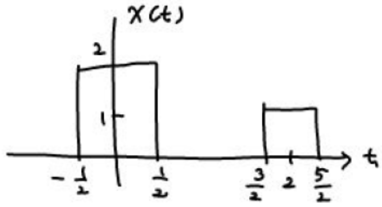
2.2 (f)

(f) $x(t) = \Pi(t) * [2\delta(t) + \delta(t-2)]$

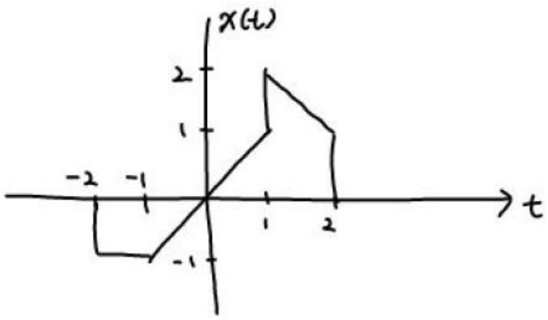
$= 2\Pi(t) + \Pi(t-2)$



2.5

2.5

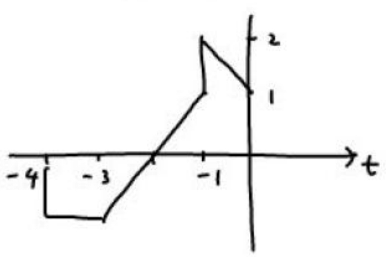
(a) $x(t) = \begin{cases} -1 & -2 \le t < -1 \\ t & -1 \le t < 1 \\ 3-t & 1 \le t < 2 \\ 0 & o/w \end{cases}$



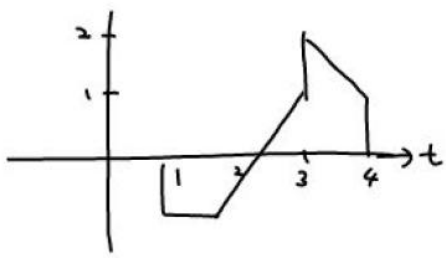
(b) $x(t) = -u(t+2) + (t+1)u(t+1) + u(t-1) - 2r(t-1)$

$+ r(t-2) - u(t-2)$

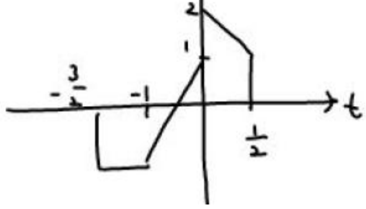
(c) i) $x(t+2)$



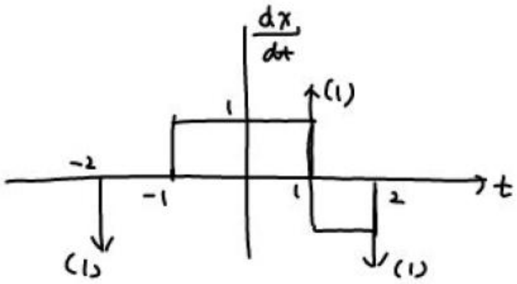
ii) $x(t-3)$



iii) $x(2t+1) = x(2(t+\frac{1}{2}))$



(d)



$$\frac{dx}{dt} = u(t+1) - 2u(t-1) + u(t-2) - \delta(t+2) + \delta(t-1) - \delta(t-2)$$

2.7 (b)

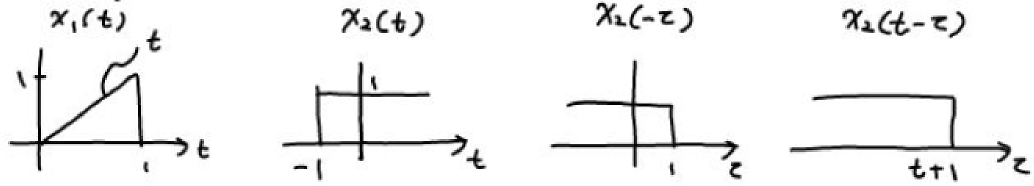
(b) $\int_{-\infty}^{\infty} (2t+1)\, \delta\left(\frac{2}{3}t - 1\right) dt$ $\qquad \delta(at+b) = \frac{1}{|a|}\delta\left(t+\frac{b}{a}\right)$

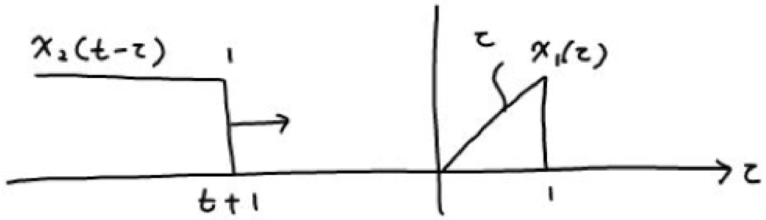
$$= \int_{-\infty}^{\infty} (2t+1) \cdot \frac{3}{2}\delta\left(t - \frac{3}{2}\right) dt$$

$$= \frac{3}{2}\left[2t+1\right]_{t=\frac{3}{2}} = \frac{3}{2} \cdot 4 = 6$$

3.3 (b)

(b) $\underbrace{t\,[u(t)-u(t-1)]}_{x_1(t)} * \underbrace{u(t+1)}_{x_2(t)}$

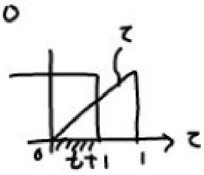




$$y(t) = \int_{-\infty}^{\infty} x_1(\tau)\, x_2(t-\tau)\, d\tau$$

i) For $t<-1$, $y(t)=0$

ii) For $-1 \le t < 0$

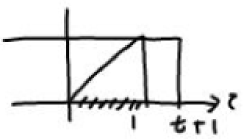


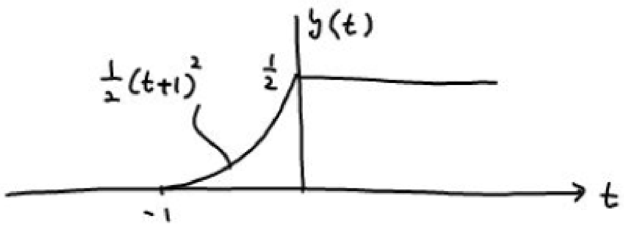
$$y(t) = \int_0^{t+1} \tau\, d\tau$$

$$= \left[\frac{\tau^2}{2}\right]_0^{t+1} = \frac{(t+1)^2}{2} \qquad \text{At } t=0^- \quad y(0^-) = \frac{1}{2}$$

iii) For $t \ge 0$

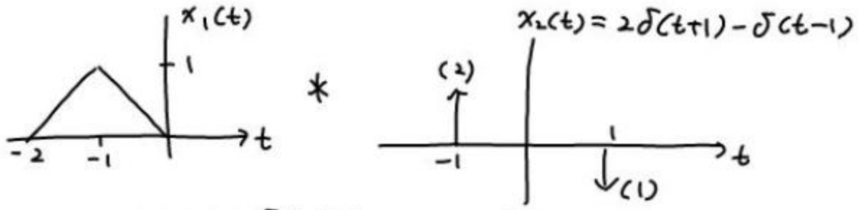
$$y(t) = \int_0^1 \tau\, d\tau = \frac{1}{2}$$





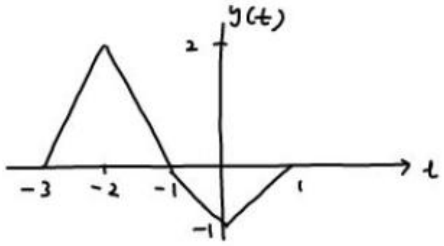
3.4 (d)

(d)



$$y(t) = x_1(t) * 2\delta(t+1) - x_1(t) * \delta(t-1)$$

$$= 2x_1(t+1) - x_1(t-1)$$



3.10

3.10

(a) $$h_e(t) = h_1(t) + h_2(t) * h_3(t)$$

$$= e^{-3t}u(t) + e^{-2t}u(t) * \delta(t-1)$$

$$= e^{-3t}u(t) + e^{-2(t-1)}u(t-1)$$

(b) $$\int_{-\infty}^{\infty} |h_e(t)|\, dt$$

$$= \int_{-\infty}^{\infty} \left| e^{-3t}u(t) + e^{-2(t-1)}u(t-1) \right| dt$$

$$\leq \int_{-\infty}^{\infty} \left|e^{-3t}u(t)\right| dt + \int_{-\infty}^{\infty} \left|e^{-2(t-1)}u(t-1)\right| dt$$

$$= \int_{0}^{\infty} e^{-3t}\, dt + \int_{1}^{\infty} e^{-2(t-1)}\, dt$$

$$= \left[-\frac{1}{3}e^{-3t}\right]_0^{\infty} + \left[-\frac{1}{2}e^{-2(t-1)}\right]_1^{\infty}$$

$$= \frac{1}{3} + \frac{1}{2} = \frac{5}{6} < \infty$$

$\Rightarrow$ BIBO stable