Problem 1 – Area of a Regular Pentagon

A regular polygon is a polygon that is equiangular and equilateral. The apothem of a regular polygon is a line segment from the center of the polygon to the midpoint of one of its sides.

Start the *Cabri Jr.* application by pressing APPS and selecting **CabriJr**. Open the file *PENTAGON* by pressing Y=, selecting **Open…**, and selecting the file. You are given regular pentagon *ABCDE* with center *R*. You are given the length of $\overline{CD}$ (side of the polygon), $\overline{RM}$ (apothem), and the area of the polygon.

1. Drag point *D* to 4 different positions and record the data in the table below. The perimeter and apothem multiplied by perimeter will need to be calculated. The perimeter is the number of sides multiplied by the length of $\overline{CD}$.

Position	Apothem (*a*)	Perimeter (*P*)	***a* · *P*** **(apothem times perimeter)**	Area
1				
2				
3				
4				

2. Using the table discuss how the **area** and ***a* · *P*** are related.

Problem 2 – Area of a Regular Hexagon

In the problem, you will repeat the process from Problem 1 for a regular hexagon. Open the file *HEXAGON* showing a regular hexagon with center *R*. You are given the length of $\overline{CD}$ (side of the polygon), $\overline{RM}$ (apothem), and the area of the polygon.

3. Drag point *D* to 4 different positions and record the data in the table. The perimeter and apothem multiplied by perimeter will need to be calculated. The perimeter is the number of sides multiplied by the length of $\overline{CD}$.

Position	Apothem (*a*)	Perimeter (*P*)	***a* · *P*** **(apothem times perimeter)**	Area
1				
2				
3				
4				

4. Using the data you found in both problems, give formula for the area of a regular polygon.

Problem 3 – Area of a Regular Polygon

Now you will look at the proof of the formula for the area of a regular polygon. $Area = \frac{1}{2}a \cdot P$

Open the file *OCTAGON*. Construct segments connecting the vertices of the regular octagon to the center *R* using the **Segment** tool. Each of these segments is a radius of the octagon.

5. How many triangles are created by the radii of the octagon?

6. Are all of the triangles congruent?

7. Use the **D. & Length** measurement tool to measure the sides and the **Angle** measurement tool to measure the angles of one of the triangles. Are the triangles equilateral?

8. What is the area of $\triangle CDR$ in terms of the apothem ***a*** and the side of the triangle ***s***?

9. Given the area of one triangle, what is the area of the regular polygon in terms of the length of the apothem ***a*** and of one side ***s*** for the octagon?

10. What is the area of an *n*-sided polygon in terms of the length of the apothem ***a*** and the length of one side ***s***?

Problem 4 – Area of Regular Polygons

Find the area of the polygon with the given measurements.

11. regular heptagon of apothem 12 in. and sides with length 11.56 in.

12. regular dodecagon of apothem 2.8 cm and sides with length 1.5 cm

13. regular octagon of apothem 12.3 ft and sides with length 10.2 ft

14. regular hexagon of apothem 17.32 mm and perimeter 120 mm