```
> restart
> H(s) := exp(-3 s)·(4 s + 7)/((s··2 + 3 s + 3)··2)
```

$$H(s) := \frac{e^{-3s}\,(4s+7)}{\left(s^2+3s+3\right)^2} \tag{1}$$

```
> F(s) := exp(-3 s)/(s··2 + 3 s + 3); G(s) := (4 s + 7)/(s··2 + 3 s + 3)
```

$$F(s) := \frac{e^{-3s}}{s^2+3s+3}$$

$$G(s) := \frac{4s+7}{s^2+3s+3} \tag{2}$$

```
> with(inttrans)
```

$$[addtable, fourier, fouriercos, fouriersin, hankel, hilbert, invfourier, invhilbert, invlaplace,$$
$$invmellin, laplace, mellin, savetable] \tag{3}$$

```
> f(t) := invlaplace(F(s), s, t)
```

$$f(t) := \frac{2}{3}\,\text{Heaviside}(t-3)\,\sqrt{3}\,e^{-\frac{3}{2}t+\frac{9}{2}}\,\sin\!\left(\frac{1}{2}\,\sqrt{3}\,(t-3)\right) \tag{4}$$

```
> g(t) := invlaplace(G(s), s, t)
```

$$g(t) := \frac{2}{3}\,e^{-\frac{3}{2}t}\left(6\cos\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)+\sqrt{3}\,\sin\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)\right) \tag{5}$$

```
> h(t) := expand(int(subs(t = tau, f(t))·subs(t = t - tau, g(t)), tau = 0 ..t))
```

$$h(t) := 2\,\text{Heaviside}(t-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\cos\!\left(\frac{3}{2}\,\sqrt{3}\right)\cos\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)+2\,\text{Heaviside}(t \tag{6}$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\sin\!\left(\frac{3}{2}\,\sqrt{3}\right)\sin\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)-\frac{4}{3}\,\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\sin\!\left(\frac{3}{2}\,\sqrt{3}\right)\cos\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)+\frac{4}{3}\,\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\cos\!\left(\frac{3}{2}\,\sqrt{3}\right)\sin\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)+\frac{32}{9}\,\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\sin\!\left(\frac{3}{2}\,\sqrt{3}\right)\cos\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)-\frac{32}{9}\,\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\cos\!\left(\frac{3}{2}\,\sqrt{3}\right)\sin\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)-\frac{2}{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\cos\!\left(\frac{3}{2}\,\sqrt{3}\right)\cos\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)-\frac{2}{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\sin\!\left(\frac{3}{2}\,\sqrt{3}\right)\sin\!\left(\frac{1}{2}\,\sqrt{3}\,t\right)$$

```
> hh(t) := expand(invlaplace(H(s), s, t))
```

$$hh(t) := 2\,\text{Heaviside}(t-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\cos\!\left(\frac{3}{2}\sqrt{3}\right)\cos\!\left(\frac{1}{2}\sqrt{3}\,t\right) + 2\,\text{Heaviside}(t \tag{7}$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\sin\!\left(\frac{3}{2}\sqrt{3}\right)\sin\!\left(\frac{1}{2}\sqrt{3}\,t\right) - \frac{4}{3}\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\sin\!\left(\frac{3}{2}\sqrt{3}\right)\cos\!\left(\frac{1}{2}\sqrt{3}\,t\right) + \frac{4}{3}\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\cos\!\left(\frac{3}{2}\sqrt{3}\right)\sin\!\left(\frac{1}{2}\sqrt{3}\,t\right) + \frac{32}{9}\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\sin\!\left(\frac{3}{2}\sqrt{3}\right)\cos\!\left(\frac{1}{2}\sqrt{3}\,t\right) - \frac{32}{9}\sqrt{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\cos\!\left(\frac{3}{2}\sqrt{3}\right)\sin\!\left(\frac{1}{2}\sqrt{3}\,t\right) - \frac{2}{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\cos\!\left(\frac{3}{2}\sqrt{3}\right)\cos\!\left(\frac{1}{2}\sqrt{3}\,t\right) - \frac{2}{3}\,\text{Heaviside}(t$$

$$-3)\,e^{-\frac{3}{2}t}\,e^{\frac{9}{2}}\,t\sin\!\left(\frac{3}{2}\sqrt{3}\right)\sin\!\left(\frac{1}{2}\sqrt{3}\,t\right)$$

`>` $comprobando := simplify(h(t) - hh(t)) = 0$

$$comprobando := 0 = 0 \tag{8}$$

`>` $restart$

`>` $Ecuacion := diff(z(x,y), x, y) + x \cdot \cdot 2 \cdot diff(z(x,y), x) = z(x,y)$

$$Ecuacion := \frac{\partial^2}{\partial y\,\partial x}\,z(x,y) + x^2\left(\frac{\partial}{\partial x}\,z(x,y)\right) = z(x,y) \tag{9}$$

`>` $EcuaSep := simplify(eval(subs(z(x,y) = F(x)\cdot g(y), Ecuacion)))$

$$EcuaSep := \left(\frac{d}{dx}\,F(x)\right)\left(\frac{d}{dy}\,g(y) + x^2\,g(y)\right) = F(x)\,g(y) \tag{10}$$

`>` $restart$

`>` $f(x) := \exp\!\left(-\frac{1}{2}\cdot x\right)\cdot x\cdot\cdot 2\cdot\cos(5x)$

$$f(x) := e^{-\frac{1}{2}x}\,x^2\cos(5x) \tag{11}$$

`>` $L := 2$

$$L := 2 \tag{12}$$

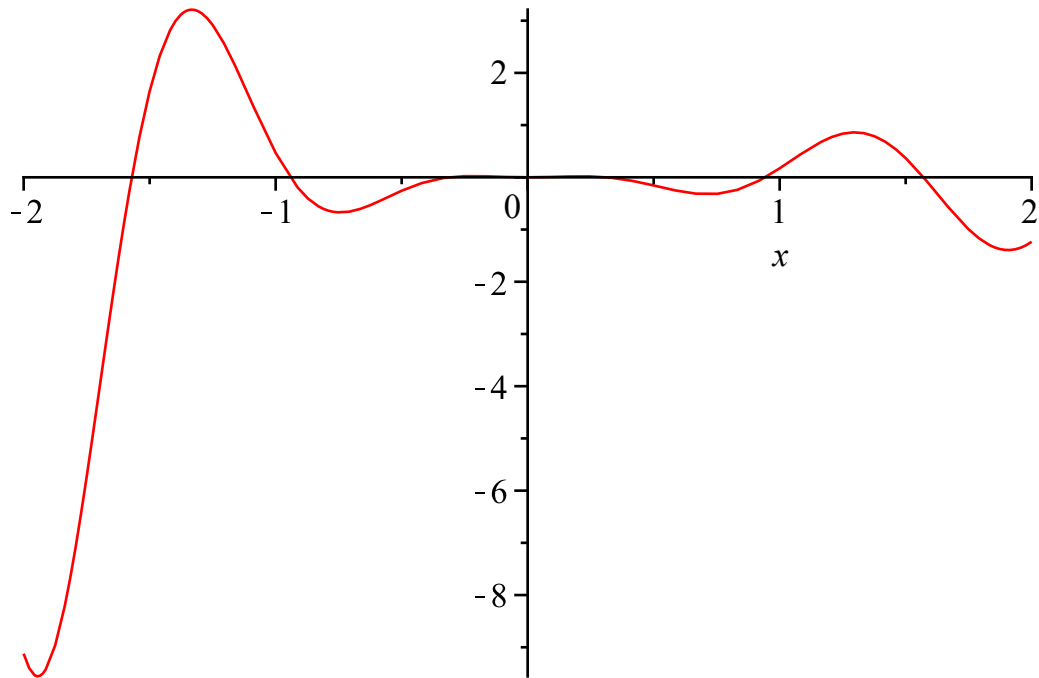`>` $a_0 := \left(\frac{1}{L}\right)\cdot int(f(x), x = -L..L):$

`>` $C := \dfrac{a_0}{2}:$

`>` $a_n := \left(\frac{1}{L}\right)\cdot int\!\left(f(x)\cdot\cos\!\left(\frac{n\cdot\text{Pi}\cdot x}{L}\right), x = -L..L\right):$

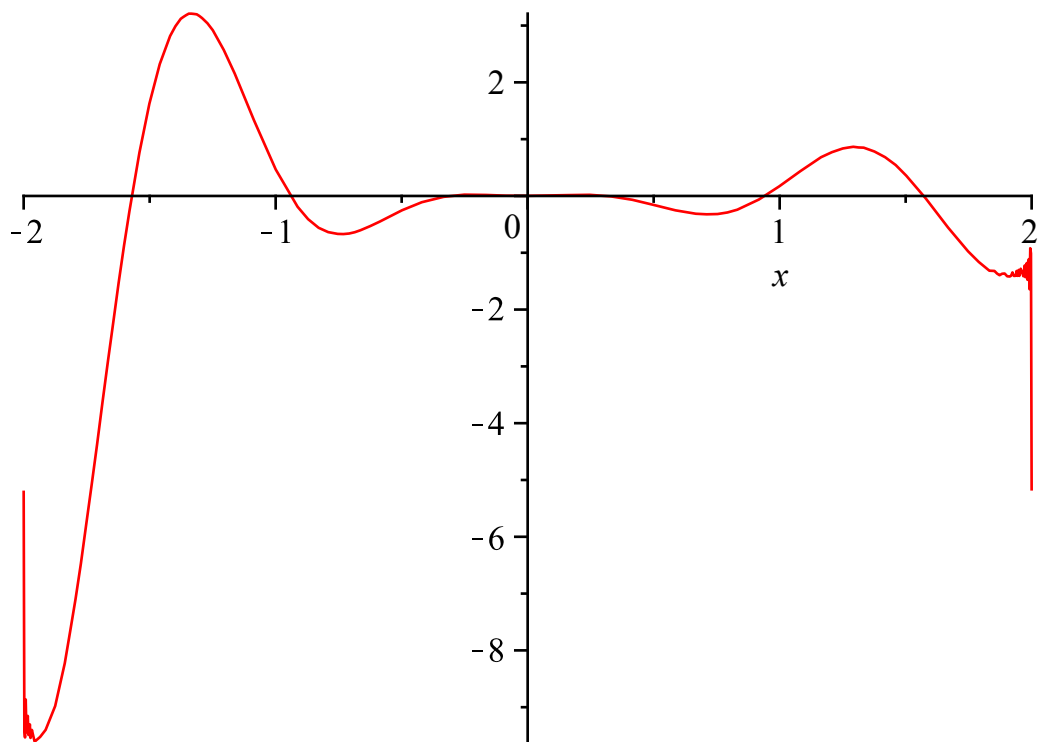`>` $b_n := \left(\frac{1}{L}\right)\cdot int\!\left(f(x)\cdot\sin\!\left(\frac{n\cdot\text{Pi}\cdot x}{L}\right), x = -L..L\right):$

> $plot(f(x), x = -L..L)$

> $STF_{500} := C + sum\left(a_n \cdot \cos\left(\dfrac{n \cdot \text{Pi} \cdot x}{L}\right) + b_n \cdot \sin\left(\dfrac{n \cdot \text{Pi} \cdot x}{L}\right), n = 1..500\right):$

> $plot\left(STF_{500}, x = -L..L\right)$

> $restart$

> $AA := array([[3, 2, -4], [0, -5, 6], [3, 4, 0]])$

(13)

$$AA := \begin{bmatrix} 3 & 2 & -4 \\ 0 & -5 & 6 \\ 3 & 4 & 0 \end{bmatrix} \tag{13}$$

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

$-0.09400000000\, e^{2.700000000\, t}\, \sin(2.400000000\, t)$ \hfill (14)

$\quad + 1.050000000\, e^{2.700000000\, t}\, \cos(2.400000000\, t) - 0.06400000000\, e^{-7.\, t}$

$\quad - 0.01200000000\, I\, e^{2.700000000\, t}\, \cos(2.400000000\, t)$

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