$h_1 = 1000 \quad d = 55 \quad d(h) = \sqrt{2h}$

$h_2 = ?$

1

$d = d(h_1) + d(h_2)$

$55 = \sqrt{2 \cdot 1000} + \sqrt{2h_2}$

$55 = 44.72 + \sqrt{2h_2}$

$\sqrt{2h_2} = 10.279$

$\boxed{h_2 = 52.83 ft}$

2

$\cancel{P_j = \frac{1}{2^{13}}}$

$P_1 = \frac{1}{2^{13}} \quad P_2 = \frac{3}{2^{13}}$

$\cancel{I_1 = \log_2(P_1) = -13}$

$\cancel{I_2 = \log_2(P_2) = -11.415}$

$\cancel{H = \sum_{j=1}^{m} P_j I_j = P_1 I_1 + P_2 I_2 =}$

$I_1 = \log_2\left(\frac{1}{P_1}\right) \quad I_2 = \log_2\left(\frac{1}{P_2}\right) \quad H = \sum_{j=1}^{m} P_j I_j$

$\boxed{H = \frac{2^{12}}{2} P_1 I_1 + \frac{2^{12}}{2} P_2 I_2 = 11.811}$

3

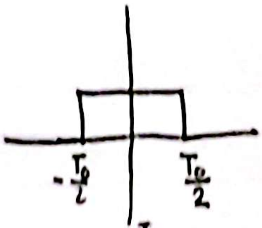
$C = B\log_2(1 + SNR)$

$SNR = 30dB = 1000$

$B = 300Hz$

$\boxed{C = 2990.2}$

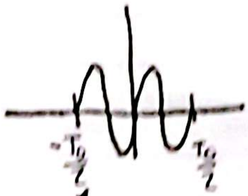
4 a) $\omega(t) = \Pi\left(\frac{t}{T_0}\right)$



energy signal

$$E\{\omega(t)\} = \int_{-\infty}^{\infty} |\omega(t)|^2 dt = \int_{-\frac{T_0}{2}}^{\frac{T_0}{2}} 1\, dt = T_0$$

b) $\omega(t) = \Pi\left(\frac{t}{T_0}\right)\cos(\omega_0 t)$



energy signal

$T_0 = 1/f_0$ $\omega_0 = 2\pi f_0$

$$E\{\omega(t)\} = \int_{-\frac{T_0}{2}}^{T_0/2} |\cos(\omega_0 t)|^2 dt = \frac{1}{2f_0}$$

c) $\omega(t) = \cos^2(\omega_0 t)$

$= \frac{\cos(2\omega_0 t) + 1}{2}$

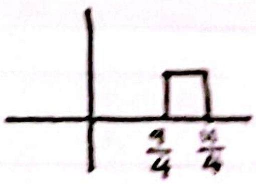
Power signal

$T_0 = \frac{2\pi}{\omega_0}$

$$P\{\omega(t)\} = \frac{1}{T_0}\int_{t_0}^{t_0+T_0} |\omega(t)|^2 dt = 0.375$$

d) $\omega(t) = \Pi(2t-5) = u(2t-5+\frac{1}{2}) - u(2t-5-\frac{1}{2})$ energy signal

$$E\{\omega(t)\} = \int_{-\infty}^{\infty} |\omega(t)|^2 dt = \int_{2.25}^{2.75} 1\, dt = 0.5$$



$$\omega(t) = \sin(2\pi f_1 t)\cos(2\pi f_2 t)$$

$$G(f) = \mathcal{F}\{\omega(t)\} = \mathcal{F}\{\sin(2\pi f_1 t)\} * \mathcal{F}\{\cos(2\pi f_2 t)\}$$

$$\mathcal{F}\{\sin(2\pi f_1 t)\} = \frac{1}{2j}[\delta(f-f_1) - \delta(f+f_1)] = G_1(f)$$

$$\mathcal{F}\{\cos(2\pi f_2 t)\} = \frac{1}{2}[\delta(f-f_2) + \delta(f+f_2)] = G_2(f)$$

$$G_1(f) * G_2(f) = \int_{-\infty}^{\infty} G_1(\tau) G_2(f-\tau)\, d\tau$$