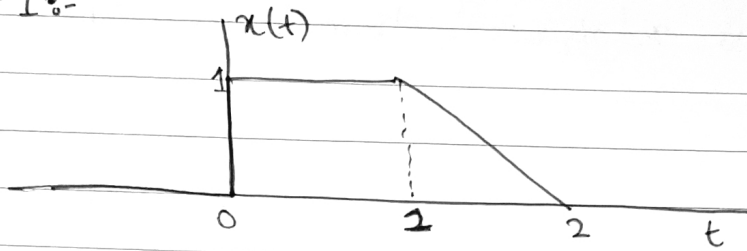


Day/Date 6^m March/18 / TUESDAY

EXAMPLE #1:-

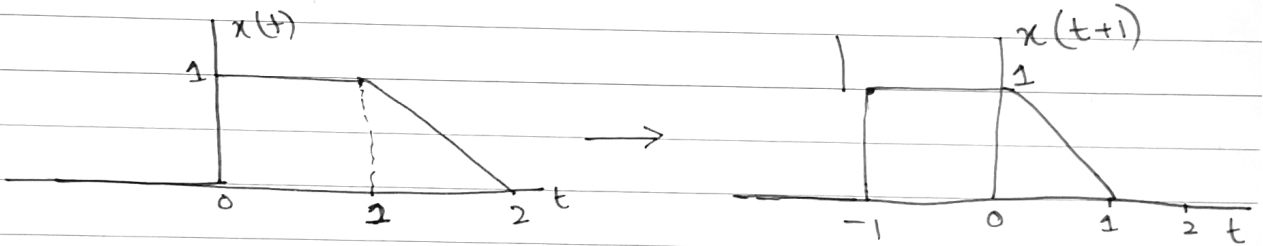


SOL:-

a) Draw the signal $x(t+1)$.

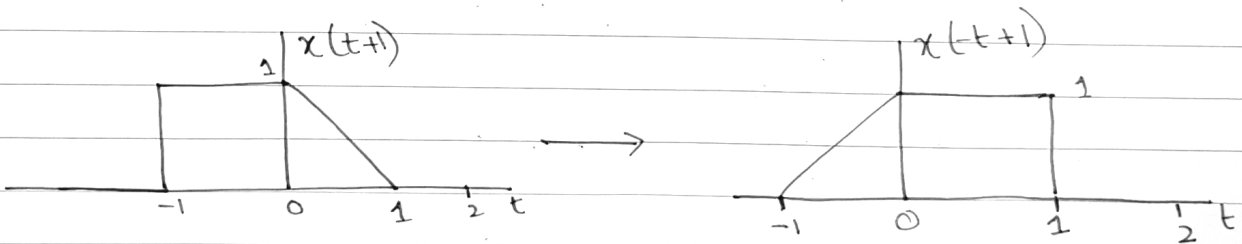
$t_0 = -1 \Rightarrow t_0 < 0$, then the signal will advance.

$$\therefore x(t) \rightarrow x(t-t_0)$$



b) Draw the signal $x(-t+1)$.

$$t_0 = -1$$



c) Draw the time scaled signal $x(3/2 t)$.

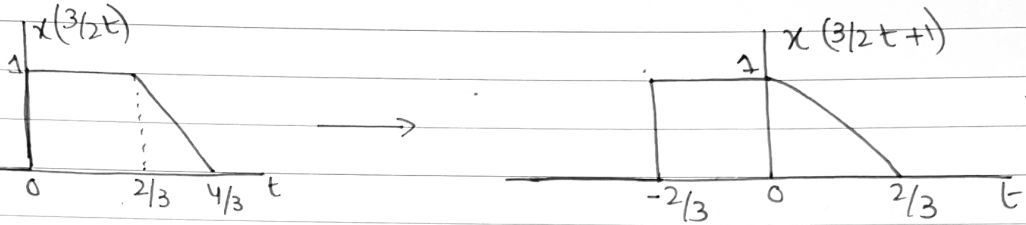
$$\therefore x(t) \rightarrow x(at) \quad a > 0$$

here $a = \frac{3}{2}$ $a > 1$ the signal will decimate.



Day/Date

d) Draw the signal $x(3/2t+1)$ obtained by a time shift and scaling.



EXAMPLE # 2:-

Determine the fundamental period of the following signals:

a) $e^{j3\pi t/5}$

Sol:-

If $x(t)$ is periodic signal, then there exists $T > 0$ such that

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

$$T = ?$$

$$\omega_0 = \frac{2\pi}{T_0}$$

$$T = \frac{2\pi}{\omega_0} \quad \therefore \omega_0 = 3\pi/5$$

$$T = \frac{2\pi}{3\pi/5} = \frac{2\pi}{3\pi} \times 5 \Rightarrow \frac{10}{3} \text{ ans}$$

b) $e^{j3\pi t/5}$

Sol:-

$$N = ?$$

$$\Omega_0 = \frac{2\pi}{N_0}$$

$$N_0 = \frac{2\pi k}{\Omega_0} \quad \therefore \Omega_0 = \frac{3\pi}{5}$$

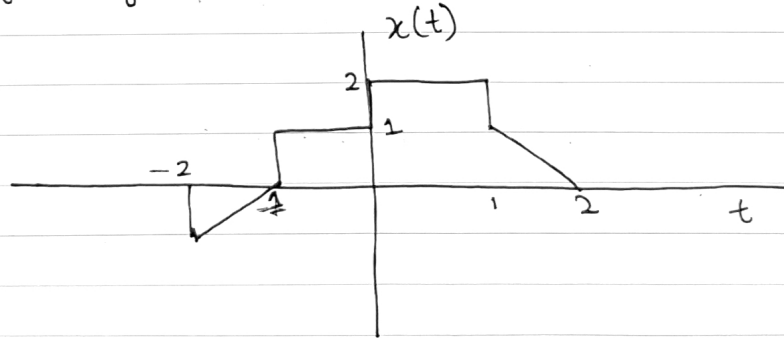
Day/Date

$$\frac{N_0}{k} = \frac{2\pi}{3\pi/5} = \frac{2 \times 5}{3} \Rightarrow \frac{10}{3}$$

$$N_0 \Rightarrow 10 \text{ ans}$$

PROBLEM EXERCISES:-

Q: A continuous time signal $x(t)$ is shown below. Sketch and label carefully each of the following signals:-



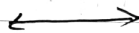
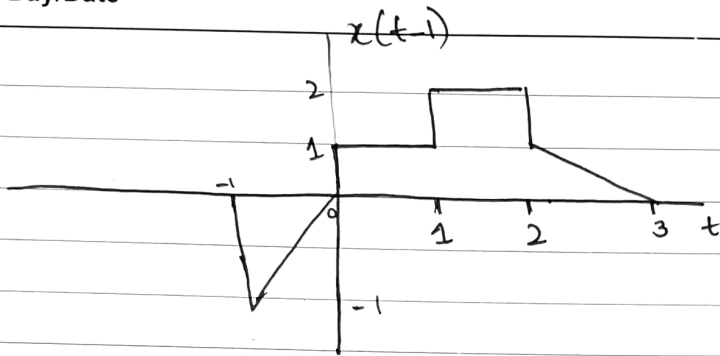
a) $x(t-1)$

Sol:-

$$t_0 = 1$$

$t_0 > 0$ then signal will be delayed.

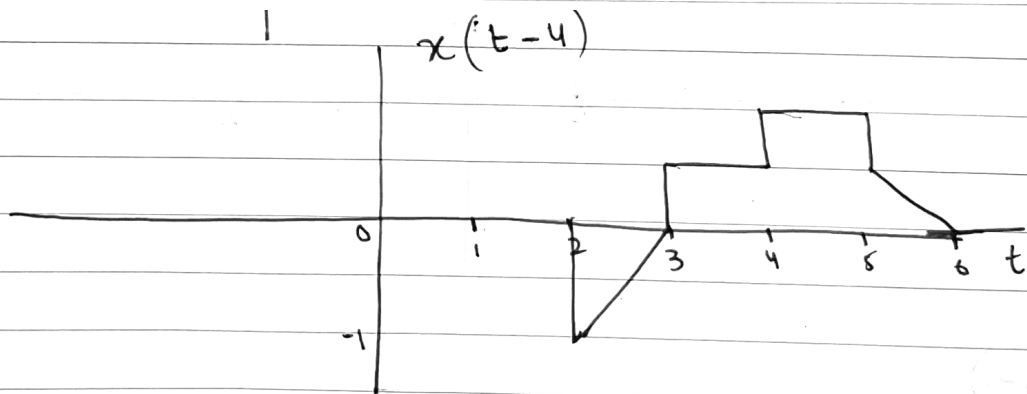
Day/Date



b) $x(4 - \frac{t}{2})$

Solⁿ

$t_0 = 4$

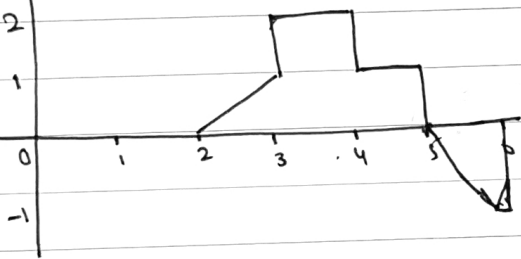


ay/Date

Now $x(4-t)$

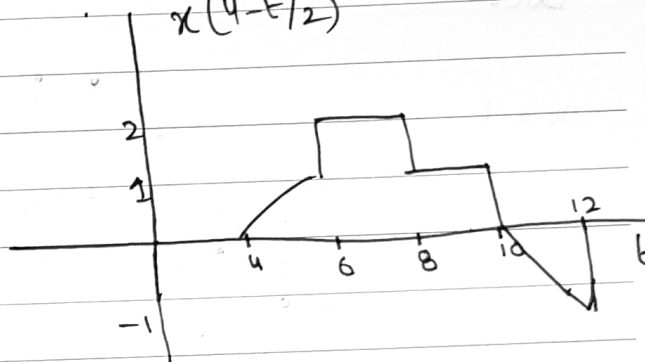
Reverse :-

$x(4-t)$

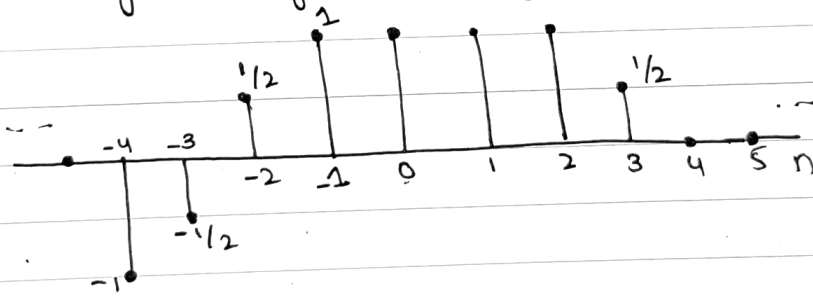


Now $x(4 - \frac{t}{2})$

$x(4 - \frac{t}{2})$

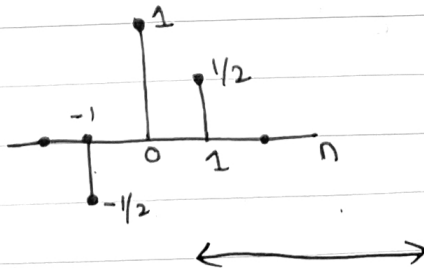


Q2:- A Discrete time signal is shown below. Sketch and label carefully each of the following signals:-



Q) $x[3n]$

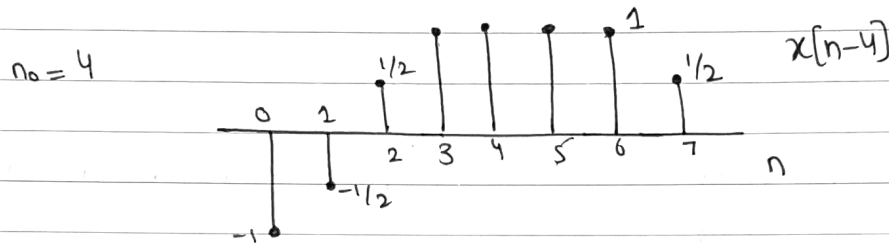
Sol:-



Day/Date

b) $x[n-4]$

Sol:-



Q3:- Determine whether or not each of the following signals are periodic or not. If the signal is periodic, determine its fundamental period.

a) $x(t) = 3 \cos(4t + \frac{\pi}{3})$

Sol:-

$3 \cos(4t + \frac{\pi}{3})$ is periodic with period π .

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

$$T = ?$$

$$\omega_0 = \frac{2\pi}{T}$$

$$T = \frac{2\pi}{\omega_0} \quad \therefore \omega_0 = 4$$

$$T = \frac{2\pi}{4} \Rightarrow \frac{\pi}{2}$$



Day/Date

$$b) x[n] = \sin\left[\frac{6\pi}{7}n + 1\right]$$

Sol:-

Periodic as well.

$$N = ?$$

$$\Omega_0 = \frac{2\pi}{N_0}$$

$$N_0 = \frac{2\pi k}{\Omega_0}$$

$$\frac{N_0}{k} = \frac{2\pi}{\Omega_0} \quad \therefore \Omega_0 = \frac{6\pi}{7}$$

$$\frac{N_0}{k} = \frac{1 \times 2\pi}{3 \times 6\pi} \times 7 \Rightarrow \frac{7}{3}$$

$$N_0 = 7.$$

Day/Date 13-03-18/TUESDAY

EXERCISE PROBLEMS:-

Q1- Determine the fundamental period of the signal $x(t) = 2\cos(10t+1) - \sin(4t-1)$.

Sol:-

Let's calculate the period of first term in R.H.S

$$2\cos(10t+1) \Rightarrow \omega = 10 \quad T = \frac{2\pi}{\omega_0}$$

$$\therefore \omega_0 = 10$$

$$T_1 = \frac{2\pi}{10} \Rightarrow \frac{\pi}{5}$$

Now calculate for second term in R.H.S

$$\sin(4t-1) \Rightarrow T = \frac{2\pi}{\omega_0}$$

$$\therefore \omega_0 = 4$$

$$T_2 = \frac{2\pi}{4} \Rightarrow \frac{\pi}{2}$$

To find the overall period take the LCM of two periods,
 T_1 & T_2 :-

$$\frac{\pi}{5} = \frac{\pi}{5} \times \frac{2}{2} \Rightarrow \frac{2\pi}{5}$$

$$\frac{T_1}{T_2} = \frac{\pi/5}{\pi/2} \Rightarrow \frac{2}{5}$$

Therefore, the overall signal is periodic which is the least common multiple of the periods of the first and second terms. This is equal to $\frac{2\pi}{5}$.



Day/Date

Q2:- Consider the continuous-time signal.

$$x(t) = \delta(t+2) - \delta(t-2)$$

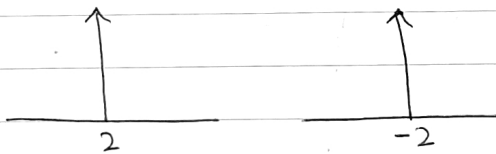
Calculate the value of E_∞ for the signal:

$$y(t) = \int_{-\infty}^t x(\tau) d\tau$$

Sol:-

$$y(t) = \int_{-\infty}^t x(\tau) d\tau = \int_{-\infty}^t [\delta(\tau+2) - \delta(\tau-2)] d\tau$$

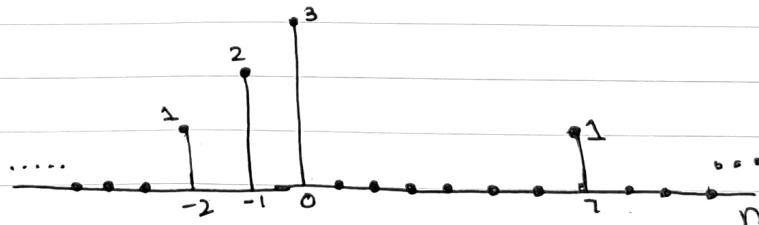
$$= \begin{cases} 0, & t < -2 \\ 1, & -2 \leq t \leq 2 \\ 0, & t > 2 \end{cases}$$



Therefore,

$$E_\infty = \int_{-2}^2 dt \Rightarrow \left. t \right|_{-2}^2 = [2 - (-2)] \Rightarrow 4$$

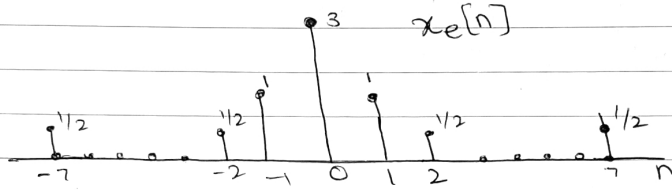
Q3:- Determine and sketch the even and odd parts of the signals shown below.



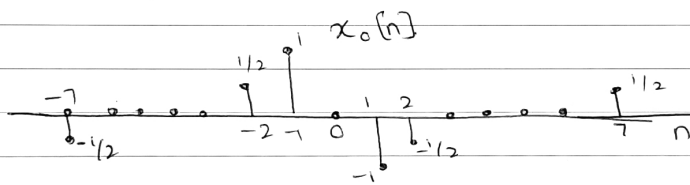
Day/Date

Soln

Even part :-



Odd part :-



$\odot -1$
 $-1/2$
 $\odot -1$