t)\cos(t)^2-0.27\sin(t)-1.6\,e^{3.t} \quad (11)$$
$$-2.6\cos(t)^3+1.9\cos(t)-1.4\,t^2-0.30\,t$$

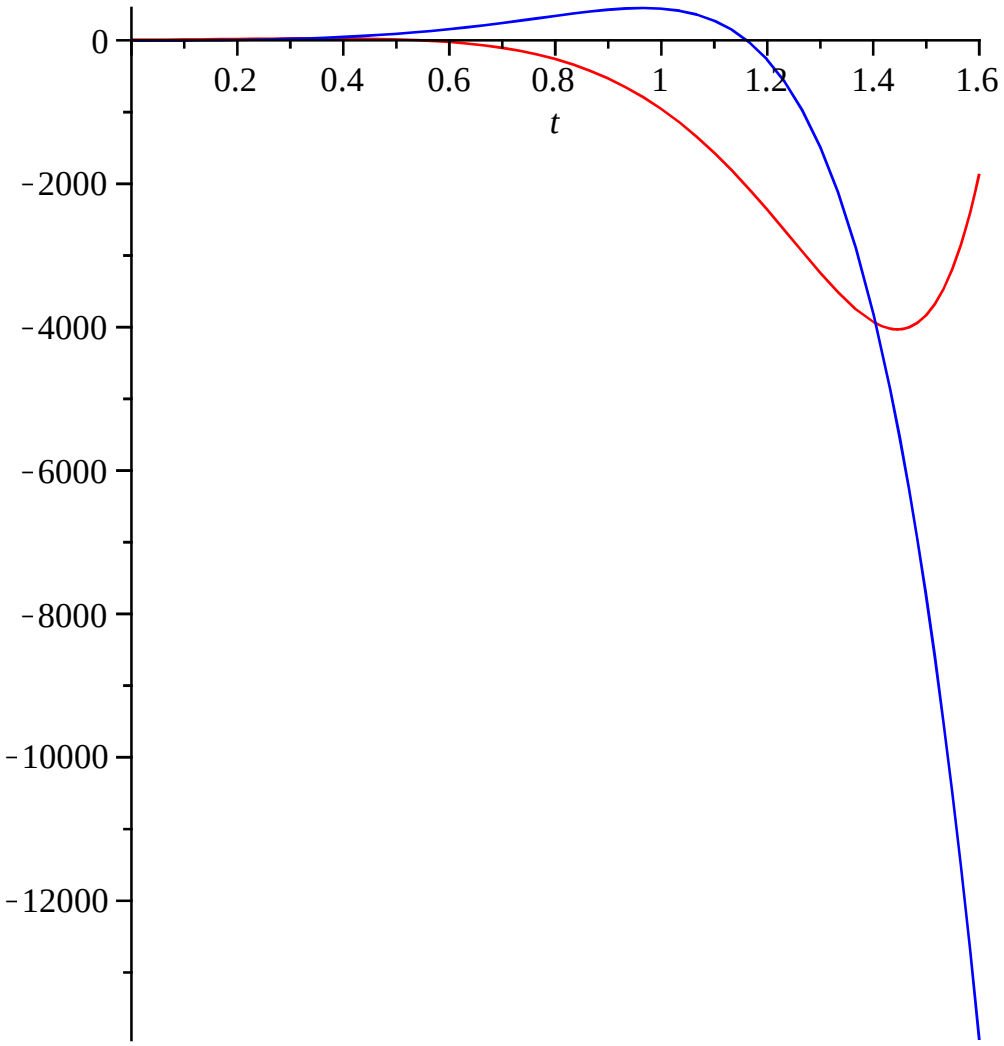
```
> Solucion := evalm(evalm(MatrizExpo &* Xcero) + IntMatBBtau):
> Sol[1] := x[1](t) = Solucion[1]: evalf (Sol[1], 3);
```

$$x_1(t)=10.7\,e^{4.50t}\cos(2.96t)+1.46\,e^{4.50t}\sin(2.96t)-0.413+1.06\sin(t)\cos(t)^2 \quad (12)$$
$$-0.266\sin(t)-1.64\,e^{3.t}-2.57\cos(t)^3+1.92\cos(t)-1.38\,t^2-0.304\,t$$

```
> Sol[2] := x[2](t) = Solucion[2]: evalf (Sol[2], 3);
```

$$x_2(t)=10.3\,e^{4.50t}\sin(2.96t)-3.22\,e^{4.50t}\cos(2.96t)-0.449-1.15\sin(t)\cos(t)^2 \quad (13)$$
$$+0.287\sin(t)-0.545\,e^{3.t}+0.850\cos(t)^3-0.638\cos(t)+0.828\,t^2+0.514\,t$$

```
> plot([rhs(Sol[1]), rhs(Sol[2])], t = 0..1.6, color = [red, blue])
```




```
> MatrizOriginal := map(rcurry(eval, t='0'), map(diff, MatrizExpo, t));
```

$$MatrizOriginal := \begin{bmatrix} 4 & -3 \\ 3 & 5 \end{bmatrix} \quad \textbf{(14)}$$

```
> InversaMatExp := map(rcurry(eval, t='-t'), MatrizExpo) :
> IdentidadaOriginal := simplify(evalm( MatrizExpo &* InversaMatExp) );
```

$$IdentidadaOriginal := \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad \textbf{(15)}$$

```
>
>
>
>
```