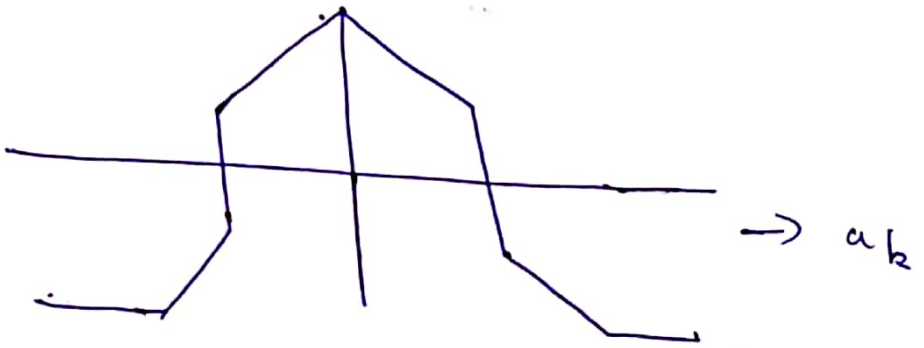
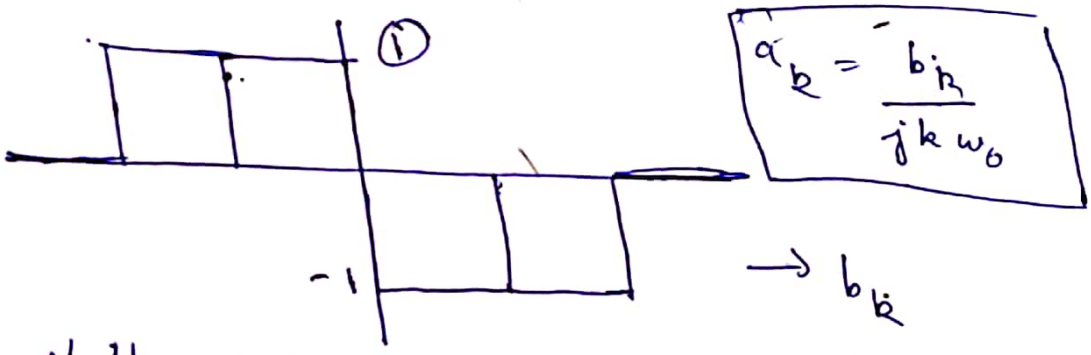
Q1) a) average value of function

$= a_0 = \frac{b}{6} = 1$

If we shift the entire graph ~~down~~ by 1.5 units down we get

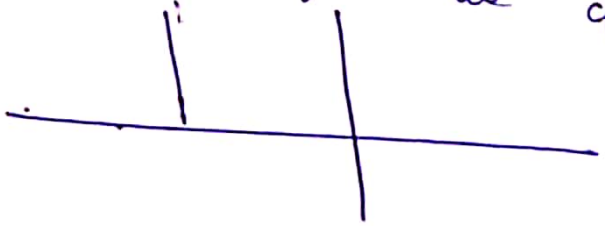


and differentiating this we will get $jk\omega_0 a_k = b_k$



$a_k = \frac{b_k}{jk\omega_0}$

shifting this up by ~~1~~ 1 units $b_0 = 0$
and to Right we get



b) $y = e^{j(\omega t + \theta)} \cdot x(t) \cdot H(\omega)$

$$H(\omega) = \begin{cases} 2 & \cdot\ |\omega| \leq \frac{5\pi}{6} \\ 1 & \frac{7\pi}{6} < |\omega| < \frac{5\pi}{6} \end{cases}$$

$$x(t) = \sum_{-\infty}^{\infty} a_k e^{jk\omega_0 t}$$

$$y(t) = \sum_{-\infty}^{\infty} a_k e^{jk\omega_0 t} H(k\omega_0)$$

let $\omega_0 = \frac{\pi}{6}$

$$y(t) = \sum_{k=-5}^{5} 2a_k e^{jk\omega_0 t} + \sum_{k=-7}^{-6} a_k e^{jk\omega_0 t} + \sum_{k=6}^{7} a_k e^{jk\omega_0 t}$$