$x(t) = A\sin(\omega_0 t + \alpha)$

$$P_\infty = \frac{1}{T-0}\int_0^T |A\sin(\omega_0 t+\alpha)|^2\,dt \qquad T = \frac{2\pi}{\omega_0}$$

$$= \frac{A^2}{2\pi/\omega_0}\int_0^{2\pi/\omega_0} \sin^2(\omega_0 t+\alpha)\,dt \qquad \sin^2(\beta) = \frac{1}{2} - \frac{1}{2}\cos(2\beta)$$

$$P_\infty = \frac{A^2\omega_0}{2\pi}\int_0^{2\pi/\omega_0} \frac{1}{2} - \underbrace{\frac{1}{2}\cos(2\omega_0 t + 2\alpha)\,dt}_{\text{becomes } 0}$$

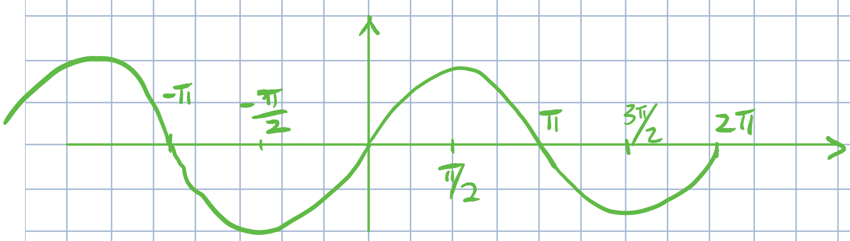
$$= \frac{A^2\omega_0}{2\pi}\cdot\left(\frac{1}{2}\left(\frac{2\pi}{\omega_0} - 0\right)\right)$$

$$= \frac{A^2}{2} \,//$$

④ odd & even signal:

$x(t)$ is an odd signal if $x(-t) = -x(t)$

e.g. $x(t) = \sin(t)$, $\sin(-t) = -\sin(t)$

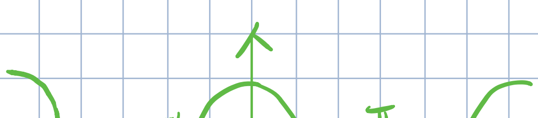


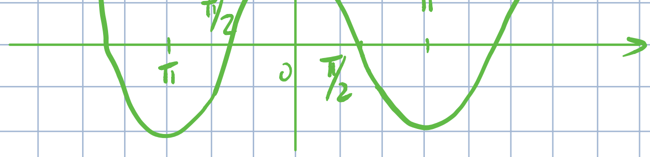
Odd signals are symmetrical w.r.t. the origin.

$x(t)$ is an even signal if $x(-t) = x(t)$

e.g. $x(t) = \cos(t)$ $\cos(-t) = \cos(t)$.

even signals are symmetrical w.r.t. the y-axis.





Most real-world signals are neither odd or even. However, all signals can be written as the sum of an even signal & an odd signal.

$$x(t) = \underbrace{x_e(t)}_{\text{even part of } x(t)} + \underbrace{x_o(t)}_{\text{odd part of } x(t)}$$

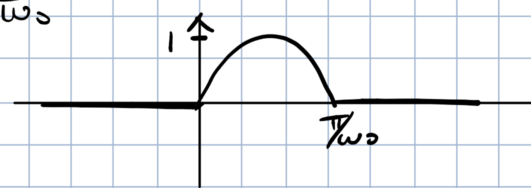
$$x_o(t) = \frac{1}{2}\left(x(t) - x(-t)\right)$$

$$x_e(t) = \frac{1}{2}\left(x(t) + x(-t)\right)$$

Example.

Find the odd & even parts of :

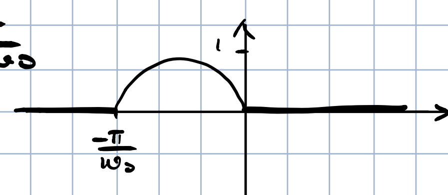
$$x(t) = \begin{cases} \sin(\omega_0 t) & 0 < t < \frac{\pi}{\omega_0} \\ 0 & \text{else.} \end{cases}$$



First, find time reversal of x(t)

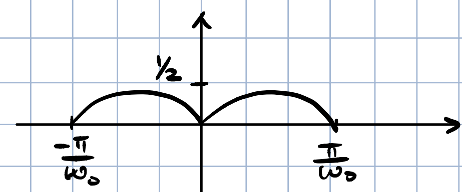
$$x(-t) = \begin{cases} \sin(-\omega_0 t) & 0 < -t < \frac{\pi}{\omega_0} \\ 0 & \text{else.} \end{cases}$$

$$x(-t) = \begin{cases} -\sin(\omega_0 t) & 0 > t > -\frac{\pi}{\omega_0} \\ 0 & \text{else.} \end{cases}$$

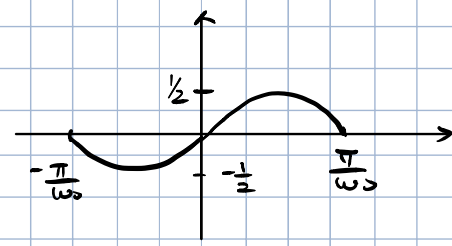


Then, use $\begin{cases} x_o(t) = \frac{1}{2}\left(x(t) - x(-t)\right) \\ x_e(t) = \frac{1}{2}\left(x(t) + x(-t)\right) \end{cases}$ for each interval.

$$\Rightarrow \quad x_e(t) = \begin{cases} -\frac{1}{2}\sin(\omega_0 t) & -\frac{\pi}{\omega_0} < t < 0 \\ \frac{1}{2}\sin(\omega_0 t) & 0 < t < \frac{\pi}{\omega_0} \\ 0 & \text{else.} \end{cases}$$



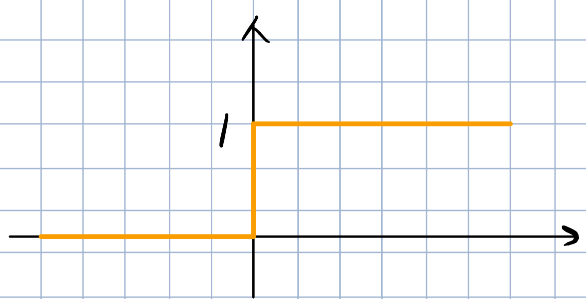
$$x_o(t) = \begin{cases} \frac{1}{2}\sin(\omega_0 t) & -\frac{\pi}{\omega_0} < t < 0 \\ \frac{1}{2}\sin(\omega_0 t) & 0 < t < \frac{\pi}{\omega_0} \\ 0 & \text{else.} \end{cases}$$

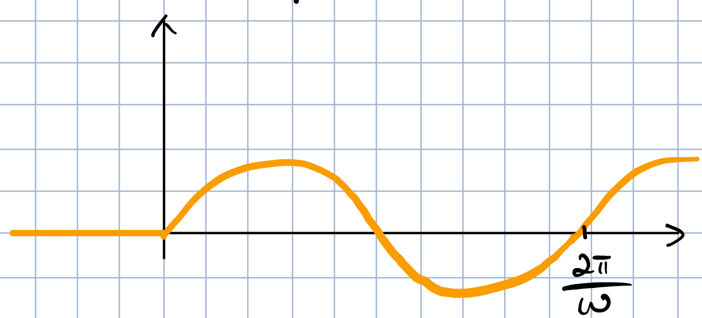


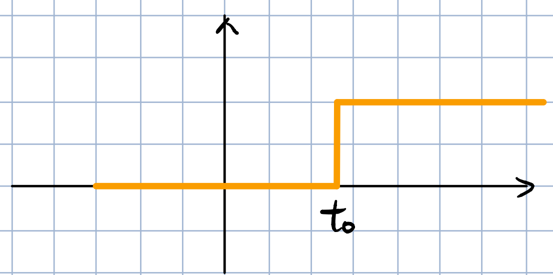
Basic Signals.

① Unit Step Function.

$$u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$$

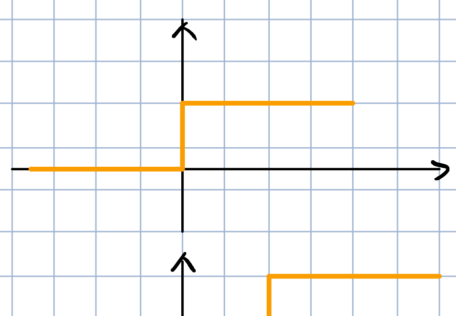






$u(t-t_0)$

② Pulse. $P(t) = u(t) - u(t-1)$



$P(t)$: