

Assignment

EE23BTECH11008 - Meenakshi

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

Solution: Sum of interior angles of a polygon with

Variable	Description	Value
$x(0)$	first term of AP	120
d	common difference of AP	5
$x(n)$	general term of AP	none

n+1 sides is given by

$$S = (n - 1)180 \quad (1)$$

Sum of n terms of AP is given by

$$y(n) = \sum_{k=0}^n x(k) \quad (2)$$

$$= x(n) * u(n) \quad (3)$$

$$x(n) * u(n) = (n - 1)180 \quad (4)$$

$$Y(z) = X(z)U(z) \quad (5)$$

$$= \left(\frac{x(0)}{1 - z^{-1}} + \frac{dz^{-1}}{(1 - z^{-1})^2} \right) \cdot \frac{1}{1 - z^{-1}} \quad |z| > 1 \quad (6)$$

$$= \frac{120}{(1 - z^{-1})^2} + \frac{5z^{-1}}{(1 - z^{-1})^3} \quad |z| > 1 \quad (7)$$

Using partial fractions:

$$Y(z) = \frac{245z^{-1}}{(1 - z^{-1})} + \frac{130z^{-2}}{(1 - z^{-1})^2} + \frac{5z^{-3}}{(1 - z^{-1})^3} + 120 \quad (8)$$

$$Z^{-1} \left[\frac{z^{-1}}{(1 - z^{-1})} \right] = u(n - 1) \quad (9)$$

$$Z^{-1} \left[\frac{z^{-2}}{(1 - z^{-1})^2} \right] = (n) u(n - 1) \quad (10)$$

$$Z^{-1} \left[\frac{z^{-3}}{(1 - z^{-1})^3} \right] = \frac{(n - 1)(n - 2)}{2} u(n - 1) \quad (11)$$

Substituting results of equation to (9),(10),(11) in equation (8):

$$y(n) = \frac{5n^2 + 245n + 240}{2} u(n) \quad (12)$$

$$= \frac{n + 1}{2} (240 + 5n) u(n) \quad (13)$$

now from (4)

$$y(n) = (n - 1)180 \quad (14)$$

$$\frac{n + 1}{2} (240 + 5n) u(n) = (n - 1)180 \quad (15)$$

$$(16)$$

now replace n by n-1:

$$n(235 + 5n) = (n - 1)360 \quad (17)$$

$$5n^2 - 125n + 720 = 0 \quad (18)$$

$$n = 16, 9 \quad (19)$$

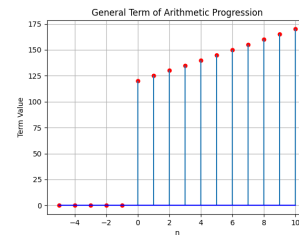


Fig. 0: Plot of the general term taken from Python