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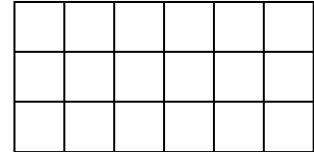
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Student Exploration: Multiplying Fractions

Vocabulary: denominator, fraction, numerator, product, simplify

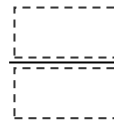
Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

Ellen cuts a cake into thirds along one side and sixths along the other, as shown at the right.



1. How many pieces did she cut? _____

2. A **fraction** shows the relationship between a part and a whole. What fraction of the cake is one piece?

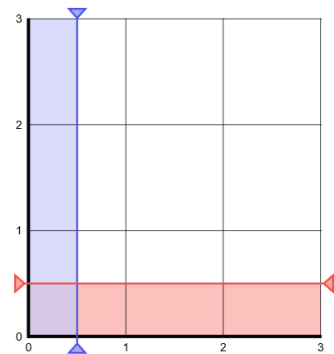


Gizmo Warm-up

In the *Multiplying Fractions* Gizmo™, you can use an area model to represent multiplying 2 fractions. The entire model is a 3-by-3 grid and contains a total of $3 \cdot 3 = 9$ square units.

The **denominators** (bottom numbers) of the fractions can be changed by dragging the red and blue sliders. (Or, you can click in the text field next to the slider, type a new value, and hit **Enter**.)

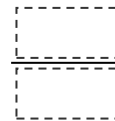
The **numerators** (top numbers) can be changed by dragging the red and blue probes on the 3-by-3 grid.



1. Set **Denominator of the first fraction** to 5. Set **Denominator of the second fraction** to 1. Drag the vertical blue probe as far left as it will go. Turn on **Show fraction model**.

A. How many parts is each square unit in the 3-by-3 grid “chopped” into? _____

B. The red model shows the first fraction. Drag the red probe to shade 3 horizontal strips red. What fraction is modeled?

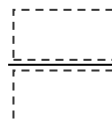


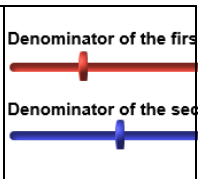
2. Set **Denominator of the second fraction** to 2. Drag the blue probe to shade one vertical strip blue. The blue probe now models $\frac{1}{2}$.

A. How many little rectangles are shaded twice (both red and blue)? _____

B. How many little rectangles are there per unit square in the grid? _____

C. Turn on **Show calculation**. What is $\frac{3}{5} \cdot \frac{1}{2}$?



Activity A: Finding the product	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Set Denominator of the first fraction to 3. • Set Denominator of the second fraction to 5. • Turn off Show calculation. 	
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1. With **Show fraction model** turned on, drag the red probe to shade 2 horizontal strips red. This models $\frac{2}{3}$. Then drag the blue probe to shade 4 vertical strips blue. This models $\frac{4}{5}$.

- How many little rectangles are in each square unit in the grid? _____
- How does the number of rectangles in each square unit relate to the denominators of the two fractions? _____
- How many rectangles are shaded twice (both red and blue)? _____
- How does the number of rectangles shaded twice relate to the numerators of the two fractions? _____
- The answer to a multiplication problem is called the **product**. Fill in the equation below to find the product of the fractions. Turn on **Show calculation** to check your work.

$$\frac{\text{Total rectangles shaded twice}}{\text{Rectangles per unit square}} = \frac{2}{3} \cdot \frac{4}{5} = \frac{\boxed{} \cdot \boxed{}}{\boxed{} \cdot \boxed{}} = \frac{\boxed{}}{\boxed{}}$$

2. Turn off **Show calculation**. Be sure **Show fraction model** is still turned on.

- Drag the red probe to model a fraction greater than 1. What fraction did you model?

 $\frac{\boxed{}}{\boxed{}}$

- Drag the blue probe to model a fraction greater than 1. What fraction did you model?

 $\frac{\boxed{}}{\boxed{}}$

- Fill in the equation below to show the product of your two fractions. Turn on **Show calculation** to check your work.

$$\frac{\boxed{}}{\boxed{}} \cdot \frac{\boxed{}}{\boxed{}} = \frac{\boxed{} \cdot \boxed{}}{\boxed{} \cdot \boxed{}} = \underline{\hspace{2cm}}$$

(Activity A continued on next page)

Activity A (continued from previous page)

3. Turn off **Show calculation**. Be sure **Show fraction model** is still turned on.

A. What is $\frac{1}{2}$ of 2? _____

B. Finding $\frac{1}{2}$ of 2 is the same as finding the product $\frac{1}{2} \cdot 2$ or $\frac{1}{2} \cdot \frac{2}{1}$. Fill in the equation below to show the product. Turn on **Show calculation** to check your work.

$$\frac{1}{2} \cdot \frac{2}{1} = \frac{\boxed{}}{\boxed{}} \cdot \frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \underline{\hspace{2cm}}$$

C. Turn off **Show calculation**. Fill in the equation below to find $\frac{5}{8}$ of $\frac{4}{3}$. **Simplify** (reduce) the product if possible. Check your answer in the Gizmo.

$$\frac{\boxed{}}{\boxed{}} \cdot \frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} \cdot \frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}}$$

4. Find the product of each pair of fractions. Write each product in simplest form. Then check your answers in the Gizmo. (Note: The last three cannot be modeled in the Gizmo.)

A. $\frac{3}{5} \cdot \frac{1}{6} = \frac{\boxed{}}{\boxed{}}$

G. What is $\frac{1}{3}$ of $\frac{3}{2}$? $\frac{\boxed{}}{\boxed{}}$

B. $\frac{5}{8} \cdot \frac{1}{4} = \frac{\boxed{}}{\boxed{}}$

H. What is $\frac{2}{5}$ of $\frac{3}{8}$? $\frac{\boxed{}}{\boxed{}}$

C. $\frac{3}{2} \cdot \frac{7}{3} = \frac{\boxed{}}{\boxed{}}$

I. What is $\frac{5}{6}$ of $\frac{15}{4}$? $\frac{\boxed{}}{\boxed{}}$

D. $\frac{4}{5} \cdot \frac{3}{8} = \frac{\boxed{}}{\boxed{}}$

J. What is $\frac{6}{14}$ of $\frac{21}{8}$? $\frac{\boxed{}}{\boxed{}}$

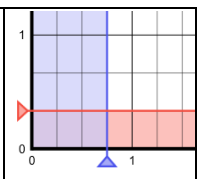
E. $\frac{7}{6} \cdot \frac{4}{2} = \frac{\boxed{}}{\boxed{}}$

K. What is $\frac{5}{12}$ of $\frac{18}{10}$? $\frac{\boxed{}}{\boxed{}}$

F. $\frac{8}{5} \cdot \frac{10}{6} = \frac{\boxed{}}{\boxed{}}$

L. What is $\frac{7}{30}$ of $\frac{3}{14}$? $\frac{\boxed{}}{\boxed{}}$



Activity B: Finding missing numbers	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Turn on Show fraction model. • Turn off Show calculation. 	
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1. Two fractions have a product of $\frac{8}{9}$.
- A. The product of the denominators must be 9. If neither denominator is 1, what is the denominator of both fractions? _____
- B. In the Gizmo, set the denominators of both fractions to match your answer above. Then drag the red and blue probes to model a product of $\frac{8}{9}$. Fill in the equation below to show your two fractions. Turn on **Show calculation** to check your answer.

$$\frac{\boxed{}}{\boxed{}} \cdot \frac{\boxed{}}{\boxed{}} = \frac{8}{9}$$

2. Turn off **Show calculation**. The product of $\frac{3}{4}$ and some fraction can be simplified to $\frac{5}{8}$. The denominator of the missing fraction is 6.
- A. What is the denominator of the unsimplified product? _____ How do you know?
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- B. Model the product in the Gizmo. Use the model to fill in the equation below. Turn on **Show calculation** to check your answer.

$$\frac{3}{4} \cdot \frac{\boxed{}}{6} = \frac{\boxed{}}{\boxed{}} = \frac{5}{8}$$

3. Fill in the blanks. Then check your answers in the Gizmo. (Note: The last two problems cannot be modeled in the Gizmo.)

A. $\frac{3}{7} \cdot \frac{\boxed{}}{\boxed{}} = \frac{9}{28}$

C. $\frac{5}{3} \cdot \frac{\boxed{}}{5} = \frac{8}{3}$

E. $\frac{7}{12} \cdot \frac{\boxed{}}{\boxed{}} = \frac{35}{72}$

B. $\frac{2}{5} \cdot \frac{\boxed{}}{\boxed{}} = \frac{3}{10}$

D. $\frac{11}{4} \cdot \frac{6}{\boxed{}} = \frac{33}{10}$

F. $\frac{14}{9} \cdot \frac{\boxed{}}{8} = \frac{7}{3}$