NCERT 11.9.2 Q7

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Question: Find the sum of n terms of the A.P. whose kth term is $5k + 1$**.**

Symbol	Value	Parameter
$x(0)$	1	First Term
$x(n)$	$(5n + 1)u(n)$	kth Term
d	5	Common Difference
$y(n)$	?	Sum of N terms

TABLE I

GIVEN PARAMETERS

Expression	Z-Transform	ROC
$nu[n]$	$\dfrac{z^{-1}}{(1 - z^{-1})^2}$	$\lvert z \rvert > 1$
$n(n-1)u[n]$	$\dfrac{2z^{-1}}{(1 - z^{-1})^3}$	$\lvert z \rvert > 1$

TABLE II

Z TRANSFORM PAIRS

Apply the Z-transform to $x(n)$:

$$X(z) = \frac{5z^{-1}}{(1 - z^{-1})^2} + \frac{1}{(1 - z^{-1})} \quad \lvert z \rvert > 1 \quad (1)$$

Sum of First n Terms:

$$y(n) = x(n) * u(n) \quad (2)$$

Applying Z transform on both sides:

$$Y(z) = X(z)U(z) \quad (3)$$

$$= \frac{1}{(1 - z^{-1})^2} + \frac{5z^{-1}}{(1 - z^{-1})^3} \quad (4)$$

Rewriting the expression:

$$= \frac{1}{(1 - z^{-1})^2} + \frac{5}{2} \cdot \frac{2z^{-1}}{(1 - z^{-1})^3} \quad (5)$$

On referring the above table we can obtain the Z trnasform inverse as follows:

$$y[n] = nu[n] + \frac{5}{2}n(n - 1)u[n] \quad (6)$$

Therefore we have got the sun of n terms as:

$$y[n] = [n + \frac{5}{2}n(n - 1)]u[n] \quad (7)$$

The stem plot is given as