HW#3 Solutions

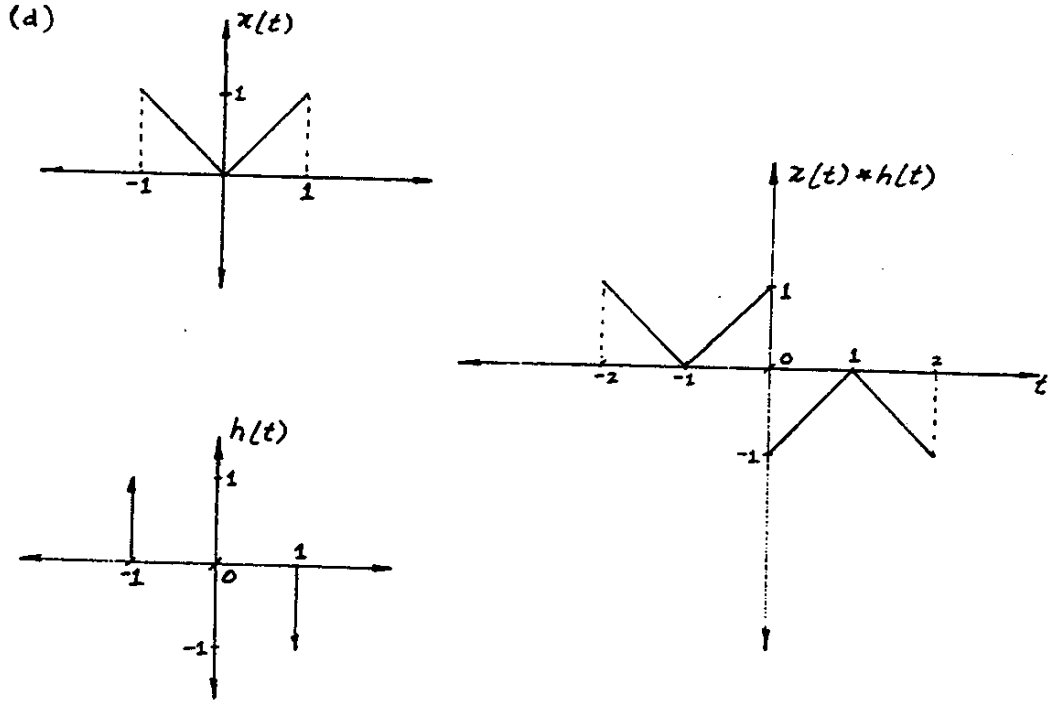
2.3 Note that $u(t+a) * u(t+b) = (t+b+a)\,u(t+b+a)$

(a) $y(t) = \begin{cases} 1 & \frac{a}{2}+b < t < \frac{3a}{2}+b \\ 0 & \text{o.w.} \end{cases} = \text{rect}\left(\frac{t-a-b}{a}\right)$

(b) $y(t) = x(t) * [\text{sgn}\, t + u(-t-1)] = x(t) * [-u(t+1) + 2u(t)]$

$= -\frac{(t+1)^2}{2} u(t+1) + t^2 u(t)$

2.4



2.10 $y(t) = x(t) * h(t)$

$$= \int_{-\infty}^{\infty} h(\tau)\, x(t-\tau)\, d\tau$$

$$= \int_{-\infty}^{\infty} h(\tau) \exp[j\omega(t-\tau)]\, d\tau$$

$$= \exp[j\omega t] \int_{-\infty}^{\infty} h(\tau) \exp[-j\omega\tau]\, d\tau$$

$$= \exp[j\omega t]\, H(\omega)$$

3.8

$$x(t) = \begin{cases} 0 & -\pi < t < -\frac{\pi}{2} \\ \cos t & -\frac{\pi}{2} < t < \frac{\pi}{2} \\ 0 & \end{cases}$$

$$c_n = \frac{1}{T} \int_{T} x(t) \exp[-jnt]\, dt$$

$$= \frac{1}{2\pi} \int_{-\pi/2}^{\pi/2} \cos t \exp[-jnt]\, dt$$

$$= \frac{1}{\pi(1-n^2)} \cos\frac{n\pi}{2} \qquad |n| \neq 1$$

for $n = \pm 1$ use L'Hospital's rule

$$c_1 = c_{-1} = \frac{1}{4}$$

3.12(a) With $k = 1$ in example 3.2.1

$C_0 = 0$ $\quad C_n = \frac{2}{jn\pi}$ $\quad n$ odd

$= 0$ $\quad n$ even

$|C_n| = \frac{2}{|n|\pi}$ $\quad n$ odd

$$\angle C_n = \begin{cases} -\pi/2 & n = 2m-1 \quad m = 1, 2 \ldots \\ 0 & n = 2m \quad m = 0, 1, 2 \ldots \\ \pi/2 & n = -(2m-1) \quad m = 1, 2 \ldots \end{cases}$$