

10.5.3

EE23BTECH11027 - K RAHUL*

I. QUESTION:

A. Question statement

The first and the last terms of an AP are 17 and 350 respectively. If the common difference is 9, how many terms are there and what is their sum?

B. Solution

The expression to find the n^{th} term of the Arithmetic Progression is given by

table 1

Parameters in expression		
Symbol	Description	Value
n	The nth term of series	To be computed
a_n	nth term of series	350
a_0	0th term of series	17
d	Common difference of AP	9

$$a_n = a_0 + nd \quad (1)$$

The question asked for the number of terms present in the AP, hence from ??

$$n = \frac{a_n - a_0}{d} \quad (2)$$

Thus, plugging the values into equation ??

$$\boxed{n = 37}$$

Now, the expression for sum of numbers in an Arithmetic Progression is given by

$$S_n = \left(\frac{n+1}{2}\right)(a_1 + a_n) \quad (3)$$

Where S_n is the sum of $n+1$ terms of AP and the rest of the symbols carry the same meaning as mentioned above.

Plugging the values into equation, we get

$$S_n = 6973$$

Thus, the number of terms present in the Arithmetic Progression is 38 and sum of terms of the Arithmetic Progression is 6973.

II. QUESTION 2

A. Question statement

Express nth term as $x(n)$ in terms of $u(n)$ and find its Z transform. Additionally, plot the graph of $x(n)$ using python and give the ROC of $X(Z)$.

B. Solution

The formula for sum of numbers in an AP is

$$a_n = a_0 + nd$$

Thus, plugging the values as given in the question

table 1

Parameters in expression		
Symbol	Description	Value
n	The nth term of series	N/A
a_n	nth term of series	To be computed
a_0	0th term of series	17
d	Common difference of AP	9

$$a_n = 8 + 9n \quad (4)$$

Now, the function $x(n)$ is in terms of $u(n)$ as well. Thus from equation ??,

$$x(n) = (8 + 9n)u(n) \quad (5)$$

where $u(n)$ is the unit step function

Now, its Z transform has to be computed. The Z

transform for a general function $f(n)$ is calculated by using the expression

$$X(Z) = \mathcal{Z}(x[n]) = \sum_{n=-\infty}^{\infty} x[n]Z^{-n} \quad (6)$$

Where

- $X(Z)$ is the function as asked in the question.
- $\mathcal{Z}(x[n])$ is the Z transform.
- $x[n]$ is the value of the function defined in equation ?? at a value n .

Now, plugging in the function defined in equation ?? into expression ??, we get

$$X(Z) = \sum_{n=0}^{\infty} (8 + 9n)Z^{-n} \quad (7)$$

Now, this expression can be evaluated only when $|Z| > 1$ (Thus, making $|Z| > 1$ the region of convergence).

If $|Z| > 1$, then expression ?? simplifies to

$$X(Z) = (8 - 5Z)((1 - Z)^{-2} \quad (8)$$

Fig. 1. Enter Caption

