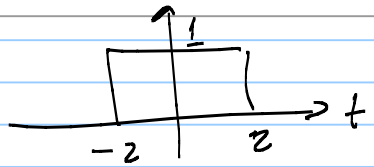
Note Title 3/5/2019

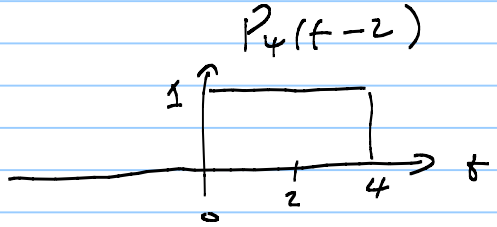
$P_2(t) \longleftrightarrow \tau \, \text{sinc}\left(\frac{\omega\tau}{2\pi}\right)$



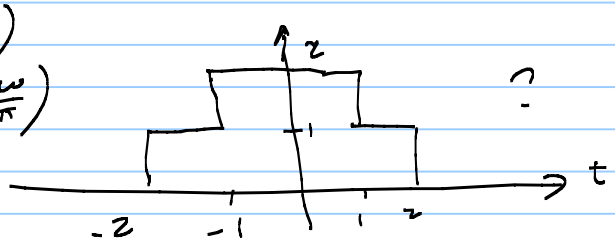
$P_4(t) \longleftrightarrow 4 \, \text{sinc}\left(\frac{4\omega}{2\pi}\right)$

$\longleftrightarrow 4 \, \text{sinc}\left(\frac{2\omega}{\pi}\right)$

$P_4(t-2) \longleftrightarrow ?$



$P_4(t) + P_2(t) \longleftrightarrow 4\,\text{sinc}\left(\frac{4\omega}{2\pi}\right) + 2\,\text{sinc}\left(\frac{2\omega}{2\pi}\right)$

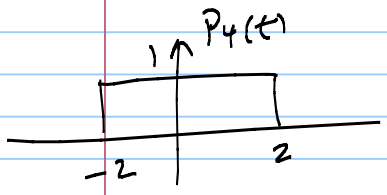


$P_{4(2t)} \longleftrightarrow ?$

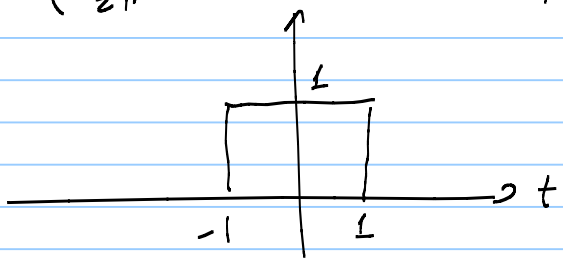
$\longleftrightarrow 2 \, \text{sinc}\left(\frac{2\omega}{2\pi}\right)$

$P_4(t) = \begin{cases} 1 & , -\frac{4}{2} \le t \le \frac{4}{2} \\ 0 & , \text{o.w.} \end{cases}$

$P_4(t) \longleftrightarrow 4 \, \text{sinc}\left(\frac{4\omega}{2\pi}\right)$



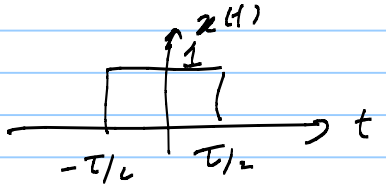
$P_4(2t)$

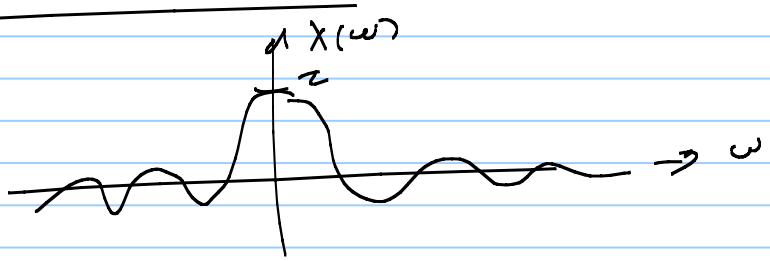


$P_4(2t) = \begin{cases} 1 & , -\frac{4}{2} \le 2t \le \frac{4}{2} \\ 0 & , \text{o.w.} \end{cases}$

$= \begin{cases} 1 & , \frac{-4}{4} \le t \le \frac{4}{4} \\ 0 & , \text{o.w.} \end{cases}$

$P_4(at) \longleftrightarrow \frac{4}{a} \, \text{sinc}\left(\frac{\omega\tau/a}{2\pi}\right)$





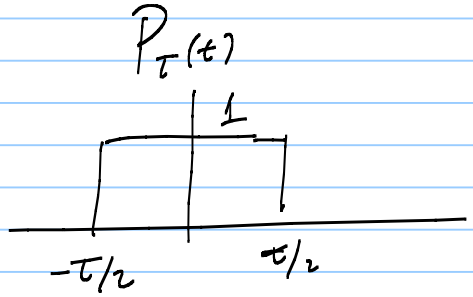
$$X(\omega) = \int_{-\infty}^{\infty} x(t) e^{-j\omega t} dt$$

$x(t-2)$

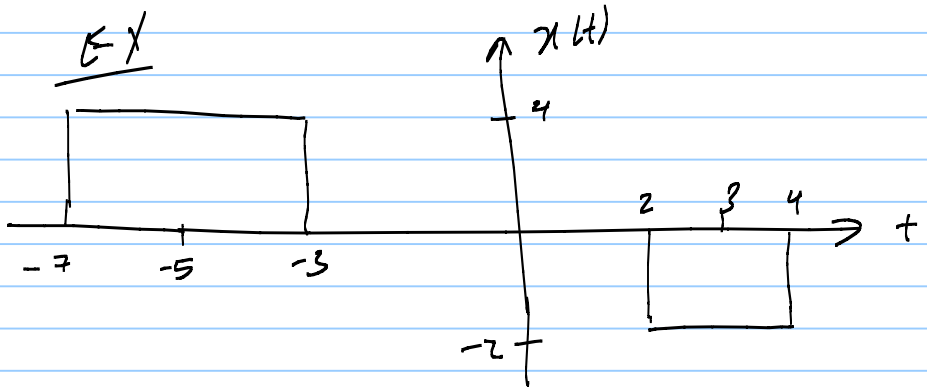
$$X(\omega) = \int_{-\infty}^{\infty} x(t)\, e^{-j\omega(t-2)}\, dt$$

$$= \int_{-\infty}^{\infty} x(t)\, e^{-j\omega t}\, e^{j2\omega}\, dt$$

$$= e^{j2\omega} \int_{-\infty}^{\infty} x(t)\, e^{-j\omega t}\, dt$$



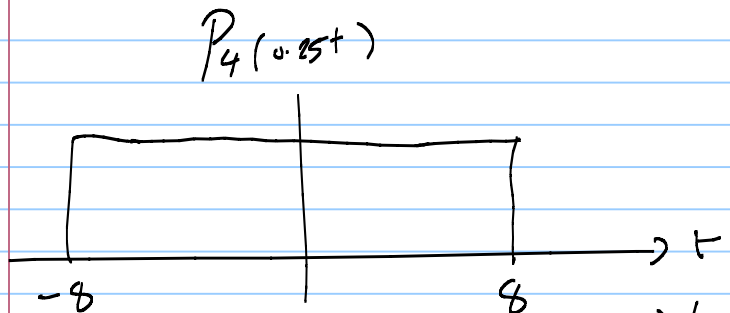
Ex



$$x(t) = 4\,P_4(t+5) - 2\,P_2(t-3)$$

$$X(\omega) = 4\left[4\,\text{sinc}\left(\frac{4\omega}{2\pi}\right)e^{j5\omega}\right\} - 2\left[2\,\text{sinc}\left(\frac{2\omega}{2\pi}\right)e^{-j3\omega}\right\}$$

$$P_4(3t) \longleftrightarrow \frac{4}{3}\,\text{sinc}\left(\frac{4\omega/3}{2\pi}\right)$$

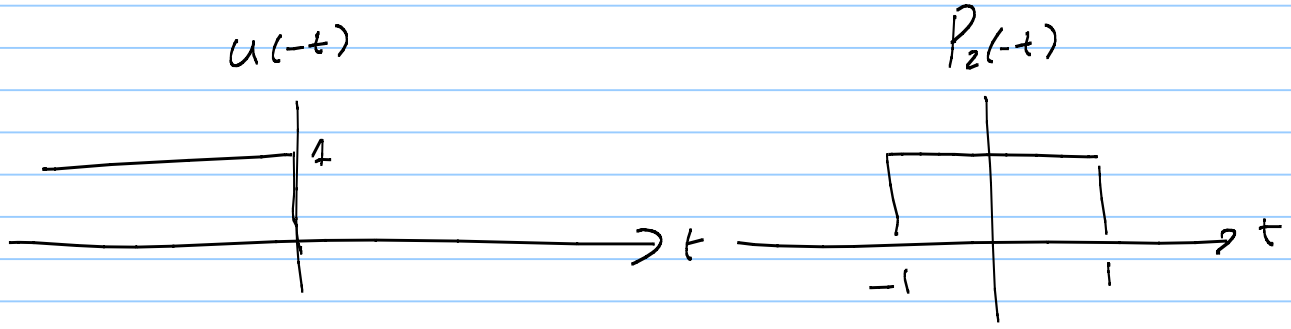


$$\rightarrow \left(\frac{\tau}{2}\right)\Big|_{0.25} = \left(\frac{4}{2}\right)\Big|_{0.25} = 8$$

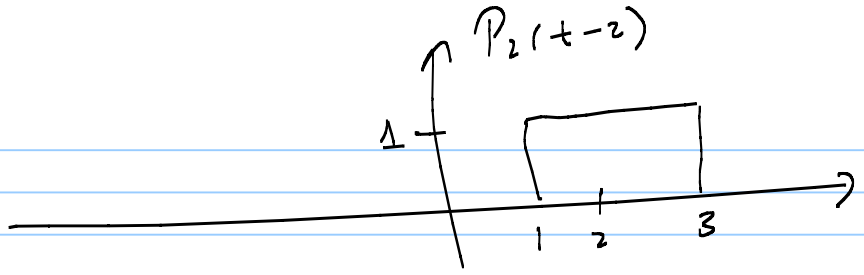
$$P_2(-t) \longleftrightarrow 2\,\text{sinc}\left(\frac{2\omega}{2\pi}\right) \qquad (2+j3)^* = 2-j3$$

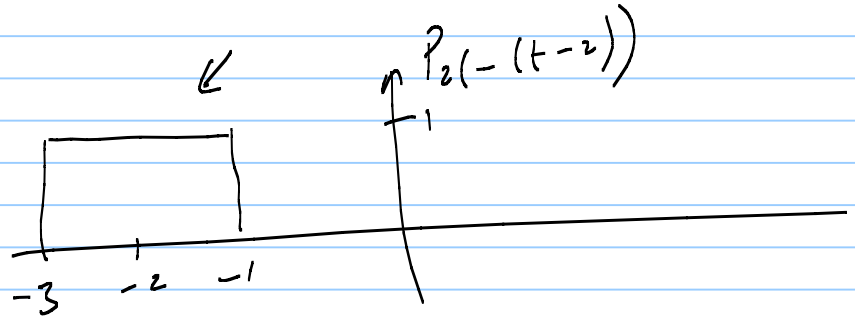
$$(5)^* = 5$$

$$P_2(t) \longleftrightarrow 2\,\text{sinc}\left(\frac{2\omega}{2\pi}\right)$$



$$P_2(-t+2) = P_2(-(t-2)) = P_2(t+2)$$





$P_2(t+2)$

$$X(\omega) = \frac{1}{1+2e^{-2j\omega}}$$

$$v(t) = x(-t)$$

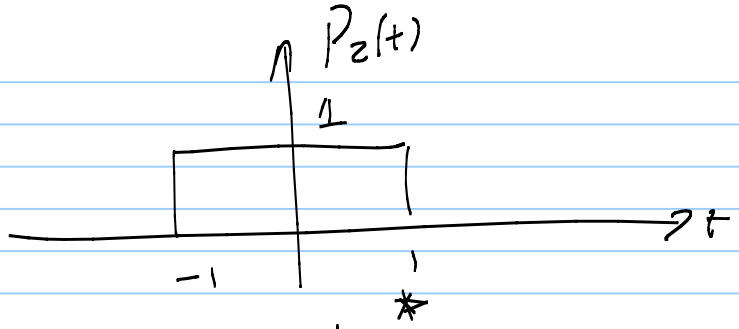
$$V(\omega) = \frac{1}{1+2e^{2j\omega}}$$

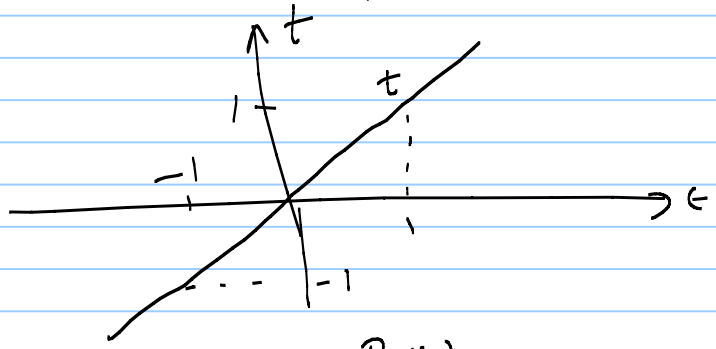
$$X(\omega) = \frac{a}{b+j\omega}$$

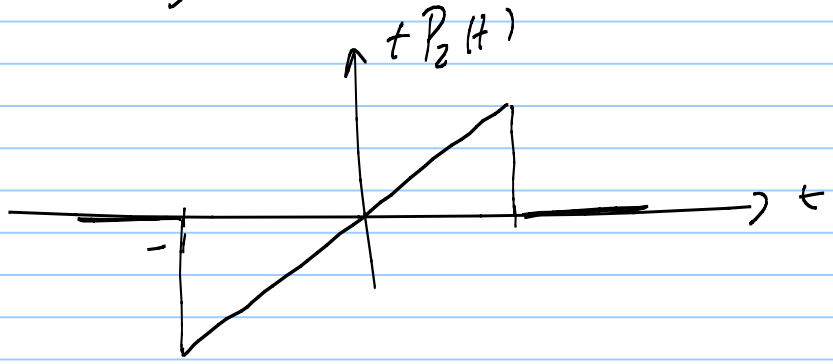
$$v(t) = x(-2t)$$

$$V(\omega) = \frac{1}{2}\left(\frac{a}{b-j\omega/2}\right)$$

$x(t) = t\,P_2(t)$







$$X(\omega) = \frac{1}{2 + j\omega}$$

$$V(t) = t\,x(t)$$

$$V(\omega) = (j)^1 \frac{d}{d\omega}\left(\frac{1}{2+j\omega}\right)$$

$$= j\,\frac{(2+j\omega)(0) - (1)(j)}{(2+j\omega)^2} = j\,\frac{-j}{(2+j\omega)^2}$$

$$= \frac{1}{(2+j\omega)^2}$$

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

$$= \int_{-\infty}^{\infty} x(t) e^{-j(\omega - \omega_0)t} dt$$

$$x(t)\sin(\omega_0 t) \leftrightarrow \frac{j}{2}[X(\omega+\omega_0) - X(\omega-\omega_0)]$$

$$x(t)\cos(\omega_0 t) \leftrightarrow \frac{1}{2}[X(\omega+\omega_0) + X(\omega-\omega_0)]$$

$P_2(t) \leftrightarrow 2\,\mathrm{sinc}\left(\frac{2\omega}{2\pi}\right)$

$$P_2(t)\sin(4t) \leftrightarrow \frac{j}{2}\left[2\,\mathrm{sinc}\left(\frac{2(\omega+4)}{2\pi}\right) - 2\,\mathrm{sinc}\left(\frac{2(\omega-4)}{2\pi}\right)\right]$$