

Q1. Find the even and odd components of the following discrete-time signal:

$$x[n] = \begin{cases} 3+n & 0 \leq n \leq 3 \\ 0, & \text{otherwise} \end{cases}$$

Solution

$$x_e[n] = 0.5 (x[n] + x[-n])$$

for $n=0$

$$\begin{aligned} x_e[0] &= 0.5 (x[0] + x[0]) \\ &= x[0] = 3+n = 3 \end{aligned}$$

for $2 \geq n \geq 1$

$$x_e[n] = 0.5 (x[n] + x[-n])$$

$$= 0.5 (x[n])$$

$$= 0.5 (3+n)$$

$$= 1.5 + 0.5n$$

↓
-ve
indices
= 0
(otherwise
part)

for $-1 \geq n \geq -3$

$$x_e[n] = 0.5 (x[n] + x[-n])$$

↓
= 0

as
 n become
negative
here

$$= 0.5 x[-n]$$

$$= 0.5 (3-n) = 1.5 - 0.5n$$

$$x_e[n] = 0, \text{ otherwise}$$

Thus,
$$x_e[n] = \begin{cases} 1.5 - 0.5n, & -1 \geq n \geq -3 \\ 1.5 + 0.5n & 3 \geq n \geq 1 \\ 3 & n=0 \\ 0, & \text{otherwise} \end{cases}$$

odd component:

$$x_o[n] = 0.5 (x[n] - x[-n])$$

for $n=0$, $x_o[n] = 0.5 (x[0] - x[0]) = 0$

for $3 \geq n \geq 1$, $x_o[n] = 0.5 (x[n] - x[-n])$ ^{$= 0$ as n is negative}

$$= 0.5 (x[n])$$

$$= 0.5 (3+n)$$

$$= 1.5 + 0.5n$$

for $-1 \geq n \geq -3$, $x_o[n] = 0.5 (x[n] - x[-n])$

\downarrow
0

as n becomes negative

$$x_o[n] = 0.5 (-x[-n])$$

$$= 0.5 (-(3-n))$$

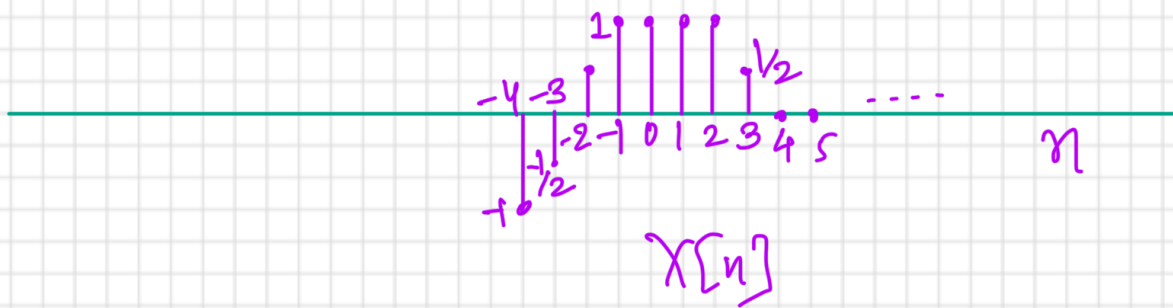
$$= -0.5 (3-n)$$

$$= -1.5 + 0.5n$$

Hence,

$$x_0[n] = \begin{cases} -1.5 + 0.5n & -1 \leq n \leq 3 \\ 0, & n=0 \\ 1.5 + 0.5n & 3 \leq n \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

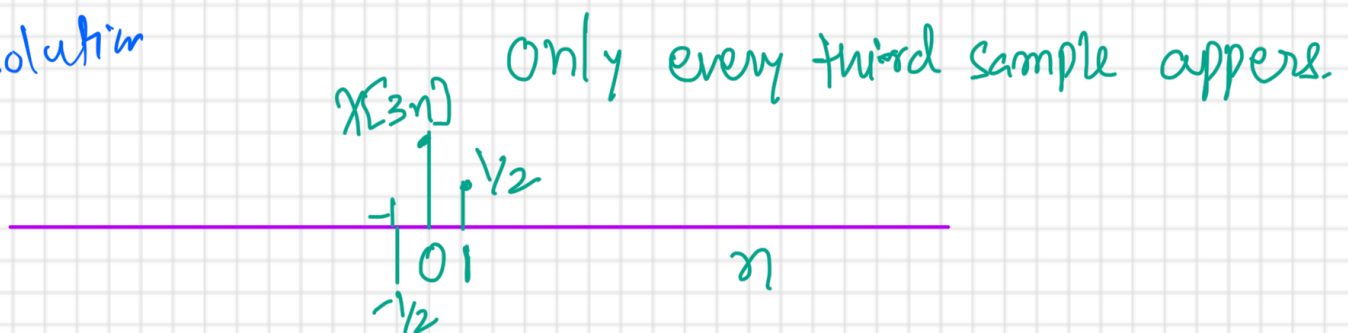
Q2. A discrete-time signal is shown below:



Sketch (a) $x[3n]$

(b) $x[n] u[3-n]$

Solution



(b) $\therefore u[3-n] = u[-(n-3)] = \begin{cases} 0, & n > 3 \\ 1, & n \leq 3 \end{cases}$

$$\therefore x[n]u[3-n] = x[n] \text{ for } n \leq 3$$

$$0 \text{ for } n > 3$$

Hence sketch will look same.
