

From the Center of the Polygon

ID: 11644

 Time Required
 45 minutes

Activity Overview

Students will explore the area of a regular polygon in terms of the apothem and the perimeter. They will derive the formula for a regular pentagon and regular hexagon. Then, students will see how the formula relates to the formula for the area of triangles. Students will then be asked to apply what they have learned about the area of a regular polygon.

Topic: Quadrilaterals & General Polygons

- *Regular Polygons*
- *Area of Regular Polygons*

Teacher Preparation and Notes

- *This activity was written to be explored with the Cabri Jr. app on the TI-84.*
- *Before beginning this activity, make sure that all students have the Cabri Jr. and Learning Check applications, and the Cabri Jr. files PENTAGON.8xv, HEXAGON.8xv, and OCTAGON.8xv loaded on their TI-84 Plus family calculators.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter “11644” in the keyword search box.***

Associated Materials

- *CenterOfThePolygon_Student.doc*
- *Pentagon.8xv*
- *Hexagon.8xv*
- *Octagon.8xv*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Area of a Regular Polygons (TI-84 Plus family) — 7227*
- *Inscribed Regular Polygons (TI-Nspire technology) — 9203*
- *Areas of Regular Polygons and Circles (TI-84 Plus family) — 7340*

Problem 1 – Area of a Regular Pentagon

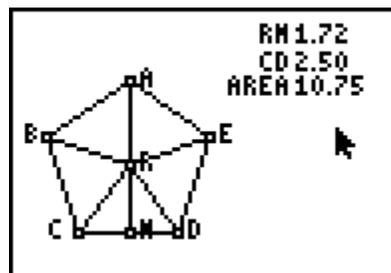
Students will begin this activity by looking at a regular pentagon. In file *PENTAGON*, regular pentagon $ABCDE$ with center R is shown and the length of \overline{CD} (side of the polygon), the length of \overline{RM} (apothem), and the area of the polygon are given.

Students are to collect data in the table given on their student worksheet. The table contains 4 columns:

Apothem, Perimeter, $a \cdot p$ (apothem times perimeter), and Area.

Students will collect data by moving point D . They will do this for four different positions of the point.

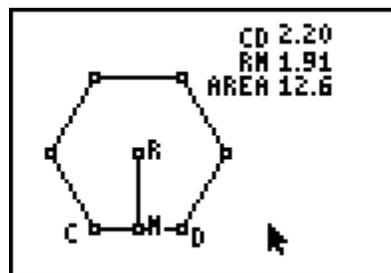
On the worksheet, students are asked about how the area and the apothem times the perimeter are related.



Problem 2 – Area of a Regular Hexagon

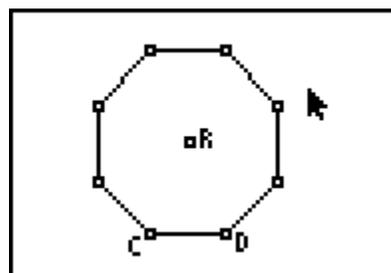
Students will repeat the same process as Problem 1 for a regular hexagon. Students will begin to discover the formula for a regular polygon is one-half the apothem times the perimeter.

$$A = \frac{1}{2} \cdot a \cdot P$$



Problem 3 – Area of a Regular Polygon

In this problem, students are to “prove” the formula for the area of a regular polygon by looking at an octagon and the triangles created by the radii of the octagon. If students are confused by the term radius of the polygon, explain that this is the radius of a circle circumscribed about a regular polygon.



Problem 4 – Area of Regular Polygons

In Problem 4, students are asked to apply what they have learned about the area of regular polygons. The students are given a question on the area of a regular polygon and a calculator on each page. The students are to use the calculator to find the area.

Student Solutions

1. Sample answers:

Position	Apothem (a)	Perimeter (P)	$a \cdot P$ (apothem times perimeter)	Area
1	1.72	12.5	21.5	10.75
2	1.93	14	27.02	13.49
3	2.13	15.5	33.015	16.53
4	2.55	18.5	47.175	23.55

2. $\text{area} = \frac{1}{2}(\text{apothem})(\text{perimeter}) = \frac{1}{2}ap$

3. Sample answers:

Position	Apothem (a)	Perimeter (p)	$a \cdot P$ (apothem times perimeter)	Area
1	1.91	13.2	25.2	12.6
2	2.25	15.6	35.1	17.76
3	2.34	16.2	37.908	18.9
4	2.60	18	46.8	23.4

4. $\text{Area} = \frac{1}{2}(\text{apothem})(\text{perimeter}) = \frac{1}{2}aP$

5. 10

6. Yes

7. Yes

8. $\text{Area } CDR = \frac{1}{2}as$

9. $\text{Area} = \frac{1}{2}as(8) = 4as$

10. $\text{Area} = \frac{1}{2}asn$

11. 485.52 sq. in.

12. 25.2 sq. cm

13. 501.84 sq. ft

14. 1,039.2 sq. mm