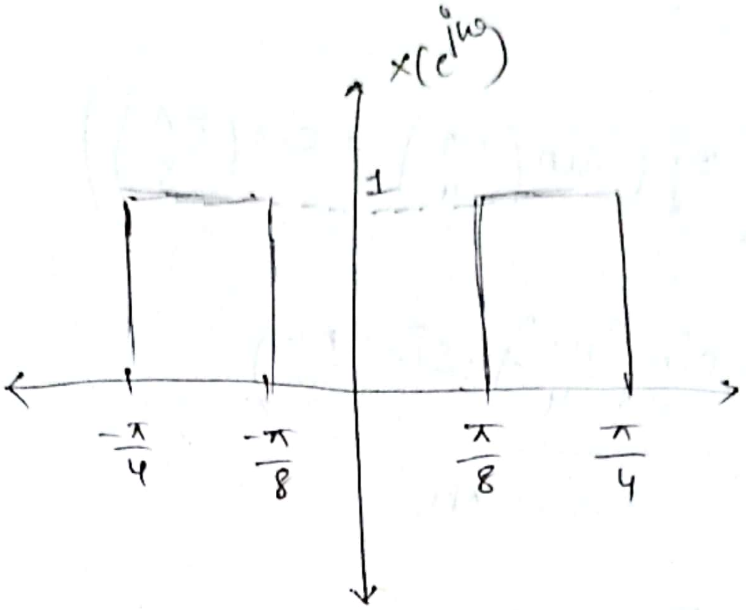
6.2 (i)



$$X(e^{j\omega}) = \begin{cases} 1, & \omega_1 \le |\omega| \le \omega_2 \\ 0, & |\omega| < \omega_1 \text{ and } \omega_2 < |\omega| < \pi \end{cases}$$

Here $\omega_1 = \frac{\pi}{8}$ & $\omega_2 = \frac{\pi}{4}$ are given.

$$x[n] = \frac{1}{2\pi}\int_{-\pi}^{\pi} X(e^{j\omega}) . e^{j\omega n} . d\omega$$

$$= \frac{1}{2\pi}\int_{-\frac{\pi}{4}}^{-\pi/8} 1. e^{j\omega n} + \frac{1}{2\pi}\int_{\pi/8}^{\pi/4} 1. e^{j\omega n} + 0 + 0.$$

$$\frac{1}{2\pi n j}\left[\left(e^{j\omega n}\right)_{-\pi/4}^{-\pi/8} + \left(e^{j\omega n}\right)_{\pi/8}^{\pi/4}\right]$$

$$= \frac{1}{2\pi n j}\left(\cancel{\cos\left(+\frac{\pi}{8}n\right)} - \cancel{j\sin\left(\frac{\pi}{8}n\right)} - \cancel{\cos\left(\frac{\pi}{4}n\right)} + j\sin\left(\frac{\pi}{4}n\right)\right.$$

$$\left. + \cancel{\cos\left(\frac{\pi}{4}n\right)} + j\sin\left(\frac{\pi}{4}n\right) - \cancel{\cos\left(\frac{\pi}{8}n\right)} - \cancel{j\sin\left(\pi/_8 n\right)}\right)$$

$$= \frac{1}{\cancel{2\pi n j}}\left[\cancel{2j}\left(\sin\left(\frac{n\pi}{4}\right)+\sin\left(\frac{n\pi}{8}\right)\right)\right]$$

$$x[n] = \frac{\sin\left(\frac{n\pi}{4}\right)+\sin\left(\frac{n\pi}{8}\right)}{\pi n}.$$

for $w_1 = \frac{\pi}{4}$ & $w_2 = \frac{\pi}{2}$,

$$x[n] = \frac{\sin\left(\frac{n\pi}{2}\right)+\sin\left(\frac{n\pi}{4}\right)}{\pi n}.$$

The peculiar nature of the plots can be explained by the 2 sin components in the numerator of $x[n]$. For values of n greater than 8 and even, $x[n] = 0$. We notice that for values of w_1 and w_2 as $\frac{\pi}{4}$ and $\frac{\pi}{2}$, we observe a sharper graph and the compression is explained in 6.2 B.