Subject : Signal & System

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Module : 4th

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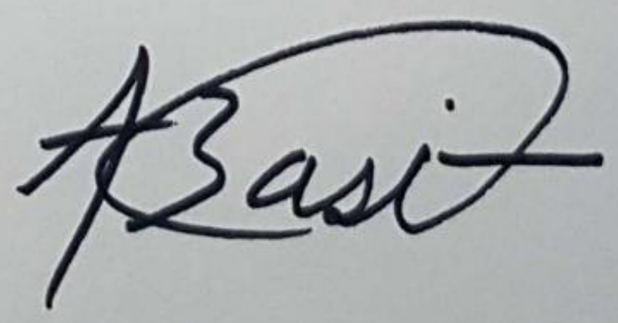
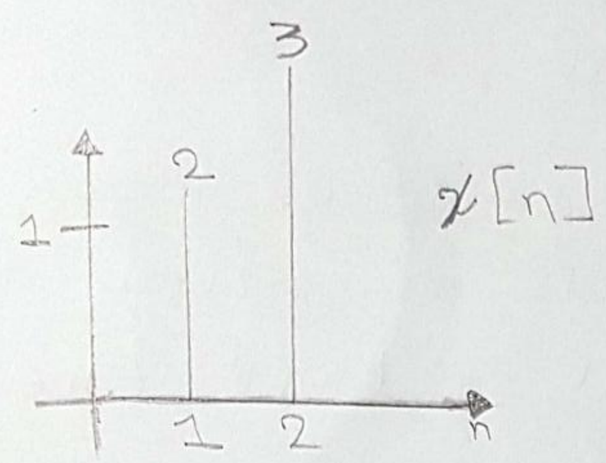
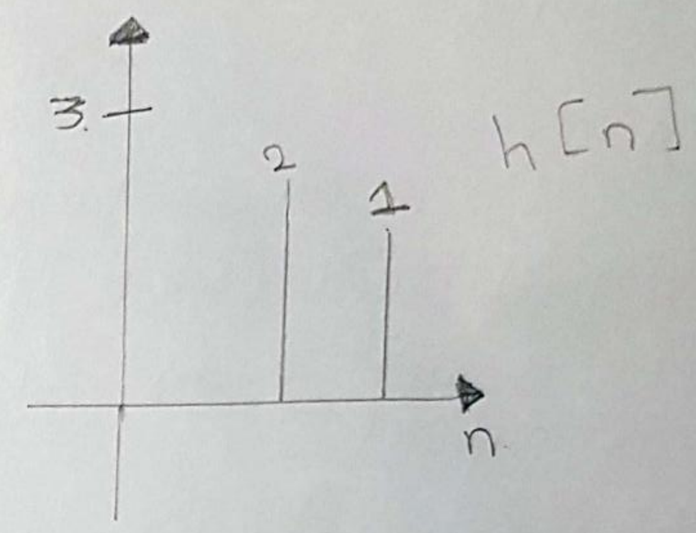
Signature : 

Date : 26 April 2020

Q1 (a)

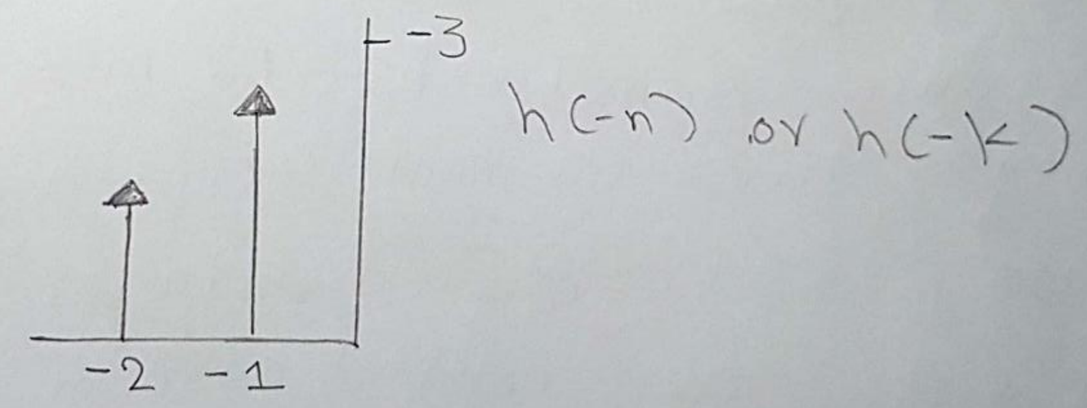
Evaluate $y[n]$ using Convolution Summation





Solution:

Reflect signal $h[x]$ to $h[k]$



formula for Convolution

$$y[n] = \sum_{k=-\infty}^{\infty} x(k)h(n-k)$$

So

$y[0] = 0$

when $n < 0$

Now for $n \geq 0$

$$y[0] = x[k]\, h[0-k]$$

$$= 1 \times 3$$

$$= 3$$

when $n = 1$

$$y[n] = x[k] . h[1-k]$$

$$= (1 \times 2) + (2 \times 3)$$

$$= 8$$

when $n = 2$

$$y[n] = x[n]\, h[n-k]$$

$$= (1 \times 1) + (2 \times 2) + (3 \times 3)$$

$$= 1 + 4 + 9 = 14$$

when $n = 3$

$$y[n] = n[k] . h[n-k]$$

$$= (1 \times 2) + (2 \times 3)$$

$$= 8$$

when $n=4$

$$y[n] = n[k]\, h[3-k]$$

$$= 3 \times 1$$

$$= 3$$

when $n>4$

$$y[n] = 0$$

overlaping of the signal $x[k]$ & $h[n-k]$

Hence overall output $y[n]$

$$y[n] = 3\delta[n] + 8\delta[n-1] + 14\delta[n-2] + 8\delta[n-3] + 3\delta[n-4].$$

Q 1 (b)

Sketch block diagram for given system

$$y[n] = x[n] + x[n-2]$$

Ans

We know that

$$y[n] = x[n] + x[n-2]$$

$$y[-1] = x[-1] + x[-3] = 0+0=0$$

$$y[0] = x[0] + x[-2] = 1+0=1$$

$$y[1] = x[1] + x[-1] = 2+0=2$$

$$y[2] = x[2] + x[0] = 3+1=4$$

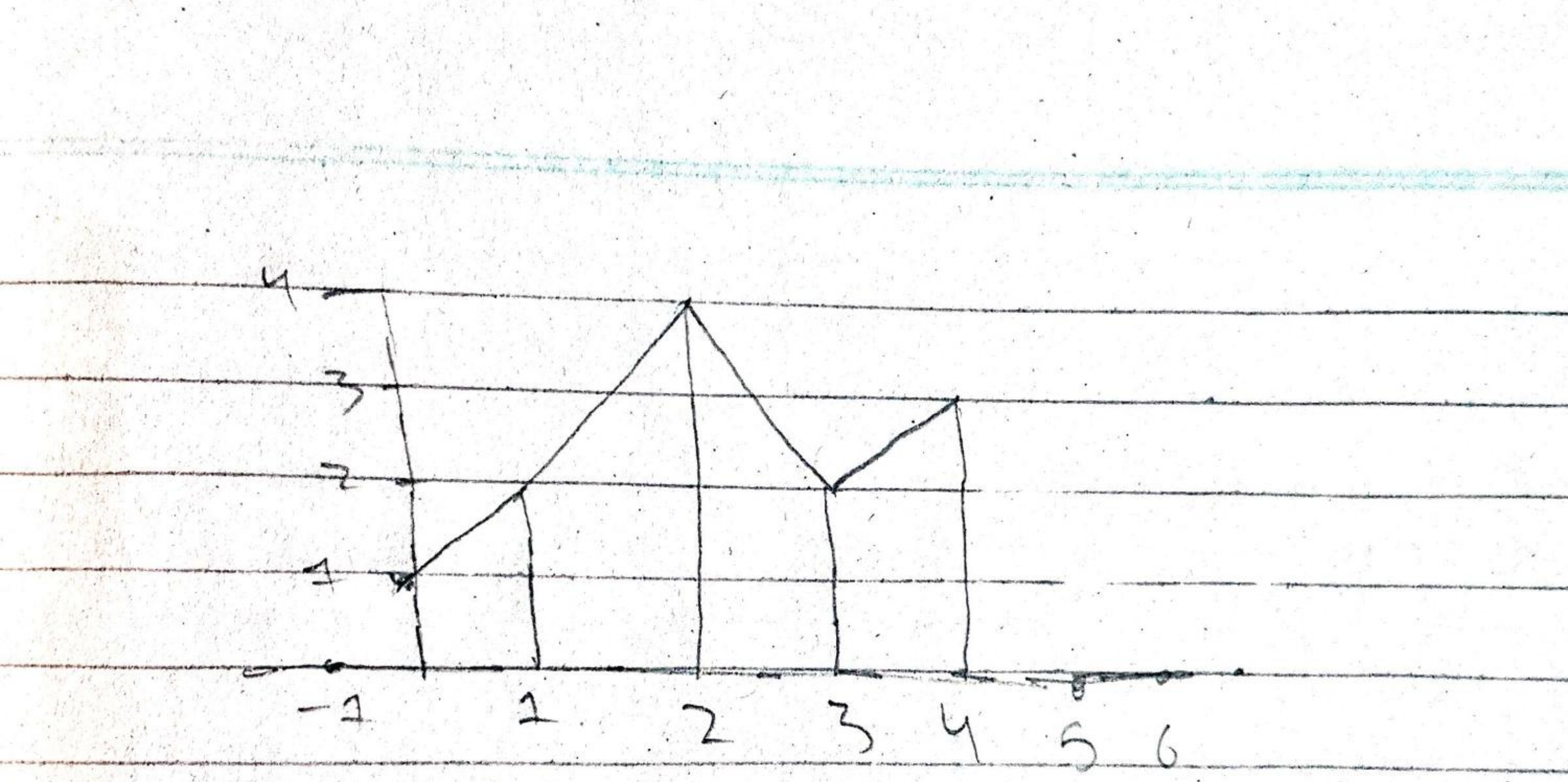
$$y[3] = x[3] + x[1] = 0+2=2$$

$$y[4] = x[4] + x[2] = 0+3=3$$

$$y[5] = x[5] + x[3] = 0+0=0$$

$$y[6] = 0$$

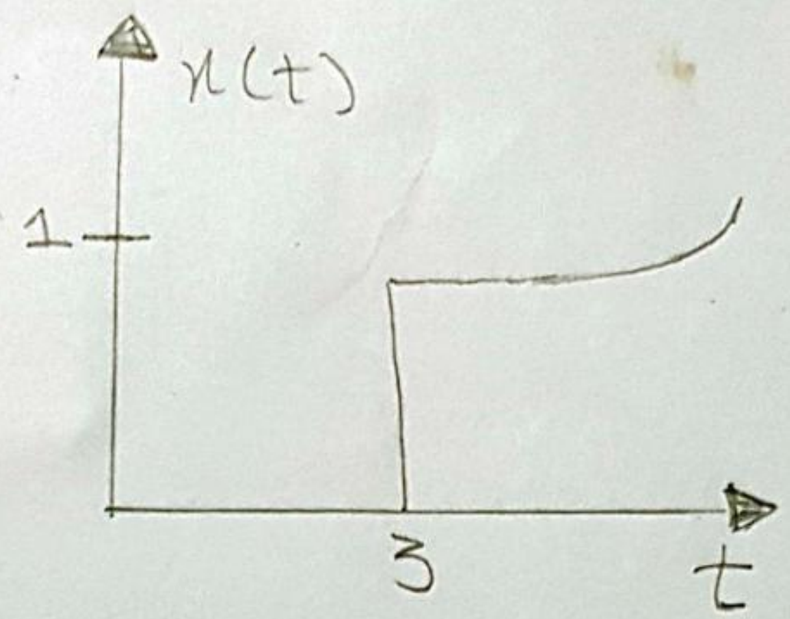
$$y[n] = \{0, 1, 2, 4, 2, 3, 0, 0\}$$



Diagram

Q2 (a)

Sketch the transformed version for the signal $x(t)$ mentioned in i. and ii



i: $x(t+5)$ and $x(3t)$

ii: $x(t/4)$ and $x(t-2)$

i) ~~Re(t)~~ $x(t+5)$

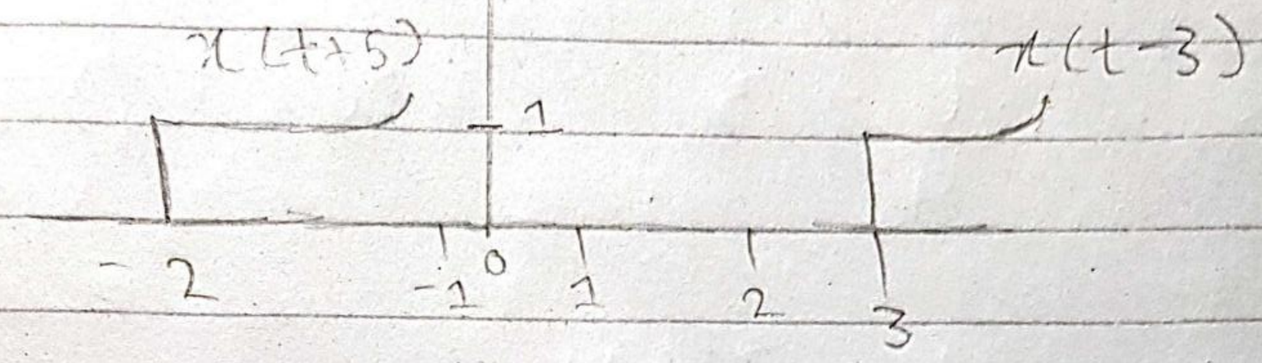
Sol:

$x(t+5)$

$t = 3$, $x(t) = 1$

At $t+5 = 3$, $x(t) = 1$

$t = -2$



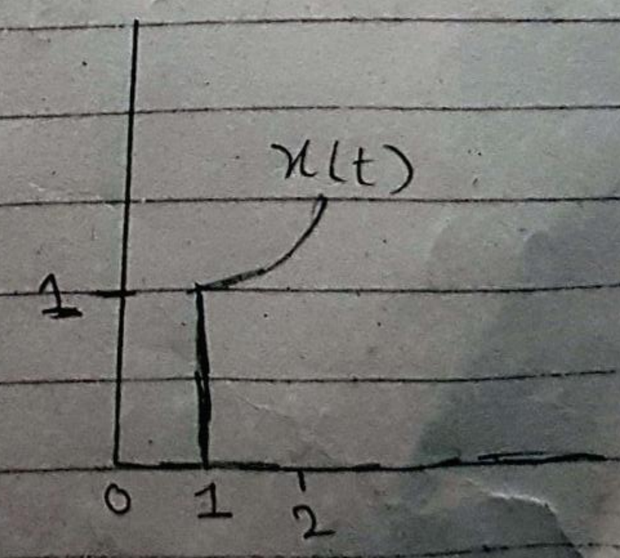
Sol

$t = 3 \quad , x(t) = 1$

at $3t = 3 \quad , x(t) = 1$

$t = \frac{3}{3}$

$t = 1$



ii)

$x(t/4)$ & $x(t-2)$

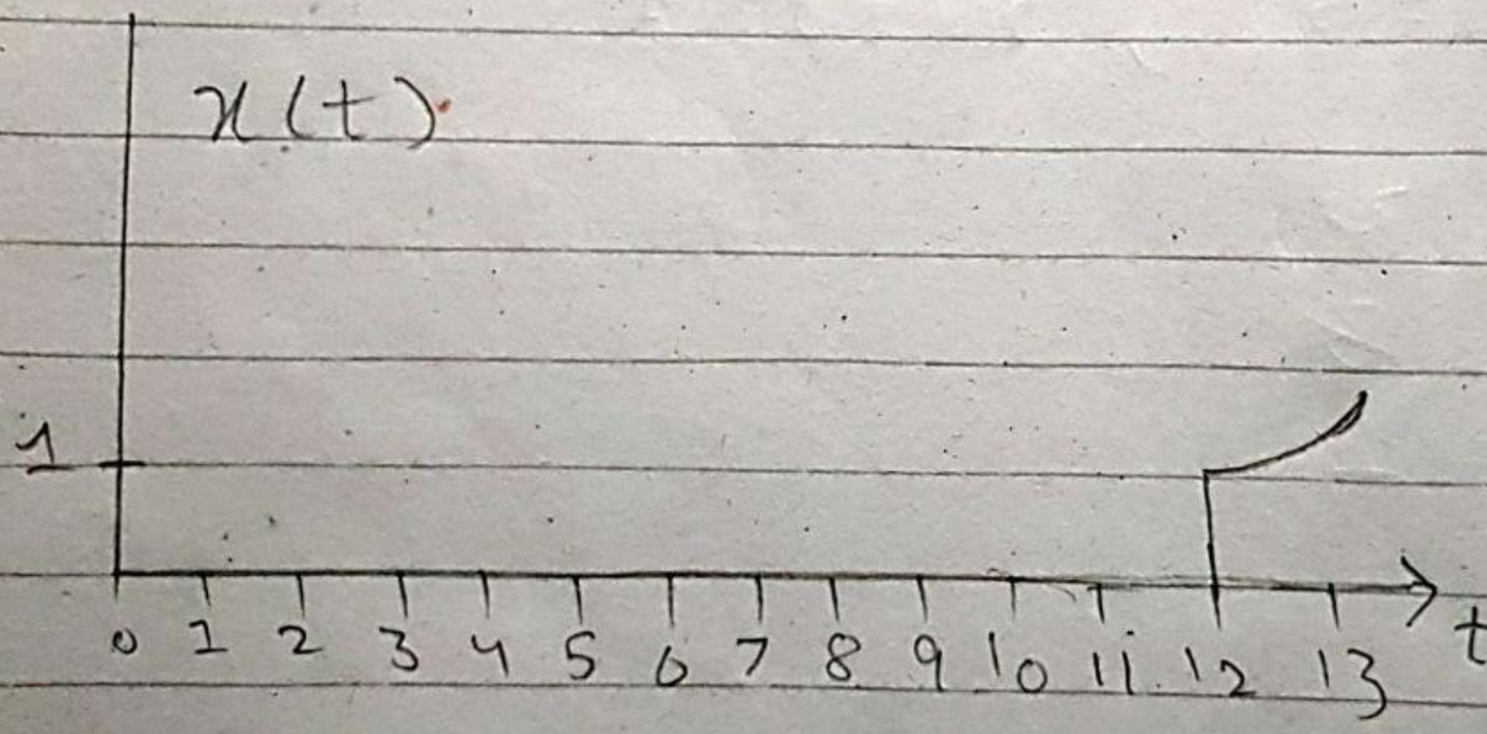
At

$t = 3$, $x(t) = 1$

So $\frac{t}{4} = 3$, $x(t/4) = 1$

$t = 3 \times 4$

$t = 12$

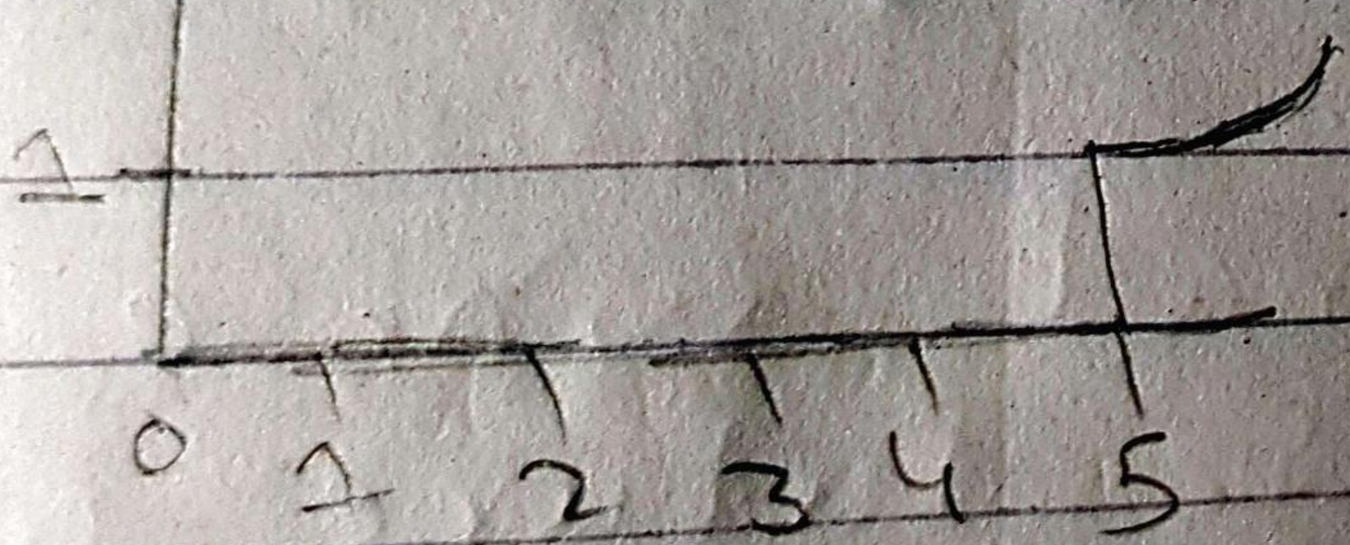


at $x(t-2)$

at $t = 3$, $x(t) = 1$

at $t - 2 = 3$, $x(t) = 1$

$t = 5$



Q2: b

outline the given System as invertible or non-invertible, linear or non linear Causal or non Causal. Give the reason for your answers too.

i: $y[n] = x^2[n]$

ii: $y[n] = x[n+2]$.

i: $y[n] = x^2[n]$

Ans:

Let $x_1(t)$ be the input to the System then,

$$y_1(n) = x_1^2[n]$$

Similarly the response to the input $x_2[n]$

$$y_2(n) = x_2^2[n]$$

Let another input $x_3(t)$

$$x_3(n) = ax_1(n) + bx_2[n]$$

Now

$$y_3(n) = x_3^2(n)$$

$$= [Kx_1(n) + Mx_2(n)]^2$$

$$= [Kx_1(x))^2 + Mx_2(x)^2 + 2(Kx_1(n) \cdot Mx_2(n)]$$

$$y_3(n) = Kx_1^2(n) + Mx_2^2(n)$$

As super position system is not satisfied the given system is non linear.

2 b (ii)

$$y[n] = n[n+2]$$

A system that whose output involves future or anticipated values of the input is said to be non-Causal system

$$y[n] = x[n+1]$$

$$y[n] = x[n] + x[x+2]$$

Non causal System

Q3 Fill in the blank

Ans

if a time shift in the input signal results in an identical time shift in the output signal, the system is said to be **time invariance.**