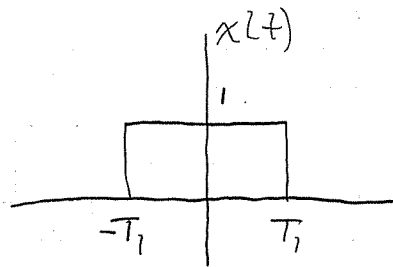


Example using CTFT Analysis integral

Take the Fourier transform of

$$x(t) = \begin{cases} 1, & |t| < T_1 \\ 0, & |t| \geq T_1 \end{cases}$$



Solution: Plug \$x(t)\$ into Eq (10.4) or Eq (10.5) on p. 342

$$\begin{aligned} X(j\omega) &= \int_{-\infty}^{\infty} x(t) e^{-j\omega t} dt \\ &= \int_{-T_1}^{T_1} (1) e^{-j\omega t} dt \\ &= \frac{1}{-j\omega} e^{-j\omega t} \Big|_{t=-T_1}^{T_1} \\ &= \frac{2}{\omega} \cdot \frac{1}{j2} (e^{j\omega T_1} - e^{-j\omega T_1}) \end{aligned}$$

$$X(j\omega) = \frac{2}{\omega} \sin(\omega T_1)$$

$$\omega = 2\pi f$$

$$X(f) = \frac{2}{2\pi f} \sin(2\pi f T_1)$$

$$X(f) = \text{sinc}(2T_1 f)$$

When \$T_1\$ is large
the spectrum \$X(f)\$ is narrow

