

AREA OF REGULAR n-POLYGON

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Abstract: In this theorem we will give a relation between perimeter and area of polygon in terms of perimeter and area of circle formed incentered in polygon and also give a formulae for area of regular polygon.

Keywords: A_c = area of circle
 $A_{pol.}$ = area of polygon
 P_c = perimeter of circle
 $P_{pol.}$ = perimeter of polygon

1. Introduction

There is a problem to calculate the area of regular n-polygon.usually if any one wants to calculate the area of regular n-polygon then the polygon must be cracked in triangles or several polygons of known ares and sum the areas of each tringles.it is also difficult to find the area of each tringle as the sides of triangles may not be easily find also whole process is very large.

But using this principal we can easily calculate the accurate area of the polygon in very short step.this helps us to calculate the accurate area of regular polygon as well as also save our time in calculation of area.

2. Statement

If a circle is incentered in a regular polygon.then;

$$P_{pol.} / A_{pol.} = P_c / A_c$$

3. Proof

Let polygon have 'n' sides of length 'a' and circle of radius 'r'.

Join all vertices to the centre of circle. for example-fig.1.(a regular hexagon)

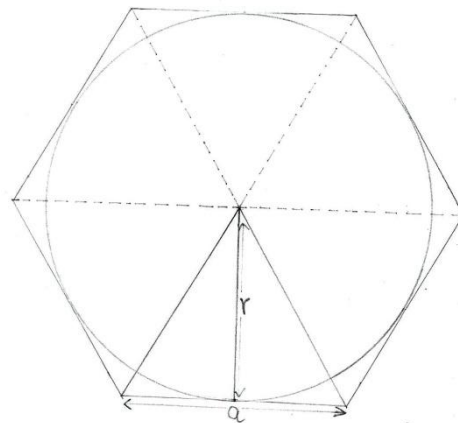


Fig.1. a regular hexagon

When conjugative vertices of polygon are jointed to centre of circle then each triangle formed will be congruent and of equal areas.

Hence,

$$P_{pol.} = n \times a$$

.....(1)

$$A_{pol.} = n \times \text{area of one triangle}$$

$$A_{pol.} = n \times a \times r \times 1/2$$

.....(2)

{ as 'r' be the perpendicular height of triangle, because each side is perpendicular to radius (as tangent) }

Deviding (1) by (2)

$$P_{\text{pol.}}/A_{\text{pol.}} = n \times a/n \times a \times r/2 = 2/r$$

$$P_{\text{pol.}}/A_{\text{pol.}} = 2/r \dots\dots\dots(3)$$

$$P_c = 2 \times \pi \times r$$

$$A_c = \pi \times r^2$$

$$P_c/A_c = 2 \times \pi \times r / \pi \times r^2 = 2/r$$

$$P_c/A_c = 2/r \dots\dots\dots(4)$$

From (3) and (4),

$$P_{\text{pol.}}/A_{\text{pol.}} = P_c/A_c.$$

Whence proved.

4. Conclusion

The relation is

$$P_{\text{pol.}}/A_{\text{pol.}} = P_c/A_c.$$

or the area of polygon

$$A_{\text{POL.}} = A_c \times P_{\text{POL.}} / P_c$$

5. Advantages

- (i) It helps us to calculate the accurate area of the regular polygon.
- (ii) It shorts the steps of calculation and prevent to missing in calculation by shorting the calculation.
- (iii) It save our time in calculation of area of polygon.
- (iv) It also supports the rule that “a regular polygon of infinite side become a circle”.

6. Limitations

- (i) It does not tell us about irregular polygon.
- (ii) For given polygon, the radius of circle must be known.

7. Applications

- (i) To calculate the area of any plot in the form of regular polygon.
- (ii) To draw the incentred circle inside a regular polygon and vice-versa.

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References

Books:

- [1] NCERT mathematics for clas 10th