Areas of Polygons

Lesson Summary:
Students will create regular polygons using geometry software and calculate the area. Students will investigate how this calculation compares to the area of the sum of the triangles in a regular polygon in Activity One. In Activity Two, students examine irregular polygons and even work with triangulation.

Key Words:
Area, regular polygon, triangulation

Existing knowledge:
Students should have previous knowledge of the parts of a regular polygon. An introduction is included which reviews apothem, radius, and central angle of a regular polygon.

Learning objectives:
1. Create regular polygons.
2. Calculate the area of regular polygons.

Materials:
Computer lab or set of calculators equipped with Cabri Geometry II and a lab worksheet.

Suggested Procedure:
- Group students in pairs.
- Discuss the definition of a tessellation with students.
- Have students complete the lab to discover the properties of tessellations.
Areas of Polygons

Activity One: Regular Polygons

Group members’ names: ____________________________________________________________

File name: ______________________________________________________________________

Introduction: The apothem of the regular polygon is the segment from the center to the midpoint of a side. The radius of a regular polygon is the segment from the center to a vertex of the regular polygon. This is also the radius of the circumscribed circle for that same regular polygon. The center of the circle is the center of the regular polygon.

Goal: Construct a five-sided regular polygon and find the area.

Procedure:

1. Create a 5-sided regular polygon (pentagon) and label the center A. [Regular polygon tool]

2. Label two consecutive vertex points of the regular polygon C and D. [Label tool]

3. Find the midpoint of C and D and label that point B. [Midpoint tool]

4. Construct segment $\overline{AB}$ [Segment tool]

5. Calculate the distance from AB. [Distance and Length tool]
Record the value here! ______________
What term describes this distance? ______________

6. Calculate the distance from C D. [Distance and Length tool]
   Record the value here! ______________

7. Can you decompose the pentagon using congruent triangles? If so how many triangles do you need? What is the area of each triangle?

   ________________________________________________________________
   ________________________________________________________________

8. From your previous answer, find the area of the pentagon.
   Show your work here. __________________________
   ____________________________________________
   ____________________________________________

9. Calculate the area of the regular polygon using cabri. Record the value here. _______ [Area tool]

10. Does the area cabri calculated match with the area you calculate? ______

11. Instead of adding all areas of the triangles within the pentagon, is there a relationship between the sides of a pentagon to the number of triangles to be added? Can you come up with a formula to find the areas of regular polygons?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

12. If necessary make additional regular polygons on cabri and calculate their areas using the same method you just used.

*Note: If you are not familiar with Cabri tools, press F1 on the keyboard. A help menu for each tool selected will appear on the bottom of the screen.
Areas of Polygons  

Activity two: Irregular Polygons

Team member’s names: ___________________________________________

An irregular polygon is one that has no uniform relationships between the sides or angles of the figure. Thus, there is no formula available to find the area of an irregular polygon. Because of this fact, in this lab, you must discover your own way to find the area of such figures.

Goal: Discover how to find the area of irregular polygons.

1. Construct any arbitrary irregular polygon. [polygon tool]  
   Because it is irregular it does not matter how many sides your polygon has, or the shape of it.

2. Find the area of this figure and record it here. [area tool]

3. How can you break this figure down the smallest possible polygons that you already know how to Find the area of?

4. Break your figure down as you suggested in number three and find the area of each individual piece and record it here. In order to find the areas of your pieces, you need to define them on Cabri. For example, if you have a triangle as one of your pieces, you need to create the triangle. Then, you can find the area of that triangle. [area tool]

5. Add the areas of your individual figures and compare their sum to the original area you calculated in number two. Are your two areas the same? [calculate tool]

6. Generalize your findings for your figure and write an algorithm to find the area of any irregular polygon.

This process you have just completed is called triangulation!

*Note: If you are not familiar with Cabri tools, press F1 on the keyboard. A help menu for each tool selected will appear on the bottom of the screen