# Gate EE - 18

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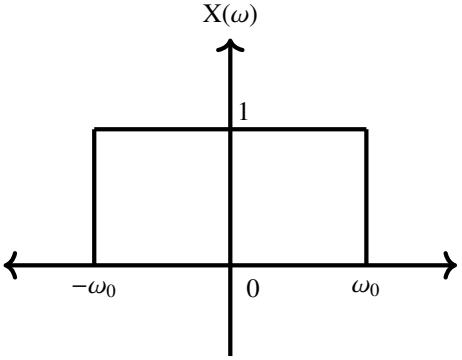
## Question

The Fourier transform x($\omega$) of the signal x($t$) is given by

$$X(\omega) = \begin{cases} 1, \text{for } |\omega| < \omega_0 \\ 0, \text{for } |\omega| > \omega_0 \end{cases}$$

(A) x($t$) tends to be an impulse as $W_0 \to \infty$.
(B) x(0) decreases as $W_0$ increases.
(C) At t = $\frac{\pi}{2W_0}$, x($t$) = -$\frac{1}{\pi}$.
(D) At t = $\frac{\pi}{2W_0}$, x($t$) = $\frac{1}{\pi}$. (GATE EE 2023)

## solution




By taking inverse Fourier transform,

$$x(t) = \frac{\sin(\omega_0 t)}{\pi t} \tag{1}$$

$$x\left(\frac{\pi}{2\omega_0}\right) = \frac{2\omega_0}{\pi^2} \tag{2}$$

So, option ($C$) and ($D$) are wrong.

$$x(0) = \lim_{t \to 0} \frac{\sin \omega_0 t}{\pi t} = \frac{\omega_0}{\pi} \tag{3}$$

So, $x(0) \propto \omega_0 \Rightarrow$ Option ($B$) is wrong.

When $\omega \to \infty$, $X(\omega)$ will be a D.C signal and inverse Fourier transform of a D.C signal will be impulse signal

So, option ($A$) is correct