Lesson 2: Interpreting Division of a Whole Number by a Fraction—Visual Models

Student Outcomes

- Students use fraction bars, number lines, and area models to show the quotient of whole numbers and fractions and to show the connection between those models and the multiplication of fractions.
- Students understand the difference between a whole number being divided by a fraction and a fraction being divided by a whole number.

Classwork

Example 1 (15 minutes)

MP.1 & MP.2

At the beginning of class, break students into groups. Each group will need to answer the question they have been assigned and draw a model to represent their answer. Multiple groups could have the same question.

Group 1: How many half-miles are in 12 miles? $12 \div \frac{1}{2} = 24$

Group 2: How many quarter hours are in 5 hours? $5 \div \frac{1}{4} = 20$

Group 3: How many one-third cups are in 9 cups? $9 \div \frac{1}{3} = 27$

Group 4: How many one-eighth pizzas are in 4 pizzas? $4 \div \frac{1}{8} = 32$

Group 5: How many one-fifths are in 7 wholes? $7 \div \frac{1}{5} = 35$

Models will vary, but could include fraction bars, number lines, or area models (arrays).

Students will draw models on blank paper, construction paper, or chart paper. Hang up only student models, and have students travel around the room answering the following:

1. Write the division question that was answered with each model.
2. What multiplication question could this model also answer?
3. Rewrite the question given to each group as a multiplication question.

Students will be given a table to fill in as they visit each model.

When discussing the opening of this example, ask students how these questions are different from the questions solved in Lesson 1. Students should notice that these questions are dividing whole numbers by fractions, while the questions in Lesson 1 were dividing fractions by whole numbers.

Discuss how the division problem is related to the multiplication problem. Students should recognize that when 12 is divided into halves, it is the same as doubling 12.

Example 1

Question # ________

Write it as a division question. ________________________________

Write it as a multiplication question. ________________________________

Make a rough draft of a model to represent the question:

As you travel to each model, be sure to answer the following questions:

Original Questions	Write the division question that was answered in each model.	What multiplication question could the model also answer?	Write the question given to each group as a multiplication question.
1. How many $\frac{1}{2}$ miles are in 12 miles?	$12 \div \frac{1}{2}$	$12 \times 2 = ?$	*Answers will vary.*
2. How many quarter hours are in 5 hours?	$5 \div \frac{1}{4}$	$5 \times 4 = ?$	
3. How many $\frac{1}{3}$ cups are in 9 cups?	$9 \div \frac{1}{3}$	$9 \times 3 = ?$	
4. How many $\frac{1}{8}$ pizzas are in 4 pizzas?	$4 \div \frac{1}{8}$	$4 \times 8 = ?$	
5. How many one-fifths are in 7 wholes?	$7 \div \frac{1}{5}$	$7 \times 5 = ?$	

Example 2 (5 minutes)

- All of the problems in the first example show what is called *measurement division*. When we know the original amount and the size or measure of one part, we use measurement division to find the number of parts. You can tell when a question is asking for measurement division because it asks, "How many __________ are in ______________?"

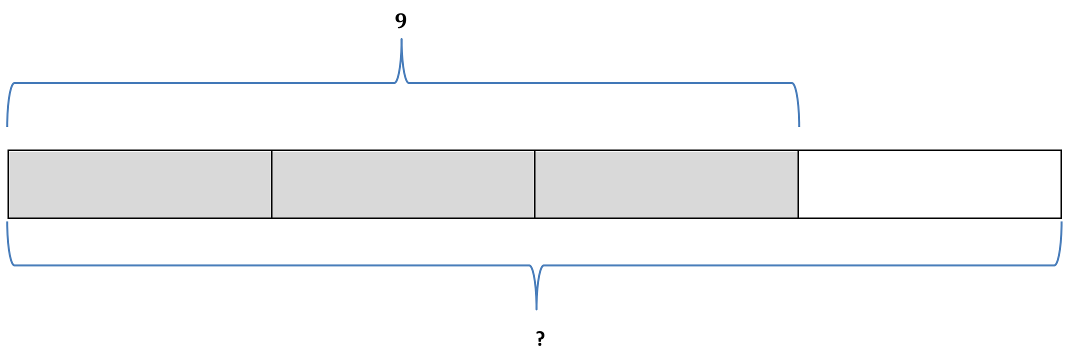
- Let's take a look at a different example:

Example 2

Molly uses 9 cups of flour to bake bread. If this is $\frac{3}{4}$ of the total amount of flour she started with, what was the original amount of flour?

- How is this question different from the measurement questions?
  - *In this example, we are not trying to figure out how many three-fourths are in* 9. *We know that* 9 *cups is a part of the entire amount of flour needed. Instead, we need to determine three-fourths of what number is* 9.

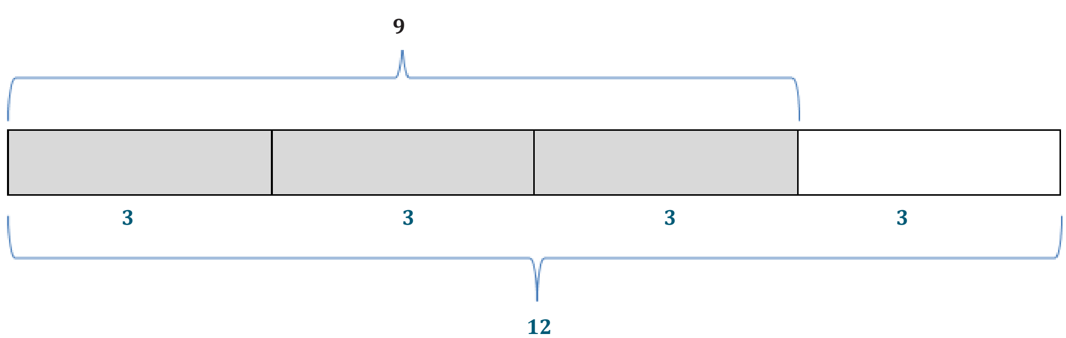
a. **Create a model to represent what the question is asking.**



b. **Explain how you would determine the answer using the model.**

To divide 9 by $\frac{3}{4}$, we divide 9 by 3 to get the amount for each rectangle; then, we multiply by 4 because there are 4 rectangles total.

$9 \div 3 = 3 \quad 3 \times 4 = 12$. ***Now, I can see that there were originally 12 cups of flour.***



Exercises 1–5 (15 minutes)

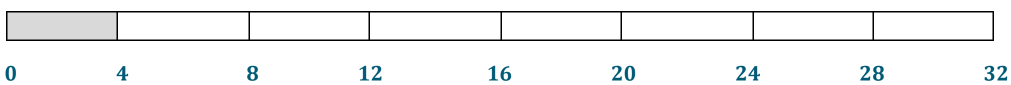
Students will work in pairs or on their own to solve the following questions. First, students will write a division expression to represent the situations. Then, students will rewrite each problem as a multiplication question. Finally, they will draw a model to represent the solution.

Allow time for students to share their models. Take time to have students compare the different models that were used to solve each question. For example, allow students to see how a fraction bar and a number line can be used to model Exercise 1.

Exercises 1–5

1. **A construction company is setting up signs on 4 miles of the road. If the company places a sign every $\frac{1}{8}$ of a mile, how many signs will it need?**

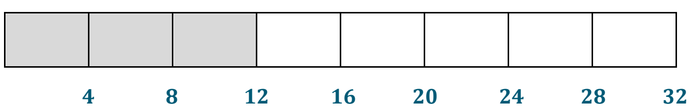
   $4 \div \frac{1}{8}$ → $\frac{1}{8}$ *of what number is* 4*?*



   The company will need 32 *signs.*

2. **George bought 12 pizzas for a birthday party. If each person will eat $\frac{3}{8}$ of a pizza, how many people can George feed with 12 pizzas?**

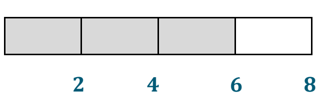
   $12 \div \frac{3}{8}$ → $\frac{3}{8}$ *of what number is* 12*?*



   The pizzas will feed 32 *people.*

3. **The Lopez family adopted 6 miles of trail on the Erie Canal. If each family member can clean up $\frac{3}{4}$ of a mile, how many family members are needed to clean the adopted section?**

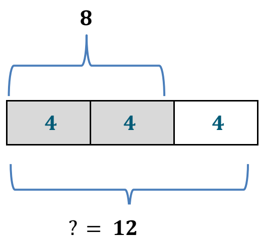
   $6 \div \frac{3}{4}$ → $\frac{3}{4}$ *of what number is* 6*?*



   The Lopez family needs to bring 8 *family members to clean the adopted section.*

4. Margo is freezing 8 cups of strawberries. If this is $\frac{2}{3}$ of the total strawberries that were picked, how many cups of strawberries did Margo pick?

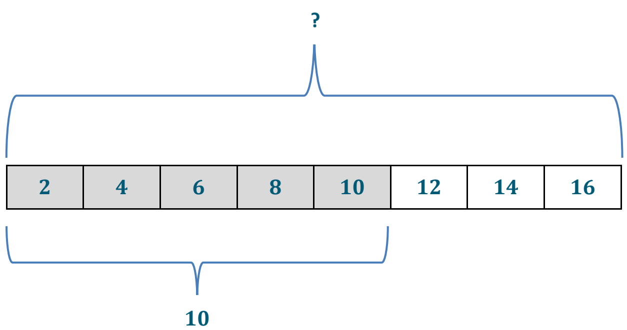
$8 \div \frac{2}{3} \rightarrow \frac{2}{3}$ of what number is 8?



Margo picked 12 cups of strawberries.

5. Regina is chopping up wood. She has chopped 10 logs so far. If the 10 logs represent $\frac{5}{8}$ of all the logs that need to be chopped, how many logs need to be chopped in all?

$10 \div \frac{5}{8} \rightarrow \frac{5}{8}$ of what number is 10?



Regina needs to chop 16 logs in all.

Closing (5 minutes)

- What are the key ideas from Lessons 1 and 2?
  - *We can use models to divide a whole number by a fraction and a fraction by a whole number.*
- Over the past two lessons, we have reviewed how to divide a whole number by a fraction and how to divide a fraction by a whole number. The next two lessons will focus on dividing fractions by fractions. Explain how you would use what we have learned about dividing with fractions in the next two lessons.
  - *We can use models to help us divide a fraction by a fraction. We can also use the multiplication problems we wrote as a tool to help us divide fractions by fractions.*

Exit Ticket (5 minutes)

Name ____ Date____________________

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Exit Ticket

Solve each division problem using a model.

1. Henry bought 4 pies which he plans to share with a group of his friends. If there is exactly enough to give each member of the group one-sixth of the pie, how many people are in the group?

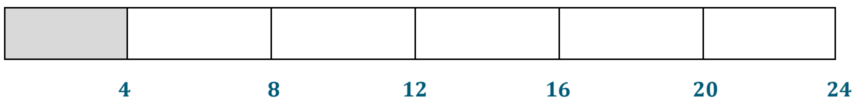
2. Rachel completed $\frac{3}{4}$ of her cleaning in 6 hours. How many total hours will Rachel spend cleaning?

Exit Ticket Sample Solutions

Solve each division problem using a model.

1. **Henry bought 4 pies which he plans to share with a group of his friends. If there is exactly enough to give each member of the group one-sixth of the pie, how many people are in the group?**

   $4 \div \frac{1}{6}$ *$\frac{1}{6}$ of what is 4?*

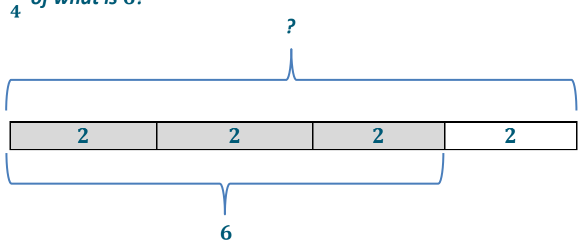


   24 people are in the group.

2. **Rachel completed $\frac{3}{4}$ of her cleaning in 6 hours. How many total hours will Rachel spend cleaning?**

   $6 \div \frac{3}{4}$

   $\frac{3}{4}$ of what is 6?



   Rachel will spend 8 total hours cleaning.

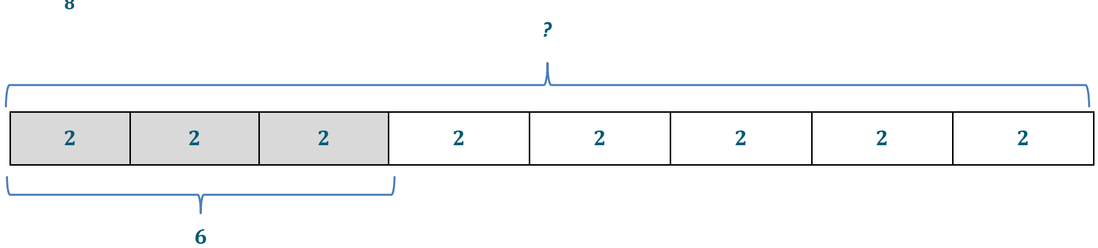
Problem Set Sample Solutions

Rewrite each problem as a multiplication question. Model your answer.

1. **Nicole has used 6 feet of ribbon. This represents $\frac{3}{8}$ of the total amount of ribbon she started with. How much ribbon did Nicole have at the start?**

   $6 \div \frac{3}{8}$

   $\frac{3}{8}$ of what number is 6?



   Nicole started with 16 feet of ribbon.

2. How many quarter hours are in 5 hours?

$5 \div \frac{1}{4}$

$\frac{1}{4}$ *of what is* 5*?*

5	5	5	5

There are 20 *quarter hours in* 5 *hours.*