

> restart :

>

$$\frac{d^3 y}{dt^3} - 5 \frac{d^2 y}{dt^2} + 4 \frac{dy}{dt} - 3y = 2e^{3t} + t^2$$

$$y(0) = -2 \quad y'(0) = 4 \quad y''(0) = -6$$

> Ecuacion := diff(y(t), t\$3) - 5·diff(y(t), t\$2) + 4·diff(y(t), t) - 3·y(t) = 2·exp(3·t) + t·2;

$$\text{Ecuacion} := \frac{d^3}{dt^3} y(t) - 5 \left( \frac{d^2}{dt^2} y(t) \right) + 4 \left( \frac{d}{dt} y(t) \right) - 3 y(t) = 2 e^{3t} + t^2 \quad (1)$$

> Condiciones := y(0) = -2, D(y)(0) = 4, D(D(y))(0) = -6;

$$\text{Condiciones} := y(0) = -2, D(y)(0) = 4, D^{(2)}(y)(0) = -6 \quad (2)$$

> AA := array([ [0, 1, 0], [0, 0, 1], [3, -4, 5] ]);

$$AA := \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 3 & -4 & 5 \end{bmatrix} \quad (3)$$

> Ycero := array([ -2, 4, -6 ])

$$Ycero := \begin{bmatrix} -2 & 4 & -6 \end{bmatrix} \quad (4)$$

> BB := array([ 0, 0, 2·exp(3·t) + t·2 ]);

$$BB := \begin{bmatrix} 0 & 0 & 2 e^{3t} + t^2 \end{bmatrix} \quad (5)$$

> with(linalg) :

> MatExp := simplify(exponential(AA, t)) :

> evalf(MatExp[1, 1], 2);

$$0.026 e^{4.2t} - 0.72 e^{0.32t} \sin(0.80 t) + 0.88 e^{0.32t} \cos(0.80 t) \quad (6)$$

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

> evalf(MatExpTau[1, 1], 2);

$$0.026 e^{4.2t - 4.2\tau} - 0.72 e^{0.32t - 0.32\tau} \sin(0.80 t - 0.80 \tau) + 0.88 e^{0.32t - 0.32\tau} \cos(0.80 t - 0.80 \tau) \quad (7)$$

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

$$BBtau := \begin{bmatrix} 0 & 0 & 2 e^{3\tau} + \tau^2 \end{bmatrix} \quad (8)$$

> Prod := evalm(MatExpTau &\* BBtau) :

> evalf(Prod[1, 2], 2);

$$-0.0012 \left( 280. e^{0.32t - 0.32\tau} \sin(0.80 t - 0.80 \tau) + 58. e^{0.32t - 0.32\tau} \cos(0.80 t - 0.80 \tau) - 58. e^{4.2t - 4.2\tau} \right) (2. e^{3\tau} + \tau^2) \quad (9)$$

```
> IntProdTau := map(int, Prod, tau = 0 .. t) :
> evalf(IntProdTau_1, 2);
```

$$\begin{aligned} & -0.20 t - 0.074 t^2 - 0.028 + 0.34 e^{0.32 t} \sin(1.4 t) \cos(0.69 t) \\ & - 0.31 e^{0.32 t} \cos(1.4 t) \sin(0.69 t) + 0.028 e^{4.2 t} - 0.049 e^{3. t} \\ & + 0.042 e^{0.32 t} \sin(1.4 t) \sin(0.69 t) + 0.044 e^{0.32 t} \cos(1.4 t) \cos(0.69 t) \end{aligned} \quad (10)$$

```
> SolHom := evalm( MatExp &* Ycero) :
```

```
> evalf(SolHom_1, 2);
```

$$-0.65 e^{4.2 t} + 9.0 e^{0.32 t} \sin(0.80 t) - 1.2 e^{0.32 t} \cos(0.80 t) \quad (11)$$

```
> Incognita := array([y_1(t), y_2(t), y_3(t)])
```

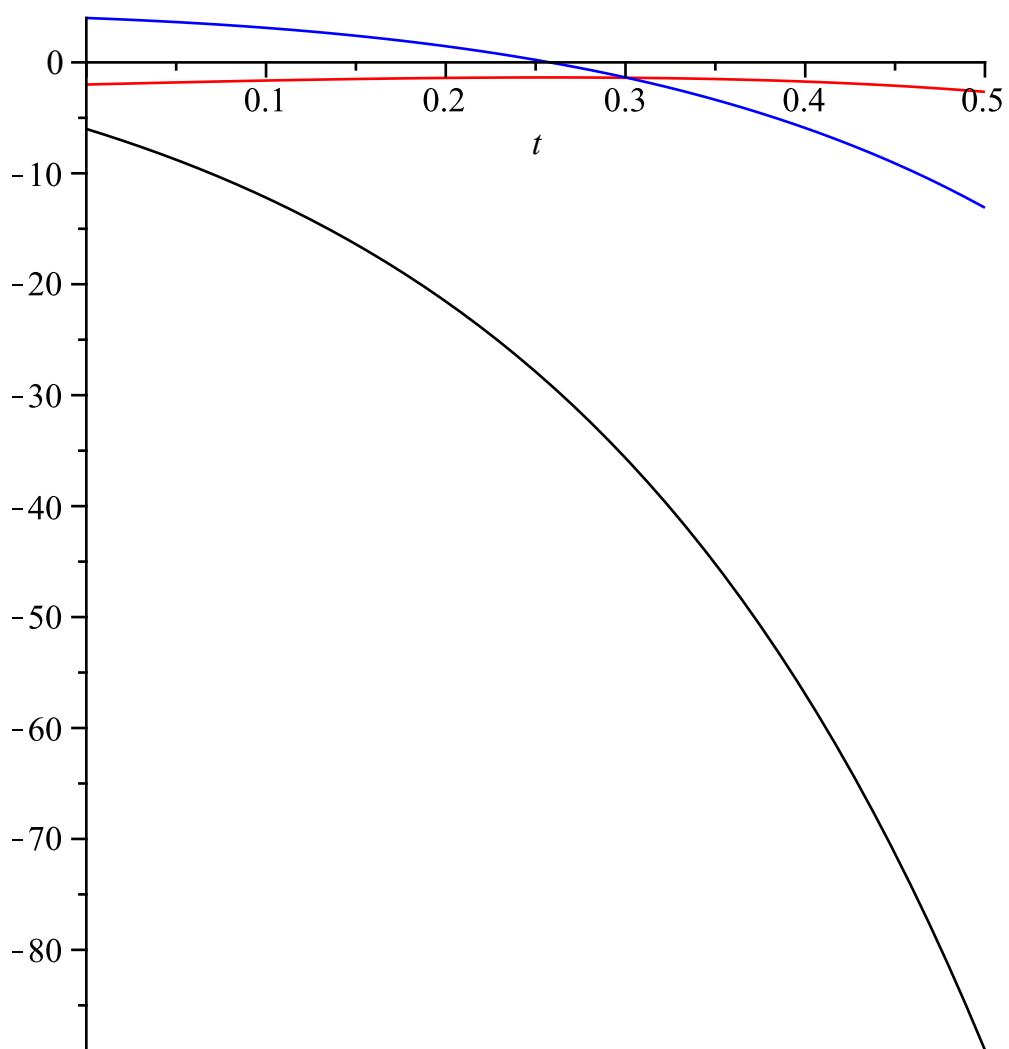
$$Incognita := \begin{bmatrix} y_1(t) & y_2(t) & y_3(t) \end{bmatrix} \quad (12)$$

```
> SolucionFinal := evalm(SolHom + IntProdTau) :
```

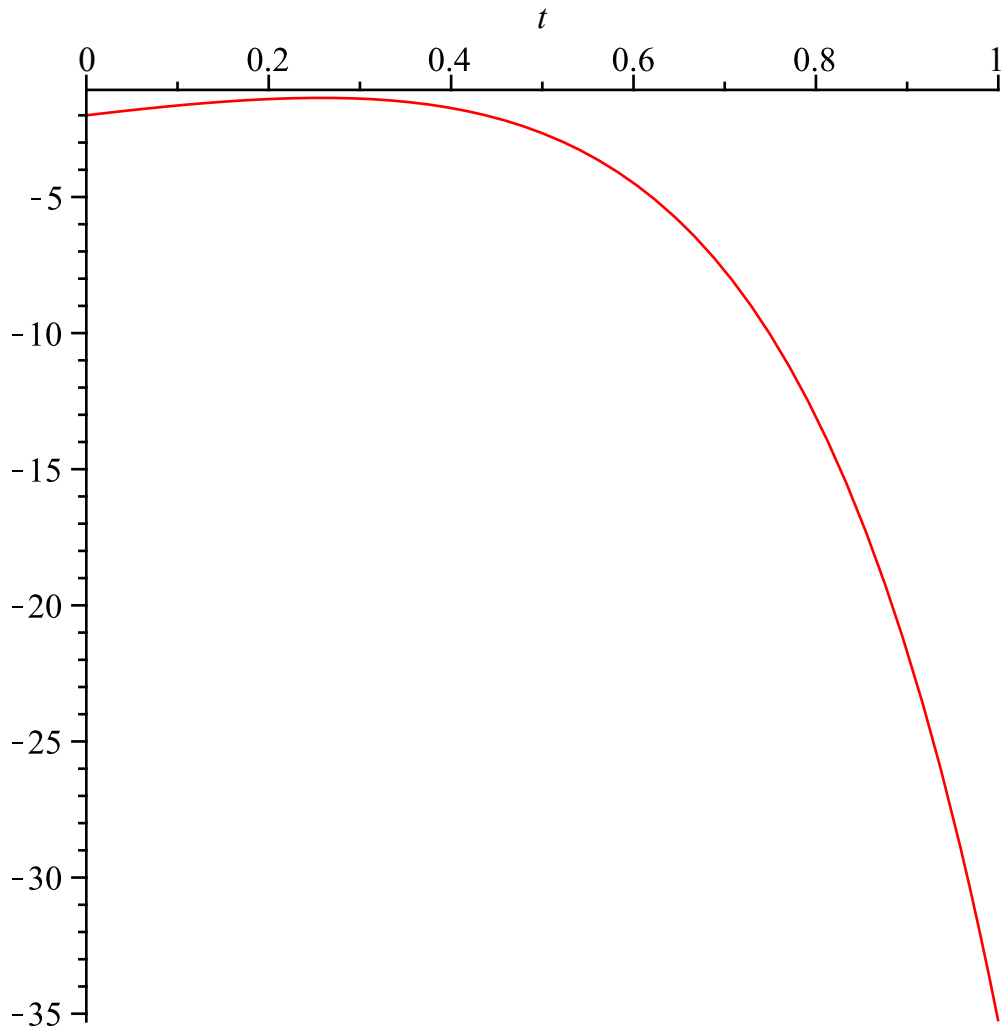
```
> evalf(SolucionFinal_1, 2);
```

$$\begin{aligned} & -0.62 e^{4.2 t} + 9.0 e^{0.32 t} \sin(0.80 t) - 1.2 e^{0.32 t} \cos(0.80 t) - 0.20 t - 0.074 t^2 - 0.028 \\ & + 0.34 e^{0.32 t} \sin(1.4 t) \cos(0.69 t) - 0.31 e^{0.32 t} \cos(1.4 t) \sin(0.69 t) - 0.049 e^{3. t} \\ & + 0.042 e^{0.32 t} \sin(1.4 t) \sin(0.69 t) + 0.044 e^{0.32 t} \cos(1.4 t) \cos(0.69 t) \end{aligned} \quad (13)$$

```
> plot([SolucionFinal_1, SolucionFinal_2, SolucionFinal_3], t = 0 .. 0.5, color = [red, blue, black]);
```



```
> plot(SolucionFinal1, t = 0 .. 1)
```



**>** `SolPart := dsolve( {Ecuacion, Condiciones} ) : evalf( SolPart, 2 );`

$$y(t) = -0.0060 t + 0.012 t^2 + 0.040 \left( \int_0^t (-0.00011 (-3000. \sin(0.78 \_z1) + 600. \cos(0.78 \_z1)) (2. e^{3. \_z1} + \_z1^2) e^{-0.48 \_z1} d\_z1 \right) e^{0.48 t} \cos(0.78 t) + 2.2 \left( \int_0^t 0.00011 (-3000. \cos(0.78 \_z1) - 600. \sin(0.78 \_z1)) (2. e^{3. \_z1} + \_z1^2) e^{-0.48 \_z1} d\_z1 \right) e^{0.48 t} \sin(0.78 t) - 0.0020 - 0.078 e^{3. t} - 0.76 e^{4.2 t} - 1.1 e^{0.48 t} \cos(0.78 t) + 9.9 e^{0.48 t} \sin(0.78 t) \quad (14)$$

**>** `plot(rhs(SolPart), t=0..1)`

