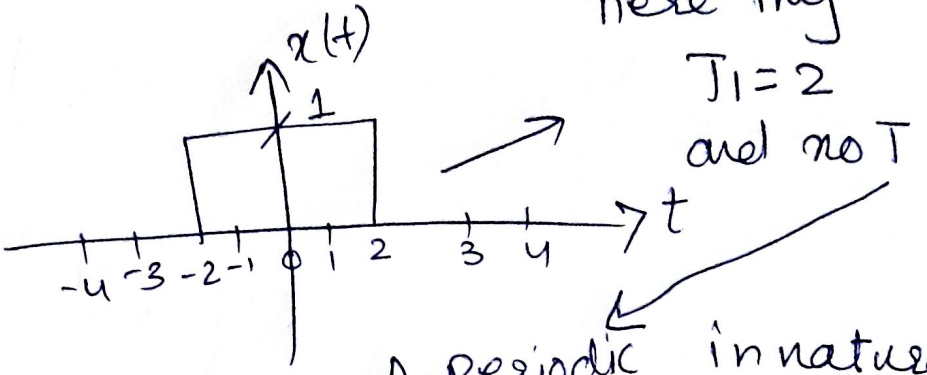
Example 4.4



here my $T_1 = 2$ and no T

A-periodic in nature.

$$X(j\omega) = \int_{-\infty}^{+\infty} x(t) e^{-j\omega t} dt.$$

$$X(j\omega) = \int_{-2}^{2} (1) e^{-j\omega t} dt.$$

$$= \frac{e^{-j\omega t}}{-j\omega}\Bigg|_{-2}^{2}$$

$$= -\frac{1}{j\omega}\left[e^{-2j\omega} - e^{+2j\omega} \right]$$

$$= \frac{1}{j\omega}\left[e^{2j\omega} - e^{-2j\omega} \right]$$

$$= \frac{1\times 2}{\omega}\left[\frac{e^{2j\omega} - e^{-2j\omega}}{2j} \right] = 2\frac{\sin 2\omega}{\omega}$$

(2).

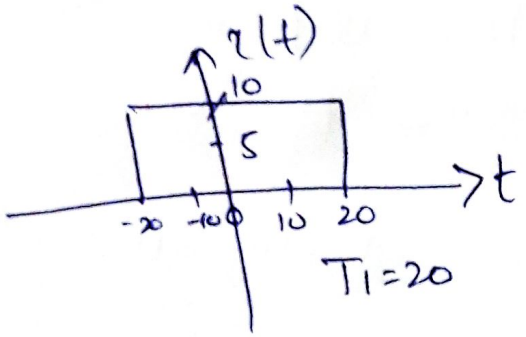
$$X(jw) = \frac{2\sin 2w}{w} \quad (OR)$$

generally:-

~~$X(jw) = 2\sin 2\bar{T}$~~

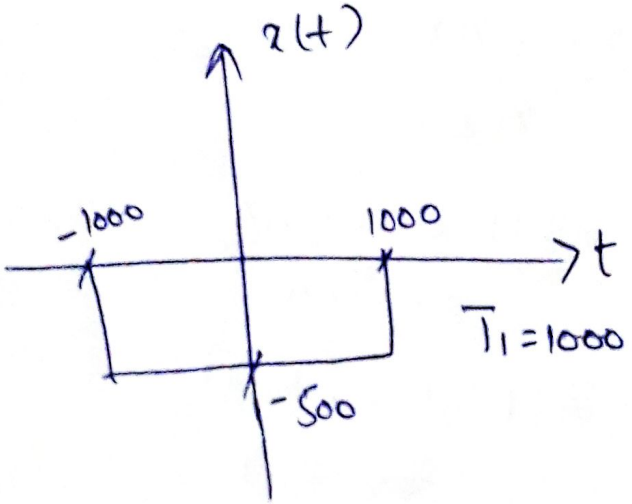
$$X(jw) = \frac{2\sin w\bar{T}_1}{w} \quad \rightarrow = 2$$

means:-



$$\rightarrow X(jw) = \frac{2\sin w\bar{T}_1}{w}$$

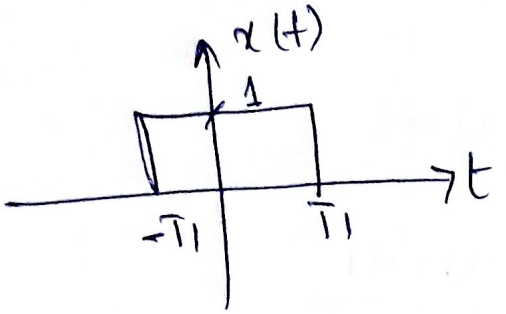
$$= \left(\frac{2\sin w(20)}{w}\right) \times b$$



$$\rightarrow X(jw) = \frac{2\sin w\bar{T}_1}{w}$$

$$X(jw) = \left(\frac{2\sin w(1000)}{w}\right)(-500)$$

So Now finally we know that :-



gate $\xrightarrow[F.T]{}$ $X(j\omega) = \frac{2\sin\omega\bar{T}_1}{\omega}$.

can be written in form of sinc function :-

Now making sinc from sin, where we know that

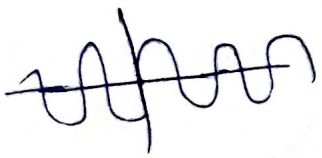
$$\text{sinc}(x) = \frac{\sin(\pi x)}{\pi x}.$$

So

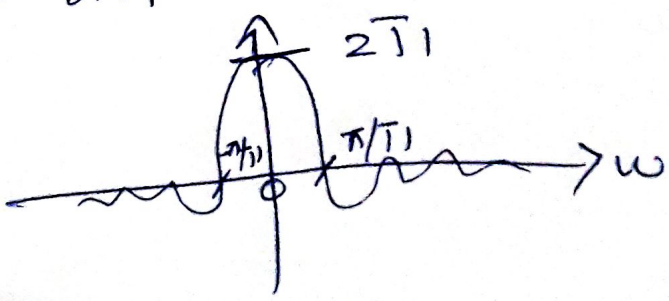
$$\frac{\bar{T}_1 \times 2\sin\omega\bar{T}_1(\pi)}{\omega(\pi)\times\bar{T}_1}. = \frac{2\bar{T}_1 \sin\omega\bar{T}_1\pi}{\omega\bar{T}_1\pi}.$$

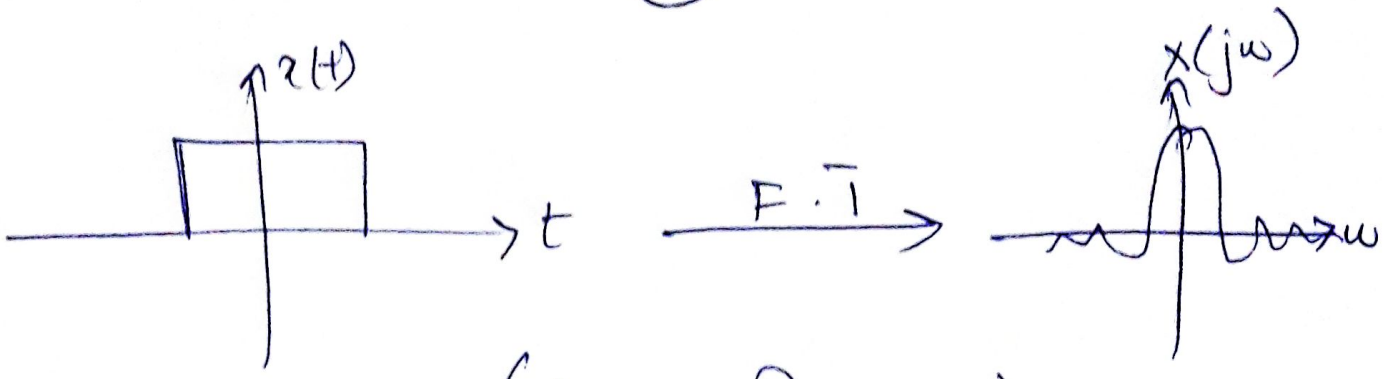
$$= 2\bar{T}_1 \text{sinc}(\omega\bar{T}_1)$$

sin →



sinc





(Always Remember)

The Fourier Transform of a gate (Rect) signal is always a Sinc Signal.