

# Assignment

EE23BTECH11008 - Meenakshi

Q:The difference between any two cosecutive interior angles of a polygon is  $5^\circ$ . If the smallest angle is  $120^\circ$ , find the number of sides of polygon.

**Solution:** The interior angles of a polygon are in AP with  $x(0) = 120$ ,  $d = 5$  The sum of  $n$  terms of

Variable	Description	Value
$x(0)$	first term of AP	120
$d$	common difference of AP	5
$x(n)$	general term of AP	none
$n$	Describing the order of term	none
$u(n)$	unit step function	mentioned above
$U(z)$	z-transform of $u(n)$	$\frac{1}{1-z^{-1}}$
$X(z)$	z-transform of $x(n)$	$x(0)U(z) + d\left(-z\frac{d(U(z))}{dz}\right)$

an AP is given by

$$S = \frac{n}{2}(2 \cdot x(0) + (n-1)d) \quad (1)$$

Sum of interior angles of AP is given by

$$S = (n-2)180 \quad (2)$$

$$\frac{n}{2}(2 \cdot x(0) + (n-1)d) = (n-2)180 \quad (3)$$

$$\frac{n}{2}(240 + (n-1)5) = (n-2)180 \quad (4)$$

$$n(235 + 5n) = 360n - 720 \quad (5)$$

$$5n^2 + 235n = 360n - 720 \quad (6)$$

$$5n^2 - 125 + 720 = 0 \quad (7)$$

$$n^2 - 25n + 144 = 0 \quad (8)$$

solving the above equation we get

$$n = 16, 9 \quad (9)$$

$$x(n) = (120 - 5n) \times u(n) \quad (10)$$

The expression for  $u(n)$  is

$$u(n) = \begin{cases} 1 & \text{if } n \geq 0, \\ 0 & \text{if } n < 0. \end{cases}$$

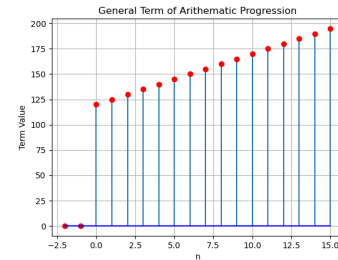


Fig. 0: Plot of the general term taken from Python

On Z-transformation

$$U(z) = \sum_{n=-\infty}^{\infty} z^{-n} u(n) \quad (11)$$

$$U(z) = \sum_{n=0}^{\infty} z^{-n} \quad (12)$$

$$\frac{d(U(z))}{dz} = \sum_{n=0}^{\infty} -nz^{-n-1} \quad (13)$$

$$(14)$$

Now,

$$X(z) = \sum_{n=-\infty}^{\infty} (x(0) + nd)z^{-n} u(n) \quad (15)$$

$$X(z) = x(0)U(z) + d\left(-z\frac{d(U(z))}{dz}\right) \quad (16)$$

$$X(z) = 120U(z) + 5\left(-z\frac{d(U(z))}{dz}\right) \quad (17)$$

$$X(z) = \frac{120}{1-z^{-1}} + \frac{5z^{-1}}{(1-z^{-1})^2} \quad \text{ROC: } |z| > 1 \quad (18)$$

$$X(z) = 120U(z) - 5z\frac{d(U(z))}{dz} \quad (19)$$