CONSTRUCTING TASK: PENTOMINO PERIMETERS

APPROXIMATE TIME: 2 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCC.3.MD.7 Relate area to the operations of multiplication and addition.

MCC.3.MD.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics. .
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

In this task, students will explore area and perimeter and their relationship. Students should be given the opportunity to explore pentominos pieces freely before working this task. To further explore pentominos, ask students to sort the pentomino pieces and determine the common attributes of the set (i.e., each piece has an area of 5 square units and all sides meet to form a right angle). Also, ask students to sort the shapes by perimeter. Students should notice that all of the pieces have a perimeter of 12 linear units with the exception of one shape that has a perimeter of 10 linear units. Discuss why only one piece has a different perimeter. Be sure students determine that shapes can have the same area but have different perimeters and vice versa. Use the correct terminology of square units and linear units in discussions.
Teachers may want to discuss the questions on the "Working with Perimeters" activity on the following web site: http://nlvm.usu.edu/en/nav/frames_asid_114_g_2_t_3.html?open=activities before students complete this task.

In preparation for working with pentominos, teachers may need to discuss how to manipulate the pieces by turning or flipping them.

To be successful with this task, students will need to understand how to find the perimeter and area of a figure. Also, students will need to understand the definition of a polygon so that they will be able to create a polygon using pentominos.

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ESSENTIAL QUESTIONS

- How are the perimeter and area of a shape related?
- How does combining and breaking apart shapes affect the perimeter and area?

MATERIALS

- "Pentominos Perimeters" student recording sheet (2 pages)
- Pentominos
- *Racing Around,* by Stuart J. Murphy, or similar book about finding perimeter

GROUPING

Whole Group/Partner Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

PART I
One way to introduce the concept of perimeter is to read *Racing Around,* by Stuart J. Murphy, or a similar book about finding perimeter.

PART II
Students will follow the directions below from the "Pentomino Perimeters" student recording sheet.

1. In each box below, choose three pentominos and create a polygon. Trace your polygon in the box.
2. Find the area and perimeter of each polygon. Be sure to include the correct label for each measure.
3. Write to tell how you found the area and perimeter of your polygons.
4. Write to explain what you noticed about the areas and perimeters of your polygons.
5. CHALLENGE:
    a. Using 3 pentomino pieces, what is the longest perimeter you can make? Sketch it below and explain how you know it has the longest possible perimeter.
    b. Using 3 pentomino pieces, what is the largest area you can make? Sketch it below and explain how you know it has the largest possible area.

FORMATIVE ASSESSMENT QUESTIONS

- How does the area compare to the perimeter of this shape?
- What units are used to measure each? Why?
- What generalizations can you make about the relationship of perimeter and area of shapes?
- Look at the shapes of other classmates. How does your area and perimeter differ from theirs? If there is a difference, why is it so?

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DIFFERENTIATION

Extension

- Ask students to complete the challenge on the student recording sheet.
- Challenge students to find 4 pieces that create a 4 x 5 rectangle or 5 pieces that form a 5 x 5 square. For more extension activities, see the following web site: http://people.rit.edu/mecsma/Professional/Puzzles/Pentominoes/P-A.html

Intervention

- Have students copy and draw the square units inside a pentomino piece and then label the perimeter and area for further understanding.
- Use a visual model for students to copy.

TECHNOLOGY CONNECTION

- http://nlvm.usu.edu/en/nav/frames_asid_114_g_2_t_3.html?open=activities Interactive pentomino tasks
- http://people.rit.edu/mecsma/Professional/Puzzles/Pentominoes/P-A.html Provides several beginner problems with solutions for pentominos.
- http://puzzler.sourceforge.net/docs/pentominoes.html Solutions to several pentominos puzzles such as the one below.

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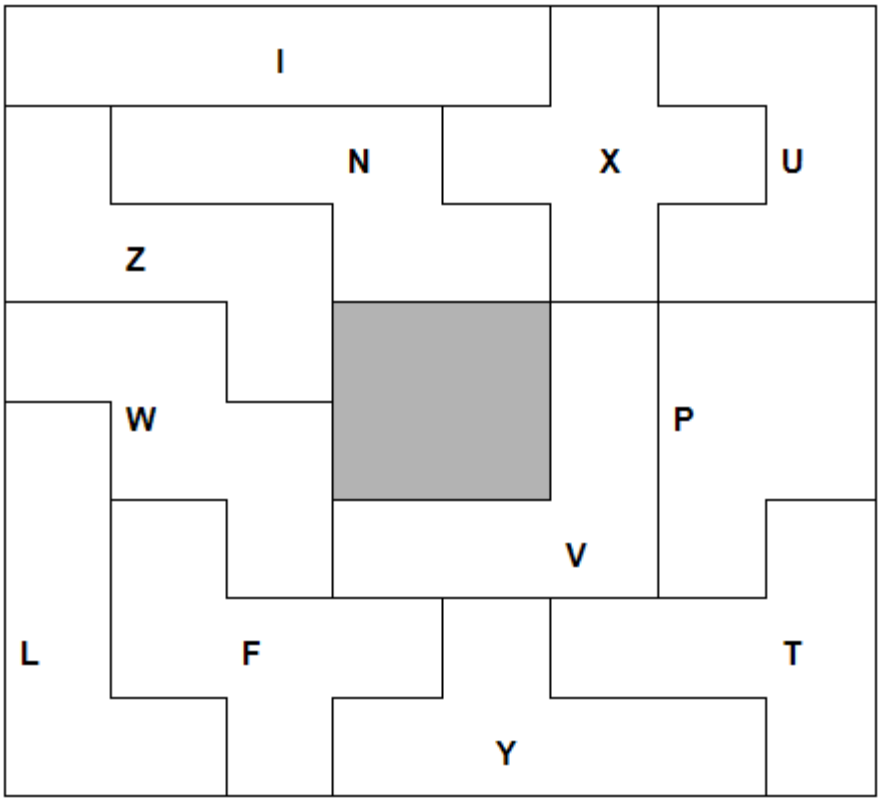
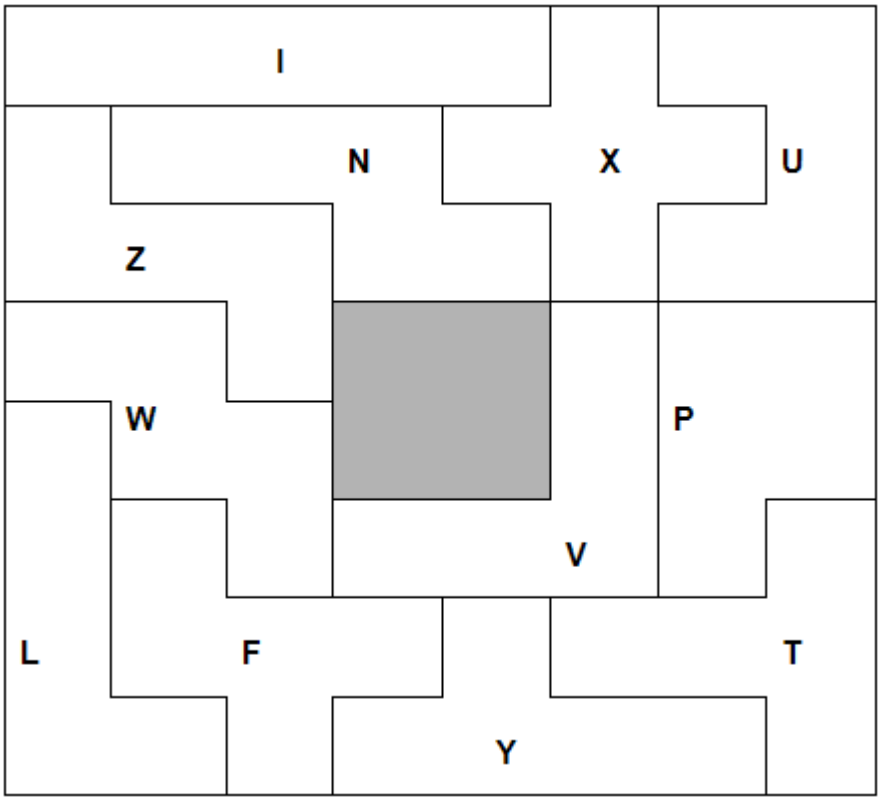
Pentomino Pieces





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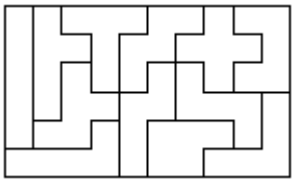
Name_____ Date _____

Pentomino Pandemonium



1. In each box below, choose three pentominos and create a polygon. Trace your polygon in the box.

A.	B.
C.	D.

2. Find the area and perimeter of each polygon. Be sure to include the correct label for each measure.

	Polygon A	Polygon B	Polygon C	Polygon D
Area				
Perimeter				

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3. Write to tell how you found the area and perimeter of your polygons.

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4. Write to explain what you noticed about the areas and perimeters of your polygons.

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5. CHALLENGE: Using 3 pentomino pieces, what is the longest perimeter you can make? Sketch it below, and explain how you know it has the longest possible perimeter.

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6. CHALLENGE: Using 3 pentomino pieces, what is the largest area you can make? Sketch it below and explain how you know it has the largest possible area.

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