

Big Idea(s):

Multiplication with fractions is similar to multiplication with whole numbers. Students grapple with similarities and differences between multiplication of whole numbers and fractions.

Essential Question(s):

What does it mean to multiply fractions?

Content Standard(s):

Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

- a. Interpret the product $\left(\frac{a}{b}\right) \times q$ as a part of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. For example, use a visual fraction model to show $\left(\frac{2}{3}\right) \times 4 = \frac{8}{3}$, and create a story context for this equation. Do the same with $\left(\frac{2}{3}\right) \times \left(\frac{4}{5}\right) = \frac{8}{15}$ (in general, $\left(\frac{a}{b}\right) \times \left(\frac{c}{d}\right) = \frac{ac}{bd}$).
- b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Mathematical Practice or Process Standard(s):

Students make sense of problems and persevere while solving them.

Students construct viable arguments and critique the reasoning of others.

**Learning Intention(s):
Mathematical Learning Intentions**

We are learning to:

- Multiply a fraction by a fraction
- Multiply fractional side lengths to find areas of rectangles

Language Learning Intentions

We are learning to:

- Explain what happens to the product when multiplying fractions

**Success Criteria:
(written in student voice)**

I know I am successful when I can:

- Use a model to show multiplication of fractions
- Use a model to multiply fractional side lengths to find the area
- Use mathematics vocabulary to explain my reasoning
- Convince others of my thinking
- Work with my classmates to solve mathematics problems

Social Learning Intentions

We are learning to:

- Listen to each other's explanations and provide feedback
- Ask questions about other students' thinking
- Politely challenge or disagree with explanations
- Apply my reasoning about multiplication of fractions to other situations

- Communicate with others to solve mathematics problems
- Create and use a representation to explain my thinking to others

Purpose:

- Conceptual Understanding Procedural Fluency Transfer

Task:**Who Ate the Most Brownies?**

Twin sisters, Satthiya and Priya, each made a pan of brownies for the fifth-grade school picnic. Satthiya made chocolate chunk brownies and Priya made caramel swirl brownies. The sisters set their brownie pans on the table to cool and when they got back they noticed that someone had been eating their brownies! Satthiya's pan had only $\frac{3}{4}$ of the brownies left in the pan! Priya had $\frac{2}{3}$ of the brownies left in the pan! They had no choice but to take the brownies to the picnic and explain what happened to their teachers. After the picnic, Satthiya saw that her class had eaten $\frac{2}{3}$ of the $\frac{3}{4}$ brownies that were in the pan. Priya saw that her class had eaten $\frac{2}{4}$ of the $\frac{2}{3}$ brownies left in her pan. Now the sisters are arguing about the class that ate the most brownies! Help the sisters find out. Show a representation to prove your idea.

Materials (representations, manipulatives, other):

Color tiles, one-inch graph paper, markers, chart paper

Misconceptions or Common Errors:

- Believing that multiplication always makes things bigger, and therefore the same will be true for fraction multiplication
- Believing that procedural fluency (multiplying numerators and multiplying denominators) is the same as conceptual understanding
- Believing that multiplication is the same as addition by creating common denominators

Format:

- Four-Part Lesson Game Format Small-Group Instruction
 Pairs Other _____

Formative Assessment:

Individual and paired interviews: Ask students, "How does your representation show multiplication of fractions?"

Launch:

Reveal this picture to the students and conduct a Notice and Wonder:



1. Record the students' Notices and Wonders. (Students might notice that the brownie pans are not full. Students might also notice that the brownie pans have different kinds of brownies and the brownie pans show different amounts.)
2. Introduce the first part of the problem to the students and ask them to add to the Notice and Wonder. They might notice that $\frac{3}{4}$ is greater than $\frac{2}{3}$.

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3. Reveal the last part of the problem:

After the picnic, Satthiya saw that her class had eaten $\frac{2}{3}$ of the $\frac{3}{4}$ brownies that were in the pan. Priya saw that her class had eaten $\frac{2}{4}$ of the $\frac{2}{3}$ brownies left in her pan. Now the sisters are arguing about the class that ate the most brownies! Help the sisters find out. Show a representation to prove your idea.

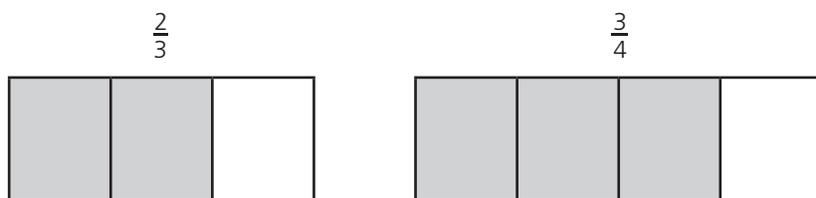
4. Share and discuss the language and social learning intentions. Do not reveal the mathematical intentions because this is an inquiry lesson.

(Continued)

Facilitate:

1. Ask the students to turn and talk to a partner about the brownie problem. Then have the students make a prediction about whose class ate the most brownies. Record their predictions.
2. Arrange the students into groups of four and distribute chart paper to the students.
3. Tell the students that they must decide which of the sister's classes ate the most brownies. They will need to find out how much of Satthiya's and Priya's brownie pans is left over after the picnic. Tell the students that they must represent their thinking using manipulatives and/or drawings. Offer graph paper, color tiles, and markers for the students to use.
4. As the students are working, monitor the groups as they solve. Ask questions and encourage the students to talk to each other and show their thinking. If students struggle, encourage them to show the amount of brownies in each pan first by creating an array.

Satthiya started with $\frac{2}{3}$ of the brownie pan. Priya started with $\frac{3}{4}$ of the brownie pan.



5. Then ask, "How can you show how much of the brownie pan was eaten by the class?" Encourage the students to share their ideas and represent their thinking using representations. Students might also use color tiles to represent the amount of the brownie pan eaten.
6. Continue to monitor the students as they work. Ask:
 - How could an array model help you?
 - How can you represent each pan's value?
 - How can you represent $\frac{2}{4}$ of $\frac{2}{3}$? What does that look like?
 - How can you represent $\frac{2}{3}$ of $\frac{3}{4}$? What does that look like?
 - How can you explain your reasoning to each other?
 - How can drawing a math picture help you solve this problem?
 - Convince a classmate about your thinking and reasoning.
7. After the students have completed the posters, ask the students to hang their posters for a gallery walk.
8. Give each student two sticky notes and tell them to examine the posters and give two pieces of feedback to two different groups. Explain to the students that the feedback must be specific and constructive. While the students are giving feedback, select two to three groups' posters and ask those groups to share during the whole-group closure.

Closure:

1. Ask the students to look at their original predictions. Ask:
 - What do you notice about our predictions?
 - If you were to make a new prediction, what might you think about?
2. Ask the groups to share their solutions with the whole class. Sequence the groups' sharing from least sophisticated solution to most sophisticated solution. The prior gallery walk should have provided the students with an opportunity to give feedback and familiarize the students with their classmates' thinking. As the groups share, provide the following prompts:
 - What representation did you use to show multiplication of fractions?
 - What did you notice about fraction multiplication?
 - How is fraction multiplication same as/different from whole-number multiplication?
 - How did the array model help you figure out which sister's class ate the most brownies?
3. Connect the students' work to the learning intentions and success criteria by asking the students to look at the learning intentions and success criteria:

I know I am successful when I:

 - Use a model to show multiplication of fractions
 - Use a model to multiply fractional side lengths to find the area

Ask the students to turn and talk with each other to answer the prompts:

 - How did you use a model to show multiplication of fractions?
 - What is one thing you can do to improve your success?