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

$$S = (n-1)180 \tag{1}$$

Sum of n terms of AP is given by

$$y(n) = \sum_{k=0}^{n} x(k) \tag{2}$$
$$= x(n) * u(n) \tag{3}$$

$$x(n) * u(n) = (n-1)180 \tag{4}$$

$$Y(z) = X(z)U(z) \tag{5}$$
$$= \left(\frac{x(0)}{1-z^{-1}} + \frac{dz^{-1}}{(1-z^{-1})^2}\right) \cdot \frac{1}{1-z^{-1}} \quad |z| > 1 \tag{6}$$
$$= \frac{120}{(1-z^{-1})^2} + \frac{5z^{-1}}{(1-z^{-1})^3} \quad |z| > 1 \tag{7}$$

Using partial fractions:

$$Y(z) = \frac{120}{(1-z^{-1})} + \frac{125z^{-1}}{(1-z^{-1})} + \frac{130z^{-2}}{(1-z^{-1})^2} + \frac{5z^{-3}}{(1-z^{-1})^3} \tag{8}$$

$$Z^{-1}\left[\frac{1}{(1-z^{-1})}\right] = u(n) \tag{9}$$
$$Z^{-1}\left[\frac{z^{-1}}{(1-z^{-1})}\right] = u(n-1) \tag{10}$$
$$Z^{-1}\left[\frac{z^{-2}}{(1-z^{-1})^2}\right] = (n)\,u(n-1) \tag{11}$$
$$Z^{-1}\left[\frac{z^{-3}}{(1-z^{-1})^3}\right] = \frac{(n-1)(n-2)}{2} u(n-1) \tag{12}$$

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

$$y(n) = \frac{5n^2 + 245n + 240}{2} u(n) \tag{13}$$
$$= \frac{n+1}{2}(240 + 5n)\,u(n) \tag{14}$$

now from (4)

$$y(n) = (n-1)180 \tag{15}$$

$$\frac{n+1}{2}(240 + 5n)\,u(n) = (n-1)180 \tag{16}$$
$$\tag{17}$$

now replace n by n-1:

$$n(235 + 5n) = (n-1)360 \tag{18}$$
$$5n^2 - 125n + 720 = 0 \tag{19}$$

$$n = 16, 9 \tag{20}$$

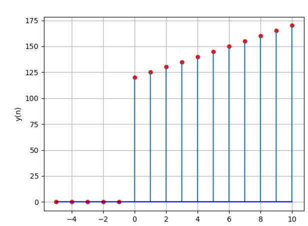

Fig. 0: Plot of the general term taken from Python