Assignment DSAD

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Assignment 1: ~~Da~~ Draw odd and even part of
$x[n] = 2u[n+1] - 2u[n-4]$

$$u[n] = \begin{cases} 1 & \text{for } n \geq 0 \\ 0 & \text{for } n < 0 \end{cases}$$

when $n=1$
$x[1] = 2u[2] - 2u[-3]$
$= 2$

when $n=-1$
$x[-1] = 2u[0] - 2u[-5]$
$= 2$

when $n=2$
$x[2] = 2u[3] - 2u[-2]$
$= 2$

when $n=-2$
$x[-2] = 2u[-1] - 2u[-6]$
$= 0$

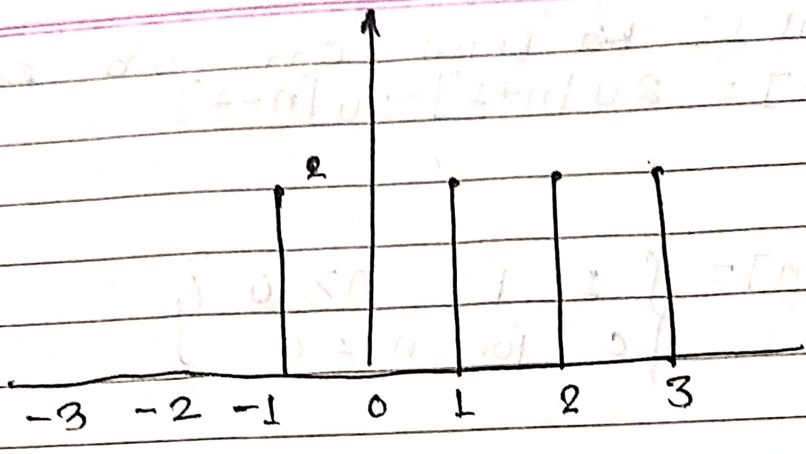
when $n = 3$
$x[3] = 2u[4] - 2u[-1]$
$= 2$

when $n=-3$
$x[-3] = 2u[-2] - 2u[-7]$
$= 0.$

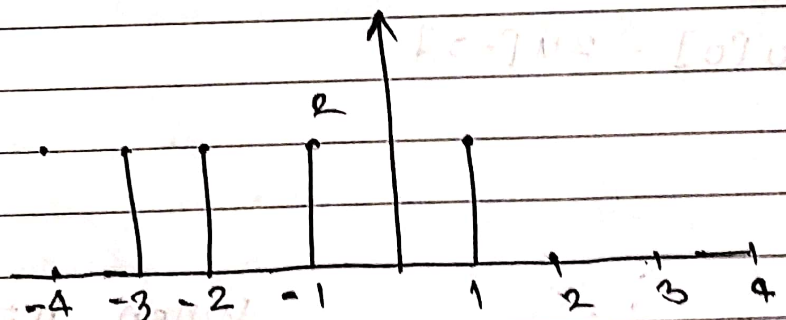
when $n = 4.$
$x[4] = 2u[5] - 2u[0]$
$= 2-2$
$= 0$

when $n=-4.$
$x[-4] = 2u[-3] - 2u[-8]$
$= 0$

$x[n]$

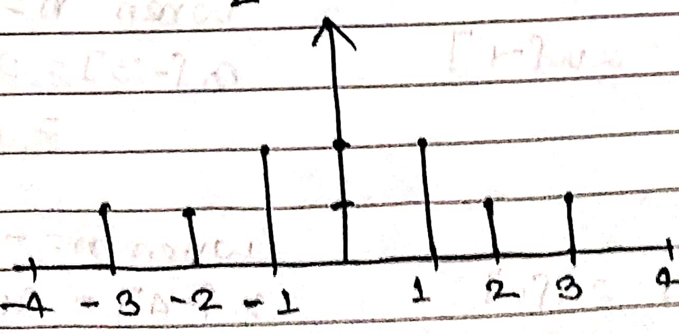


$x[-n]$.



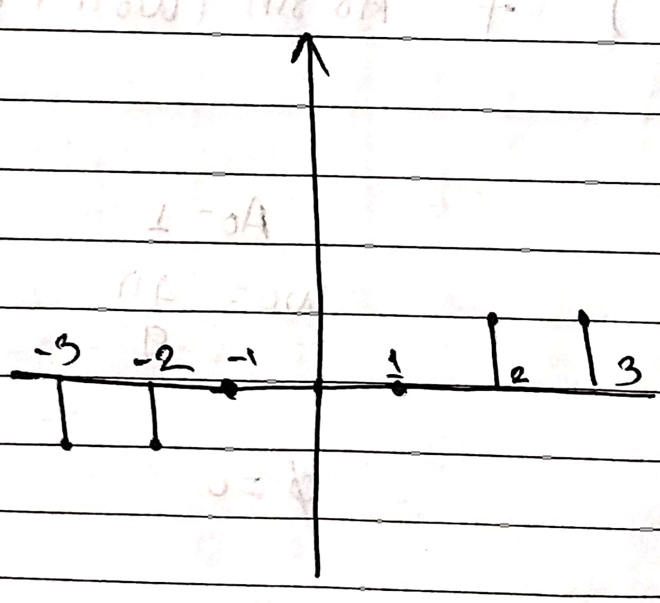
For even signal.

$$\frac{x[n] + x[-n]}{2}$$



for odd signal

$$\frac{x[n] - x[-n]}{2}$$



Periodic and aperiodic signal

Q) $\cos \frac{3\pi}{7} n + \sin \frac{4\pi}{9} n$

Comparing with

$A_0 \cos (w_0 n + \phi) + A_0 \sin (w_0 \pi + \phi)$

where

$A_0 = 1$ $\qquad$ $A_0 = 1$

$w_0 = \frac{3\pi}{7}$ $\qquad$ $w_0 = \frac{4\pi}{9}$

$\phi = 0$ $\qquad$ $\phi = 0$

Since,

$w_0 = \frac{3\pi}{7}$ $\qquad$ $w_0 = \frac{4\pi}{9}$

$\frac{2\pi}{N_1} = \frac{3\pi}{7}$ $\qquad$ $\frac{2\pi}{N_2} = \frac{4\pi}{9}$

$N_1 = \frac{14}{3}$ $\qquad$ $N_2 = \frac{18}{4}$

finally,

$\frac{N_1}{N_2} = \frac{14}{3} \times \frac{4}{18} = \frac{56}{54}$

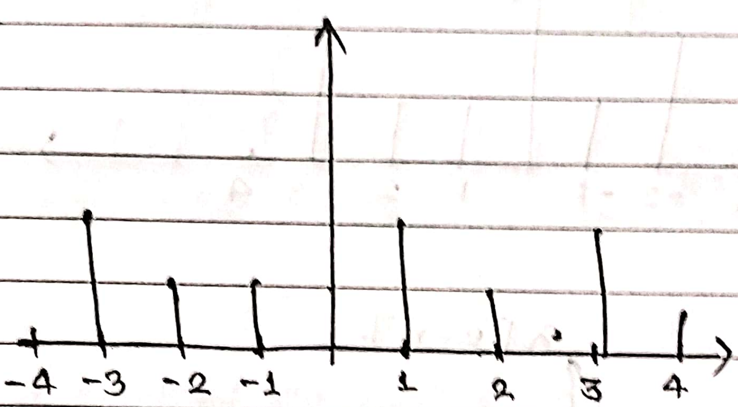
= rational.

Thus it is periodic with N.

Operation on signal:

Time Scaling & Time shifting

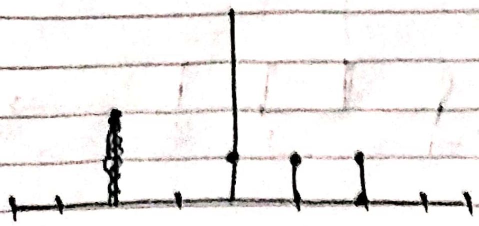
Given signal $x[n]$ find $x[2-2n]$.



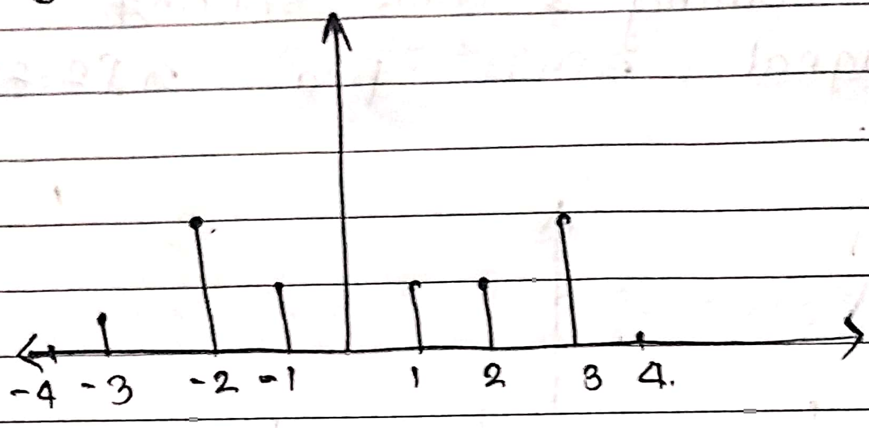
n	2 - 2n.
-3	5/2
-2	2
-1	3/2
0	1
1	1/2
2	0
3	-1/2
4	-1

$$\left[\begin{array}{l} 2-2n=-3 \\ 2+3=2n \\ n=5/2 \end{array}\right].$$

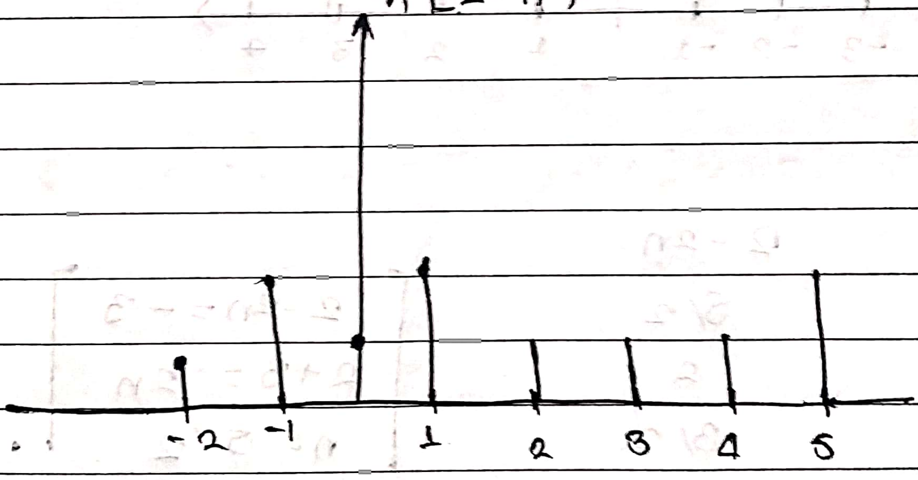
We can simply plot this in the table



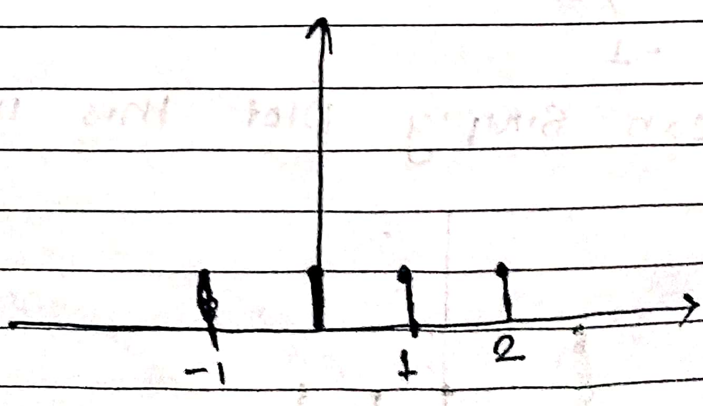
Plotting by every step.



x[2-n].



x[2-2n]



Linear Time invarient system.

2) Find the output of LTI system having

i) $x[n] = \{1, \underset{\uparrow}{3}, 5, 2\}$ and $h[n] = \{2, \underset{\uparrow}{3}, 4, 6\}$

Output of LTI system is given by

$$y[n] = x[n] * h[n].$$

$$= \sum_{k=-\infty}^{\infty} x[k]\, h[n-k]$$

$$= x[-1]h[n+1] + x[0]h[n] + x[1]h[n-1] + x[2]h[n-2] + x[3]h[n-3]$$

$$= 1h[n+1] + 3h[n] + 5h[n-1] + 2h[n-2]$$

for $n=0$, $y[0] = h[1] + 3h[0] + 5h[-1] + 2h[-2]$

$$= 3 + 3\times 2$$
$$= 3+6$$
$$= 9.$$

for $n=1$, $y[1] = h[2] + 3h[1] + 5h[0] + 2h[-1]$

$$= 4 + 3\times 3 + 5\times 2$$
$$= 4+9+10$$
$$= 23$$

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For $n=2$, $y[2] = h[3] + 3h[2] + 5h[1] + 2h[0]$

$= 6 + 3\times4 + 5\times3 + 2\times2$

$= 6 + 12 + 15 + 4$

$= 37$

for $n=3$, $y[3] = h[4] + 3h[3] + 5h[2] + 2h[1]$.

$= 0 + 3\times6 + 5\times4 + 2\times3$

$= 18 + 20 + 6$

$= 44$

for $n=4$, $y[4] = h[5] + 3h[4] + 5h[3] + 2h[2]$

$= 5\times6 + 2\times4$

$= 30 + 8$

$= 38$

for $n=5$, $y[5] = h[6] + 3h[5] + 5h[4] + 2h[3]$

$= 2\times6$

$= 12$

for $n=-1$, $y[0] = h[0] + 3h[-1] + 5h[-2] + 2h[-3]$

$= 2$

$y[n] = \{ 2, \underset{\uparrow}{9}, 23, 37, 44, 38, 12 \}$

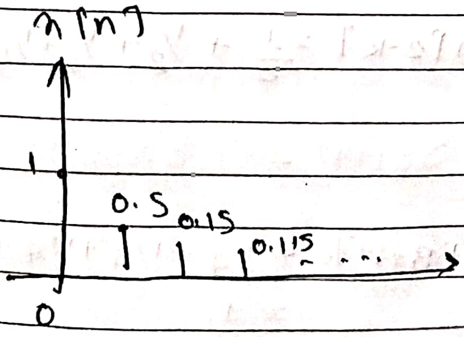
To check Answer

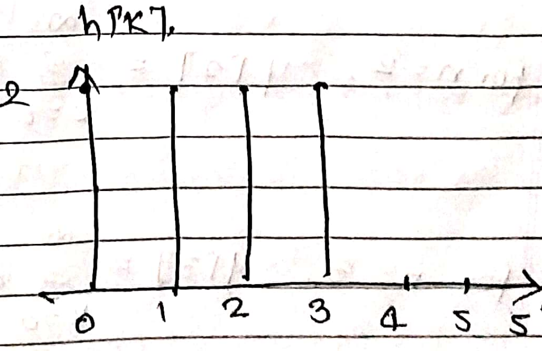
$x[n]$ \ $h[n]$	2 $h[0]$	3 $h[1]$	4 $h[2]$	6 $h[3]$
$x[-1]$ (1)	2	3	4	6
$x[0]$ (3)	6	9	12	18
$x[1]$ (5)	10	15	20	30
$x[2]$ (2)	4	6	8	12

Diagonally Sum $= \{2, (6+3), (10+9+4), (4+15+12+6), (6+20+18), (8+30), 12\}$

$= \{2, 9, 23, 37, 44, 38, 12\}$

ii) $x[n] = \left(\frac{1}{2}\right)^n u[n]$ and $h[n] = 2u[n] - 2u[n-4]$





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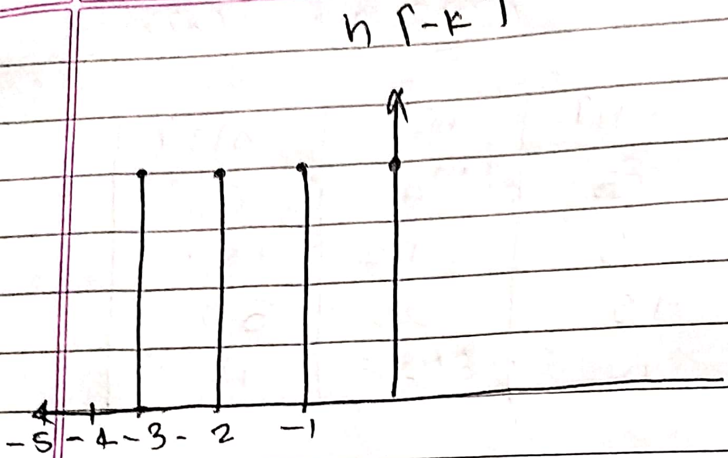

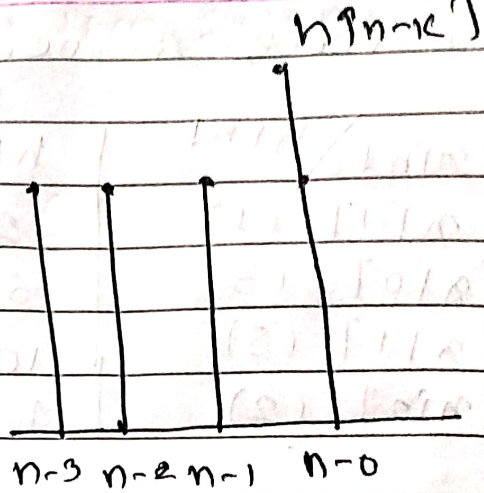

for n < 0, $y[n] = \sum_{n=1}^{\infty} x[n]\, h[n-k] = 0.$

for n = 0, $y[0] = \sum_{k=0}^{\infty} x[0]\, h[-k] = 2+2+2+2 = 8.$

for n = 1, $y[1] = \sum_{k=0}^{\infty} x[1]\, h[1-k] = 1+1+1+1 = 4$

for n = 2, $y[2] = \sum_{k=0}^{\infty} x[2]\, h[2-k] = \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$

for n = 3, $y[3] = \sum_{k=0}^{\infty} x[3]\, h[3-k] = 1/4 + 1/4 + 1/4 + 1/4$
$= 1.$

The general expression will be

$$y[n] = \begin{cases} 0 & \text{for } n < 0 \\ (1/2)^{n-3} & \end{cases}$$

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Given,

$x_a(t) = 3\cos 2000\pi t + 5\sin 6000\pi t + 10\cos 12000\pi t$.

Find.

a) Niquist Sampling Rate

b) If $f_s = 5$ KHz then find $x[n]$.

c) if we reconstruct original signal from $x[n]$ obtained in (b) then what will be $x_r(t)$.

Given,

a) $f_n = 2 f_{max}$

$= 2 \times 12000$ Hz

$= 24000$ Hz.

b) $f_s = 5$ KHz

Then, $x[n] = x_a[t]$. / $t = nT = \frac{n}{f_s} = \frac{n}{5000}$

$x[n] = 3\cos \frac{2000\pi n}{5000} + 5\sin \frac{6000 n\pi}{5000} + 10\cos \frac{12000 n\pi}{5000}$

$= 3\cos \frac{2n\pi}{5} + 5\sin \frac{6n\pi}{5} + 10\cos \frac{12n\pi}{5}$

c) $x[n] = 8\cos\frac{2\pi n}{5} + 5\sin\frac{2\times 3\pi n}{5} + 10\cos\frac{2\times 6\pi n}{5}$

$f_1' = \frac{1}{5} \qquad f_2' = \frac{3}{5} \qquad f_3' = \frac{6}{5}$

$f_s = 5\,KHz$

$f_{r_1}' = \frac{1}{5}\times 5 = 1\,KHz$

$f_{r_1}' = \frac{3}{5}\times 5 = 3\,KHz$

$f_{r_1}' = \frac{6}{5}\times 5 = 6\,KHz$

$x_r(t) = 8\cos(2\pi\times 10^3 t) + 5\sin(2\pi\times 3\times 10^3 t)$

$+ 10\cos(2\pi\times 6\times 10^3 t)$.