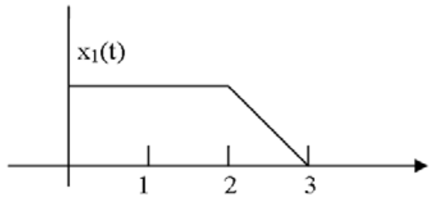
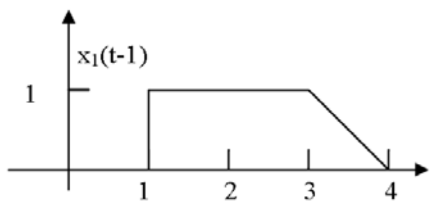
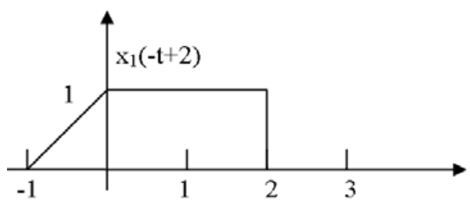
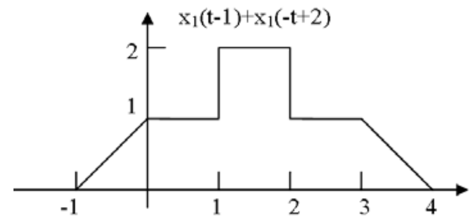
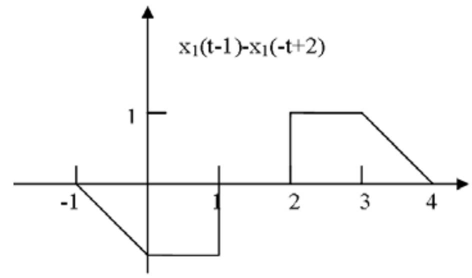
1.1

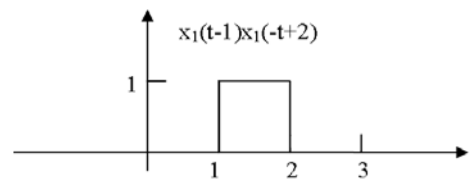












1.2

(a) x1= –u(t+2)+2u(t)-u(t-2)

(b) The triangle in [0,2] is x(t)=r(t)-r(t-2)-2u(t-2);

x2= $\sum_{k=-\infty}^{\infty} x(t-2k) = \sum_{k=-\infty}^{\infty} r(t-2k) - r\left(t-2k-2\right)$- $2u(t-2k-2)$

1.3

$x_e\left(-t\right) = \frac{x\left(-t\right)+x\left(-\left(-t\right)\right)}{2} = \frac{x\left(-t\right)+x\left(t\right)}{2} = x_e\left(t\right)$, so $x_e(t)$ is even;

$x_0\left(-t\right) = \frac{x\left(-t\right)-x\left(-\left(-t\right)\right)}{2} = -\frac{x\left(t\right)-x\left(-t\right)}{2} = -x_0\left(t\right)$, so $x_0(t)$ is odd.

1.4

a. $\int_0^9 \left[\cos \pi\tau\right]\delta(\tau-3)d\tau = \cos 3\pi = -1$

b. $\int_5^9 \left[\cos \pi\tau\right]\delta(\tau-3)d\tau = 0$

c. $\int_{-\infty}^{\infty} \left[\cos(t-\tau)\right]\delta(\tau+3)d\tau = \cos\left(t+3\right)$

d. $\int_0^{\infty} \left[\cos(t-\tau)\right]\delta(\tau+3)d\tau = 0$

e. $\int_{-\infty}^{\infty} (1+t^2)\dot{\delta}(t-1.5)dt = -\frac{d}{dt}(1+t^2)\big|_{t=1.5} = -3$

1.5

a) Nonlinear b) noncausal c) Dynamic e) Fixed

1.6

(a) $E = \int_{-\infty}^{\infty} |x(t)|^2 dt = \int_0^{\infty} e^{-2at} dt = \frac{1}{2a} < \infty$

Thus, $x(t)$ is an energy signal.

(b) x(t) is periodic → it has average power given by

$$P = \frac{1}{T_0}\int_0^{T_0}[x(t)]^2 dt = \frac{\omega_0}{2\pi}\int_0^{2\pi/\omega_0} A^2\cos^2(\omega_0 t + \theta)\, dt$$

$$= \frac{A^2\omega_0}{2\pi}\int_0^{2\pi/\omega_0}\frac{1}{2}[1 + \cos(2\omega_0 t + 2\theta)]\, dt = \frac{A^2}{2} < \infty$$

→ it is a power signal

1.7

(a) Periodic, period $= \pi$

(b) Periodic, period $= \pi$

(c) Nonperiodic

(d) Periodic, period $= 2$

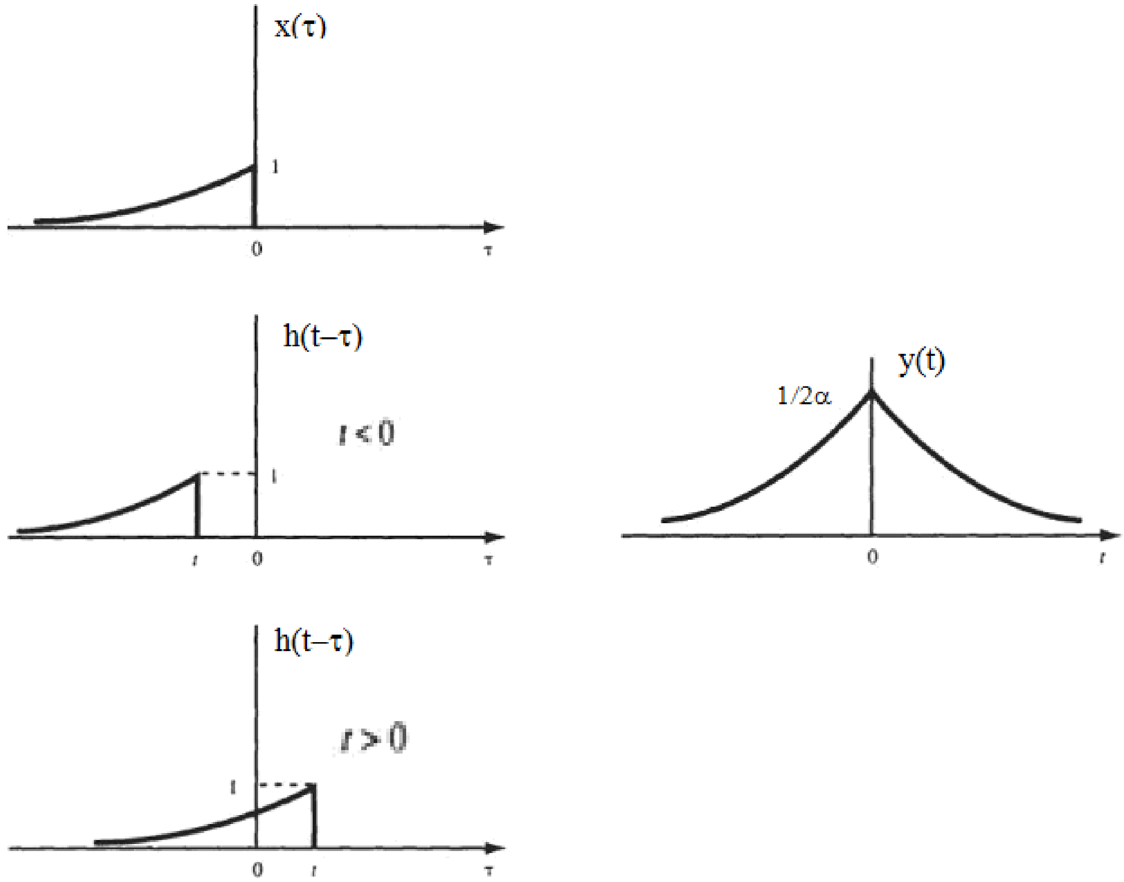
1.8

see that for $t < 0$, $x(\tau)$ and $h(t-\tau)$ overlap from $\tau = -\infty$ to $\tau = t$, while for $t > 0$, from $\tau = -\infty$ to $\tau = 0$. Hence, for $t < 0$, we have

$$y(t) = \int_{-\infty}^{t} e^{\alpha\tau} e^{-\alpha(t-\tau)}\, d\tau = e^{-\alpha t}\int_{-\infty}^{t} e^{2\alpha\tau}\, d\tau = \frac{1}{2\alpha}e^{\alpha t}$$

For $t > 0$, we have

$$y(t) = \int_{-\infty}^{0} e^{\alpha\tau} e^{-\alpha(t-\tau)}\, d\tau = e^{-\alpha t}\int_{-\infty}^{0} e^{2\alpha\tau}\, d\tau = \frac{1}{2\alpha}e^{-\alpha t}$$



x(τ)
1
0
τ
h(t−τ)
t < 0
1
t
0
τ
h(t−τ)
t > 0
1
0
t
τ
y(t)
1/2α
0
t