CONSTRUCTING TASK: Area Models

STANDARDS FOR MATHEMATICAL CONTENT

MCC4.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

a. Understand a fraction *a*/*b* as a multiple of 1/*b*. *For example, use a visual fraction model to represent 5/4 as the product 5 × (1/4), recording the conclusion by the equation 5/4 = 5 × (1/4).*

b. Understand a multiple of *a*/*b* as a multiple of 1/*b*, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express 3 × (2/5) as 6 × (1/5), recognizing this product as 6/5. (In general, n × (a/b) = (n × a)/b.)*

c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*

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.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

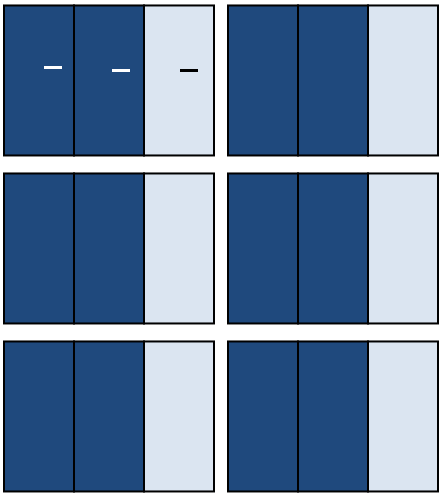
Students are often taught at younger ages that the operation of multiplication produces a larger product and the operation of division produces a smaller quotient. Multiplying whole numbers does produce larger numbers and dividing whole numbers does produce smaller numbers. However, when students begin using these operations with fractions the exact opposite occurs. This task will illustrate that idea. Below is one example of how the task could be accomplished.

Draw an area model to represent each of the following operations. Use your area model to help you compute the answer to each problem.

Answers will vary.

Possible Solution

A possible solution for – is below. This model shows six rectangles with each having – of their area shaded. The results show — shaded which is equivalent to 4 whole rectangles.



ESSENTIAL QUESTIONS

- What strategies can be used for finding products when multiplying a whole number by a fraction?
- How can I model the multiplication of a whole number by a fraction?

MATERIALS

- Colored pencils or crayons
- Area Model recording sheet

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this task, students will use area models to demonstrate their conceptual understanding of multiplying a whole number by a fraction. Teachers should support good student dialogue and take advantage of comments and questions to help guide students into correct mathematical thinking.

Comments

The area model of representing fraction is an important way for students to understand both multiplication and division of fractions. This task would allow students some freedom to create their own models and create a miniature book to represent the difference between multiplying a whole number by a fraction and dividing a whole number by another whole number.

Task Directions

Have students follow the directions on the area model recording sheet.
Use the square below to draw an area model to represent the following multiplication problems. Use your area model to help you compute the answer to each problem.

FORMATIVE ASSESSMENT QUESTIONS

- What did you notice when you multiplied a whole number by a fraction? Did this surprise you? Why or why not?
- How is multiplying a whole number by a fraction different than multiplying a whole number by another whole number?
- How is dividing a whole number by another whole number similar to multiplying a whole number by a fraction?

DIFFERENTIATION

Extension

- Students can extend this activity by creating other models, such as a set model for multiplying a whole number by a fraction.

Intervention

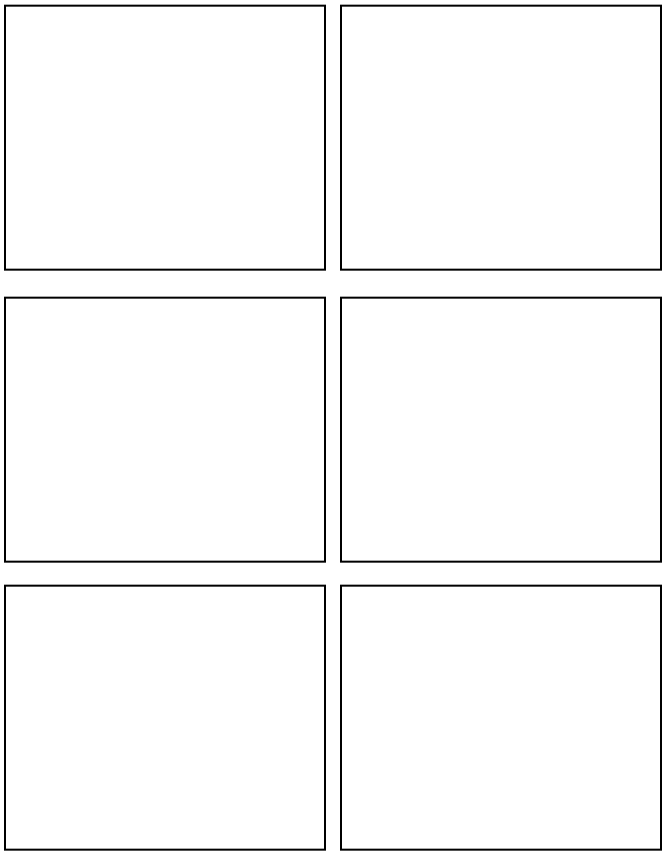
- Students could begin by multiplying whole numbers with fractions that have a numerator of 1, such as ¼, ½, ⅓, before moving on to fractions with larger numerators.

Name _____ Date _____

Area Models: Multiplication

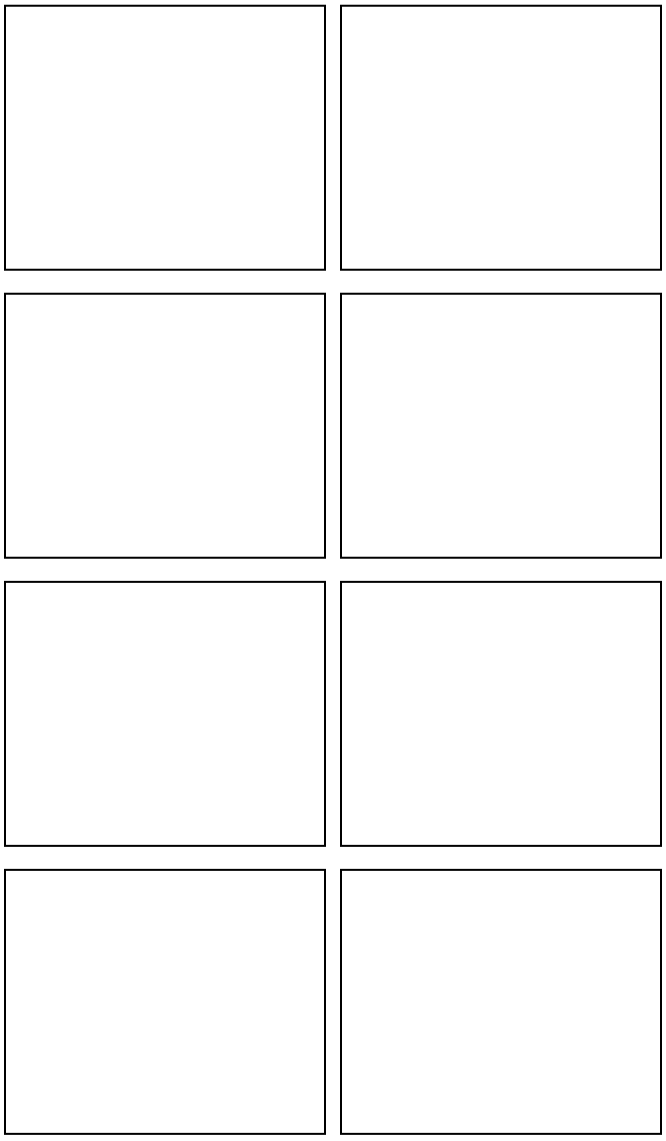
Use the square below to draw an area model to represent the following multiplication problems. Use your area model to help you compute the answer to each problem.

6 · $\frac{2}{3}$



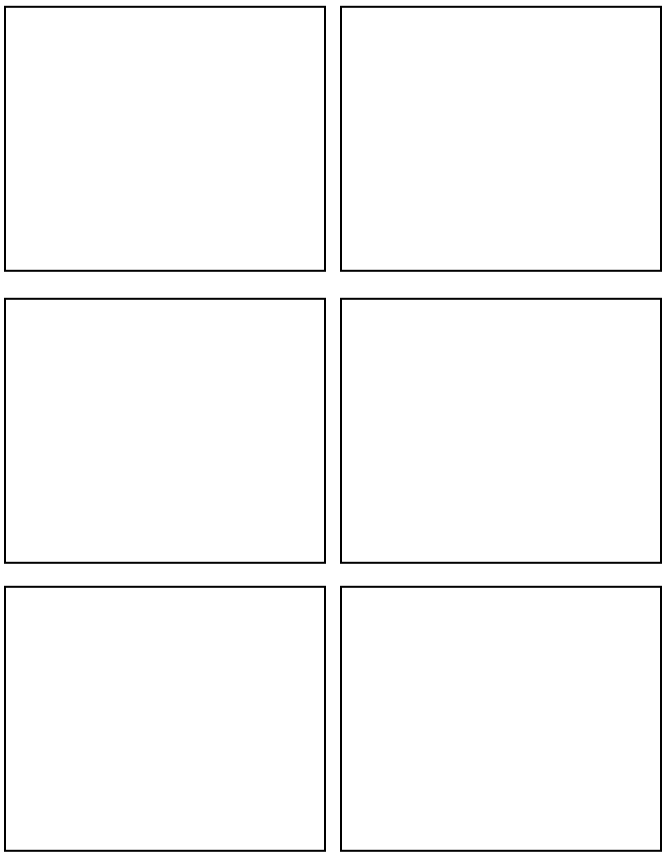
Explanation:

8 · $\frac{3}{4}$



Explanation:

$\frac{2}{5} \cdot 6$



Explanation:

Use the square below to draw an area model to represent the following operations. Use your area model to help you compute the answer to each problem. What happens if you switch the equation around to read ½ times 8?

8 · $\frac{1}{2}$