area of regular polygon*

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2013-03-21 23:05:06

Theorem 1. *Given a regular n-gon with apothem of length a and perimeter P, its area is*

$$A = \frac{1}{2}aP.$$

Proof. Given a regular n-gon R, line segments can be drawn from its center to each of its vertices. This divides R into n congruent triangles. The area of each of these triangles is $\frac{1}{2}as$, where s is the length of one of the sides of the triangle. Also note that the perimeter of R is $P = ns$. Thus, the area A of R is

$$\begin{aligned} A &= n\left(\frac{1}{2}as\right) \\ &= \frac{1}{2}a(ns) \\ &= \frac{1}{2}aP. \end{aligned}$$

□

To illustrate what is going on in the proof, a regular hexagon appears below with each line segment from its center to one of its vertices drawn in red and one of its apothems drawn in blue.

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*⟨*AreaOfRegularPolygon*⟩* created: ⟨*2013-03-21*⟩ by: ⟨*Wkbj79*⟩ version: ⟨*39501*⟩ Privacy setting: ⟨*1*⟩ ⟨*Theorem*⟩ ⟨*51-00*⟩

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