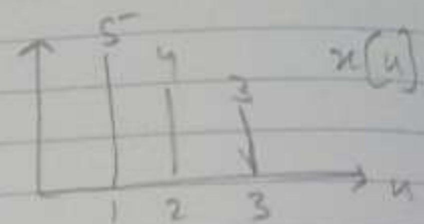
Course: Signal and System.

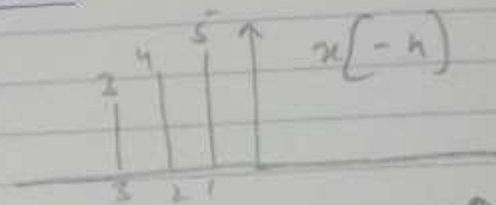
Name Zia "UR Rehman."

"ID 11473."

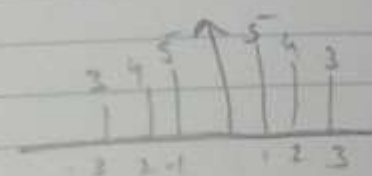
Q1 Evaluate the even and odd Components for the given function.




sol: $x_e[n] = \frac{x[n] + x[-n]}{2}$

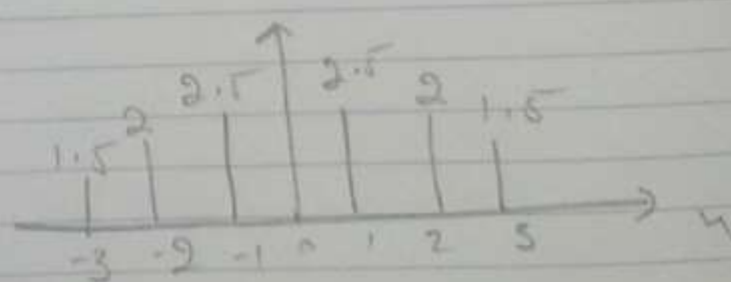



Now finding $x[n] + x[-n]/2$




$\cancel{x[n] + x[-n]/2}$

$x[n] + x[-n]/2$



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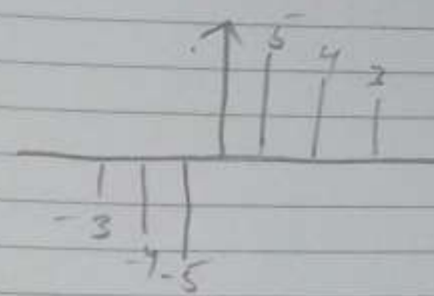
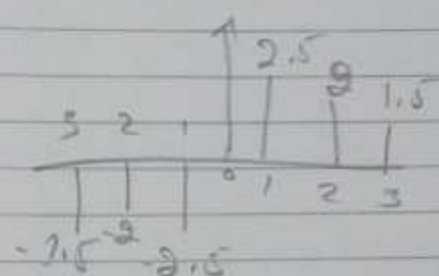
Now for odd part:

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

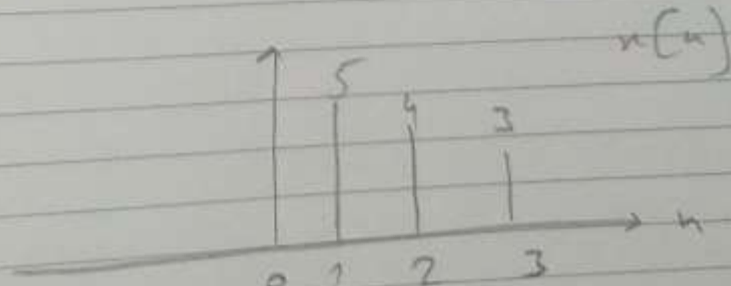



for $\frac{x[n] - x[-n]}{2}$.




Now adding:

$$x[n] = x_e[n] + x_o[n]$$



Q2 Calculate the inverse laplace transform of the given equation.

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

Sol: $$Y(S) = \frac{S+4}{S^2+6S-2S-12}$$

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

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

Now using partial fraction.

$$\frac{S+4}{(S+6)(S-2)} = \frac{A}{S+6} + \frac{B}{S-2} \longrightarrow (i)$$

Now mul L.S of equation with $(S+6)(S-2)$.

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

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

Now for $S=2$

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

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

$$6 = 8B$$

$$B = 6/8 = 3/4$$

$$\boxed{B = 3/4}$$

For $S = -6$

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

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

$$-2 = -8A$$

$$A = \frac{-2}{-8} = 1/4$$

$$\boxed{A = 1/4}$$

Now to put A and B in eq (i)

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

So $Y(S) = 1/4(S+6) + \dfrac{3}{4(S-2)}$

Applying $L^{-1}$ on B.S.

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

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

Q3 To convert an analog signal into digital signal we can convert it through sampling and quantization.

(i) Sampling: The definition of proper sampling is quite simple. Suppose you sample a continous signal in some ~~manner~~ maner.

If you exactly reconstract the analog signal from the samples. you must have done the sampling. if the sample properly. Eeven data appears confusing as incomplete, the key information has been captured if you can reverse the process

A continuous signal is sampled properly if the sample contain all the information needed to recreate the orignal waveform.

Digitizing this same signal would produce virtually no increase in the noise, and nothing would be be lost due to quantization.

Q4 Show that. 6

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

Sol: Taking R.H.S and let $n = k$

$$x[k] * h_1(k] * h_2[k]$$

as $[x(k] * h_1(k]]$ Can be obtained by convolution Sum So we Can write by multiplying $x(k]$ & $h_1(k])$.

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

Now again the star sign indicated another Convolution Sum b/w.

$$\sum_{m=-\infty}^{\infty} x[m] h_1(k-m) \; \& \; h_2(k].$$

So $\sum_{n=-\infty}^{\infty} \left(\sum_{m=-\infty}^{\infty} x[m] h_1(n-m]\right\} h_2[k-n$

$$= \sum_{n=-\infty}^{\infty} \sum_{m=-\infty}^{\infty} x[m] h_1[n-m] h_2(k-n].$$

$$= \sum_{m=-\infty}^{\infty} x(m] \sum_{r=+\infty}^{-\infty} h_1(k-r-m) h_2[r].$$

$$= \sum_{m=-\infty}^{\infty} x[m] \sum_{r=-\infty}^{\infty} h_2[r] h_1[(k-m)-r]$$

As $\sum_{r=-\infty}^{\infty} h_2[r] h_1[(k-m)-r] = h_2[m] * h_1[k-m]$

using Commutative Property and time shift property

let $z[k] = h_1[k] * h_2[k]$.

hence $h_2[m] * h_1[k-m] = h_1[k-m] * h_2[m]$
$= z[k-m]$.

Now $\sum_{m=-\infty}^{\infty} x[m]\, z[k-m]$.

$= x[k] * z[k]$.

Put the value of $z[k]$.

$= x[k] * h_1[k] * h_2[k]$ which is equal to $x[k] * (h_1[k] * h_2[k])$