

name:

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Multiplying Fractions on a Number Line

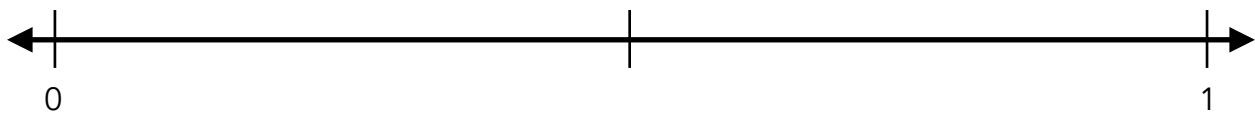
Opening Predictions:

You jump $\frac{1}{2}$ of a meter. Predict the following based upon this.

- 1) If your friend jumps half of the distance you do, will they have gone farther, the same distance or less than you jumped? _____
Why? _____
- 2) If your friend jumps three-fourths of the distance you do, will they have gone farther, the same distance or less than you jumped? _____
Why? _____
- 3) If your friend jumps twice the distance you do, will they have gone farther, the same distance or less than you jumped? _____
Why? _____

Task 1:

The number line below is marked to show halves. Use this number line to simplify the following expressions, reading each problem as, "Find _____ of one-half."



a) $\frac{1}{4} \times \frac{1}{2}$

e) $\frac{5}{4} \times \frac{1}{2}$

b) $\frac{2}{4} \times \frac{1}{2}$

f) $\frac{7}{4} \times \frac{1}{2}$

c) $\frac{3}{4} \times \frac{1}{2}$

g) $\frac{8}{4} \times \frac{1}{2}$

d) $\frac{4}{4} \times \frac{1}{2}$

Challenge: What is another way to write $\frac{8}{4}$?



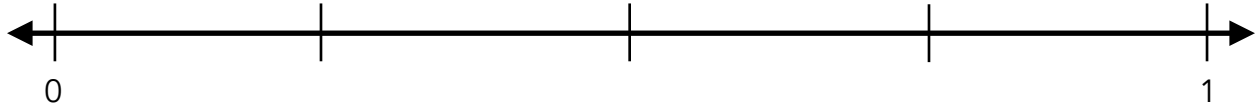
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Task 2:

Use the number line to simplify the problems below, reading each problem as, "Find _____ of one-fourth."



a) $\frac{1}{4} \times \frac{1}{4}$

e) $\frac{5}{4} \times \frac{1}{4}$

b) $\frac{1}{2} \times \frac{1}{4}$

f) $\frac{7}{4} \times \frac{1}{4}$

c) $\frac{3}{4} \times \frac{1}{4}$

g) $\frac{8}{4} \times \frac{1}{4}$

d) $\frac{4}{4} \times \frac{1}{4}$

Noticing Patterns: What Happens to the Product?

4) Look at problems a-c in each task. They all involve multiplying two fractions less than 1. What can you say about the product of two fractions less than one? Is it more than, equal to or less than 1? _____

Is it more than, equal to, or less than the two factors? _____

Why? _____

How does this match your prediction? _____

5) Look at problem d in both tasks. What is the result of multiplying a number (a fraction, in this case) by one? _____

Is this the same as or different from multiplying a whole number by one? _____

Why? _____

6) Look at problems e-g in each task. These involve multiplying a fraction greater than one by a fraction smaller than one. What can you say about the product? Is it more than, equal to or less than 1? _____

Is it more than, equal to, or less than the two factors? _____

Why? _____

How does this match your prediction? _____



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Noticing Patterns: What's the Algorithm?

Look back at each problem simplified in the Task 2 and the answers in the table below. Study the table for patterns and answer the question below.

Problem	Factor 1	Factor 2	Product
a	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{16}$
b	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$
c	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{16}$
d	$\frac{4}{4}$	$\frac{1}{4}$	$\frac{4}{16}$
e	$\frac{5}{4}$	$\frac{1}{4}$	$\frac{5}{16}$
f	$\frac{7}{4}$	$\frac{1}{4}$	$\frac{7}{16}$
g	$\frac{8}{4}$	$\frac{1}{4}$	$\frac{8}{16}$

Summary: What math can you do with the numerator and denominator the factors that will give you the product?

To find the product of two fractions, I can _____

Example: $\frac{3}{5} \times \frac{6}{10}$



Teacher Directions:

Multiplying Fractions on a Number Line

Materials:

- Optional: Number Line or Meter Stick on the floor

Objective:

Students will use a number line to model the multiplication of fractions, seeing a factor as representing one distance and the other factor representing the fraction of that distance they will travel. Students will study the results to explain when the product of two fractions is greater than, equal to, or less than 1. Students will look at patterns with the factors and products to derive the fact that $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$.

Directions:

Pass out the activity sheet and have a student read the opening scenario aloud. Give the students a few minutes to complete the prediction section on their own. Let them share ideas with a partner and then select students to share with the class. To check their predictions and help with the concept of the lesson, have two students come up front to model. Have one student try to jump and land on a half-meter. Have another student jump about half that distance and discuss where the second student is in relation to the first. Repeat this for the next two scenarios.

Task 1:

Ask the student to point to $\frac{1}{2}$ on their number line. Direct the class's attention to the sentence frame just above the number line, "find ____ of one-half." Have the class chorally reply to explain what letter a means. (They should say, "find one-fourth of one-half"). Since they have already found one-half, give them a minute to figure out what one-fourth of that distance would be (there should be marking going on!). Call on a few students to come up and show you how they determined where one-fourth of one-half was and then ask the class what the name for this point is and how they know. They should state $\frac{1}{8}$. Label this point on the number line as both $\frac{1}{8}$ and under that, $\frac{1}{4}$ of $\frac{1}{2}$.

Follow the same process for problem b and then have students work in pairs to complete the rest of Task 1. Bring the class back together to have them share their solutions and explain how they came up with their solutions.



Task 2:

The students will be following the same method of thinking in Task 2, but now finding a fraction of one-fourth. Ask the class to tell you the sentence frame for problem a, and then have them work alone on the remaining problems. Come back together and select students to present answers and methods.

Noticing Patterns: What Happens to the Product

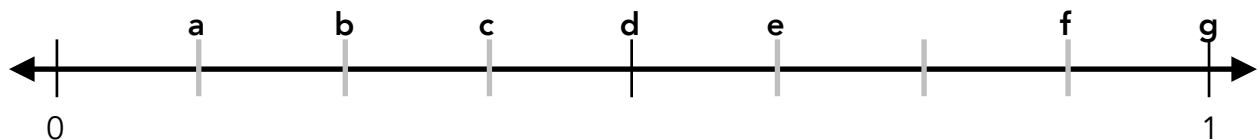
Complete this section together, by showing the students on which problems to focus, reading the sentence and then using think-pair-share to have the class explain what they have noticed and how this relates to the predictions. They should conclude that the product of two fractions less than 1 results in a product less than 1 and less than either factor; the product of a fraction and 1 is the fraction itself and the product of a fraction and a number greater than 1 is a number greater than the fraction.

Noticing Patterns: What's the Algorithm?

This last section provides an opportunity for students to verify what they may have already discovered using the area model to multiply fractions: that you can multiply the numerators and denominators to find the product. Give the students a few minutes to study the table and then complete the summary. Call on students to read their summary and show the example problem to the class.

ANSWER KEY:

Task 1:



Task 2:

- | | |
|---|--|
| a) $\frac{1}{16}$ | e) $\frac{5}{16}$ |
| b) $\frac{2}{16}$ or $\frac{1}{8}$ | f) $\frac{7}{16}$ |
| c) $\frac{3}{16}$ | g) $\frac{8}{16}$ or $\frac{4}{8}$ or $\frac{2}{4}$ or $\frac{1}{2}$ |
| d) $\frac{4}{16}$ or $\frac{2}{8}$ or $\frac{1}{4}$ | |



Noticing Patterns: What Happens to the Product

- 4) less than 1; less than; We are finding part of a part.
- 5) Multiplying a fraction by one gives us the same fraction; same;
When you multiply *anything* by one, it has the same value.
- 6) less than 1; the product is less than one factor and greater than the other factor;
We are finding part of a fraction that is greater than 1. Sometimes that part will be less than 1 and sometimes that part will be greater than 1.

Summary:

To find the product of two fractions, I can multiply the numerators together, then multiply the denominators together.

