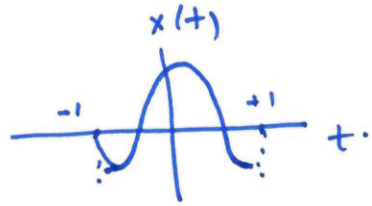
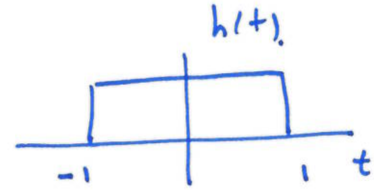
Discussion 4
Solution

problem1.





$t < -2 \qquad y(t) = 0$

$-2 < t < 0 \qquad \int_{-1}^{t+1} \cos(\pi\tau)\,d\tau = \frac{1}{\pi} \sin(\pi\tau)\Big|_{-1}^{t+1} = \frac{\sin(\pi(t+1))}{\pi}$

problem2. $\quad x(t) = \sin\left(\frac{3\pi t}{2}\right) + \cos(7\pi t)$

$\omega_1 = \frac{3\pi}{2} \quad ; \quad \omega_2 = 7\pi.$

$T_1 = \frac{4}{3} \qquad T_2 = \frac{2}{7}$

To obtain Fundamental frequency Find $lcm\left\{\frac{4}{3}, \frac{2}{7}\right\}$

$\frac{4}{3} n = \frac{2}{7} m \implies \frac{n}{m} = \frac{2/7}{4/3} = \frac{3}{14}$

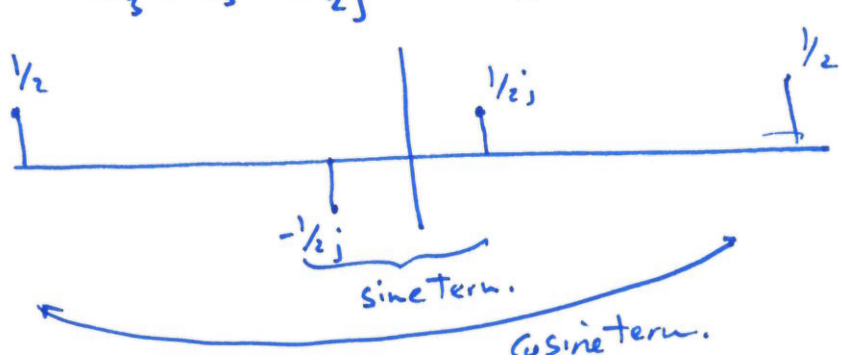
$\therefore \quad n = 3 \qquad m = 14$

$\left(\frac{4}{3}\right)(3) = \left(\frac{2}{7}\right)(14) = 4 = T_0$ This is The period of fundamental freq.

$\therefore \quad \omega_0 = \frac{2\pi}{T_0} = \frac{2\pi}{4} = \frac{\pi}{2}$

hence $\quad x(t) = \sin(3\omega_0 t) + \cos(14\omega_0 t)$

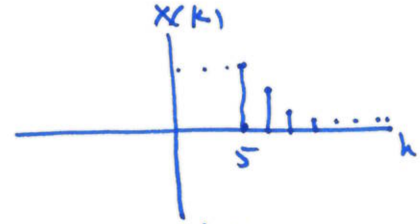
$a_3 = a_3^* = \frac{1}{2j} \qquad a_{14} = a_{-14} = \frac{1}{2}$



Discussion 4
Solution

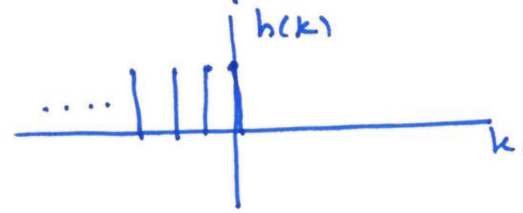
problem 3.

$$y(n) = \sum_{k=-\infty}^{\infty} x(k) \cdot h(n-k)$$



$x(n) = a^n u(n-5)$

$h(n) = u(-n)$



For $n \leq 5$

$$y(n) = \sum_{k=5}^{\infty} a^k = \frac{a^5}{1-a}$$

For $n \geq 5$ $\quad y(n) = \sum_{k=n}^{\infty} a^k = \dfrac{a^n}{1-a}$

problem 4.

$$y(n) = x(n) * h(n)$$

perform Convolution you obtain

$$y(n) = [\underset{n=0}{a} \quad \underset{n=1}{2a+b} \quad \underset{n=2}{2a+2b} \quad \underset{n=3}{2b} \quad \underset{n=4}{0}]$$

Then $\quad a=1 \qquad 2a+b=c \qquad 2a+2b=d \qquad 2b=1$

$a=1 \qquad c = 5/2$

$b = 1/2 \qquad d = 3$