a.) $d(x_1, x_2) = \bar{P}_{x_1 - x_2} = \lim_{T \to \infty} \frac{1}{T} \int_T |x_1(t) - x_2(t)|^2 dt$

$$x_1(t) = Ae^{j\omega_0 t} \qquad \omega_0 = \frac{2\pi}{T}$$

$$x_2(t) = Be^{j5\omega_0 t}$$

$$\frac{1}{T} \int |x_1(t) - x_2(t)|^2 dt = \frac{1}{T} \left[\int_T |x_1(t)|^2 dt - 2\int_T x_1(t) x_2(t) dt \right.$$

$$\left. + \int_T |x_2(t)|^2 dt \right] \qquad |x_1(t)|^2 = x_1(t)\, x_1^*(t)$$

$$= \bar{P}_{x_1} - \frac{2}{T} \int_T x_1(t) x_2(t) dt + \bar{P}_{x_2}$$

$$\bar{P}_{x_1} = \frac{1}{T} \int_0^T Ae^{j\omega_0 t} \cdot Ae^{-j\omega_0 t} dt$$

$$\bar{P}_{x_1} = \frac{1}{T} \int_0^T A^2 e^{\cancel{j\omega_0 t - j\omega_0 t}^{\,0}} dt$$

$$\bar{P}_{x_1} = \frac{1}{T} A^2 \int_0^T 1\, dt = \frac{1}{T} [t]_0^T = \frac{A^2}{T} [T - 0]$$

$$\bar{P}_{x_1} = \frac{A^2 \cancel{T}}{\cancel{T}} \qquad \boxed{\bar{P}_{x_1} = A^2}$$

$$\bar{P}_{x_2} = \frac{1}{T} \int_0^T B e^{j5\omega_0 t} \cdot Be^{-j5\omega_0 t} dt$$

$$\bar{P}_{x_2} = \frac{1}{T} \int_0^T B^2 e^{\cancel{j5\omega_0 t - j5\omega_0 t}^{\,1}} dt$$

$$\bar{P}_{x_2} = \frac{B^2}{T} \int_0^T 1\, dt = \bar{P}_{x_2} = \frac{B^2}{T} [t]_0^T =$$

$$\bar{P}_{x_2} = \frac{B^2}{T} [T - 0] = \frac{B^2 \cancel{T}}{\cancel{T}} \to \boxed{\bar{P}_{x_2} = B^2}$$

$$-\frac{2}{T}\int_0^T Ae^{j\omega_0 t}\,Be^{j5\omega_0 t}\,dt = -\frac{2}{T}\int_0^T AB\,e^{j\omega_0 t + j5\omega_0 t}\,dt$$

$$= -\frac{2}{T}AB\int_0^T e^{j6\omega_0 t}\,dt$$

$$= -\frac{2}{T}AB\left[\frac{e^{j6\omega_0 t}}{j6\omega_0}\right]_0^T$$

$$= -\frac{2}{T}AB\left[\frac{e^{j6\frac{2\pi}{T}T}}{j6\frac{2\pi}{T}} - \frac{\cancel{e^{j6\frac{2\pi}{T}0}}^{1}}{j6\frac{2\pi}{T}}\right]$$

$$e^{j\frac{12\pi}{T}} = \cancel{\cos(12\pi)}^{1} + j\,\cancel{\operatorname{sen}(12\pi)}^{0}$$

$$= -\frac{2}{T}AB\,\cancel{\left[\frac{1}{\frac{j12\pi}{T}} - \frac{1}{\frac{j12\pi}{T}}\right]}^{0}$$

$$-\frac{2}{T}\int_T x_1(t)x_2(t)\,dt = 0$$

$$\bar{P}_{x_1} - \frac{2}{T}\int_T x_1(t)x_2(t)\,dt + P_{x_2} = A^2 - 0 + B^2$$

$$d(x_1,x_2) = \lim_{T\to\infty} A^2 + B^2 = d(x_1,x_2) = A^2 + B^2$$

b.) $F_s = 5kHz$

$x(t) = 3\cos(1000\pi t) + 5\sin(2000\pi t) + 10\cos(11000\pi t)$

$x[t = nT_s] = 3\cos(1000\pi nT_s) + 5\sin[2000\pi nT_s] +$
$10\cos[11000\pi nT_s]$

$T_s = \frac{1}{F_s} = \frac{1}{5k}\ [s]$

$x[n] = 3\cos\left[\frac{1\cancel{000}\pi n}{5\cancel{k}}\right] + 5\sin\left[\frac{2\cancel{000}\pi n}{5\cancel{k}}\right] + 10\cos\left[\frac{11\cancel{000}\pi n}{5\cancel{k}}\right]$

$x[n] = 3\cos\left[\frac{\pi}{5}n\right] + 5\sin\left[\frac{2\pi n}{5}\right] + 10\cos\left[\frac{11\pi n}{5}\right]$

$\Omega_1 = \frac{\pi}{5}$; $\Omega_2 = \frac{2\pi}{5}$; $\Omega_3 = \frac{11\pi}{5}$

Ω_3 es una copia

$\frac{11\pi}{5} > \pi$; $-\pi \leq \Omega \leq \pi$

$\Omega_{3_{real}} = \frac{11\pi}{5} - 2\pi = \frac{\pi}{5}$

$x[n] = 3\cos\left[\frac{\pi}{5}n\right] + 5\sin\left[\frac{2\pi n}{5}\right] + 10\cos\left[\frac{\pi}{5}n\right]$

$x[n] = 13\cos\left[\frac{\pi}{5}n\right] + 5\sin\left[\frac{2\pi n}{5}\right]$

$\omega_1 = 1000\pi$; $\omega_2 = 2000\pi$; $\omega_3 = 11000\pi$

$F_1 = \frac{1000\pi}{2\pi}$; $F_2 = \frac{2000\pi}{2\pi}$; $F_3 = \frac{11000\pi}{2\pi}$

$F_1 = 500[Hz]$; $F_2 = 1000[Hz]$; $F_3 = 5500[Hz]$

$[F_s = 5kHz] \rightarrow$ No apropiada $\quad F_s \geq 2F_{max}$

F_s apropiada

$F_s = 2[5500]\ Hz$

$F_s = 11kHz$

c.) $h_c[n] = \{2, 4, 1, 5, 0, 10\} \quad n \in \mathbb{Z}$

$x(t)\ 20\cos(t/3) + \cos(t/4) \quad [A]$

$\omega_1 = \frac{1}{3} \qquad \omega_2 = \frac{1}{4}$

$\frac{\omega_1}{\omega_2} = \frac{\frac{1}{3}}{\frac{1}{4}} = \frac{4}{3} \in \mathbb{Q}$

Señal cuasiperiodica

$T_1 = \frac{2\pi}{\omega_1} = \frac{2\pi}{\frac{1}{3}} = 6\pi$

$T_2 = \frac{2\pi}{\omega_2} = \frac{2\pi}{\frac{1}{4}} = 8\pi$

$T = T_1 L = T_2 k \qquad L, k \in \mathbb{Z}$

$\frac{T}{\pi} = \frac{6\cancel{\pi}}{\cancel{\pi}} L = \frac{8\cancel{\pi} k}{\cancel{\pi}} =$

$\frac{T}{\pi} = 6L = 8k \qquad MCM(6,8) = 24$

$24\pi = T$