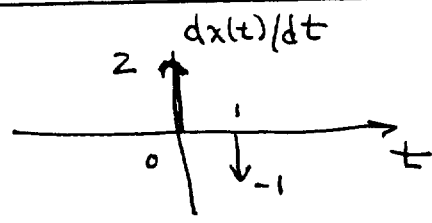
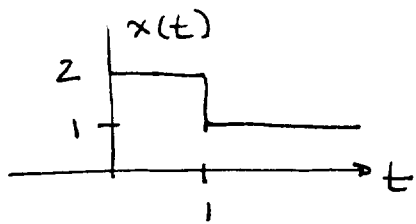
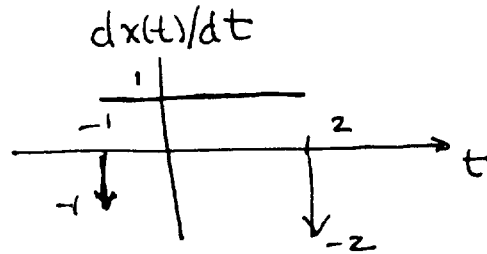
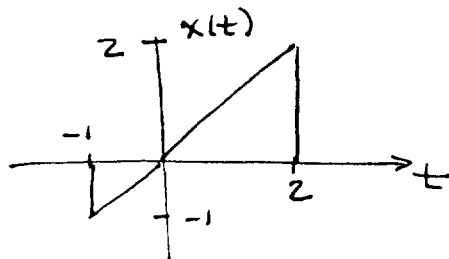


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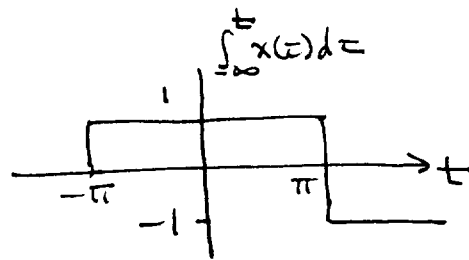
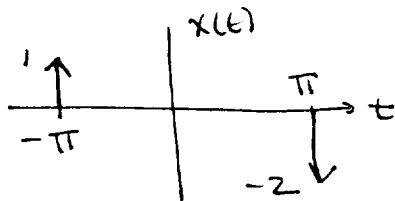
1.1 (a)



(c)



(d)



1.2

$$(b) \int_{-\infty}^t \cos(\tau) \delta(\tau) d\tau = \cos(0) \int_{-\infty}^t \delta(\tau) d\tau = u(t)$$

$$(c) \int_{-\infty}^{\infty} \cos(\tau) \delta(\tau) d\tau = \cos(0) \int_{-\infty}^{\infty} \delta(\tau) d\tau = 1$$

$$(d) \int_{-\infty}^{\infty} \cos(\tau) u(\tau-1) \delta(\tau) d\tau = \int_{-\infty}^{\infty} \cos(0) \underbrace{u(-1)}_0 \delta(\tau) d\tau = 0$$

$$(1.3) \text{ (a) let } S = \sum_{n=0}^{N-1} a^n, \quad a \neq 1$$

$$(1-a)S = \sum_{n=0}^{N-1} a^n - a \sum_{n=0}^{N-1} a^n$$

$$\left| \begin{aligned} &= \sum_{n=0}^{N-1} a^n - \sum_{m=1}^N a^m = a^0 + \sum_{m=1}^{N-1} (a^m - a^m) - a^N \\ &= 1 - a^N \end{aligned} \right.$$

$$(1-a)S = 1 - a^N$$

$$\Rightarrow S = \sum_{n=0}^{N-1} a^n = \frac{1-a^N}{1-a}$$

$$(b) \sum_{n=0}^{\infty} a^n = \lim_{N \rightarrow \infty} \sum_{n=0}^{N-1} a^n = \lim_{N \rightarrow \infty} \frac{1-a^N}{1-a} = \frac{1}{1-a}, \quad |a| < 1.$$

$$(c) x(t) = e^{-bt} \left[\sum_{k=-\infty}^{\infty} \delta(t-kT) \right] u(t+\epsilon)$$

$$\left| \begin{aligned} &= \left[\sum_{k=-\infty}^{\infty} e^{-bt} \delta(t-kT) \right] u(t+\epsilon) \\ &= \left[\sum_{k=-\infty}^{\infty} e^{-bkT} \delta(t-kT) \right] u(t+\epsilon) \end{aligned} \right.$$

$$x(t) = \sum_{k=0}^{\infty} e^{-bkT} \delta(t-kT)$$

$$\int_{-\infty}^{\infty} x(t) dt = \sum_{k=0}^{\infty} \int_{-\infty}^{\infty} e^{-bkT} \delta(t-kT) dt = \sum_{k=0}^{\infty} (e^{-bT})^k$$

$$= \frac{1}{1-e^{-bT}}$$

$$(1.4) \text{ (a) } x_o(t) = \text{Od}\{x(t)\} = \frac{1}{2} \{x(t) - x(-t)\} \text{ and } x(t) = x(t+T)$$

$$\begin{aligned} x_o(t+T) &= \frac{1}{2} \{x(t+T) - x(-t-T)\} \\ &= \frac{1}{2} \{x(t) - x(-t)\} = x_o(t) \end{aligned} \Rightarrow \text{periodic with period } T.$$

(b) $y(t) = e^{x(t)}$ and $x(t) = x(t+T)$

$$y(t+T) = e^{x(t+T)} = e^{x(t)} = y(t)$$

\Rightarrow periodic with period T .

(c) $y(t) = x(t^2)$ and $x(t) = x(t+T)$

$$y(t+T_2) = x((t+T_2)^2) = x(t^2 + 2tT_2 + T_2^2)$$

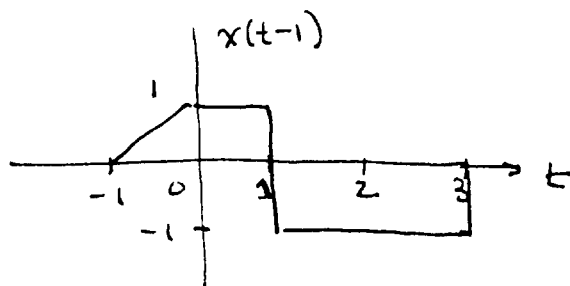
\Rightarrow Need $T = 2tT_2 + T_2^2$ which depends on t .
 \Rightarrow not periodic.

(d) $y(t) = x(2 - t/3)$ and $x(t) = x(t+T)$

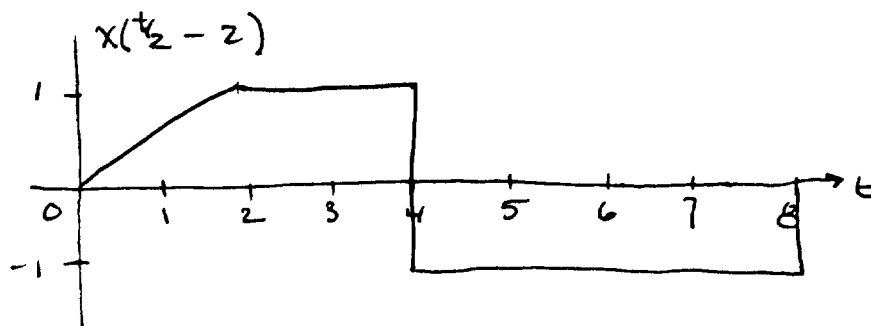
$$y(t+T_2) = x(2 - \frac{t+T_2}{3}) = x(2 - \frac{t}{3} - \frac{T_2}{3})$$

\Rightarrow Need $T = T_2/3 \Rightarrow T_2 = 3T$
 \Rightarrow periodic with period $3T$.

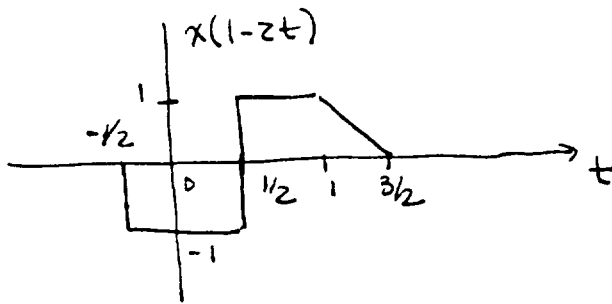
1.5 (a)



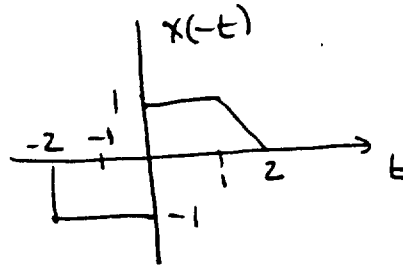
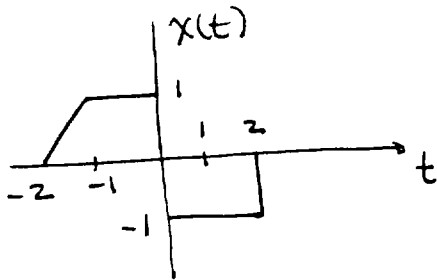
(c)



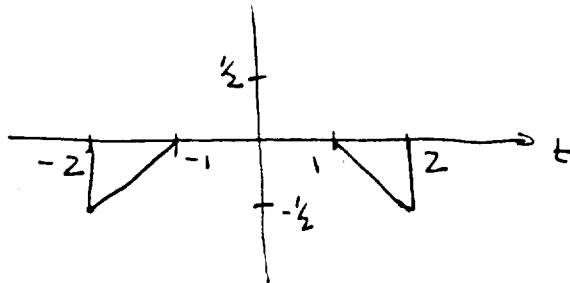
(e)



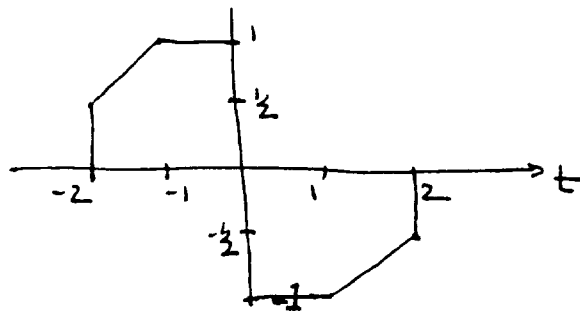
(g)



$$\text{Ev}\{x(t)\} = \frac{1}{2} \{x(t) + x(-t)\}$$



$$\text{Od}\{x(t)\} = \frac{1}{2} \{x(t) - x(-t)\}$$



Check: $\text{Ev}\{x(t)\} + \text{Od}\{x(t)\} = x(t) \quad \checkmark$