31-08-22

Delta

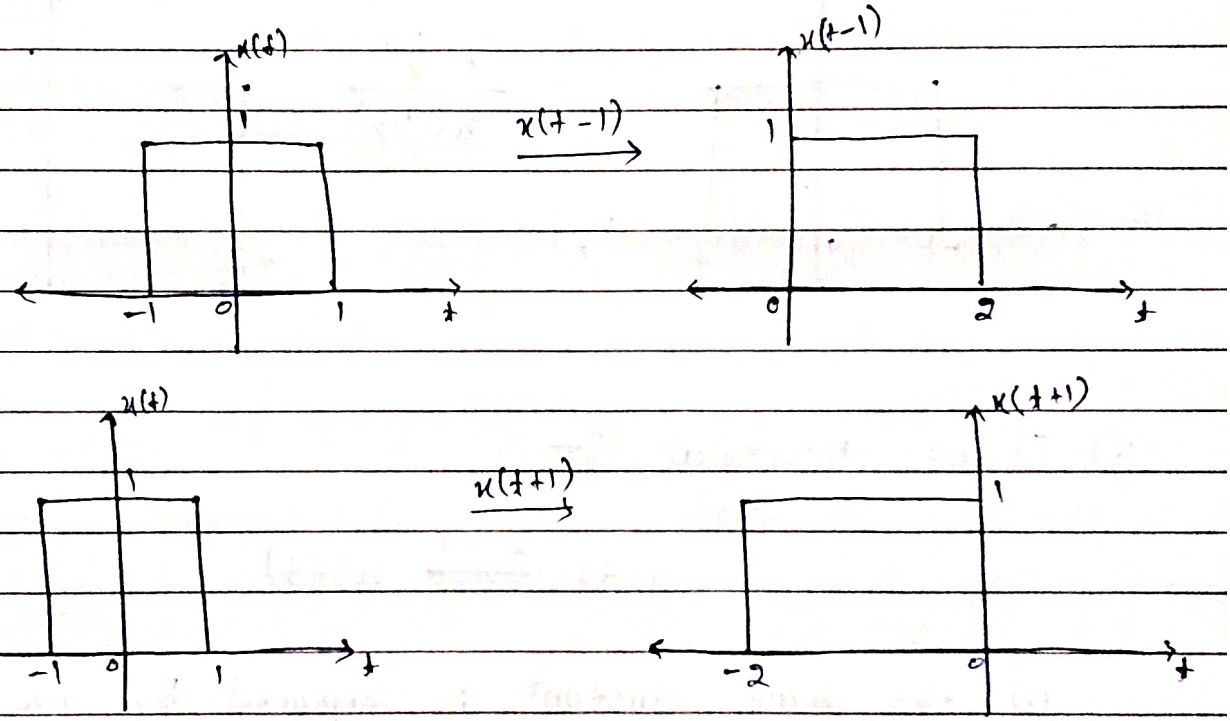
* Transformation on Signals —

① Time Shifting :-

$x(t) \xrightarrow{t \to (t - t_0)} x(t - t_0)$ ⇒ Delayed version of $x(t)$

$x(t) \xrightarrow{t \to (t + t_0)} x(t + t_0)$ ⇒ Advanced version of $x(t)$

e.g. →



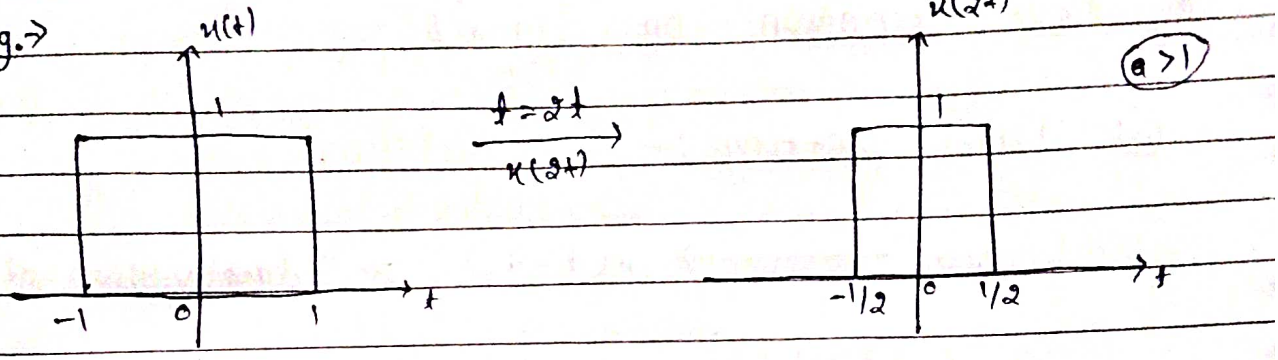
② Time Scaling :-

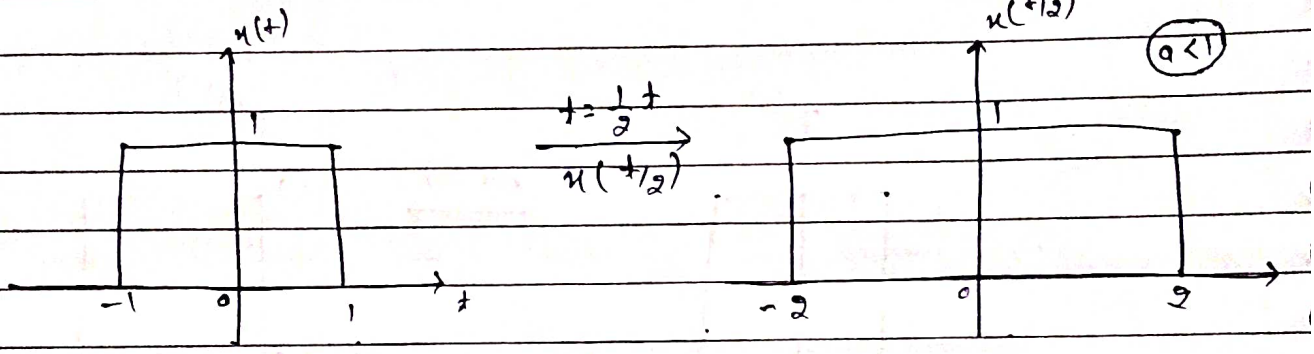
$x(t) \xrightarrow{t \to at} x(at)$ → (divide by a)

if, $a > 1$, then compression of signal

$a < 1$, then expansion of signal

e.g.→

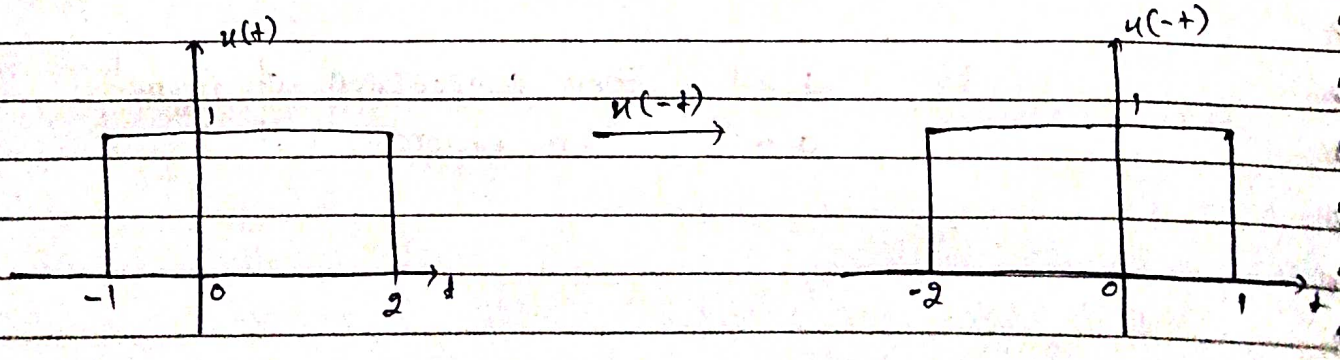




(3) Time Reversal :-

$$x(t) \xrightarrow{t = -t} x(-t)$$

(i) -ve time instant is replaced by +ve time instant & vice-versa.
(ii) Rotation about y-axis by 180°.
(iii) Mirror image across y-axis.
(iv) Adding extra -ve sign.



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* Properties of $\delta(t)$ —

① $\delta(at) = \frac{1}{|a|}\delta(t)$

$\delta(-t) = \delta(t)$ → even function

② $x(t)\delta(t) = x(0)\delta(t)$

$x(t)\delta(t-a) = x(a)\delta(t-a)$

only if $x(t)$ is continuous at $t = a$.

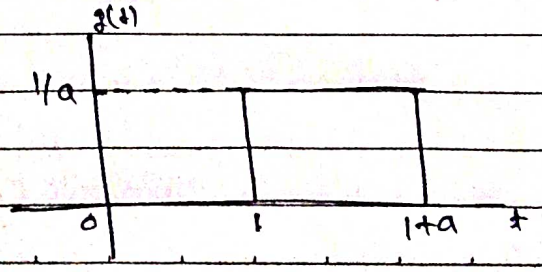
③ $\int_{-\infty}^{\infty} x(t)\delta(t)\,dt = \int_{-\infty}^{\infty} x(0)\delta(t)\,dt = x(0)\int_{-\infty}^{\infty}\delta(t)\,dt = x(0)$

$\int_{-\infty}^{\infty} x(t)\delta(t-a)\,dt = x(a)$ ← same method

e.g. → $\int_{-\infty}^{\infty} \cos 3t\,\delta(t) = \cos 0 = 1$

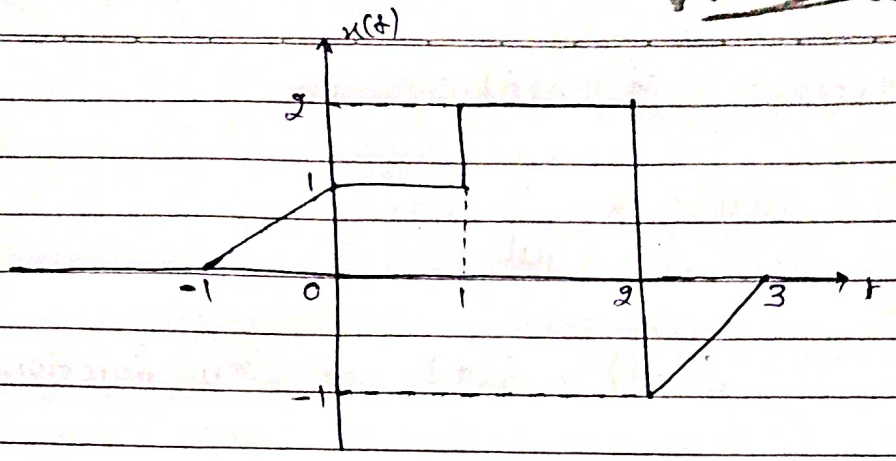
$\int_{-\infty}^{\infty} \cos 3t\,\delta(t-\pi) = \cos 3\pi = -1$

Q1 ⇒ Find $\int_{-\infty}^{\infty} \frac{\sin\frac{3\pi}{2}(t-2)}{t^2+4}\, g(t)\,dt$, where $g(t)$ is defined as following pulse where $a \to 0$



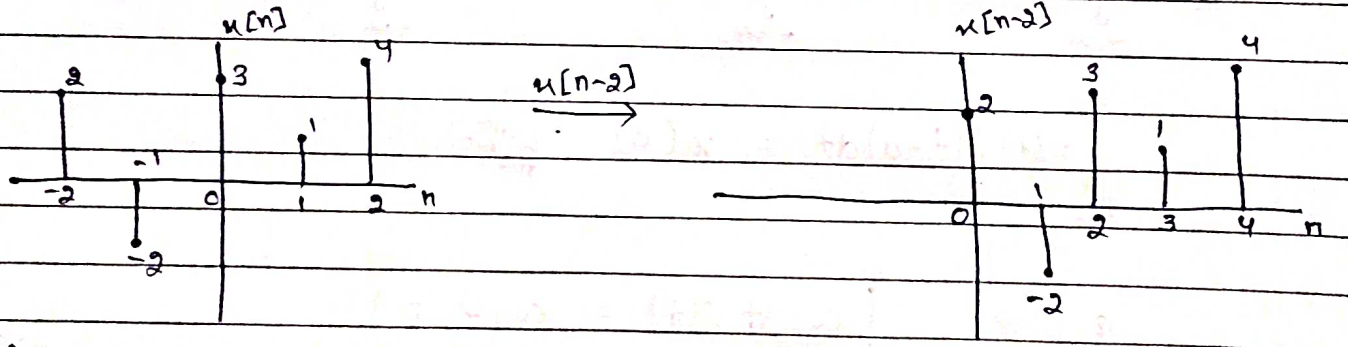
Delta

Q2 ⇒



Sketch the graph $x(-2t+3)$.

* Time Shifting for Discrete time Signal —



↳ $x[n] = \{2, -2, \underset{\uparrow}{3}, 1, 4\}$

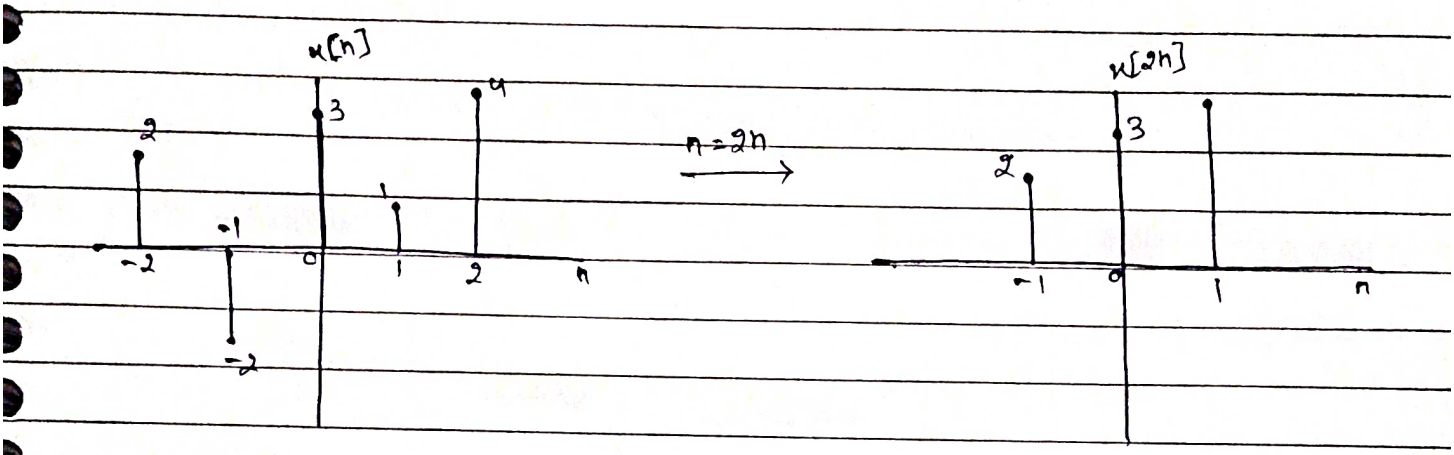
(here arrow shows 3 at n=0)

$x[n] = \{2, -2, 3, 1, 4\}$

(here no arrow show ie., 2 is at n=0)

* Time Scaling for Discrete time Signal —

$$x[n] \xrightarrow[x[2n]]{n=2n} x[2n]$$



There may be loss of sampled values whenever we are scaling a discrete time signal.

$\Rightarrow x[n] = \{2, -2, \underset{\uparrow}{3}, 1, 4\} \xrightarrow{x[2n]} x[2n] = \{2, \underset{\uparrow}{3}, 4\}$

Q3⇒ Plot the time reversed value of $x[n]$ i.e., $x[-n]$.