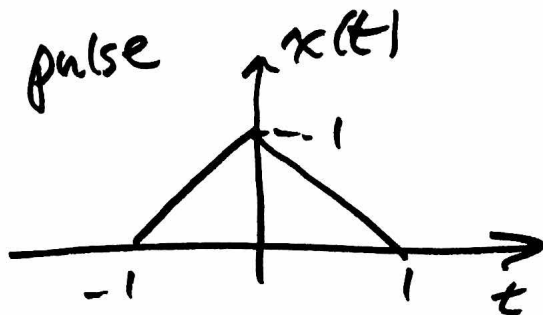


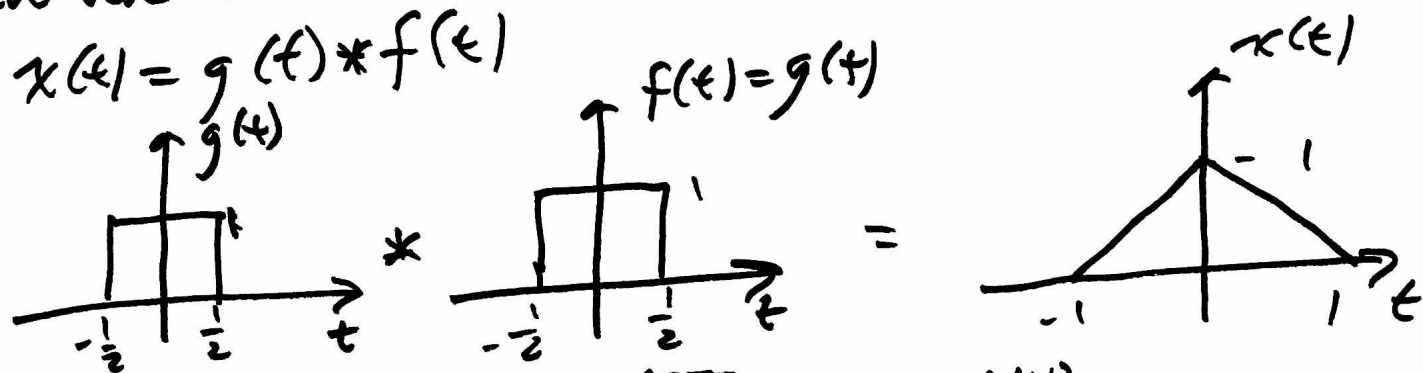
Ex Triangular pulse $x(t)$



- Find $X(\omega)$
 → Previously, we found ~~the~~ $x'(t)$ and used the diff. property to find $X(\omega)$.

→ We can use the convolution property instead.

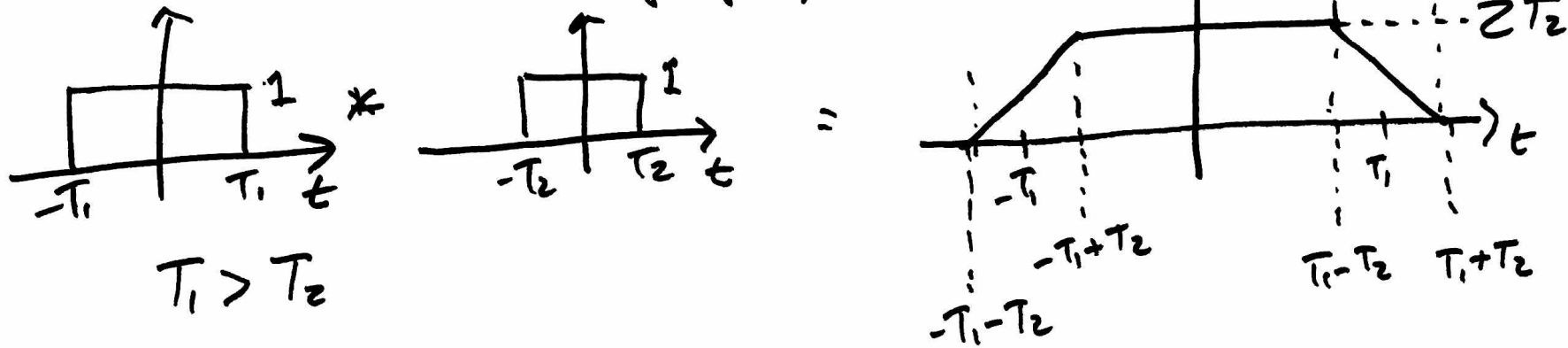
$$x(t) = g(t) * f(t)$$



We know that $g(t) \xleftrightarrow{\text{CTFT}} 2 \frac{\sin(\frac{\omega}{2})}{\omega}$

$$\mathcal{F}\{x(t)\} = G(\omega)^2 = 4 \frac{\sin^2(\frac{\omega}{2})}{\omega^2}$$

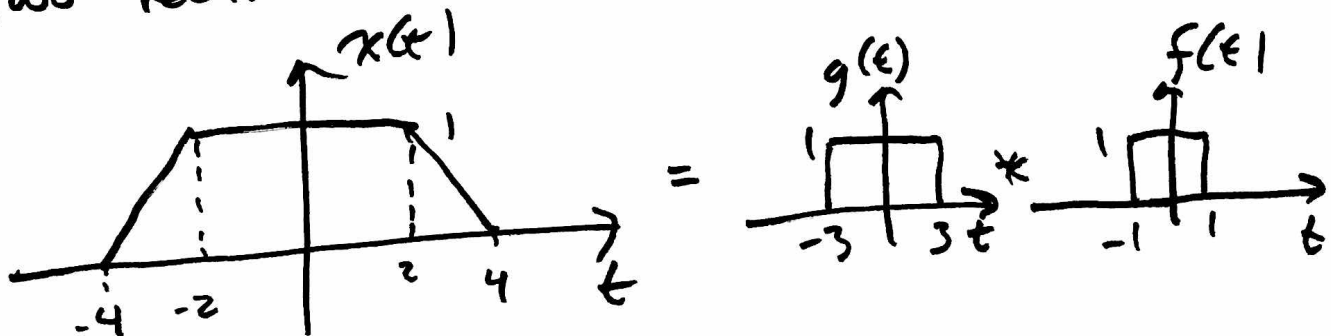
More about the convolution property



$$T_1 > T_2$$

If you see trapezoids, consider using the convolution of two rects.

Ex



Find $X(\omega)$
 $X(\omega) = G(\omega) \cdot F(\omega) \cdot A \Rightarrow A = \frac{1}{2}$ so that we match
 using the pair $x(t) = \begin{cases} 1, & |t| < T_1 \\ 0, & \text{else} \end{cases} \longleftrightarrow 2 \frac{\sin \omega T_1}{\omega}$

$$X(\omega) = 2 \frac{\sin(\omega \cdot 3)}{\omega} \cdot 2 \frac{\sin(\omega \cdot 1)}{\omega} \cdot \frac{1}{2} = 2 \frac{\sin(3\omega) \sin(\omega)}{\omega^2}$$

(2)

OW 4.18

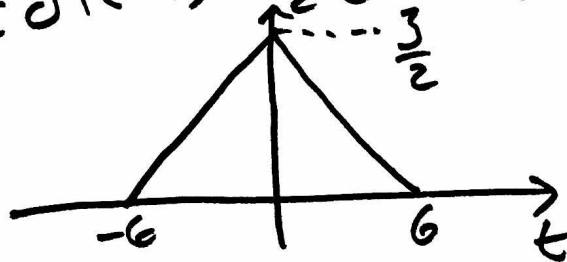
$$H(\omega) = \frac{\sin^2 3\omega}{\omega^2} \cos \omega = \underbrace{\left(\frac{\sin(3\omega)}{\omega}\right)^2}_{G(\omega)} \cdot \underbrace{\cos \omega}_{F(\omega)}$$

Using the table \Rightarrow $G(\omega)$ is a sinc $\rightarrow g(t)$ is a rect

$$g(t) = \begin{cases} \frac{1}{2}, & |t| < 3 \\ 0, & \text{else} \end{cases}$$

$$f(t) = \mathcal{F}^{-1}\{\cos \omega\} = \mathcal{F}^{-1}\left\{\frac{1}{2}e^{j\omega} + \frac{1}{2}e^{-j\omega}\right\}$$
$$= \frac{1}{2}\delta(t-1) + \frac{1}{2}\delta(t+1)$$

$g(t) * g(t)$



$f(t)$

