

# Study of the Area of Regular Polygons

## Materials:

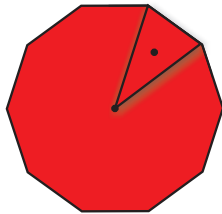
- Equivalent Figure Material
  - Insets #13, 14, 15, 16., the Decagon

## Presentation One:

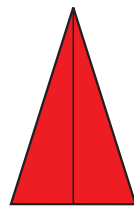
We have already demonstrated that the decagon is composed of as many triangles as there are sides in the decagon. We have also shown the equivalence between the polygon and the two rectangles from Insets #15, 16.

Can we calculate the area of one triangle in the decagon? Yes.

$$A = \frac{bh}{2}$$



**If I know the side of the polygon and its apothem, I can then calculate the area of the polygon by first finding the area of one triangle and then multiplying by the number of sides.**



Height of the triangle  
(apothem of the decagon)

Base of the triangle  
(one side of decagon perimeter)

**Formula:** Area of the regular polygon = Area of the triangle x the number of sides

$$A_{\text{polygon}} = A_{\text{triangle}} \times (\# \text{ of sides})$$

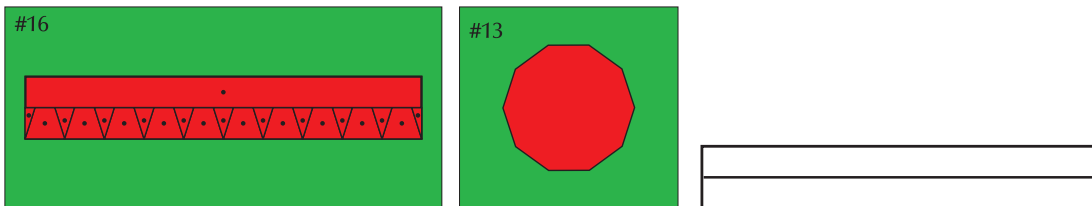
### Presentation Two:

We will use the perimeter of the polygon.

1. Demonstrate with inset #16 the idea of a double rectangle and equivalences:

Base of the rectangle = perimeter of the polygon

Height of the rectangle = apothem of the polygon

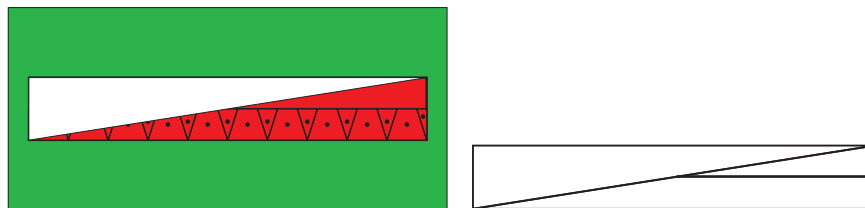


3. The rectangle is equivalent to one decagon however, the paper we have traced is equivalent to two decagons.

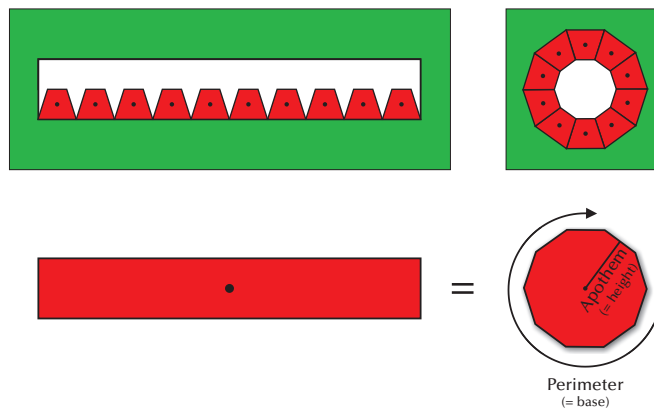
The area of two polygons = perimeter x apothem

4. We need to cut the rectangle along the diagonal to form two triangles.

One triangle is equivalent to one decagon.



The base of the triangle equals the perimeter of the decagon.



The height of the triangle equals the apothem of the decagon.

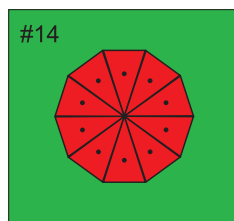
5. Using triangle formula  $\frac{bh}{2}$ , we have perimeter multiplied by apothem, divided by 2:

Formula:  $A = \frac{pa}{2}$

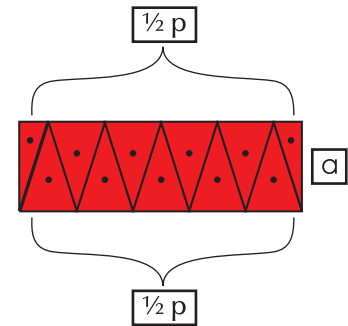
### Presentation Three:

Inset #14

1. Take the larger rectangle which is equivalent to the decagon.
2. The base of the rectangle equals  $\frac{1}{2}$  the perimeter; the height of the rectangle equals the apothem.

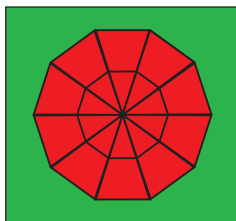


Formula:  $A = \frac{p}{2} \times a$



### Presentation Four:

1. Use the long rectangle which is equivalent to the decagon.
2. Its base equals the perimeter of the polygon. Its height equals  $\frac{1}{2}$  the apothem.



Formula:  $A = \frac{a}{2} \times p$

