

NCERT Question 10.5.2.5

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Question 10.5.2.5 : Find the number of terms in each of the following APs. Then express each term as $x(n)$ and find the z transform, ROC and plot the graph for $x(n)$:

- 1) 7, 13, 19, ... 205
- 2) 18, $15\frac{1}{2}$, 13, ... -47

Solution:

Parameter	Used to denote	Values
$x_i(n)$	n^{th} term of i^{th} series ($i = (1, 2)$)	$(x_i(0) + nd_i)u(n)$
$x_i(0)$	First term of i^{th} AP	$x_1(0) = 7$ $x_2(0) = 18$
d_i	Common difference of i^{th} AP	$d_1 = 6$ $d_2 = -2.5$

TABLE 2
PARAMETER TABLE

The number of terms in the AP $x(n)$ is given by:

$$\frac{x(n) - x(0)}{d} + 1 \quad (1)$$

$$X_i(z) = \frac{x_i(0)}{1 - z^{-1}} + d_i \frac{z^{-1}}{(1 - z^{-1})^2}, \text{ for } i=1,2 \quad (2)$$

$$\text{ROC} : |z| > 1 \text{ as it is an AP} \quad (3)$$

1)

$$x_1(n) = (7 + (n)6)u(n) \quad (4)$$

Using the values in Table 2 and equation (1),

$$k_1 = \frac{205 - 7}{6} + 1 = 34 \quad (5)$$

Using the values in Table 2 and equation (2) :

$$X_1(z) = \frac{7 - z^{-1}}{(1 - z^{-1})^2} \quad (6)$$

ROC is $|z| > 1$

2)

$$x_2(n) = (18 + n(-2.5)u(n)) \quad (7)$$

Using the values in Table 2 and equation (1),

$$k_2 = \frac{-47 - 18}{-2.5} + 1 = 27 \quad (8)$$

Using the values in Table 2 and equation (2) :

$$X_2(z) = \frac{18 - (20.5)z^{-1}}{(1 - z^{-1})^2} \quad (9)$$

ROC is $|z| > 1$.

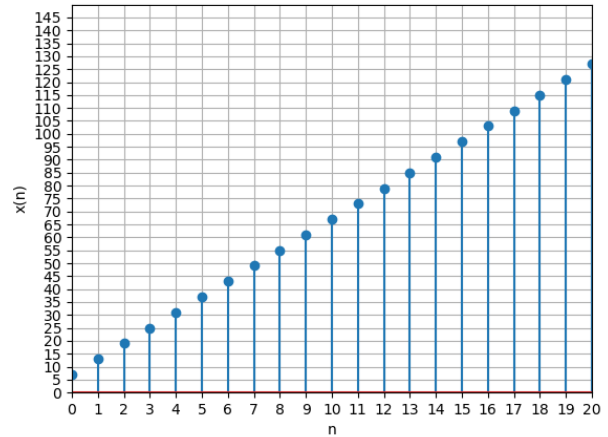


Fig. 2. Plot of $x_1(n)$

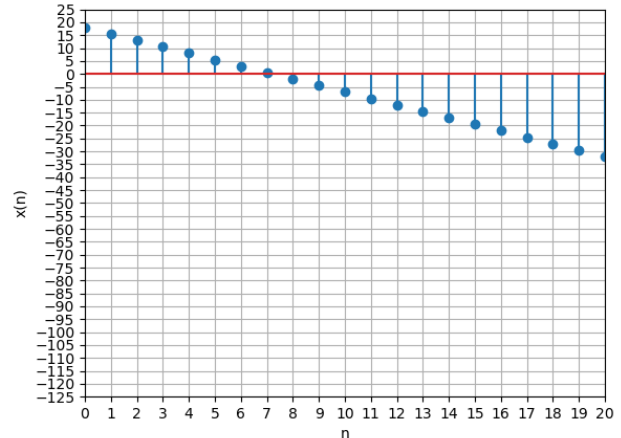


Fig. 2. Plot of $x_2(n)$