

# NCERT 11.9.2.3

EE23BTECH11043 - BHUVANESH SUNIL NEHETE\*

## Question:

In an A.P. the first term is 2 and the sum of the first five terms is one-fourth of the next five terms. Show that 20<sup>th</sup> term is -112.

## Solution:

Parameter	Description	Value
$x(0)$	First term	2
$x(19)$	20 <sup>th</sup> term	-112
$y(n)$	sum upto $n^{\text{th}}$ term	

TABLE 1  
INPUT DATA

General term can be written as

$$x(n) = (x(0) + nd)u(n) \quad (1)$$

By refereing (??)

$$X(z) = \frac{x(0)}{1 - z^{-1}} + \frac{dz^{-1}}{(1 - z^{-1})^2} \quad (2)$$

Taking the inverse Z-transform by contour integration by refering (??),

$$y(n) = x(0)[(n+1)u(n)] + \frac{d}{2}[n(n+1)u(n)] \quad (3)$$

$$= \frac{n+1}{2} \{2x(0) + nd\}u(n) \quad (4)$$

Therefore,

$$y(4) = 5x(0) + 10d \quad (5)$$

$$y(9) = 10x(0) + 45d \quad (6)$$

Given,

$$\sum_{n=0}^4 x(n) = \frac{1}{4} \sum_{n=5}^9 x(n) \quad (7)$$

Simplifying:

$$y(4) = \frac{1}{4}(y(9) - y(4)) \quad (8)$$

$$\Rightarrow 5x(0) + 10d = \frac{1}{4}(5x(0) + 35d) \quad (9)$$

$$x(0) = \frac{-d}{3} \quad (10)$$

$$\Rightarrow d = -6 \quad (11)$$

From (11) and Table 1

$$\Rightarrow x(n) = (2 - 6n)u(n) \quad (12)$$

From (12):

$$x(19) = x(0) + 19d \quad (13)$$

$$= -112 \quad (14)$$

From (12) :

$$X(z) = \frac{2}{1 - z^{-1}} - \frac{6z^{-1}}{(1 - z^{-1})^2} \quad |z| > 1 \quad (15)$$

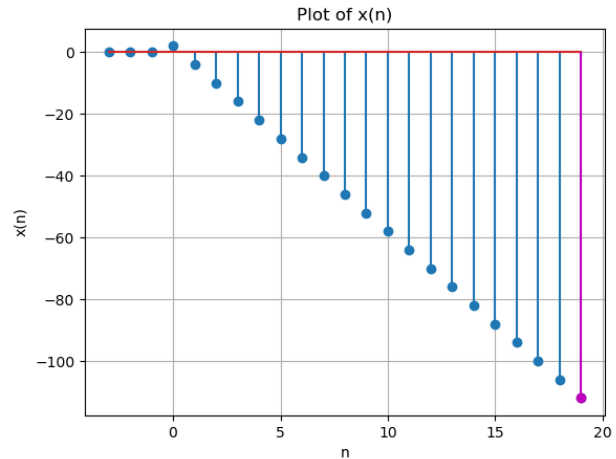


Fig. 1. graph of  $x(n) = 2 - 6n$