Problem

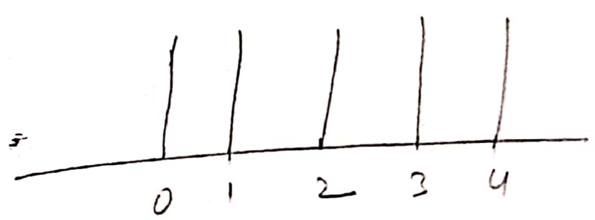
$$x[n] = \begin{cases} 1 & -2 \le n \le 2 \\ 0 & |n| > 2 \end{cases}$$

find $y[n] = x[3n-2]$

$v[n] = x[n-2]$.

$x(n)$

$v(n) = x[n-2]$



$\boxed{x[3n-2]}$. $y[n] = v[3n]$.

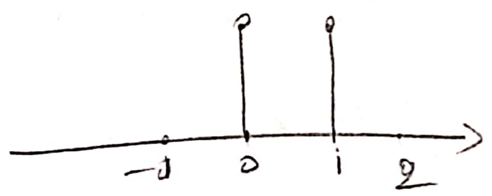
$3n = 0 \Rightarrow n = 0$ ✓

$3n = 1$ ✗

$3n = 2$ ✗

$3n = 3$ $n = 1$. ✓

$3n = 4$ ✗.



$$\therefore y[n] = \begin{cases} 1 & n = 0, 1 \\ 0 & \text{else} \end{cases}$$

1.12 Consider a signal

$$x[n] = 1 - \sum_{k=3}^{\infty} \delta[n-1-k]$$

Determine M & n_0 such that

$$x[n] = u[Mn - n_0]$$

From $x[n] = 1 - \sum_{k=3}^{\infty} \delta(n-1-k)$.

$n = 0$. $\quad x[0] = 1 - \sum_{k=3}^{\infty} \delta[-1-k] = 1$

$n = 1 \quad x[1] = 1 - \sum_{k=3}^{\infty} \delta[-k] = 1$

$n = 2$. $\quad x[2] = 1 - \sum_{k=3}^{\infty} \delta[1-k] = 1$

$n = 3 \quad x[3] = 1$

$n = 4 \quad x[4] = 1 - \sum_{k=3}^{\infty} \delta[3-k] = 0$

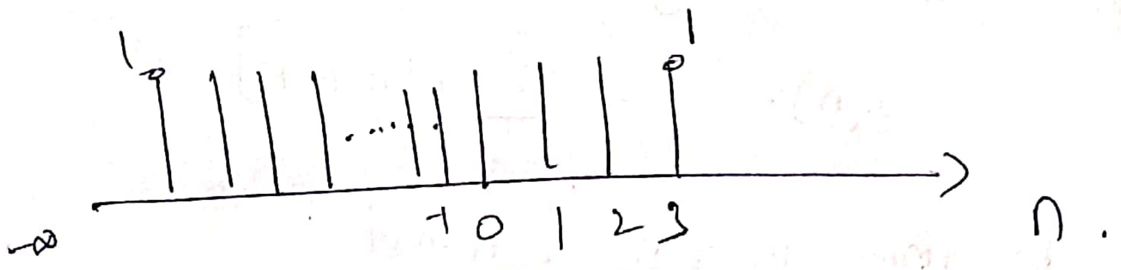
$n = 5 \quad x[5] = 1 - \sum_{k=3}^{\infty} \delta[4-k] = 0$

$n = -1 \quad x[-1] = 1 - \sum_{k=3}^{\infty} \delta[-2-k] = 1$

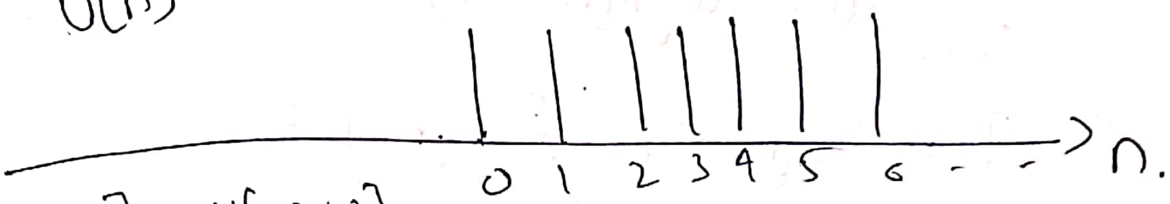
$n = -2$ .. $x[-2] = 1$

$\therefore$

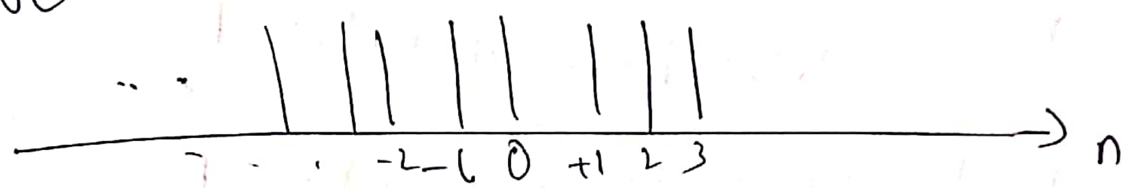
$x(n)$



$u[n]$



$u[3-n] = u[-n+3]$.



$\therefore x[n] = u[-n-(-3)]$

$\therefore M = -1, \; n_0 = -3$.

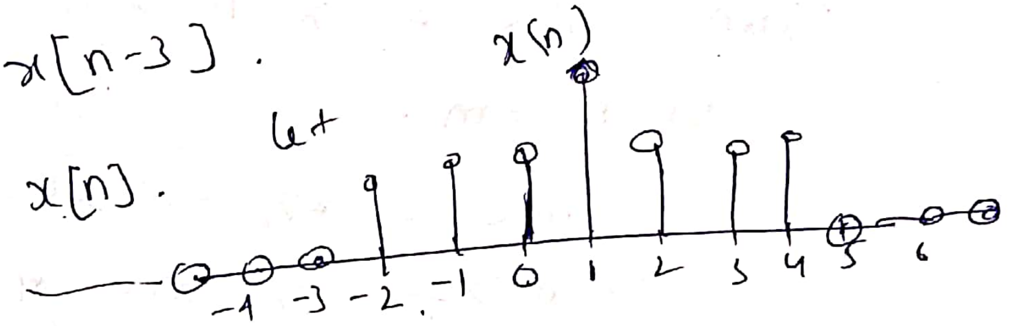
Given.

$x[n] = 0 \quad n < -2 \;\&\; n > 4.$

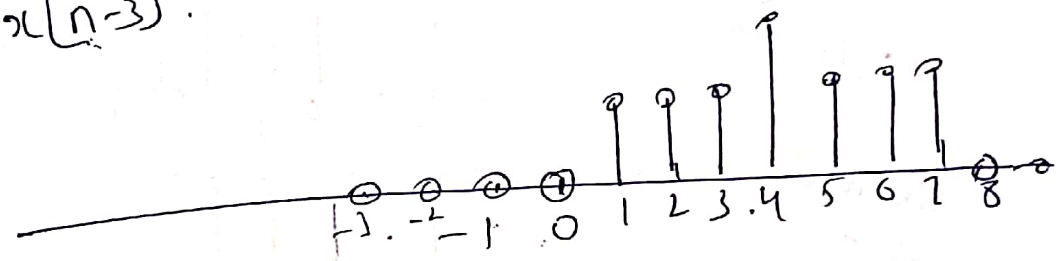
For each signal below determine which values of n, the new signal is zero.

(i) $x[n-3]$.

Sol: let $x[n]$.

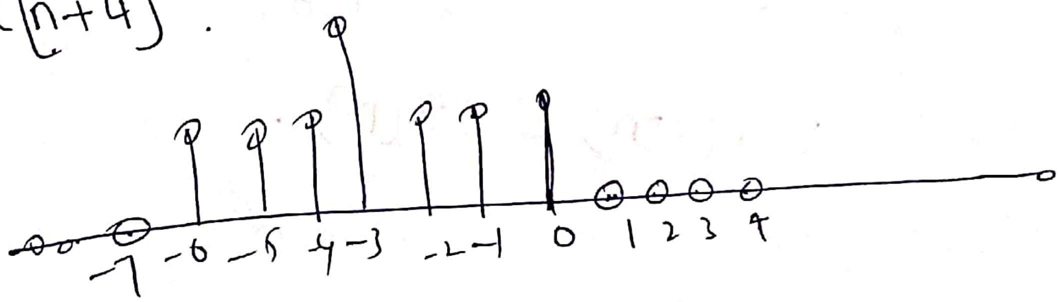


$x[n-3]$.



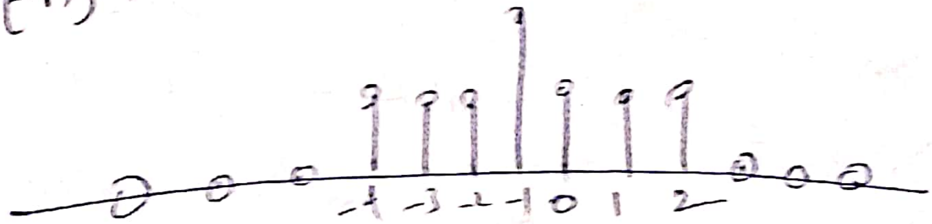
$\therefore x[n-3] = 0 \quad n < 1 \;\&\; n > 7.$

(ii) $x[n+4]$.



$x[n+4] = 0 \quad n < -6 \;\&\; n > 0.$

(3) $x[-n]$.



$x[-n] = 0 \quad n<-4 \text{ \& } n>2$

From $n<-2$ & $n>4$

let $n=-m$.

$-m<-2$ & $-m>4$.

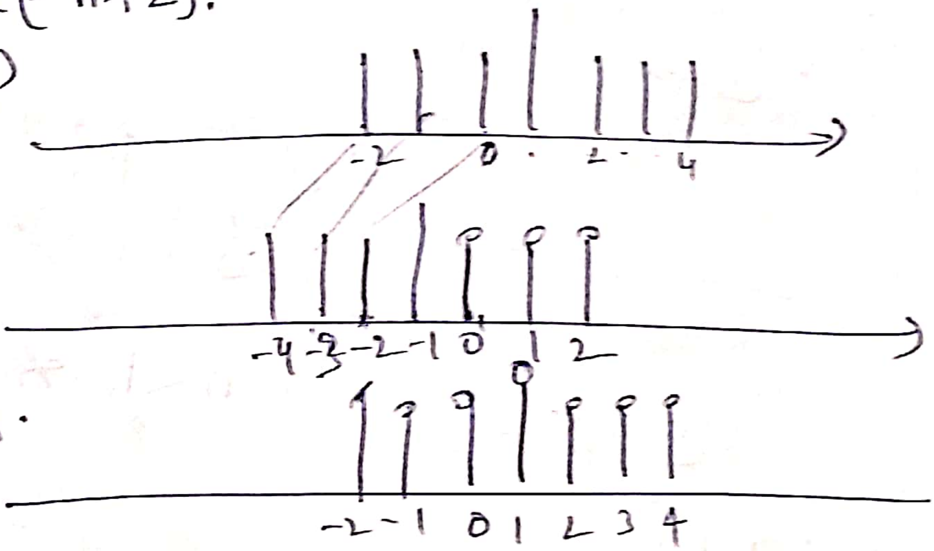
$\Rightarrow m>2$ & $m<-4$.

(4). $x[-n+2]$.

$x(n)$

advance by 2

Time reversal.



$\therefore x[2-n] = x[n]$.

Given $y_1(t) = x(2t)$ & $y_2(t) = x(t/2)$

(i) If $x(t)$ is periodic then $y_1(t)$ is also periodic?

def: $x(t+T) = x(t)$.

$\therefore$ $y_1(t+T_1) = y_1(t)$ → requirement.

$$y_1(t+T_1) = x(2(t+T_1))$$
$$= x(2t+2T_1).$$

Now if $2T_1 = T$.

$$= x(2t+T) = x(2t) = y_1(t).$$

$\therefore$ (i) is true with period $\boxed{T_1 = \frac{T}{2}}$

(ii) If $y_1(t)$ is periodic then $x(t)$ is periodic

Sol: $y_1(t) = y_1(t+T)$

To prove $x(t+T_1) = x(t)$.

→ $x(t+T_1) = y_1\left(\frac{t+T_1}{2}\right) = y_1\left(\frac{t}{2}+\frac{T_1}{2}\right)$

if $T_1 = 2T$ ⇒ $= y_1\left(\frac{t}{2}+T\right)$

$$= y_1\left(\frac{t}{2}\right) = x(t).$$

(Exercises)

(CW)

4A)

$\therefore$ (ii) is true with period $T/2$.

(iii).