

# Arithmetic Progression Problem

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Which term of the arithmetic progression (AP): 3, 8, 13, 18, ... is 78?  
Find the term ( $k$ ) when the term  $x(k)$  is equal to 78.

## 1 Input Table

Here is the input table with common difference, initial term, and a description:

| $n$ | Parameters         | Description       |
|-----|--------------------|-------------------|
| 1   | $a(0)$             | Initial Term      |
| 2   | $d$                | Common Difference |
| 3   | $a(k) \times u(k)$ | Target Term       |

## 2 Solution

Let's solve the problem:

$$\text{Let } x(n) = [3 + (n - 1)5] \times u(n)$$

$$\text{Given: } x(k) = 78$$

Substitute values into the formula:

$$78 = 3 + (k - 1) \times 5$$

$$78 = 3 + (k - 1) \times 5$$

$$78 - 3 = 5(k - 1)$$

$$75 = 5(k - 1)$$

$$15 = k - 1$$

$$k = 16$$

Therefore, the correct term number ( $k$ ) when  $x(k) = 78$  in the given arithmetic progression is  $k = 16$ .

### 3 Z-Transform

Let the Z-transform of  $x(n)$  be  $X(z)$ . Let  $U(z)$  be the Z-transform of  $u(n)$ .

$$X(z) = x(0)U(z) + dz^{-1}Z\{nu(n)\} \quad (1)$$

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

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

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

$$= \frac{3 + (5 - 3)z^{-1}}{(1 - z^{-1})^2} \quad \text{for } |z| > 1 \quad (5)$$