$$\int_{-\infty}^{\infty} \delta(T)\,dT = 1$$

$$\int_{-\infty}^{\infty} \delta(T-t_0)\,dT = 1$$

$$\int_{-\infty}^{t} \delta(T)\,dT = u(t)$$

$$\int_{-\infty}^{t} \delta(T-t_0)\,dT = u(t-t_0)$$

$$\int_{-\infty}^{\infty} x(T)\,\delta(T)\,dT = x(0)$$

$$\int_{-\infty}^{\infty} x(T)\,\delta(T-t_0)\,dT = x(t_0)$$

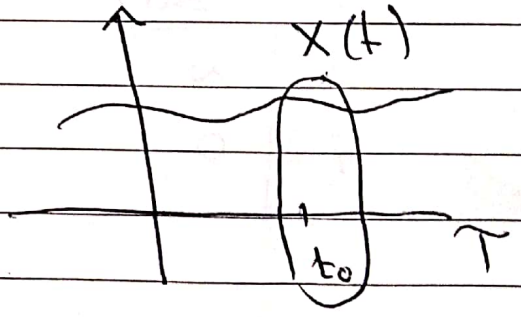
$$\int_{-\infty}^{t} x(T)\,\delta(T)\,dT = x(0) \quad t>0$$

$$= 0 \quad t<0$$

$$= x(0)\,u(t)$$

$$\int_{-\infty}^{t} x(T)\,\delta(T-t_0)\,dT$$

$$= x(t_0)\,u(t-t_0)$$



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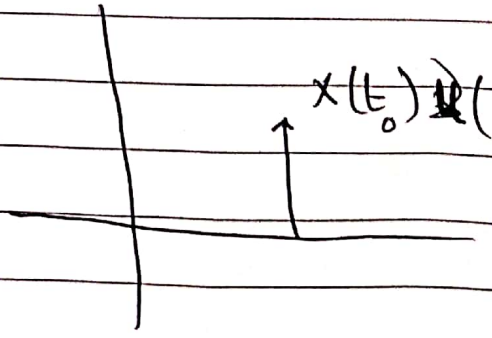
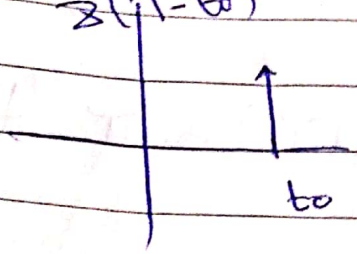


$$\int_{-\infty}^{\infty} x(\tau)\,\delta(t_0-\tau)\,d\tau = -x(t_0) \quad \times$$

$\delta(\tau - t_0)$

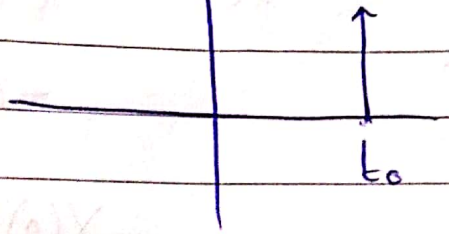


$$= -x(-t_0) \quad \times$$

$$= x(-t_0) \quad \times$$

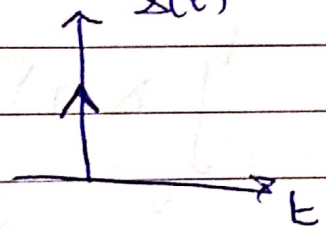
$$= x(t_0) \quad \checkmark$$

$\delta(t_0 - \tau)$



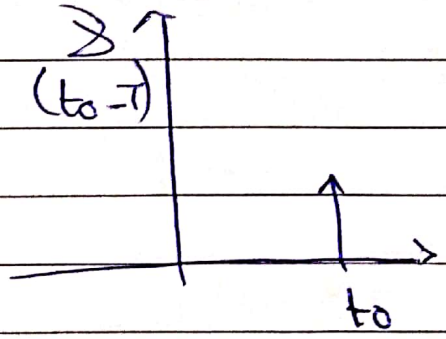
τ	$\tau - t_0$	$\delta(\tau - t_0)$
t_0	0	∞
$\neq t_0$	$\neq 0$	0

$\delta(t)$ $\quad$ $\delta(t)$



t	$\delta(t)$
0	∞
$\neq 0$	0

$\delta(t_0 - \tau)$



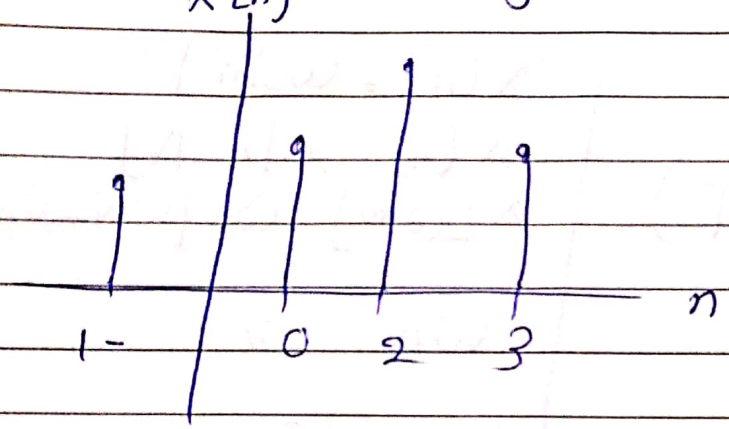
$$\int_{-\infty}^{\infty} x(\tau)\,\delta(t-\tau) = x(t)$$

Discrete Signals

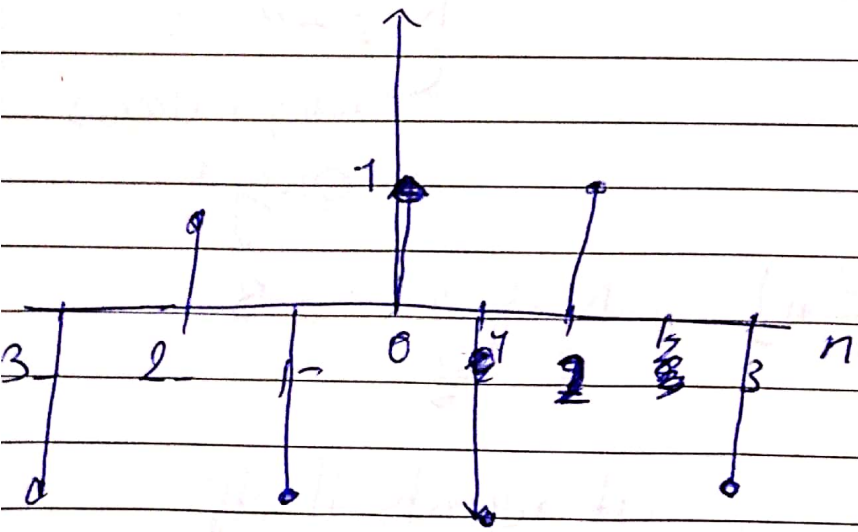
$x[n]$ → talking about discrete

Exists only in discrete (integer) values of the independent variable

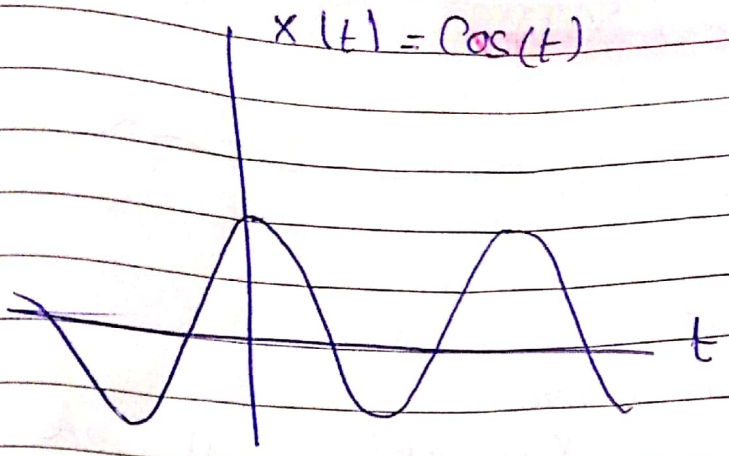
x can take any value.



Plot $x[n] = [-1]^n$



Periodic discrete signals



$$x(t) = x(t+T)$$

$$\cos(\omega t) = \cos(\omega t + \omega T)$$

$$\omega T = 2\pi$$

$$\boxed{T = \frac{2\pi}{\omega}}$$

$$x[n] = \cos[n]$$

$$x[n] = x[n+N]$$

$$x[\omega N] = \cos[\omega N + \omega n]$$

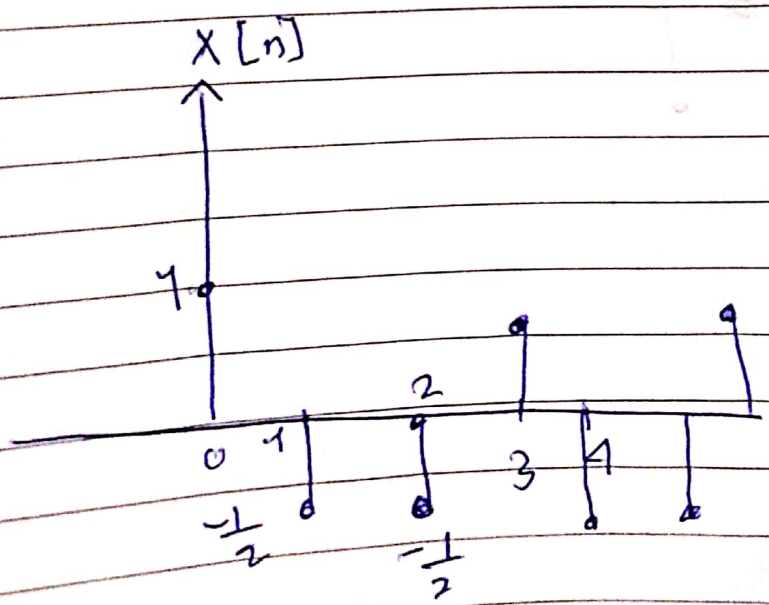
$$\omega N = 2\pi$$

$$\boxed{N = \frac{2\pi}{\omega}}$$

$N \neq 2\pi$ ...

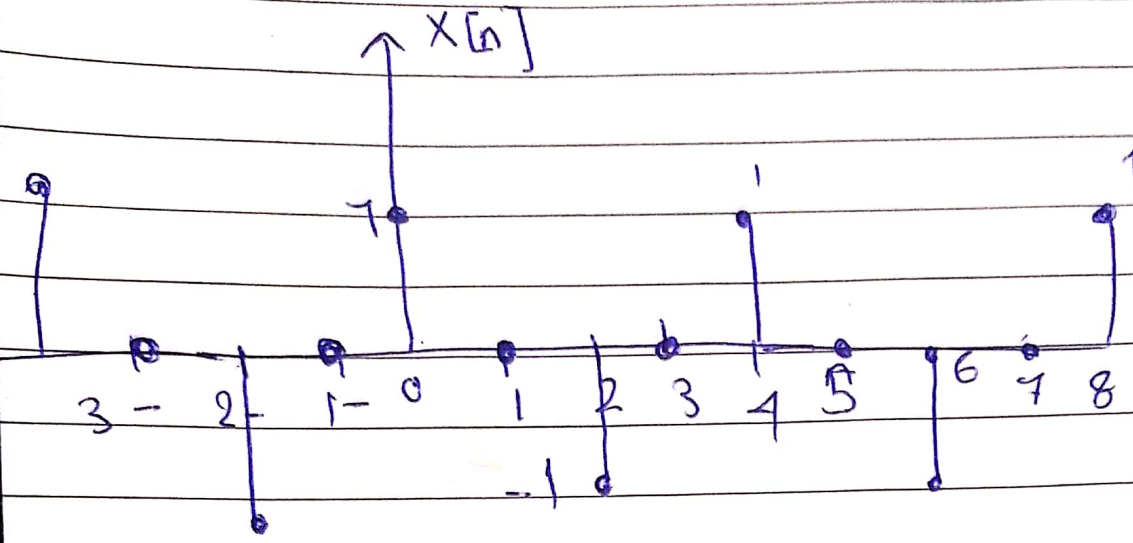
↳ integer values only!

$$x[n] = \cos\left[\frac{2\pi}{3} n\right] \qquad N = \frac{2\pi}{\frac{2\pi}{3}} = 3$$



it repeats itself after an integer Period.

$$x[n] = \cos\left[\frac{5\pi}{2}n\right] \qquad N = 4/5$$



- believe your eyes → next Class!