(Q1) Given the signal x(t) shown in figure 1, sketch and label the following signals.

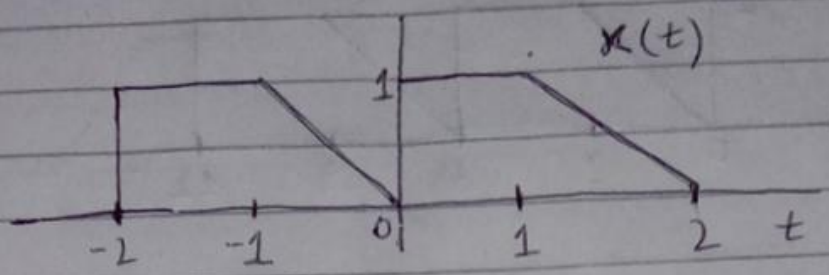
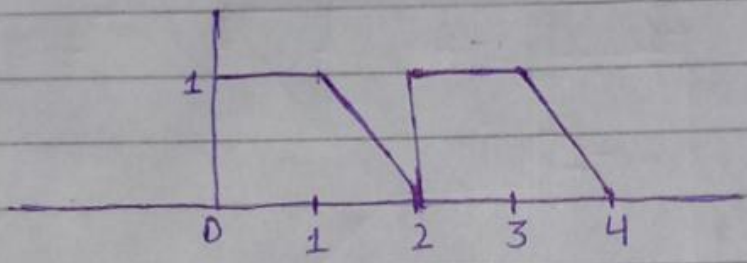



figure 1

1. x(t-2)

solution:

Shifting Right by 2

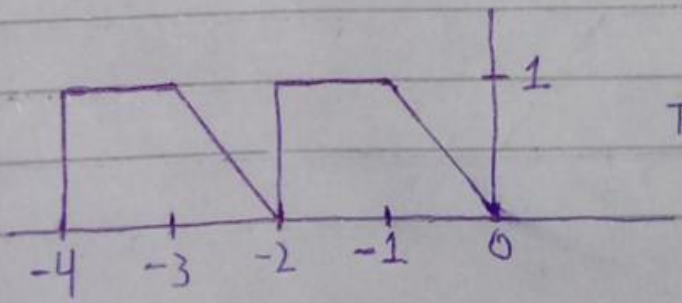



2. x((2-t)/3)

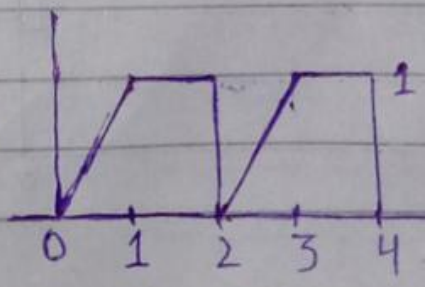
solution:

x((-t+2)/3)

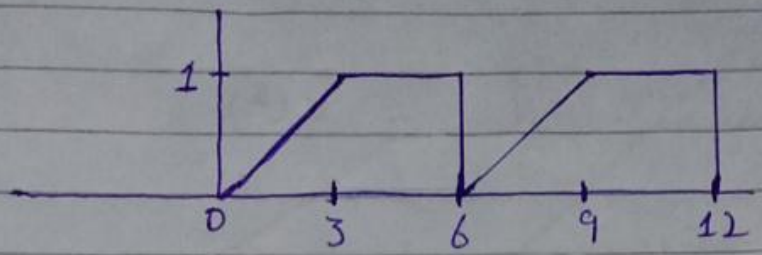
shift : t+2



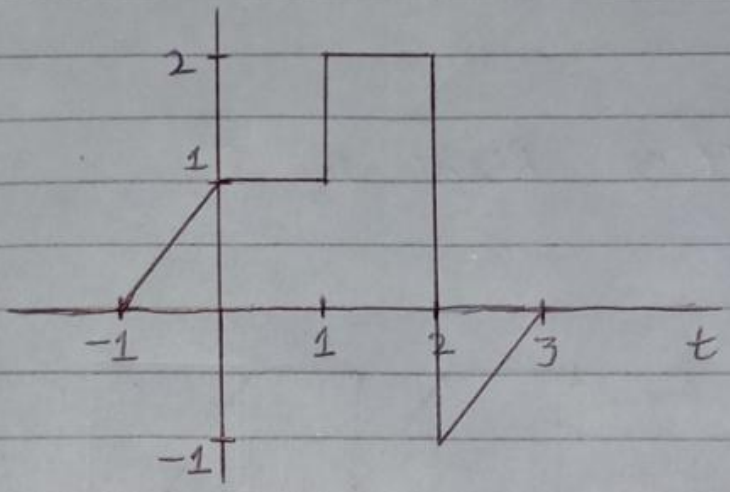

Then Reverse (-t+2)



Now scaling $x((2-t)/3)$



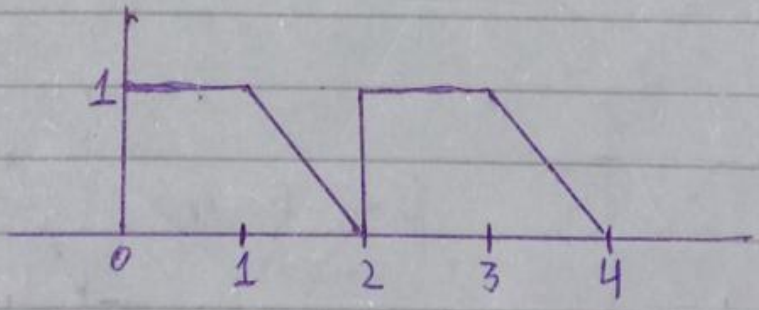

(Q2) Using Q1's $x(t)$ signal and $h(t)$, sketch the following:



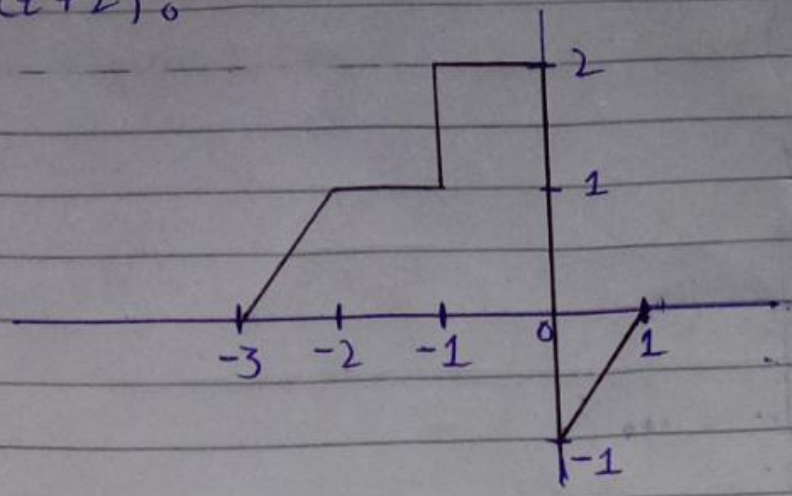

1. $x(t-2)\,h(t+2)$

solution:

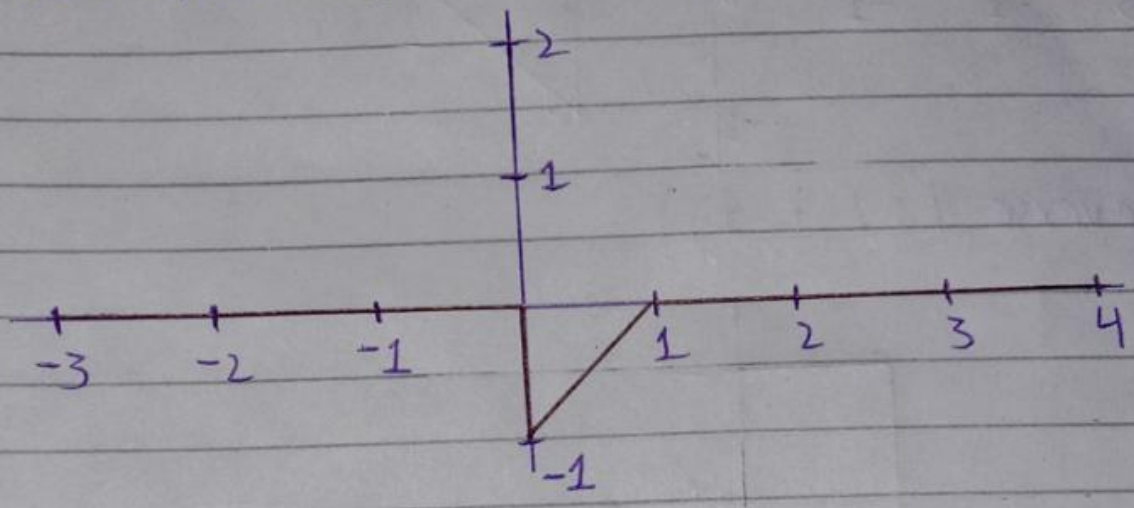
$x(t-2)$:



h(t+2):



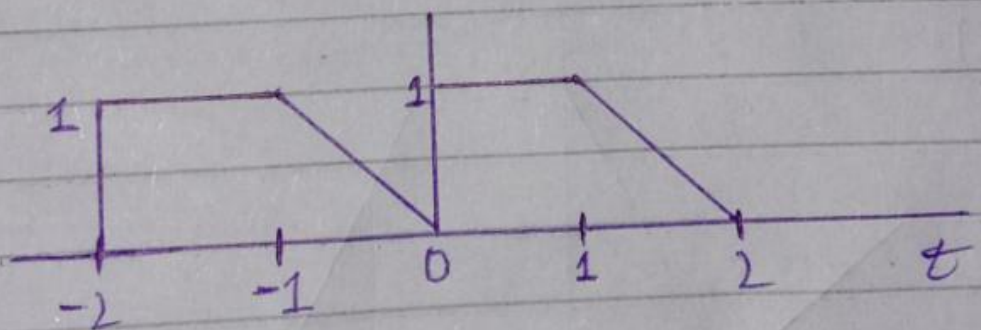

Now x(t-2)h(t+2):




2. x(t) + h(1-t)

Solution:

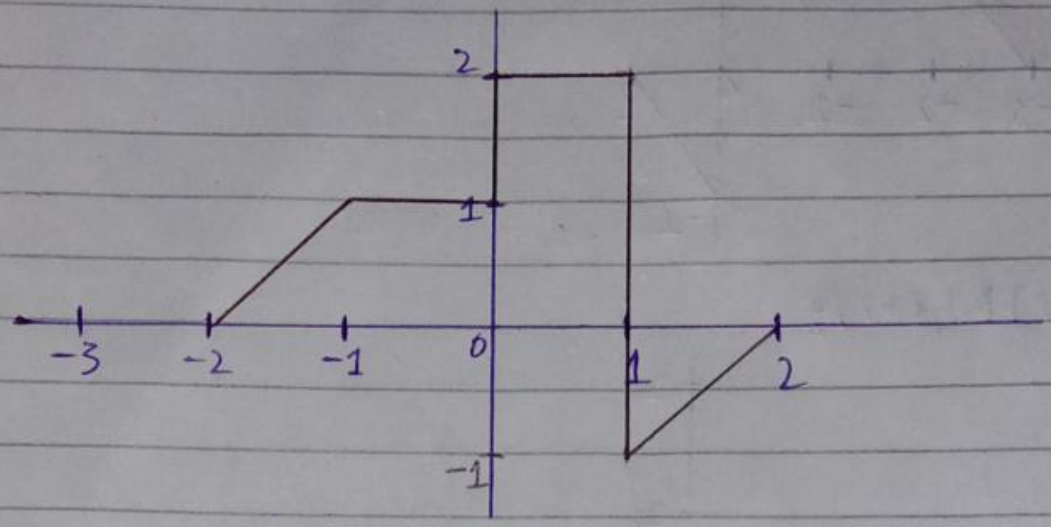
x(t):



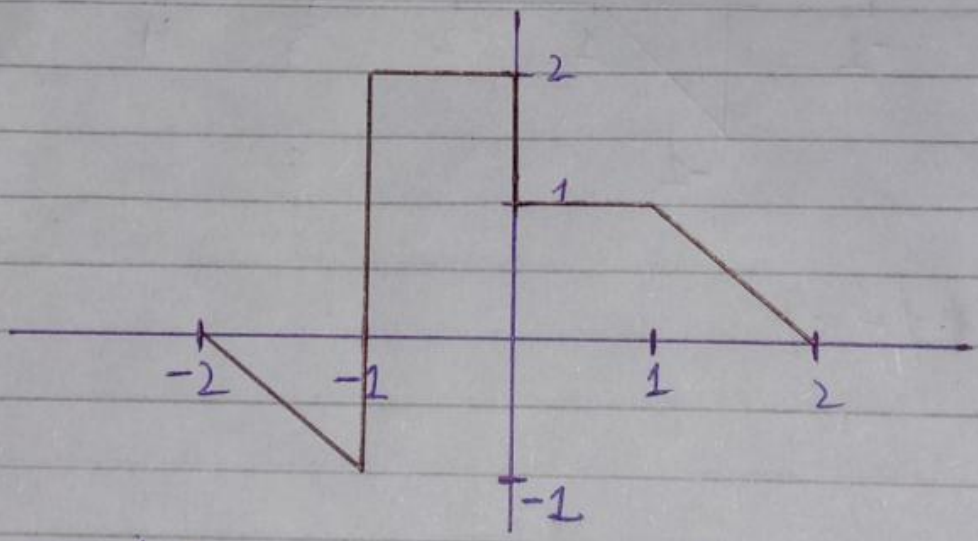
$h(1-t)$:

$h(1-t) \Rightarrow h(-t+1)$

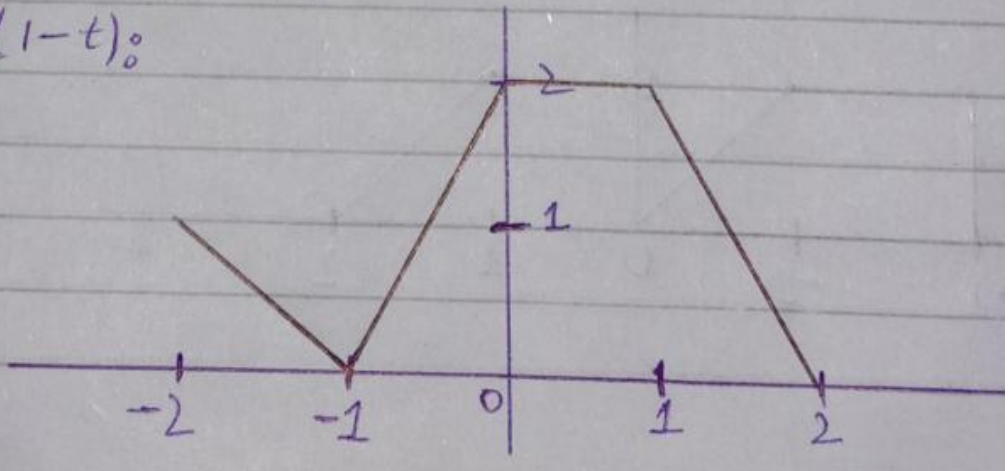
Shifting left by 1



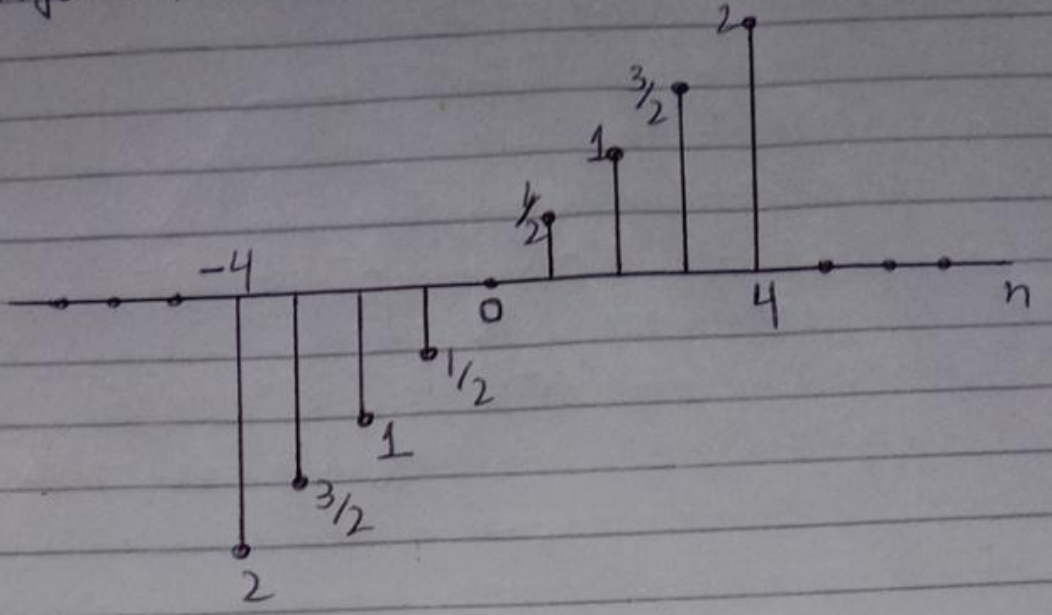

Now Reverse $(h(-t+1))$




Now $x(t) + h(1-t)$:



(Q3) Given the discrete-time signal x[n] in the figure, sketch and label the following:

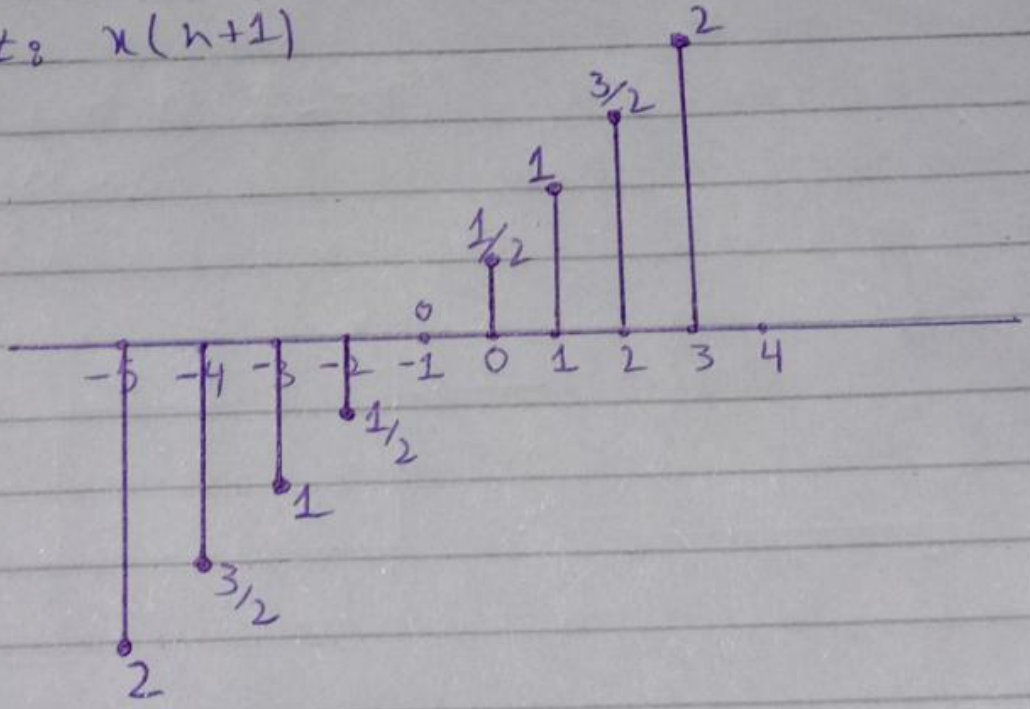



1. $x[-2-2n]$

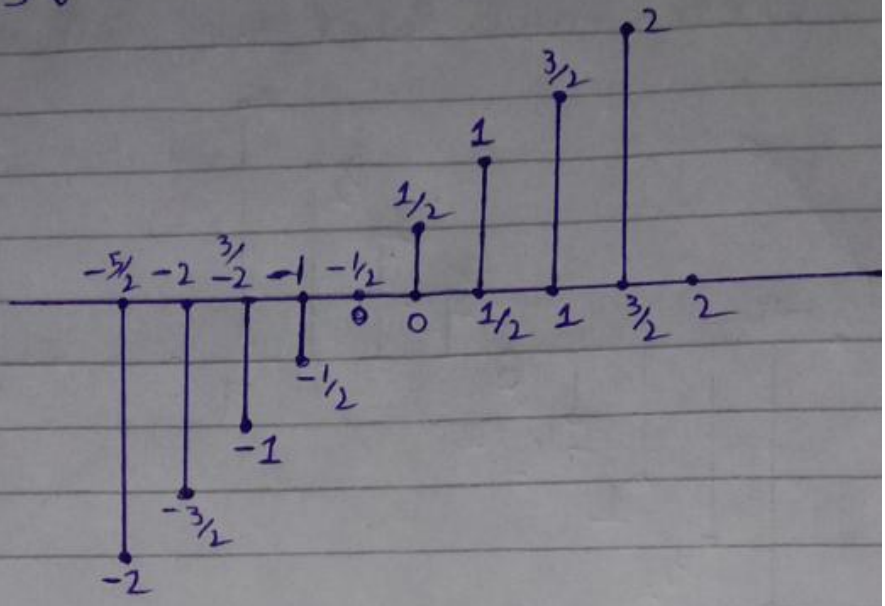
Solution:

$$x[-2-2n] = x[-2(1+n)] \Rightarrow x[-2(n+1)]$$

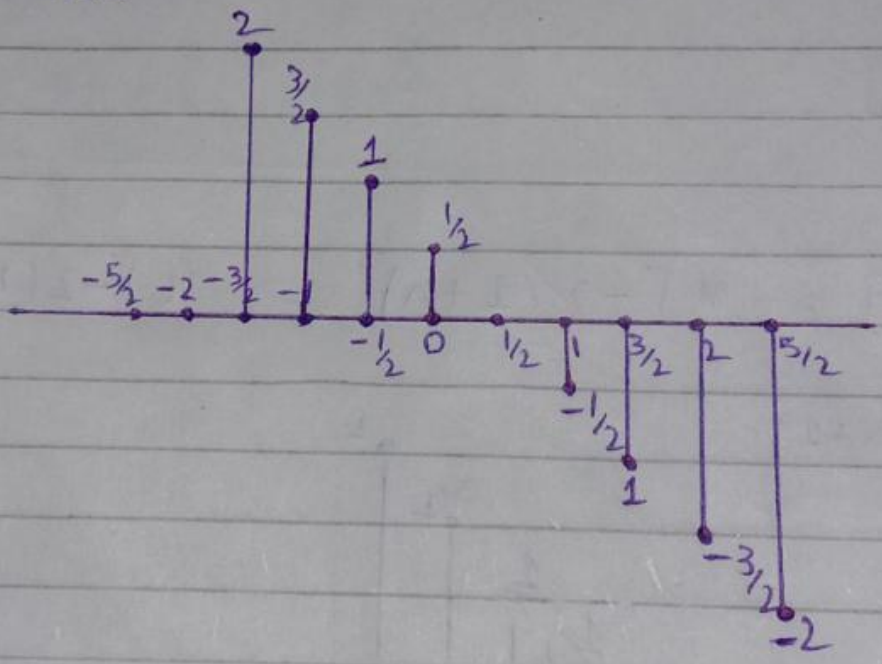
Shift: $x(n+1)$



$x[2(n+1)]$:


2
3/2
1
1/2
-5/2 -2 -3/2 -1 -1/2
0 0 1/2 1 3/2 2
-1/2
-1
-3/2
-2

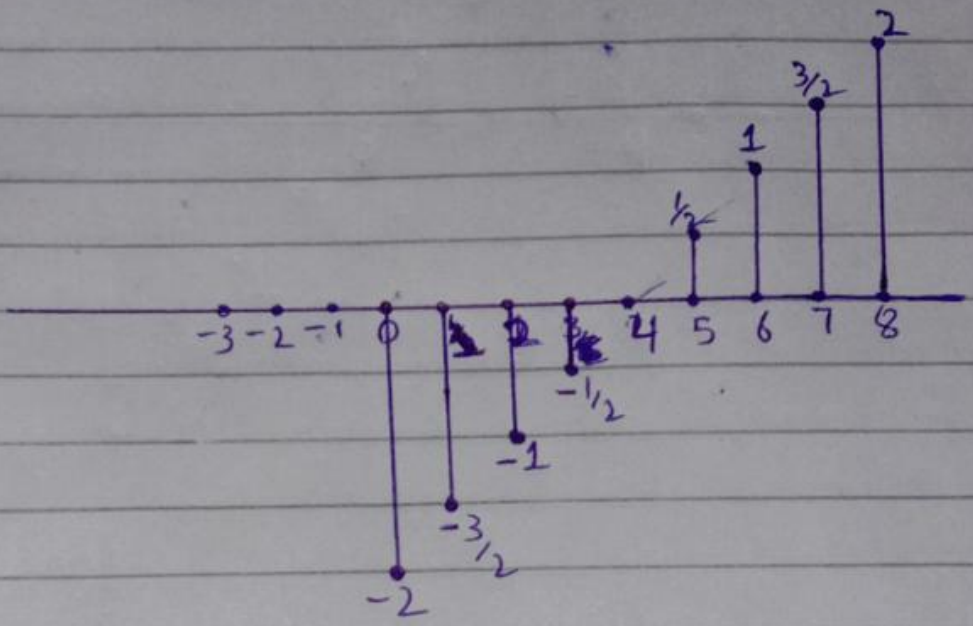
$x[-2(n+1)]$:


2
3/2
1
1/2
-5/2 -2 -3/2 -1
-1/2 0 1/2 1 3/2 2 5/2
-1/2
1
-3/2
-2

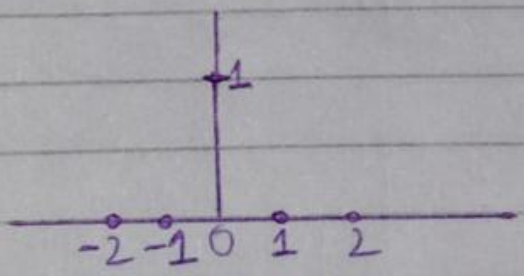
(2) $x[n-4]\,\delta[n-1]$

Solution:

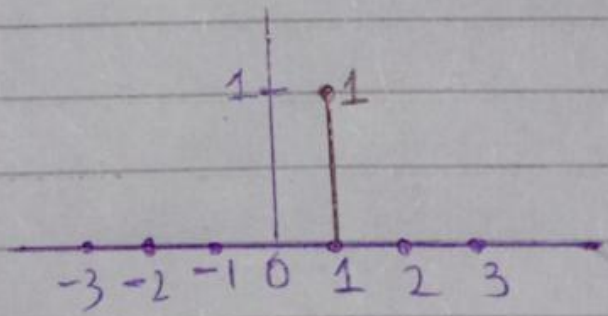
$x(n-4)$: Shift Right by 4



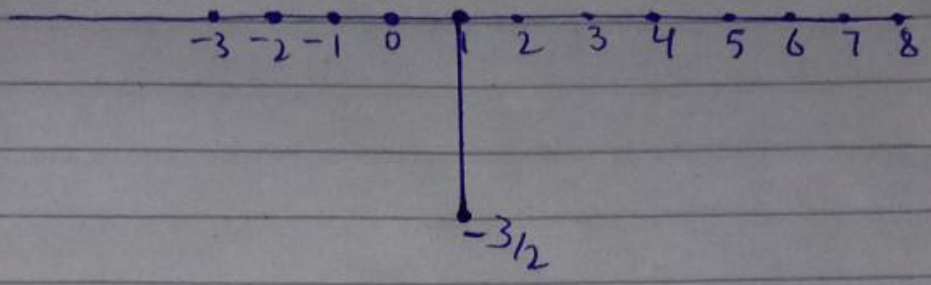

$\delta(n)$:




$\delta(n-1)$:



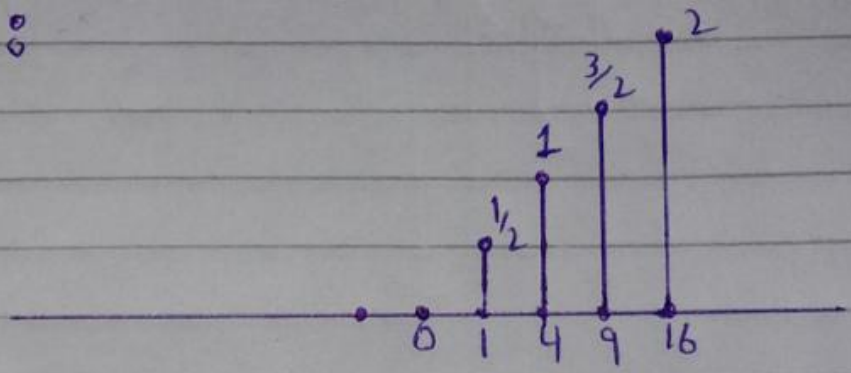
$x[n-4]\delta[n-1]$:



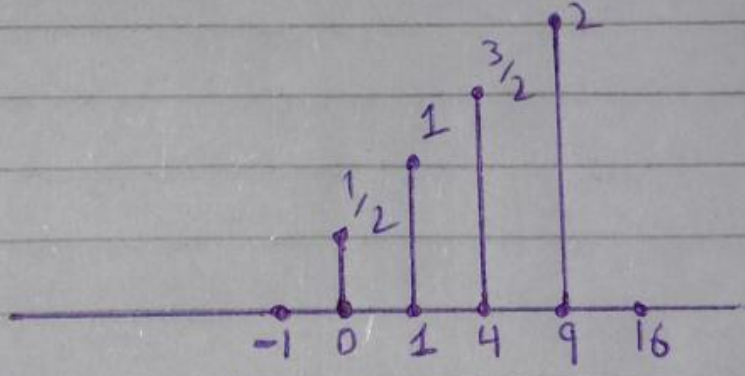

3. $x[n^2+1]$

solution:

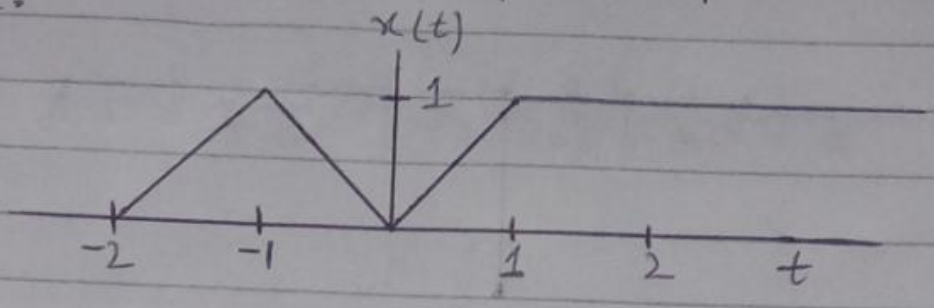
$x(n^2)$:



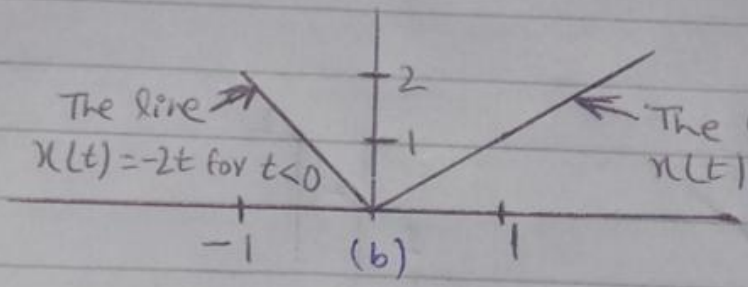

$x(n^2+1)$ => shifting left by 1



(Q4) Determine and sketch even and odd parts of the continuous-time signals depicted in the figure.




(a)



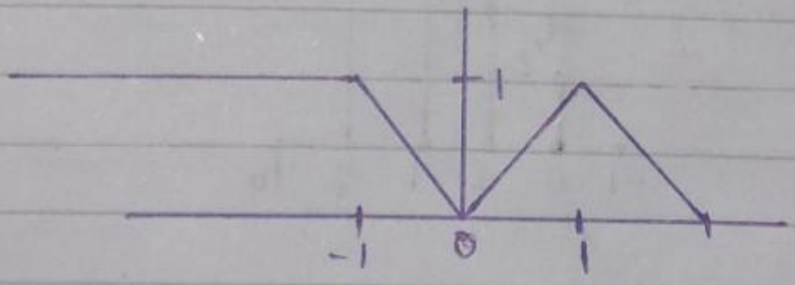

(b)

Solution:

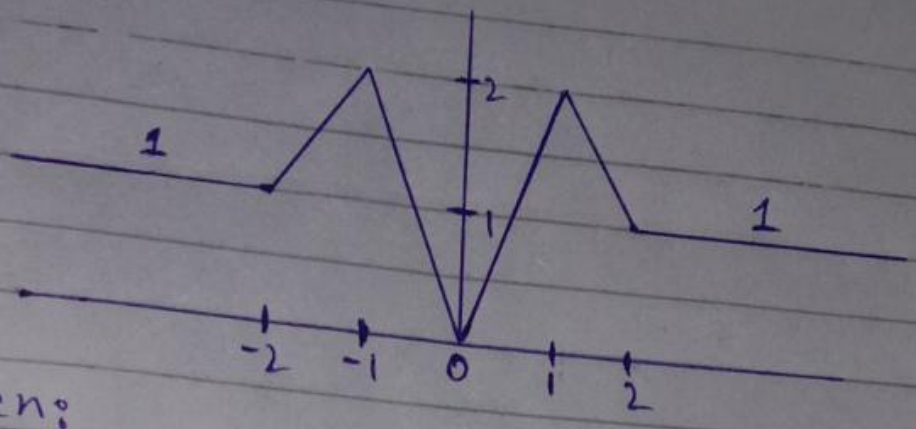
for even $x_e(t) = \frac{1}{2}(x(t) + x(-t))$

for odd $x_o(t) = \frac{1}{2}(x(t) - x(-t))$

$x(-t)$:

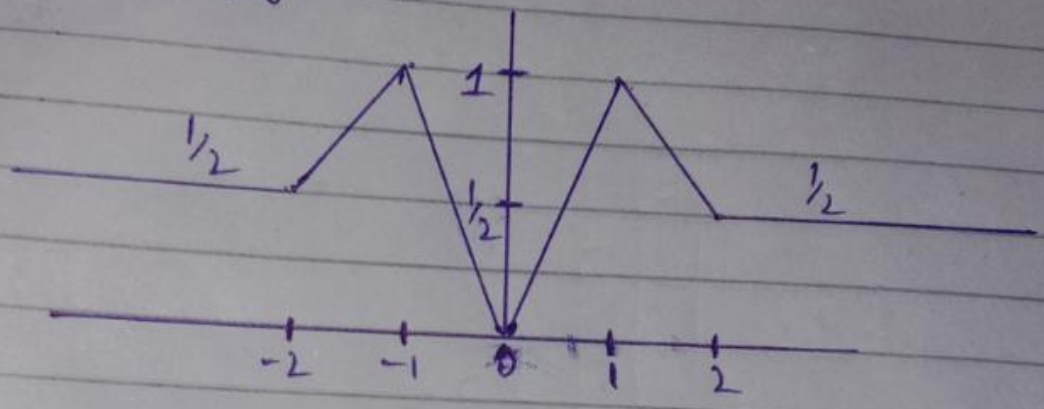


$x(t) + x(-t)$ :




For even:

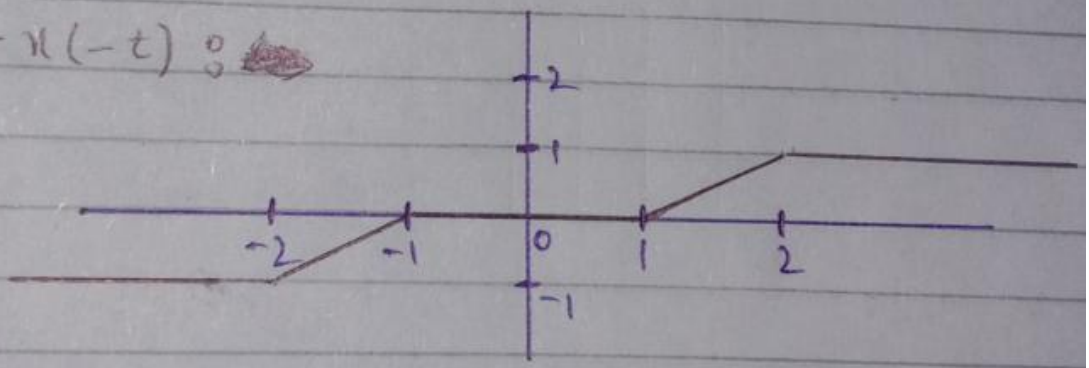
$\frac{1}{2}[x(t)+x(-t)]$ :



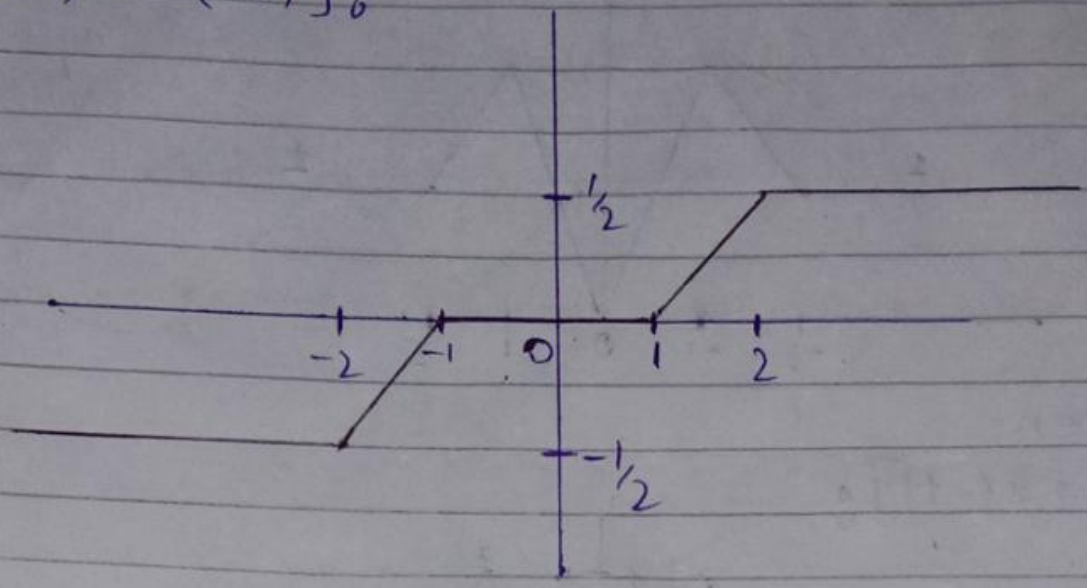

for odd $x_o(t)$ :

$\frac{1}{2}[x(t)-x(-t)]$

$x(t)-x(-t)$ :

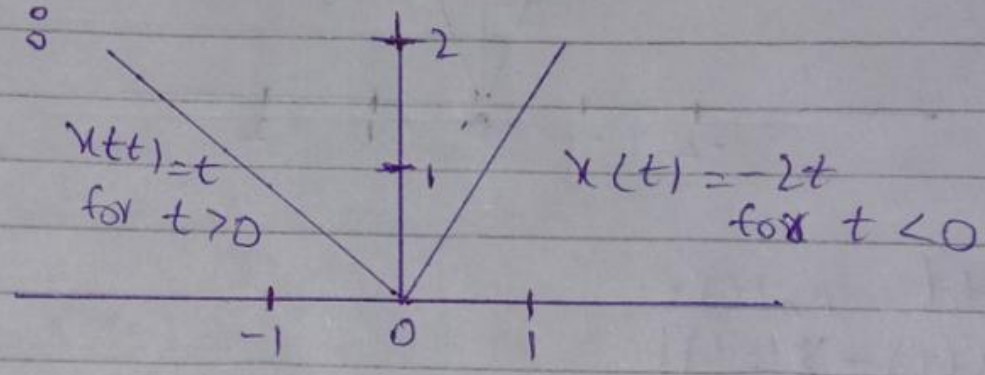


$\frac{1}{2}[x(t) - x(-t)]$ :



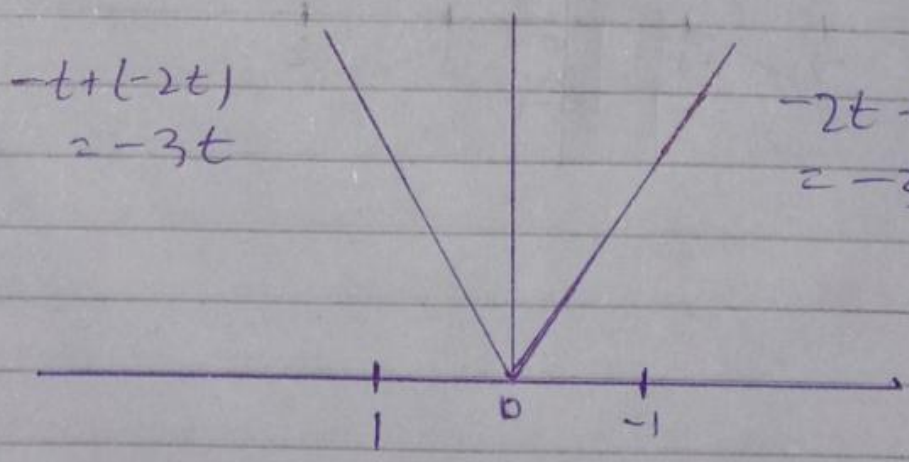

(b)

$x(-t)$ :

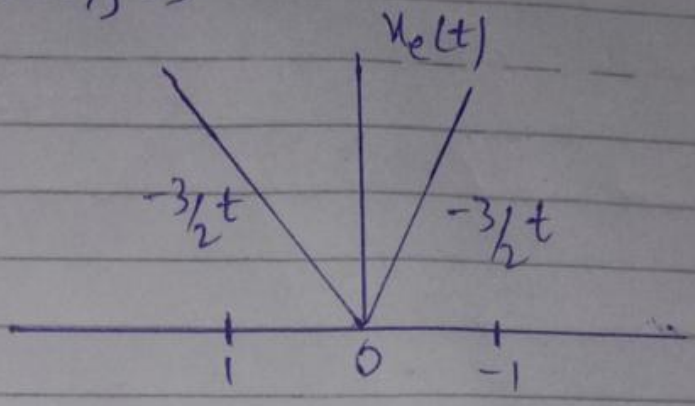



For Even :

$x(t) + x(-t)$

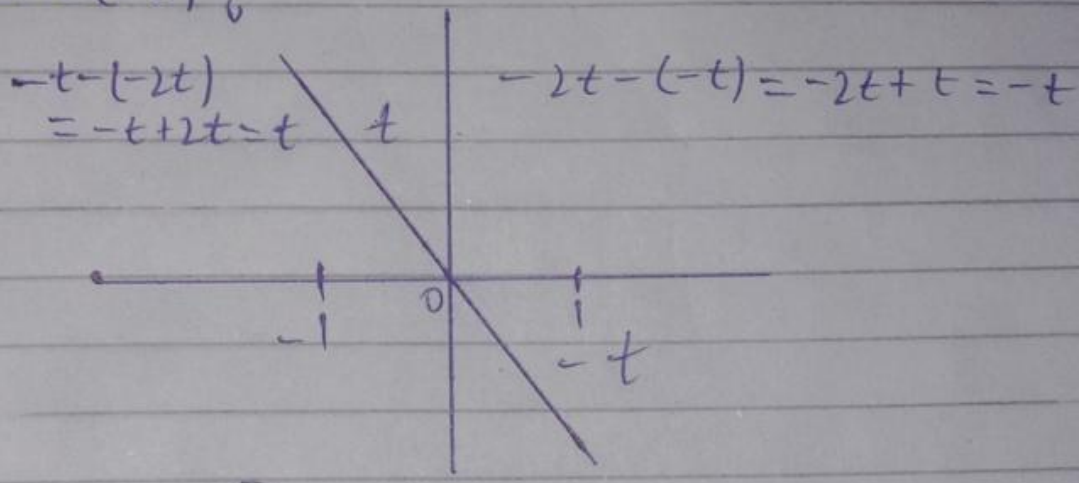


$\frac{1}{2}[x(t)+x(-t)] \Rightarrow$

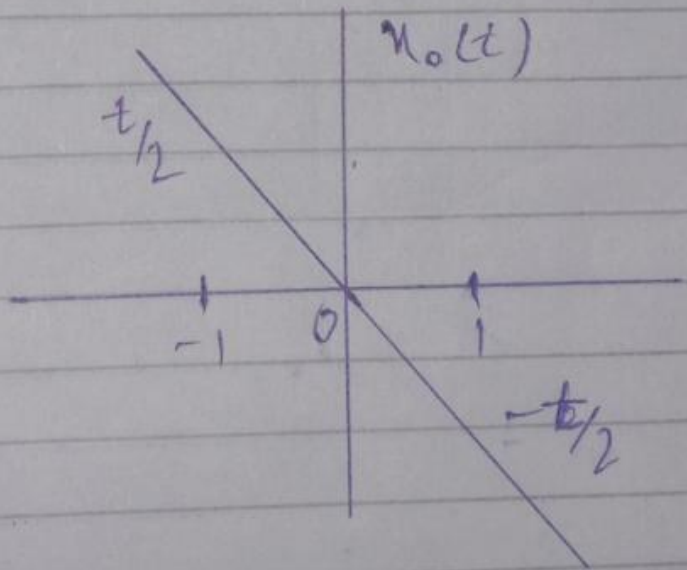



For odd:

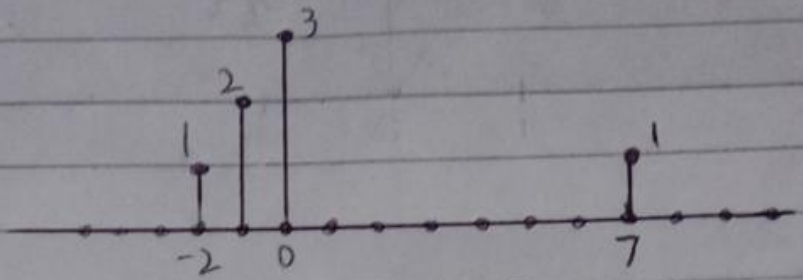
$x(t) - x(-t)$ :



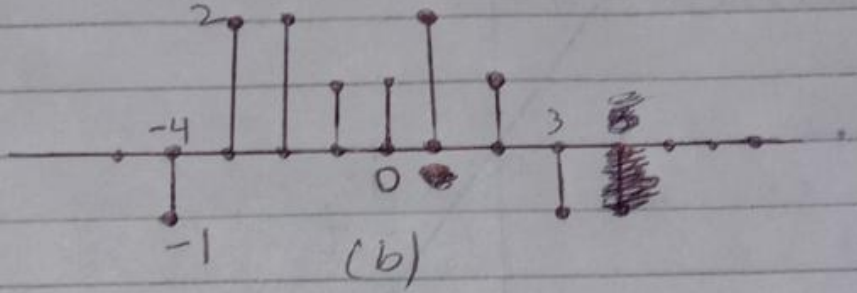

$\frac{1}{2}[x(t)-x(-t)]$ :



[Q5] Determine and sketch even and odd parts the discrete-time signals depicted in the following figures:




(a)

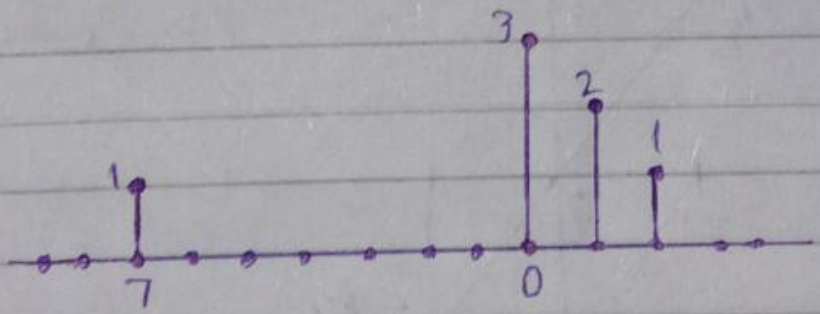



(b)

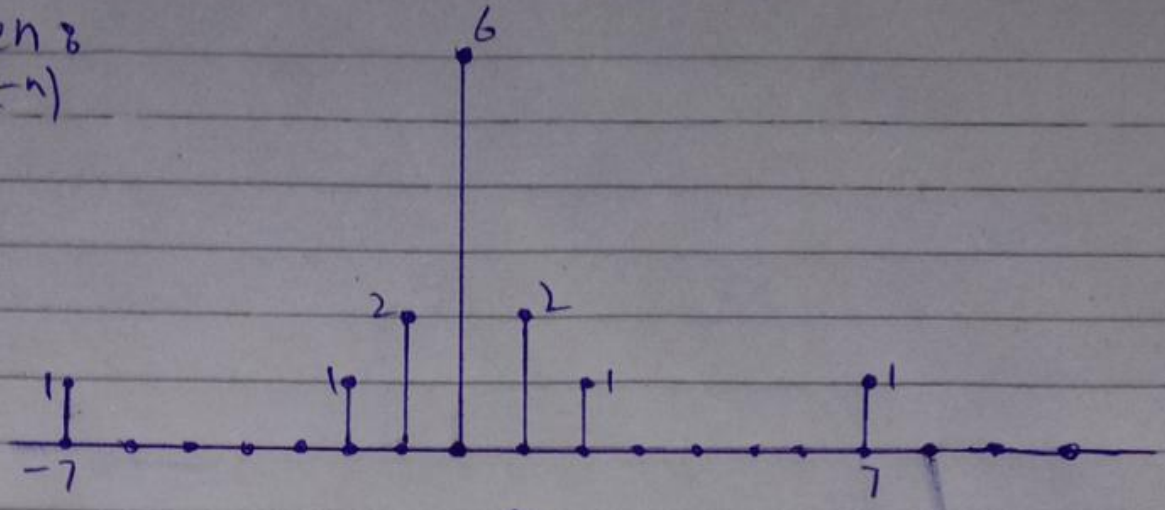
Solution:

(a)

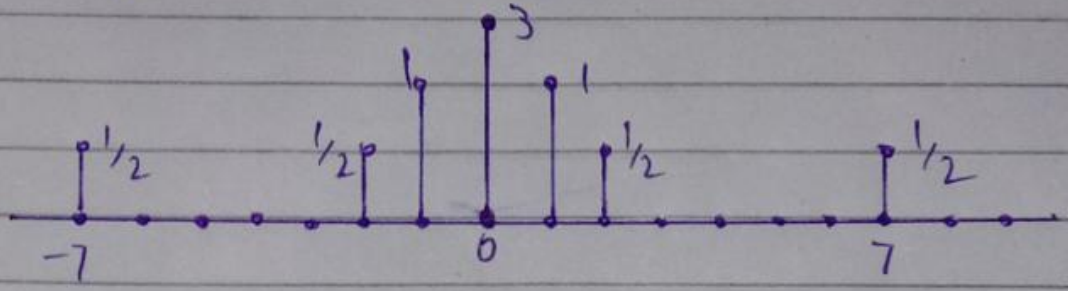
$x(-n)$:



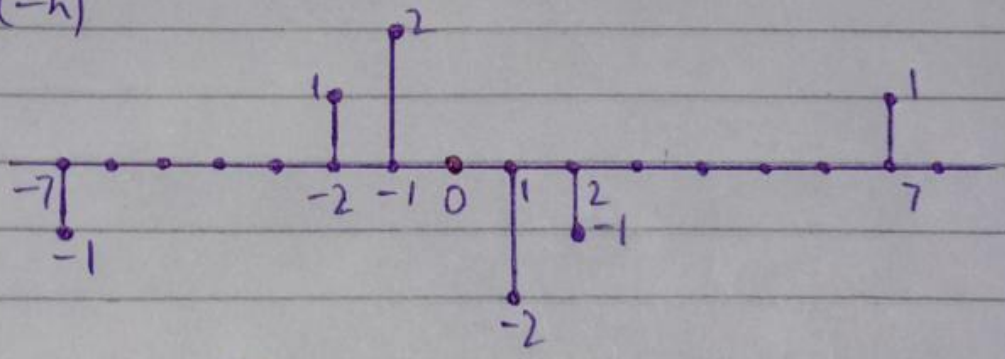
For even :
$x(n) + x(-n)$



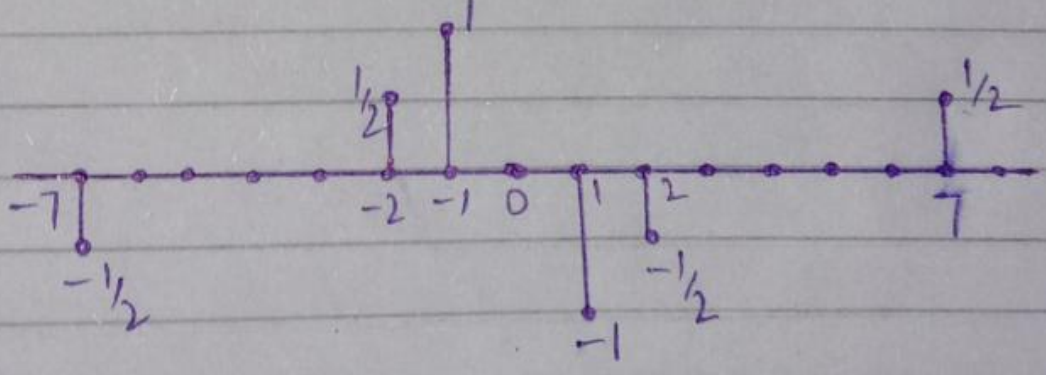

$x_e(n) = \frac{1}{2}[x(n) + x(-n)]$ :




For odd :
$x(n) - x(-n)$

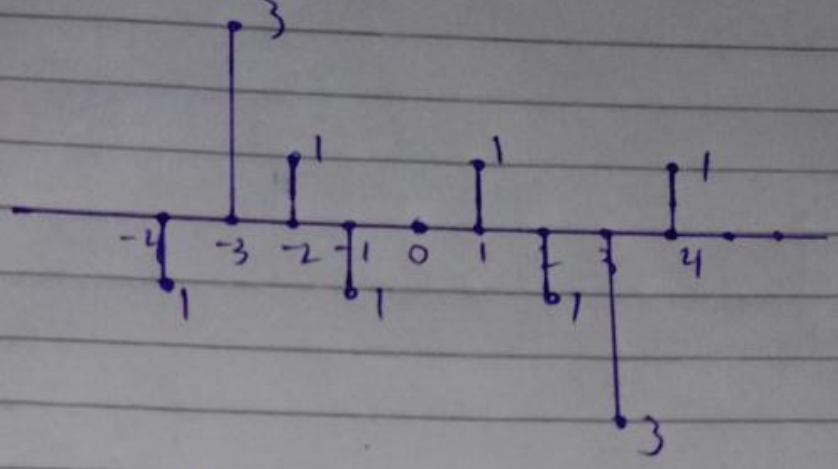



$\frac{1}{2}[x(n) - x(-n)]$ :

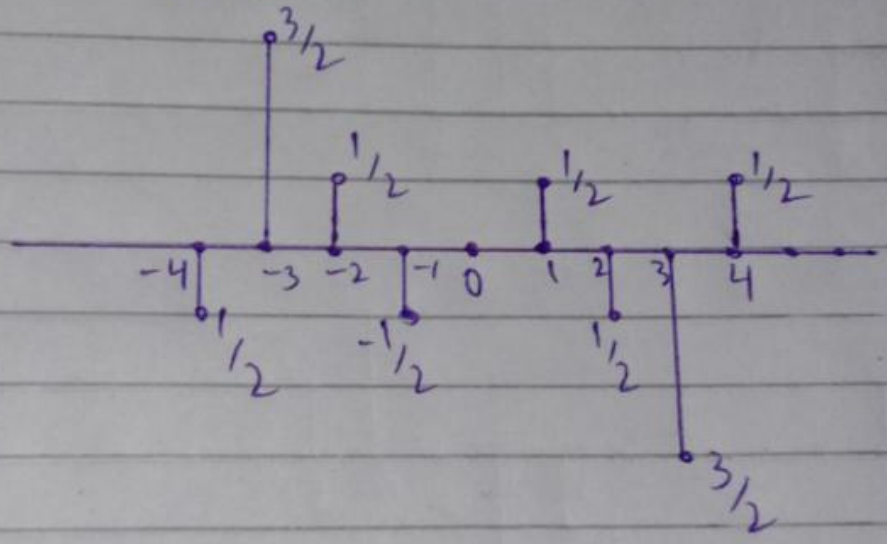


For odd:

$x(n) - x(-n)$

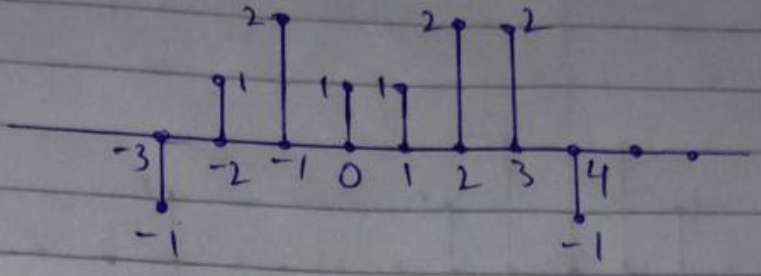



$\frac{1}{2}[x(n) - x(-n)]$:



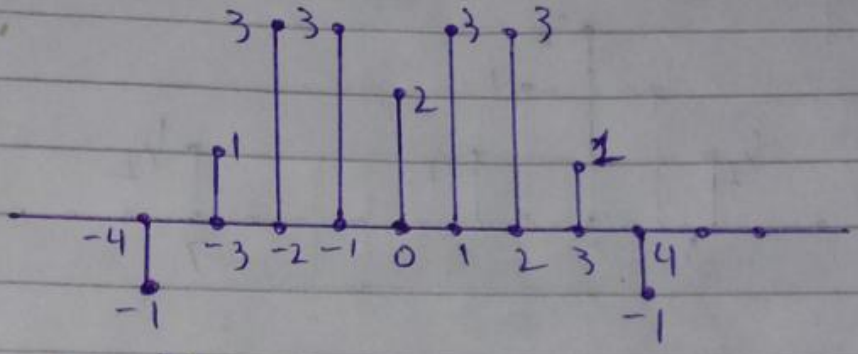
(b)

$x(-n)$ :




For Even :

$x(n) + x(-n)$




$\frac{1}{2}[x(n) + x(-n)]$ :