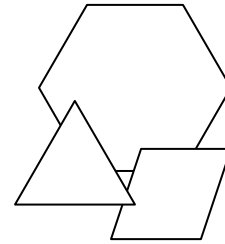# Algebra/Geometry Summer Institute 2006

Polygon Division Models

Faculty Name: Lauren Zarandona
School: Chambers Middle, Arcola, Mississippi
Grade Level: 5th-7th

1. Teaching Objectives

- The student will solve problems involving fraction division. (1c, e)
- The student will explore and model equivalent ratios and express them in simplest form. (1i)

2. Instructional Activities

a. Bell-ringer: "Write a brief paragraph defining and explaining the concept of division. Fully explain any examples that you use." (6 minutes)

b. After discussing the bell-ringer, pass out pattern blocks (see "Materials and Resources" for details) to groups of 2-4 students. Ask students to hold up a hexagon, a triangle, a rhombus, and then a trapezoid. Ask the students to explain what the figures have in common. Say, "Today these pattern blocks represent parts of a whole. You will use these pattern blocks to model fraction division and develop methods that work for dividing fractions with and without the blocks." (6 minutes)

c. Activity. (32 minutes)

    i. Give each student a copy of the "Pattern Block Puzzles" worksheet. (Attachment 1)

    ii. Activity I: Basic Fraction Division Model

        1. Read the directions to the class and model question 1 using 6 triangles and 1 hexagon (on the overhead). Explain that the triangle represents $\frac{1}{6}$ of the whole. Answer and model questions 2 and 3 soliciting student input for each.

        2. Explain to the students that we will divide by asking ourselves how many of the second number (divisor/factor) is necessary to cover the first number (dividend/product). Model question 4a on the overhead using 6 triangles ($\frac{1}{6}$) to cover 1 hexagon (1). Explain that $1 \div \frac{1}{6} = 6$ because 6 triangles covered the hexagon completely. Guide

students through 4b and allow them to finish 4c-f in groups. Call on volunteers to answer and model 4c-f.

     iii. Activity II: Advanced Fraction Division Model

         1. Instruct students to read the directions and answer questions 1-3 in groups. Discuss the answers as a class.

         2. Instruct students to model and answer questions 4a-c in groups. Call on volunteers to answer and model 4a-c.

     iv. Activity III: Create-a-Model

         1. Instruct groups to read and complete the final activity in groups. Ask volunteers to present their models and solve the final problem on the overhead. Check solutions as students present their models.

d. Post-game discussion: ask students to study their answers and look for another way to solve their problems. Develop the algorithm for dividing fractions ($\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \bullet \frac{d}{c}$) by guiding class observations. Solve the problem $\frac{1}{5} \div \frac{3}{10}$ using both the algorithm and a model from the third activity. (8 minutes)

3. Materials and Resources

    a. Materials

       i. "Pattern Block Puzzles" worksheets- 1 per student (Attachment 1)*

      ii. Pattern blocks (at least 4 hexagons, 6 trapezoids, 12 rhombi, and 20 triangles per group of 4)

     iii. Overhead pattern block set

    b. Resources: *Mathematics in Action, Teacher's Edition Part II* (MacMillan/McGraw-Hill, 1993)

*Adapted from *Mathematics in Action, Teacher's Edition Part II*.

4. Assessment

    a. Observe student participation and work during the game and during the post-game discussion.

    b. Grade "Pattern Block Puzzles" worksheets.

    c. Problem-solving assessment: Kendra had 3 sheets of construction paper that she needed to divide by $\frac{1}{6}$ to cut letters for her science project board. How many pieces of paper did she have after making the cuts? Justify your answer two ways.

Pattern Block Puzzles
Adapted from *Mathematics in Action: Teacher's Edition Part II*
(MacMillan/McGraw-Hill, 1993)

Activity I: Basic Fraction Division Model
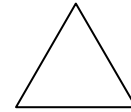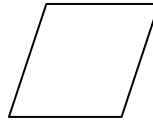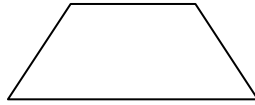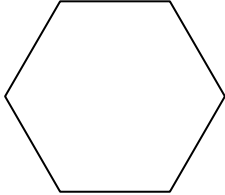
Materials pattern blocks (hexagons, trapezoids, rhombi, triangles)

Directions Let the hexagon represent one whole. To answer the following questions, build a hexagon from the other pattern blocks.

Questions
1. What fraction does the triangle represent? _____

2. What fraction does the rhombus represent? _____

3. What fraction does the trapezoid represent? _____

4. Use the blocks to solve the following problems. Explain how you got your answers.

| a. $1 \div \dfrac{1}{6} =$	b. $\dfrac{1}{2} \div \dfrac{1}{6} =$	c. $\dfrac{1}{3} \div \dfrac{1}{6} =$
_____ \n _____ \n _____ \n _____	_____ \n _____ \n _____ \n _____	_____ \n _____ \n _____ \n _____
d. $\dfrac{1}{2} \div \dfrac{1}{3} =$	e. $\dfrac{1}{6} \div \dfrac{1}{3} =$	f. $\dfrac{1}{3} \div \dfrac{1}{2} =$
_____ \n _____ \n _____ \n _____	_____ \n _____ \n _____ \n _____	_____ \n _____ \n _____ \n _____

Activity II: Advanced Fraction Division Model

Materials pattern blocks (hexagons, trapezoids, rhombi, triangles) **Directions** Suppose the complete pattern shown in Figure 1 represents one whole. Use your pattern blocks to model the figure then answer the questions below. **Questions** 1. What fraction does a triangle represent? _____ 2. What fraction does a rhombus represent? _____ 3. What fraction does a trapezoid represent? _____ 4. Use the blocks to solve the following problems. Explain how you got your answers.	Figure 1
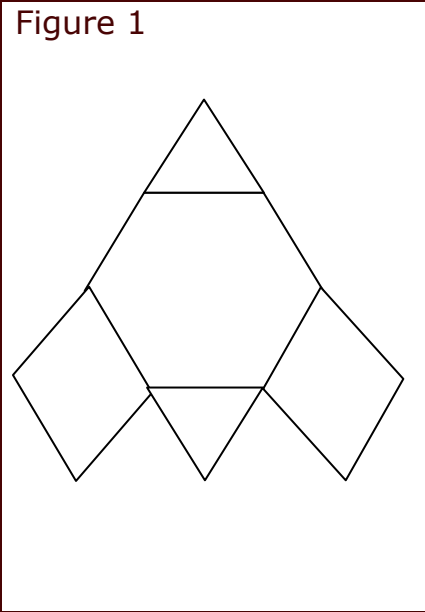
a. $1 \div \dfrac{1}{12} =$	b. $\dfrac{1}{2} \div \dfrac{1}{4} =$	c. $\dfrac{1}{3} \div \dfrac{1}{12} =$
_____	_____	_____
_____	_____	_____
_____	_____	_____

Activity III: Create-a-Model

Materials pattern blocks (hexagons, trapezoids, rhombi, triangles)

Directions Use the pattern blocks to create a model in which a triangle represents $\frac{1}{10}$ of the whole. Draw/trace the figure below then explain how you would use your model to solve the problem $\frac{3}{5} \div \frac{1}{10}$.