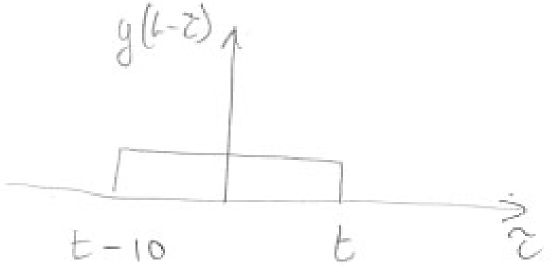
1) $y(t) = \mathrm{rect}\left(\frac{\tau-5}{10}\right)$ (1)



$$z(t) = \int_{t-10}^{t} e^{-\pi\tau^2} d\tau = \phi\left(t\sqrt{2\pi}\right) - \phi\left((t-10)\sqrt{2\pi}\right)$$

2) $$x(t) = \mathrm{triangle}\left(\frac{t-\frac{1}{2}}{\frac{1}{2}}\right)\left(\frac{e^{-j2t}e^{j\pi/6} - e^{j2t}e^{-j\frac{\pi}{6}}}{2j}\right)$$

$$= x_1(t)\left(\frac{e^{j\frac{\pi}{6}}}{2j} e^{-j2\pi\frac{1}{\pi}t} - \frac{e^{-j\frac{\pi}{6}}}{2j} e^{+j2\pi\frac{1}{\pi}t}\right)$$

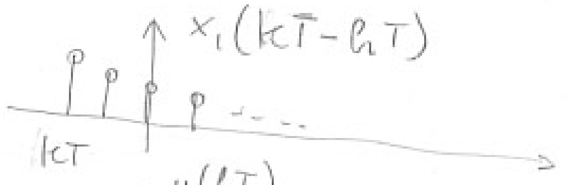
$$X_1(f) = \frac{1}{2}\,\mathrm{sinc}^2\left(\frac{f}{2}\right) e^{-j2\pi\frac{1}{2}f}$$

$$X(f) = \frac{e^{j\frac{\pi}{6}}}{2j} X_1\left(f+\frac{1}{\pi}\right) - \frac{e^{-j\frac{\pi}{6}}}{2j} X_1\left(f-\frac{1}{\pi}\right)$$

3)

$$z(kT) = x * y(kT) = x_1 * y(kT) + y(kT-2T)$$

$$x_1(kT) = (0.5)^{-k} 1_0(-kT)$$



$k \leq 0$

$$x_1 * y(kT) = T\sum_{h=0}^{+\infty}(0.5)^h (0.5)^{h-k}$$

$$= T \cdot 0.5^{-k}\sum_{h=0}^{+\infty}\left((0.5)^2\right)^h$$

$$= T \cdot 0.5^{-k} \frac{1}{1-\frac{1}{4}} = \frac{4}{3} T \cdot 0.5^{-k}$$

per $k > 0$

$$x_1 * y(kT) = T \sum_{h=k}^{+\infty} (0.5)^h (0.5)^{h-k}$$

$$= T \sum_{h=0}^{+\infty} (0.5)^{h+k} (0.5)^h$$

$$= T \cdot 0.5^k \sum_{h=0}^{+\infty} \left(\frac{1}{4}\right)^h = \frac{4}{3} T \cdot 0.5^k$$

$$x_1 * y(kT) = \frac{4}{3} T \cdot (0.5)^{|k|}$$

4)

$$P_s = \lim_{T \to +\infty} \frac{1}{2T} \cdot \int_{-T}^{T} V_0^2 \cos^2\left(2\pi f_0 t + \frac{\pi}{5}\right) dt$$

$$= \lim_{k \to +\infty} \frac{1}{2kT_p} \int_{-kT_p}^{kT_p} V_0^2 \cos^2\left(2\pi f_0 t + \frac{\pi}{5}\right) dt$$

$T_p = \frac{1}{f_0}$

$$= \lim_{k \to +\infty} \frac{1}{2kT_p} 2k \int_0^{T_p} \frac{V_0^2}{2} + \frac{V_0^2}{2} \cos\left(4\pi f_0 t + \frac{2\pi}{5}\right) dt$$

$$= \frac{V_0^2}{2}$$

5) $H_z(z) = T \dfrac{1-z^{-1}}{(1-0.2z^{-1})(1-0.4z^{-1})}$ (3)

$$= T\left(\frac{4}{1-0.2z^{-1}} + \frac{-3}{1-0.4z^{-1}}\right)$$

$$h(kT) = 4 \cdot 0.2^{k} 1_0(kT) - 3(0.4)^{k} 1_0(kT)$$