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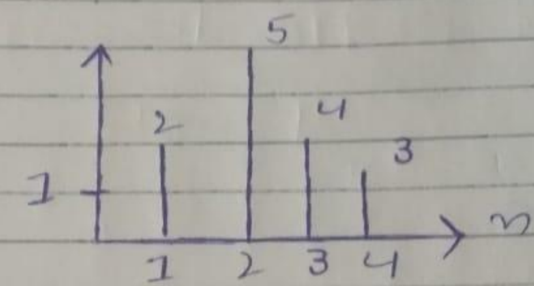
①

Q1 Ans:



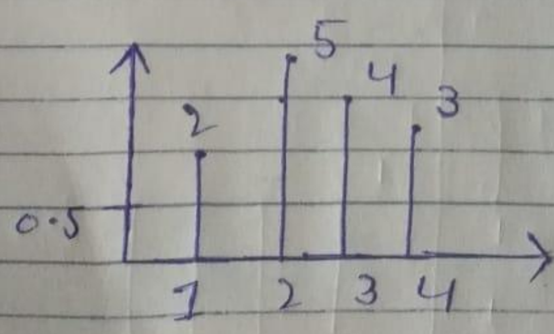
⇒ For even:

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

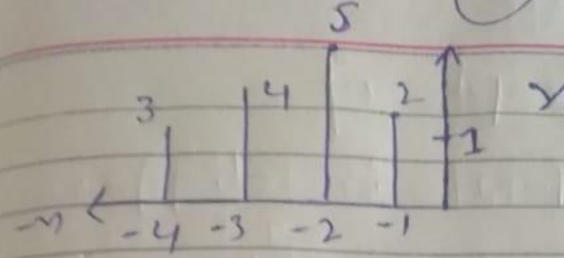
⇒ For odd:

$$x_o(t) = \frac{1}{2}\cdot[x[n] - x[-n]].$$

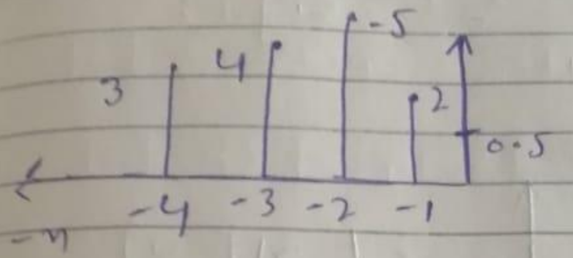
Now $\frac{1}{2}x[n]$



2



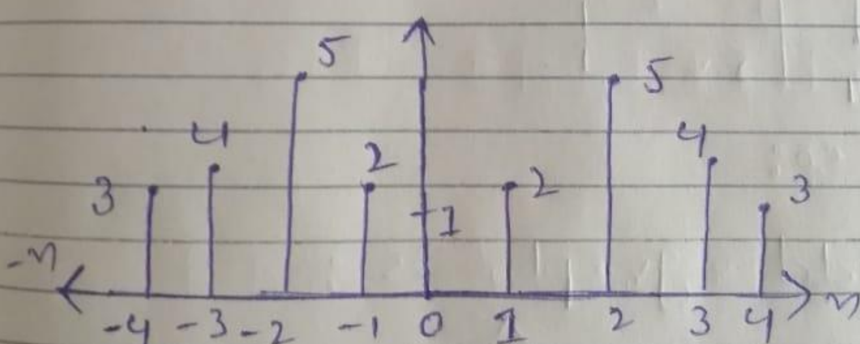
$x[-n]$



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

$\Rightarrow x_e[n] = \frac{1}{2} x[n] + \frac{1}{2} x[-n]$

$\Rightarrow$ For even:

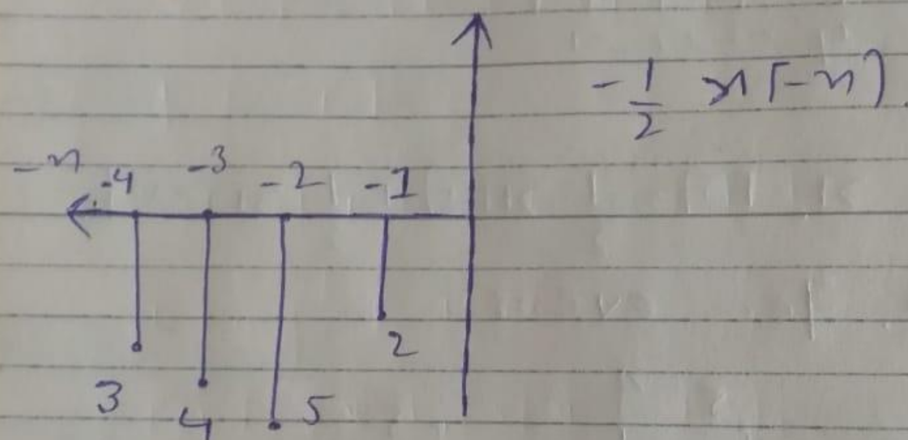


$\Rightarrow$ For odd:

graph of $\frac{1}{2} x[n]$ is

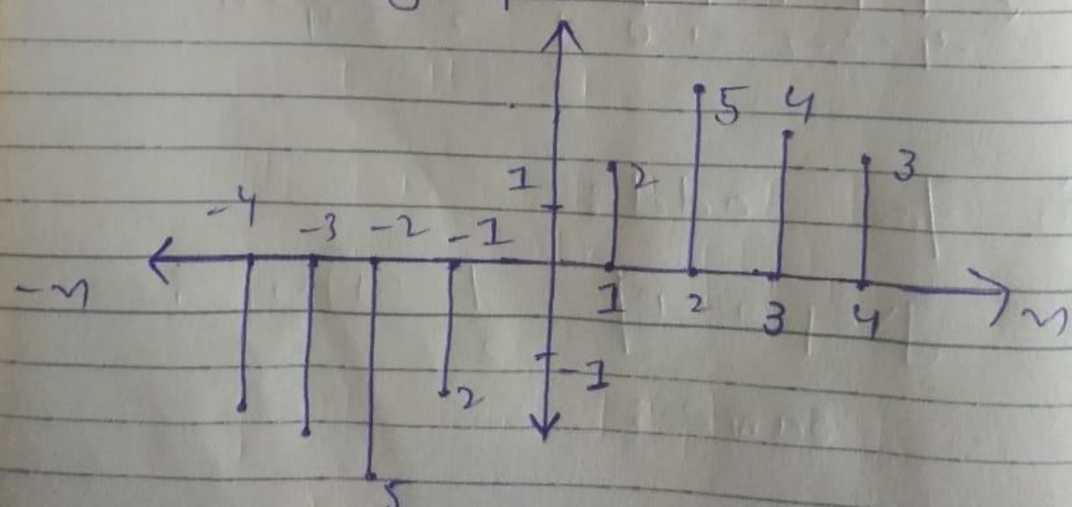
same:

But graph of
$-\frac{1}{2}x[-n]$ is different
due to '−' sign:
i-e



so:

odd graph is:



Q # 2   Ans:

$$Y(s) = \frac{s+4}{s^2+4s-12}$$

Sol:

$$\frac{s+4}{s^2+4s-12} \Rightarrow \frac{s+4}{s^2+6s-2s-12}$$

(By factors).

$$\Rightarrow \frac{s+4}{s(s+6)-2(s+6)} \Rightarrow \frac{s+4}{(s+6)(s-2)}$$

Now:

$$\frac{s+4}{(s+6)(s-2)} = \frac{A}{s+6} + \frac{B}{s-2} \rightarrow (a)$$

$\Rightarrow$ X'ing $(s+6)(s-2)$ on B/S:

$$\frac{s+4}{\cancel{(s+6)(s-2)}} \times \cancel{(s+6)(s-2)} = \frac{A}{\cancel{(s+6)}}\cancel{(s+6)}(s-2) + \frac{B}{\cancel{(s-2)}} \times \cancel{(s-2)}(s+6)$$

$$s+4 = A(s-2) + B(s+6) \rightarrow (b)$$

⇒ Now we have 2 values:

$s = 2$ And $s = -6$

when $s = 2$ equ (b) becomes:

$$2+4 = A(2-2) + B(2+6).$$

$$6 = A(0) + B(8).$$

$$6 = 8B.$$

$\div$ing by 8 B/S:

$$\frac{6}{8} = \frac{\cancel{8}B}{\cancel{8}} \Rightarrow \boxed{B = \frac{3}{4}}$$

⇒ Now put $s = -6$ in (b).

$$-6+4 = A(-6-2) + B(-6+6).$$

$$-2 = A(-8) + B(0).$$

$$+2 = +8A \Rightarrow 2 = 8A.$$

$\div$ing by 8 on B/S.

$$\frac{2}{8} = \frac{8A}{8} \Rightarrow \boxed{A = \frac{1}{4}}$$

⇒ putting value of 'A' and 'B' in equ '(a)'.

$$\frac{s+4}{(s+6)(s-2)} = \frac{1/4}{(s+6)} + \frac{3/4}{(s-2)}.$$

$$\frac{s+4}{(s+6)(s-2)} = \frac{1}{4(s+6)} + \frac{3}{4(s-2)}$$

As :

$$Y(s) = \frac{s+4}{(s+6)(s-2)}$$

So:

$$Y(s) = \frac{1}{4(s+6)} + \frac{3}{4(s-2)}.$$

$\Rightarrow$ Now we applying Laplace inverse on B/S :

$$L^{-1}(Y(s)) = L^{-1}\left[\frac{1}{4(s+6)} + \frac{3}{4(s-2)}\right].$$

$$L^{-1}(Y(s)) = L^{-1}\left[\frac{1}{4}\cdot\frac{1}{(s+6)} + \frac{1}{3}\cdot\frac{1}{(s-2)}\right].$$

$$L^{-1}[Y(s)] = L^{-1}\left[\frac{1}{4}\cdot\frac{1}{(s+6)}\right] + L^{-1}\left[\frac{1}{3}\cdot\frac{1}{(s-2)}\right].$$

$$y(t) = \frac{1}{4}L^{-1}\left[\frac{1}{s+6}\right] + \frac{1}{3}L^{-1}\left[\frac{1}{s-2}\right].$$

$$L^{-1}\frac{1}{s+6} = e^{-6t}$$

And:

$$L^{-1}\frac{1}{s-2} = e^{+2t}$$

So:

$$\boxed{y(t) = \frac{1}{4}e^{-6t} + \frac{3}{4}e^{2t}}$$

Q 3 (i) :

Ans:

Analog signal is converted to a digital signal by a 2 step:

1) Sampling

2) Quantization.

Sampling:

It convert a continuous time and continuous amplitude signal that is real value into discrete time continuous amplitude that is still real value.

Quantization:

It convert discrete time continuous amplitude signal to discrete time. and also into discrete value.

Q 3 (iii): Ans:

Given:

$f = 60\,Hz$

If condition of niquist criteria prove this then it will no aliasing occurs.

And condition is:

$f_s \geq 2 f_m$

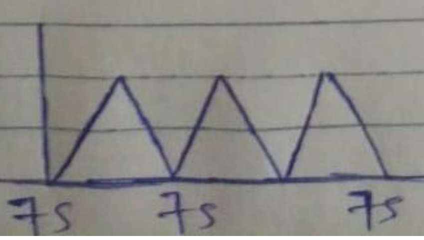
As $f_m = 60$

so:

$f_s \geq 2(60)$

$f_s \geq 120$

By graph:



Q4 Ans:

$x[n] * (h_1[n] * h_2[n]) =$

$x[n] * h_1[n] * h_2[n]$.

Let $a[n] = h_1[n] * h_2[n]$.

Now we take $K = -\infty$ to ∞

$$a[n] = h_1[n] * h_2[n] = \sum_{K=-\infty}^{\infty} h_1[K] h_2[n-K$$

And:

$$b[n] = x[n] * h_1[n] = \sum_{K=-\infty}^{\infty} x[l] h_1[n-l]$$

Now:

$$x[n] * a[n] = \sum_{l=-\infty}^{\infty} x[l] a[n-l].$$

$$= \sum_{l=-\infty}^{\infty} x[l] \left(\sum_{K=-\infty}^{\infty} h_1[K] h_2[n-l-K]\right.$$

$$b[n] * h_2[n] = \sum_{K=-\infty}^{\infty} b[K] h_2(n-K)]$$

$$= \sum_{K=-\infty}^{\infty} \left(\sum_{K=-\infty}^{\infty} x[l] h_1(K-l)\right) h_2(n-K)$$

$$= \sum_{l=-\infty}^{\infty} x[l] \left(\sum_{k=-\infty}^{\infty} h_1[k-l] h_2[n-k] \right).$$

Let $k' = k-l$

we have $k = l - k'$

Hence:

$$b[n] * h_2[n] = \sum_{l=-\infty}^{\infty} x[l] \left(\sum_{k'=\infty}^{\infty} h_1[k'] h_2(n-l-k') \right).$$

Q#4 Ans:

$x[n] * [h_1[n] * h_2[n]] = [x[n] * h_1[n]] * h_2[n].$

Taking L.H.S equal $y[n]$.

$y[n] = x[n] * h_1[n] * h_2[n]$

And Take:

$x[n] * h_2[n] = w_1[n].$

Taking R.H.S:

$[x[n] * h_1[n] * h_2[n].$

As:

$x[n] * h_1[n] * = w_1[n].$

So R.H.S become:

$w_1[n] * h_2[n].$ that is equal to $y[n]$.

so:

$y[n] = w_1[n] * h_2[n].$

And.

$y[n] = [x[n] * h_1[n]] * h_2[n]$.
which we consider.

By block digram:

$x[n] \rightarrow \boxed{h_1[n]} \rightarrow \boxed{h_2[n]} \rightarrow y[n]$.

For this the response of
$x[n]$ is $y[n] \rightarrow (a)$.

Now we take:

$w_2[n] = h_1[n] * h_2[n]$.

where:

$y[n] = x[n] * [h_1[n] * h_2[n]]$.

$y[n] = x[n] * w_2[n]$.

By block digram:

$x[n] \longrightarrow \boxed{w_2[n]} \longrightarrow y[n]$.

For this the reponse of
$x[n] = y[n] \rightarrow (b)$.

As equ (a) is equal to
equ (b) so