Assignment

EE23BTECH11001 - Aashna Sahu

Q:Check whether -150 is a term of the AP: 11,8,5,2,....

Solution: Let nth term of given AP be $x(n)$

Given:

First term,$x(0) = 11$ and Common difference,$d = -3$

$$x(n) = x(0) + nd$$
$$x(n) = 11 + n(-3)$$
$$x(n) = 11 - 3n$$

Now, we need to check if -150 is a term of the given AP.

$$-150 = 11 - 3n$$
$$3n = 161$$
$$n = 161/3$$

Here $n \notin N$

Thus -150 is not a term of the given AP.

$$\boxed{x(n) = (11 - 3n) \times u(n)} \quad (1)$$

The expression for u(n) is

$$u(n) = \begin{cases} 1 & \text{if } n \geq 0, \\ 0 & \text{if } n < 0. \end{cases}$$

On Z-transformation

$$U(z) = \sum_{n=-\infty}^{\infty} z^{-n} u(n)$$
$$U(z) = \sum_{n=0}^{\infty} z^{-n}$$
$$\frac{d(U(z))}{dz} = \sum_{n=0}^{\infty} -nz^{-n-1}$$

Now,

$$X(z) = \sum_{n=-\infty}^{\infty} (11 - 3n) z^{-n} u(n)$$
$$X(z) = \sum_{n=-\infty}^{0} (11 - 3n) \times 0 + \sum_{n=0}^{\infty} (11z^{-n} - 3nz^{-n}) \times 1$$
$$X(z) = 11 \sum_{n=0}^{\infty} z^{-n} - 3 \sum_{n=0}^{\infty} nz^{-n}$$
$$X(z) = 11U(z) - 3\left(-z\frac{d(U(z))}{dz}\right)$$
$$X(z) = \frac{11}{1 - z^{-1}} - \frac{3z^{-1}}{(1 - z^{-1})^2} \quad \text{ROC: } |z| > 1$$

$$\boxed{X(z) = 11U(z) + 3z\frac{d(U(z))}{dz}} \quad (2)$$

Variable	Description	Value
$x(0)$	First term of AP	11
d	Common difference	-3
$x(n)$	General term of given AP	None
n	Describing the order of term	None
$u(n)$	Unit Step Functions	Mentioned above
$U(z)$	Z-transform of u(n)	$\sum_{n=0}^{n=\infty} z^{-n}$
$X(z)$	Z-transform of x(n)	None

TABLE 0: Input parameters

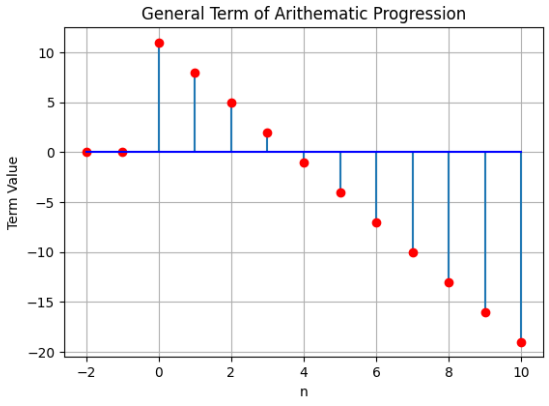

Fig. 0: Representation of x(n)