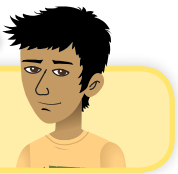
Understand Fraction Multiplication

PA Core:
CC.2.1.4.C.2
Eligible Content:
M04.A-F.2.1.5
M04.A-F.2.1.6
M04.A-F.2.1.7

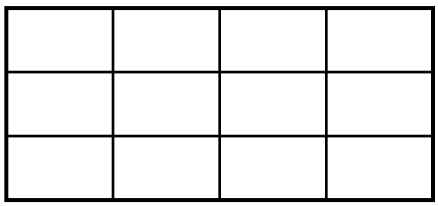
Think It Through



What's really going on when we multiply numbers?

Multiplication is finding the total number of objects in equal groups.

Think about how you would explain how to multiply 3 by 4 to a third grader. You could draw an area model with 3 rows and 4 columns, and then count the boxes.

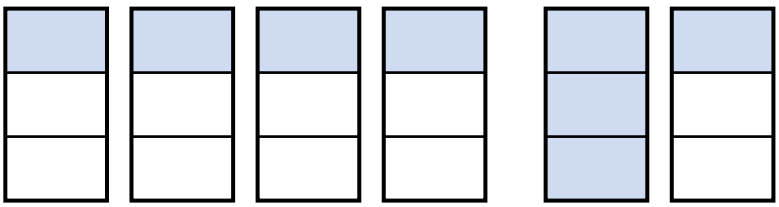


When you multiply 4×3, you have four groups of three, or four copies of 3 boxes.

Think **How is multiplying fractions like multiplying whole numbers?**

When you multiply a fraction, like $\frac{1}{3}$, by a whole number, like 4, you are making 4 copies of $\frac{1}{3}$.

You can use a model to help you multiply $\frac{1}{3}$ by 4.



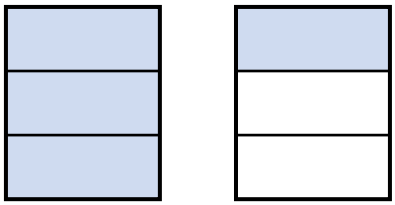
$4 \times \frac{1}{3} = \frac{4}{3}$

When you multiply $4 \times \frac{1}{3}$, you have 4 copies of $\frac{1}{3}$.

Underline the sentence that tells what you are doing when you multiply $4 \times \frac{1}{3}$.

Think Where does that product come from?

Look at the model of $4 \times \frac{1}{3}$ below.



The parts are thirds and there are 4 shaded, so the model shows $\frac{4}{3}$!

The model shows four thirds. You can count four $\frac{1}{3}$ parts.

Notice that the denominator of the fraction $\frac{1}{3}$ and the denominator of the product $\frac{4}{3}$ are the same. The denominator tells the size of the equal parts in one whole. So the fraction and the product both have the same equal-size parts (thirds).

Suppose you have two groups of $\frac{4}{3}$s. To find the total number of $\frac{4}{3}$s in two copies of $\frac{4}{3}$s, you can multiply $\frac{4}{3}$ by 2.

$$2 \times \frac{4}{3} = 2 \times \left(4 \times \frac{1}{3}\right)$$
$$= (2 \times 4) \times \frac{1}{3}$$
$$= 8 \times \frac{1}{3}$$

This is the same as having eight copies of $\frac{1}{3}$.

Reflect

1 Explain what $5 \times \frac{1}{3}$ means.

Think About Multiplying Fractions

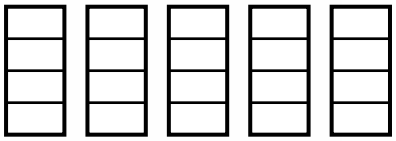
Let's Explore the Idea

Repeated addition and using a model are two ways to think about multiplying fractions.

2 Fill in the blanks to find $5 \times \frac{3}{4}$ using repeated addition:

$\frac{3}{4} + \frac{3}{4} + \_\_\_\_ + \_\_\_\_ + \frac{3}{4} = \_\_\_\_$

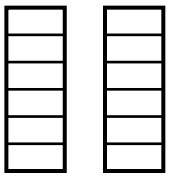
Shade the model at the right to show $5 \times \frac{3}{4}$.



3 Fill in the blanks to find $2 \times \frac{5}{6}$ using repeated addition:

$\frac{5}{\square} + \_\_\_\_ = \_\_\_\_$

Shade the model at the right to show $2 \times \frac{5}{6}$.



Use the models above to answer problems 4 and 5.

4 Fill in the blanks to show other ways to write problems with the same product as $5 \times \frac{3}{4}$.

$\_\_\_\_ \times \frac{1}{4}$ $\quad$ $3 \times \frac{\square}{4}$

5 Fill in the blanks to show other ways to write problems with the same product as $2 \times \frac{5}{6}$.

$10 \times \frac{\square}{6}$ $\quad$ $\_\_\_\_ \times \frac{2}{6}$

Now try these two problems.

6 Draw a model to show $4 \times \frac{2}{3}$.

7 Draw a model to show $3 \times \frac{2}{4}$.

Let's Talk About It

Solve the problems below as a group.

8 Look at your model for problem 6. Draw another model that shows $8 \times \frac{1}{3}$.

How are the two models different?

_____

_____

_____

_____

What is the total number of thirds shaded in each model?

_____

9 Look at your model for problem 7. How many fourths are shaded in all?

_____

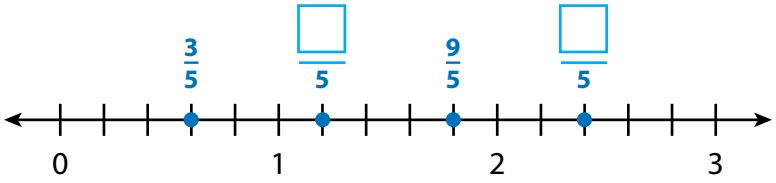
10 Think of a different model with a total of 6 fourths shaded. Fill in the blank to write a multiplication equation for this model:

_____ $\times \frac{1}{4} = \frac{6}{4}$

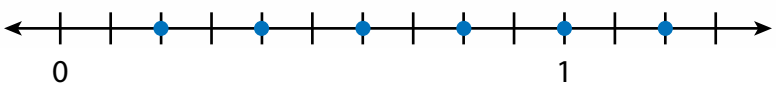
Try It Another Way

Work with your group to use number lines to multiply fractions.

11 Fill in the blanks on the number line to show $4 \times \frac{3}{5}$.



12 Label the number line below to show $6 \times \frac{2}{10}$.

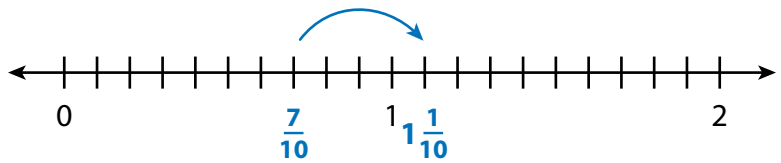


Connect Ideas about Multiplying Fractions

Talk through these problems as a class, then write your answers below.

13 Analyze How is $3 \times \frac{3}{6}$ the same as $9 \times \frac{1}{6}$?

14 Evaluate Violet solved the problem $4 \times \frac{7}{10}$ as shown.



What did Violet do wrong?

15 Construct Fraction models and number lines are not the only models you can use to show fraction multiplication. Make a different kind of drawing to solve the problem below.

Anders filled a $\frac{1}{2}$-cup measure with flour 3 times for a recipe. How much flour did he use?

Answer Anders used _____ cups of flour.

Apply Ideas about Multiplying Fractions

16 Put It Together Use what you have learned to complete this task.

Joaquin ran $\frac{4}{5}$ of a mile each day on Monday, Wednesday, and Friday. How many miles did he run in all?

Part A Describe two methods you could use to solve the problem $3 \times \frac{4}{5}$.

i _____

ii _____

Part B Write a different multiplication problem with the same product as $3 \times \frac{4}{5}$. Use $\frac{1}{5}$ instead of $\frac{4}{5}$. _____

Part C Allison is starting to run a little each day. She ran $\frac{1}{5}$ of a mile on all 7 days last week. Joaquin and Allison each wanted to run at least 2 miles during the week. Did they? Use a drawing or words to explain how you know.