1) a) Sem memória, causal, linear.
b) Sem memória, causal, não-linear.
c) Com memória, causal, não-linear.
d) Com memória, não-causal, não-linear.
e) Sem memória, causal, linear.
f) Causal, com memória, linear.

2) a) $\frac{d}{dt}y(t)+\frac{1}{RC}y(t)=\frac{1}{RC}x(t)$

b) $\frac{d}{dt}y(t)+\frac{1}{RC}y(t)=\frac{1}{R}\frac{d}{dt}x(t)$

3) a) $y(t)=\frac{1}{C}\int_{-\infty}^{t}x(\tau)d\tau$

b) (i) com memória e (ii) causal.

4) $h(t)=te^{-t}\cdot 1(t)$

5)

a) $H(s)=\frac{1}{\left(s+\frac{3}{2}\right)^2}$ $h(t)=te^{-\frac{3}{2}t}\cdot 1(t)$

b) É não linear → não admite função de transferência

c) $H(s)=\frac{5s+1}{s^3+7s^2+12s+8}$

$h(t)=-1{,}553e^{-4{,}875t}+1{,}553e^{-1{,}063t}\cos(0{,}7156t)-1{,}284e^{-1{,}063t}sen(0{,}7156)$
(Calculado por Mathcad)

6)
a) $h(t)=2e^{-t}\cdot\cos(t)\cdot 1(t)$

b) $y(t)=3e^{-t}\cdot sen(t)\cdot 1(t)$

7) $\dot{y}=u$

8)
a) $H_a(s)=\frac{-5j/2}{(s-j)}+\frac{5j/2}{(s+j)}+\frac{1}{(s+1)}$

b) $H_b(s)=(s-4)+\frac{-5}{(s+2)}+\frac{20}{(s+3)}$

c) $H_c(s) = \dfrac{1/2}{(s+1)^2} + \dfrac{1/2}{(s+1)} - \dfrac{1/4}{(s+i)} - \dfrac{1/4}{(s-i)}$

d) $H_d(s) = \dfrac{1}{3} + \dfrac{0.7222 + 1.4928\,i}{(s+p_1)} + \dfrac{0.7222 - 1.4928\,i}{(s+p_2)}$

9)

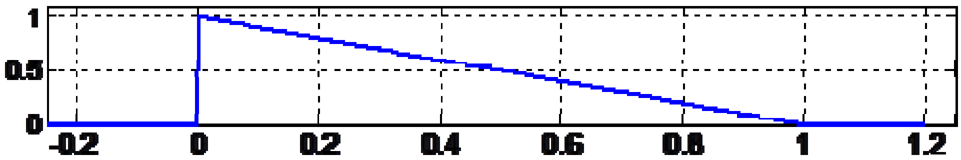
a) $h(t) = 3\delta(t) - e^{-2t}\mathbf{1}(t)$

b) $h(t) = (2 - e^{-2t})\mathbf{1}(t)$

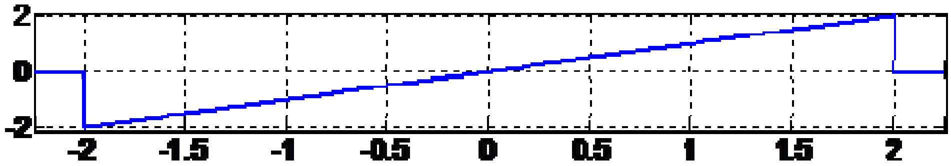
c) $h(t) = (1-t)e^{-t}\mathbf{1}(t)$

10)

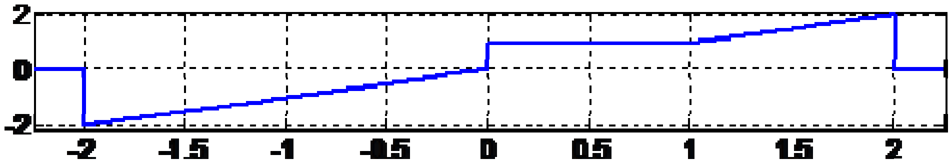
$h_1(t)$



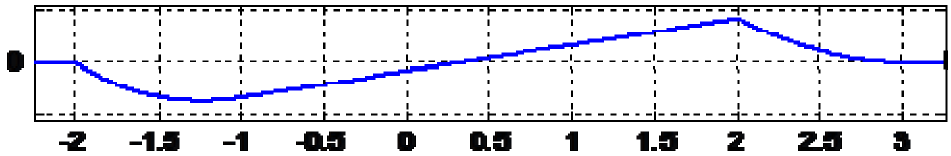
$h_2(t)$



$h_1(t) + h_2(t)$



$h_1(t) * h_2(t)$

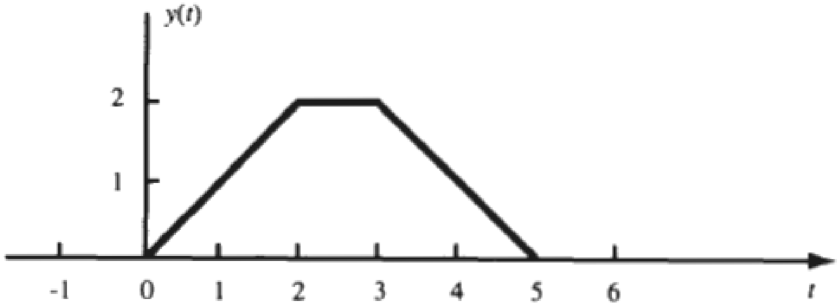


11)

a)

$$y(t) = t \cdot \mathbf{1}(t) - (t-2) \cdot \mathbf{1}(t-2) - (t-3) \cdot \mathbf{1}(t-3) + (t-5) \cdot \mathbf{1}(t-5))$$

b)

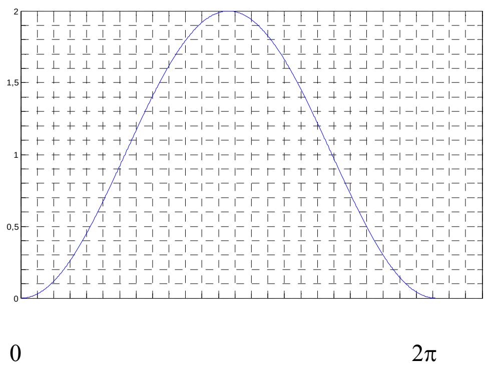


12)

a) $c(t) = 1 - \cos(t)$ para $t = [0, 2\pi]$

$c(t) = 0$ para os demais valores de *t*.

c(t)

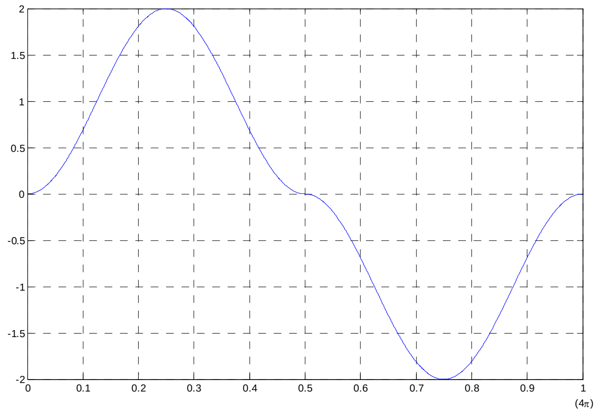


b)

$c(t) = c_o(t)$ para $t = [0, 2\pi]$

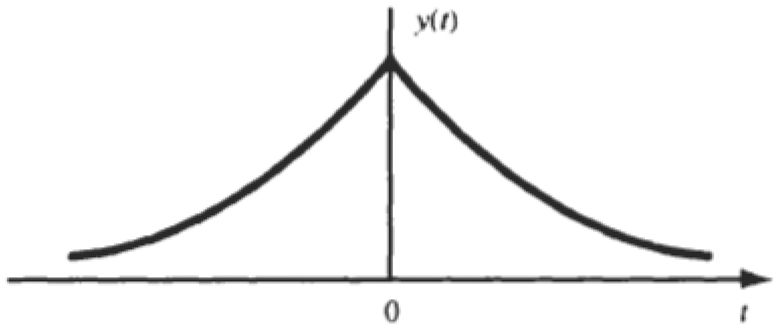
$c(t) = -c_o(t)$ para $t = [2\pi, 4\pi]$

Ou ainda $c(t) = c_o(t) - c_0(t - 2\pi)$



13)

$$y(t)=\frac{1}{2\alpha}e^{-\alpha|t|} \qquad \alpha>0$$



14) $y(t)=e^{-(t-1)}\mathbf{1}(t-1)-e^{-(t-3)}\mathbf{1}(t-3)$

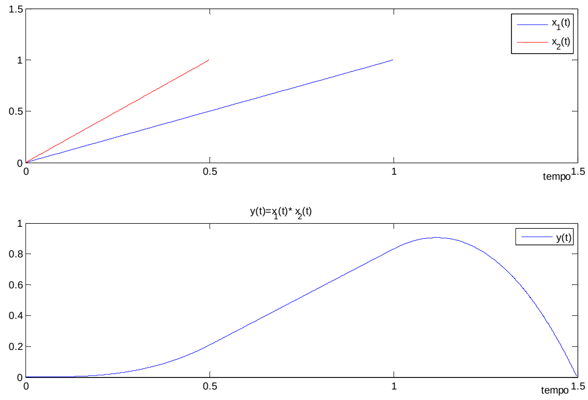
15)

a) $y(t)=\begin{cases}2a-|t| & |t|<2a\\ 0 & |t|\geq 2a\end{cases}$

b) $y(t)=\begin{cases}0 & t<0\\ \frac{1}{2}t^2 & 0<t\leq T\\ \frac{1}{2}T^2 & T<t\leq 2T\\ -\frac{1}{2}t^2+2T-\frac{5}{2}T^2 & 2T<t\leq 3T\\ 0 & 3T<t\end{cases}$

c) $y(t)=\frac{1}{3}\left[1-e^{-3(t-1)}\right]\cdot\mathbf{1}(t-1)$

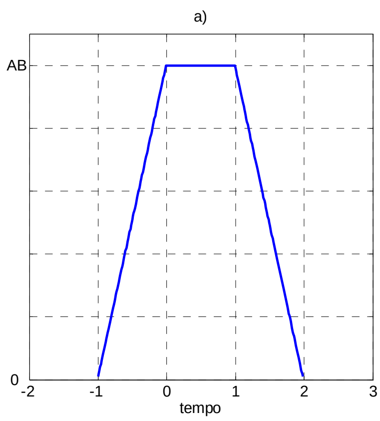
16)

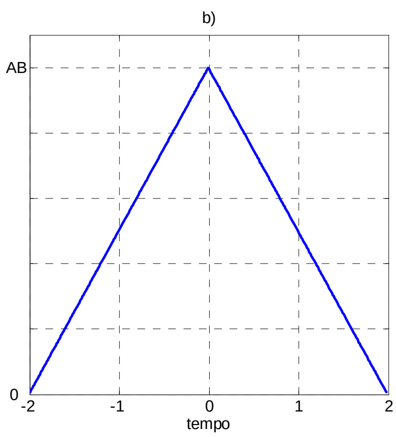


17)

a) $$y(t)=\begin{cases} AB; & t\in[0,1] \\ AB(2-t); & t\in[1,2] \\ AB(1+t); & t\in[-1,0] \end{cases}$$ e $y(t)=0$ para os demais valores de t.

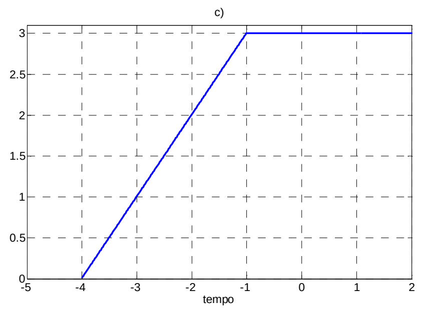
b) $$y(t)=\begin{cases} AB; & t=0 \\ AB(2-t)/2; & t\in[0,2] \\ AB(2+t)/2; & t\in[-2,0] \end{cases}$$ e $y(t)=0$ para os demais valores de t.

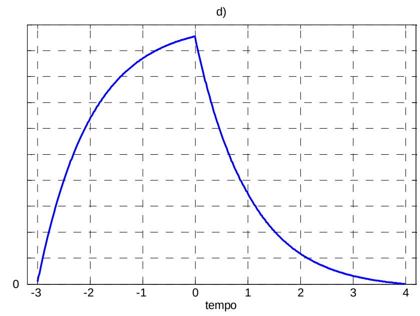




c) $$y(t)=\begin{cases} 3; & t\in[-1,\infty] \\ (4+t); & t\in[-4,-1] \end{cases}$$ e $y(t)=0$ para os demais valores de t.

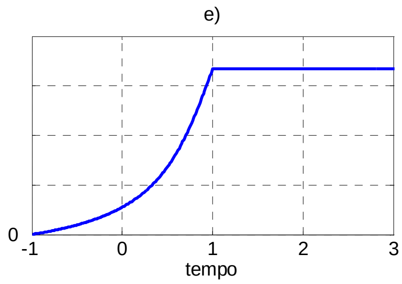
d) $$y(t)=\begin{cases} \int_{-3}^{0} e^{-(t-\tau)}d\tau=(1-e^{-3})e^{-t}; & t\in[0,\infty] \\ \int_{-3}^{t} e^{-(t-\tau)}d\tau=1-e^{-(t+3)}; & t\in[-3,0] \end{cases}$$ e $y(t)=0$ para os d.v. de t.

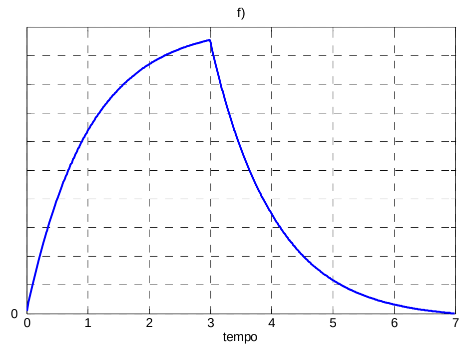




e) $y(t)=\begin{cases}\displaystyle\int_{-\infty}^{-1+t}\frac{1}{1+\tau^2}d\tau=\tan^{-1}\tau\Big|_{-\infty}^{t-1}; & t\in[0,1]\\ \displaystyle\int_{-\infty}^{0}\frac{1}{1+\tau^2}d\tau=\tan^{-1}\tau\Big|_{-\infty}^{0}; & t\in[1.\infty]\end{cases}$ $y(t)=0$ para os d.v. de t.

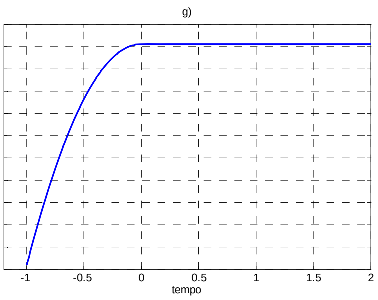
f) $y(t)=\begin{cases}\displaystyle\int_0^t e^{-(t-\tau)}d\tau=1-e^{-t}; & t\in[0,3]\\ \displaystyle\int_0^3 e^{-(t-\tau)}d\tau=e^{-t}(e^3-1); & t\in[3,\infty]\end{cases}$ $y(t)=0$ para os d.v. de t.

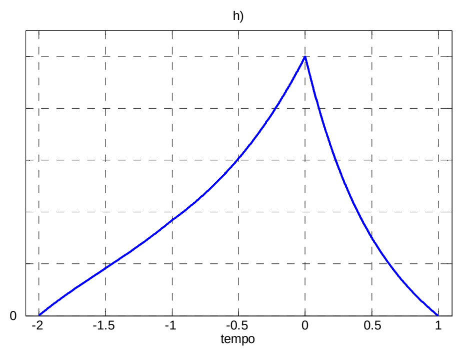




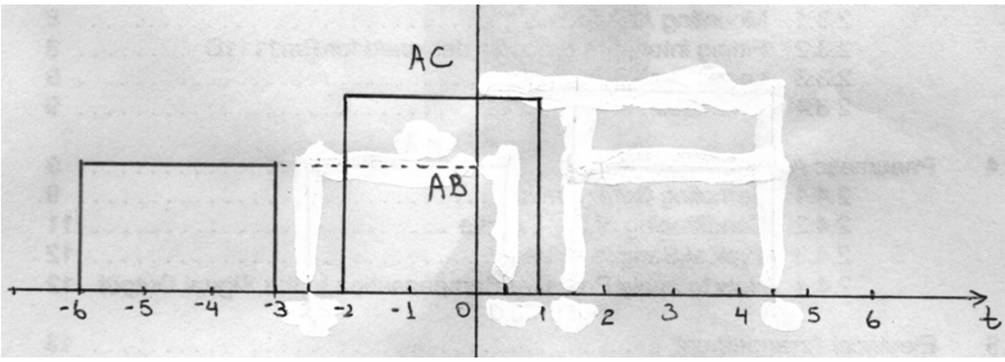
g) $y(t)=\begin{cases}\displaystyle\int_0^1 \tau\, d\tau=1/2; & t\in[0,\infty]\\ \displaystyle\int_{-t}^{1}\tau\, d\tau=(1-t^2)/2; & t\in[-1,0]\end{cases}$; $y(t)=0$ para os d.v. de t.

h) $y(t)=\begin{cases}\displaystyle\int_t^1 e^{-\tau+t}e^{-2\tau}d\tau & t\in[0,1]\\ \displaystyle\int_0^1 e^{-\tau+t}e^{-2\tau}d\tau & t\in[-1,0]\\ \displaystyle\int_0^{t+1} e^{-\tau+t}e^{-2\tau}d\tau & t\in[-2,-1]\end{cases}$; $y(t)=0$ para d.v. de t.





18)



19)

a) $h(t) = e^{-t} \cdot \mathbf{1}(t)$

b) $y(t) = \int_{-\infty}^{t} e^{-(t-\tau)} e^{s\tau} d\tau = \dfrac{1}{s+1} e^{st}$

20)

$$y(t) = \frac{1}{sT}\left(e^{\frac{sT}{2}} - e^{-\frac{sT}{2}} \right) e^{st}$$

21)

a) $y(t) = \left(e^{t}(2-t) - 2\right) e^{-3t}\mathbf{1}(t)$

b) $y(t) = (t\, e^{-t}) e^{-t}\mathbf{1}(t)$

22)

a) $(4e^{-2t} + 3e^{3t})\mathbf{1}(t)$

b) $2\delta(t) + (7e^{-t} - 13e^{-2t})\mathbf{1}(t)$

c) $(6 + 10e^{-5t}\cos(3t + 126.9^{\circ}))\mathbf{1}(t)$

d) $(2e^{-t} + (3t^{2} - 2t - 2)e^{-2t})\mathbf{1}(t)$

e) $(2e^{-t} - e^{-2t})\mathbf{1}(t) + 5(e^{-(t-2)} - e^{-2(t-2)})\mathbf{1}(t-2)$