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| Marist college |
| Lesson Plan- Area of Irregular Polygons Project |
| Performance Based Assessment |
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| **Brandi Ripa** |
| **5/5/2013** |

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6th Grade Math Spring 2013

**Goal:**

Students will be able to find the area of a polygon with more than four sides, by finding the area of the triangles and quadrilaterals that encompass it.

**Objectives:**

Students will:

1. determine the area of an irregular polygon.

2. create irregular polygons with specific guidelines.

**Learning Standards**

***New York State Learning Standard MST 3:***

 Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world setting, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability and trigonometry.

**Process Strand:**

*Problem Solving Strand:* Students will solve problems that arise in mathematics and in other contexts.

6.PS.6 Translate from a picture/diagram to a numeric expression

6.PS.7 Represent problem situations verbally, numerically, algebraically, and/or graphically.

Students will apply and adapt a variety of appropriate strategies to solve problems.

6.PS.10 Work in collaboration with others to solve problems.

6.PS.11 Translate from a picture/diagram to a number or symbolic expression.

6.PS.13 Model problems with pictures/diagrams or physical objects

*Communication Strand:* Students will organize and consolidate their mathematical thinking through communication.

6.CM.1 Provide an organized thought process that is correct, complete, coherent, and clear

6.CM.3 Organize and accurately label work

Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

6.CM.4 Share organized mathematical ideas through the manipulation of objects, numerical tables, drawings, pictures, charts, graphs, tables, diagrams, models, and symbols in written and verbal form.

**Content Strand:**

*Geometry Strand:* Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

6.G.2 Determine the area of triangles and quadrilaterals (squares, rectangles, rhombi, and trapezoids) and develop formulas

6.G.3 Use a variety of strategies to find the area of regular and irregular polygons

**Standards of the National Council of Teachers of Mathematics:**

**Process Strand:**

*Problem Solving Standard:* instructional programs from kindergarten through grade 12 should enable all students to:

* Apply and adapt a variety of appropriate strategies to solve problems
* Monitor and reflect on the process of mathematical problem solving

*Communication Standard:* instructional programs from kindergarten through grade 12 should enable all students to:

* Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

**Content Strand:**

*Geometry:* instructional programs from kindergarten through grade 12 should enable all students to:

* Precisely describe, classify, and understand relationships among types of two- and three- dimensional objects using their defining properties;
* Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;

**Materials**

* Task sheet
* Calculators
* Polygon cutouts
* Graph Paper

**Introduction**

Begin the class by telling the students that today they will be assigned a project requiring them to find the areas of polygons with four or more sides. Remind the students that they have just learned how to find the area of triangles, and some quadrilaterals, and now they are going to apply that knowledge to find the area of other polygons. First the teacher will ask the students for area formulas that they already know, and write them on the board. Once the three formulas are written down, the teacher will quickly review these formulas with the students inform them that they are going to use them again today for different polygons.

**Development**

 Once the teacher has reviewed the formulas for finding the area of triangles, parallelograms, and trapezoids, she will pass out the task sheet and present an example of a polygon to the class and ask them if any of the three known formulas can be used for this polygon. If the students answer the question correctly, the teacher will praise the student and explain why that answer was correct. If the student answers incorrectly, then the teacher will take the time to explain that the example polygon does not meet the classifications needed for the area formulas on the board. Next the teacher will ask the students to think about how they can break the shape up into smaller shapes that they learned thus far. After allowing the students’ time to critically think about the various shapes that encompass the polygon, the teacher show some ways the polygon can be divided into a triangle and a quadrilateral. Using this example polygon, the teacher will think aloud, and describe the steps to finding the area of the polygon by breaking it up into triangles, parallelograms, or trapezoids, then adding their areas to find the area of the whole polygon. Inform the students that they are to write this work down on their task sheet for the problem labeled “example.”

After the teacher goes through the process of finding the area for the example polygon, she tell the students that now they will have to complete a project requiring them to find the area of two different irregular polygons. The students are going to be given two large shapes that they will need to break up into the triangles and quadrilaterals that encompass them. In addition, students will be asked to find one irregular polygon outside of the classroom, determine its area, as well as draw a figure to scale on graph paper when given specific dimensions. The students will need to fill in the worksheet as they work. On the worksheet they will need to sketch an example of the polygon, distinguish the triangles/quadrilaterals they break it up into, write the dimensions of their base and height, and solve for the total area.

**Guided Practice:**

 The example polygon that the teacher completes will provide the class with the guidance for completing the activity.

**Independent Practice**

 The students will be asked to complete the three questions on the task sheet for homework. These questions will require the students to reflect on the steps they took in class to complete the activity. In addition, there are extension questions that challenge the students to reach higher levels of thinking as well as think of irregular polygons in an authentic context.

**Evaluation**

 Students will be graded on their completion of the Areas of Irregular Polygons Worksheet (see attached). Each question specifies its point value and partial credit will be given.

Example Shape (5 points): Students will receive full credit for completing the sketch, writing the dimensions, and completing the calculations with the teacher’s guidance. The purpose of this question is to ensure students watch the teacher’s demonstration of the project, and have an exemplar to refer to when working independently.

Shape A and B and Extension Question 1 (4 questions; 10 points each; 40 points total): Students will receive full credit for sketching the shape (2 points), stating its dimensions (2 points), completing calculations using appropriate formulas (4 points), and stating what shapes encompassed the irregular polygon (2 points).The work for these two questions is similar to the Example Shape, but now students will be required to complete the process and calculations independently.

Extension Question 2 (15 points): Students are required to complete the same steps they had in the previous problems, however this time they need to create the shape on their own using the guidelines provided for them. They will receive 5 points for sketching a shape that matches the characteristics laid out for them, and the remaining 10 points for completing the same steps for the previous questions.

Extension Question 3 (5 points): Students will receive 1 point for each occupation and/or job they can state, and 2 points for correctly identifying any tools they may use (i.e. tape measure, level, calculator/computer etc.) The purpose of this question is to get students think about how area is applicable to the real world, and authentic applications for it.

Extension Question 4 (10 points): Students are expected to consider the consequences of not knowing how to calculate the area of objects when your job requires you to do so. By transitioning from mathematical, to practical thinking, students can begin to understand the importance of this material in their lives. Full credit will be given to those students to successfully show an understanding of how this lesson could affect their lives if calculations were made incorrectly.

**Closure**

 At the end of the lesson, the teacher will remind the class that they can use the area formulas that they know, to find the areas of other polygons. The teacher will call on students in the class to share some formulas that they used in class today. After they reviewed what they did in class, the teacher will remind the students that they will use these techniques whenever they are asked to find the area of a polygon that they don’t have a formula for.

**Evaluation**

At the end of the chapter, the students will take a test requiring them to find the area and perimeters of various polygons. At least one problem will require the students to use the methods and steps they used in this lesson.

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period:\_\_\_\_\_\_

**Areas of Irregular Polygons**

Directions: Find the area of each irregular polygon.

Example Shape (5 points)

Sketch:

Dimensions/Calculations:

Total Area of Example Shape:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What types of polygons make up the Example Shape?

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Shape A (10 points)

Sketch:

Dimensions/Calculations:

Total Area of Shape A:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What types of polygons make up Shape A?

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Shape B (10 points)

Dimensions/Calculations:

Sketch:

Total Area of Shape B:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What types of polygons make up Shape B?

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**Extension**

Directions: Answer the questions below.

1. Find two irregular polygons outside of the classroom and find their areas just as you did for Shapes A and B. Include a sketch, the dimensions, and calculations for each object. You may show your work on the graph paper provided to you (2 shapes; 10 points each; 20 points total).

2. Create an irregular polygon with the following characteristics:

-5 sides

-includes a right angle

-has a base of 10 cm

Sketch the figure on graph paper to scale, and find its area (15 points).

3. What are three occupations or jobs that require the skill of being able to calculate area? What tools would they need to do their job? (5 points)

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4. What problems would arise if you hired one of these individuals to do work for you and they were incorrect with their calculations? (10 points)

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