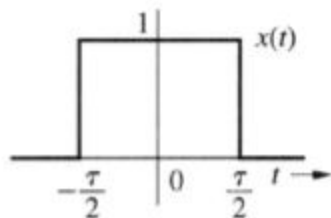


Fourier Transform of $x(t) = \text{rect}(t/\tau)$

- ◆ Evaluation:

$$X(\omega) = \int_{-\infty}^{\infty} \text{rect}\left(\frac{t}{\tau}\right) e^{-j\omega t} dt$$



- ◆ Since $\text{rect}(t/\tau) = 1$ for $-\tau/2 < t < \tau/2$ and 0 otherwise

$$X(\omega) = \int_{-\tau/2}^{\tau/2} e^{-j\omega t} dt = -\frac{1}{j\omega} (e^{-j\omega\tau/2} - e^{j\omega\tau/2}) = \frac{2 \sin\left(\frac{\omega\tau}{2}\right)}{\omega} = \tau \frac{\sin\left(\frac{\omega\tau}{2}\right)}{\left(\frac{\omega\tau}{2}\right)} = \tau \text{sinc}\left(\frac{\omega\tau}{2}\right)$$

$$\text{rect}\left(\frac{t}{\tau}\right) \iff \tau \text{sinc}\left(\frac{\omega\tau}{2}\right)$$

Bandwidth $\approx 2\pi/\tau$

