6.2 Dividing a Fraction by a Whole Number

Focus on...

After this lesson, you will be able to...

- ❑ divide a fraction by a whole number
- ❑ solve problems involving the division of fractions by whole numbers

Iqaluit, the capital of Nunavut, has frost on about $\frac{3}{4}$ of the days in a year. Iqaluit has frost on five times as many days as Vancouver, British Columbia. Work with a partner to explore how you might determine the fraction of the days in a year that Vancouver has frost.

Materials

- pattern blocks
- fraction strips

Literacy Link

Understanding Division

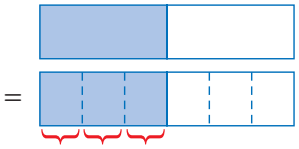
In the equation $6 \div 2 = 3$, the dividend is 6, the divisor is 2, and the quotient is 3.

The equation $6 \div 2 = 3$ means that in 6 there are 3 groups of 2. This division statement also means that if 6 is separated into 2 equal groups, there are 3 in each group.

Explore the Math

How can you model the division of a fraction by a whole number?

1. a) The long rectangle in the following diagram represents one whole. The diagram models a division. Describe it.



b) Work with a partner to explore other diagrams you could use to model the division.

2. a) Work with a partner to explore how you could use manipulatives to model $\frac{2}{3} \div 2$.

b) Write an equation to represent your model.

Reflect on Your Findings

3. a) Share your models with your classmates.

b) Can you think of other manipulatives or diagrams you could use? If so, explain how you would use them.

Example 1: Divide Using a Model

Determine $\frac{1}{4} \div 3$.

Solution

Use a fraction strip to represent $\frac{1}{4}$.

$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$

Identify the fraction strip that shows $\frac{1}{4}$ cut into three equal parts.

The fraction strip shows that $\frac{1}{4}$ is equivalent to $\frac{3}{12}$.

Each of the three equal parts of $\frac{1}{4}$ is $\frac{1}{12}$.

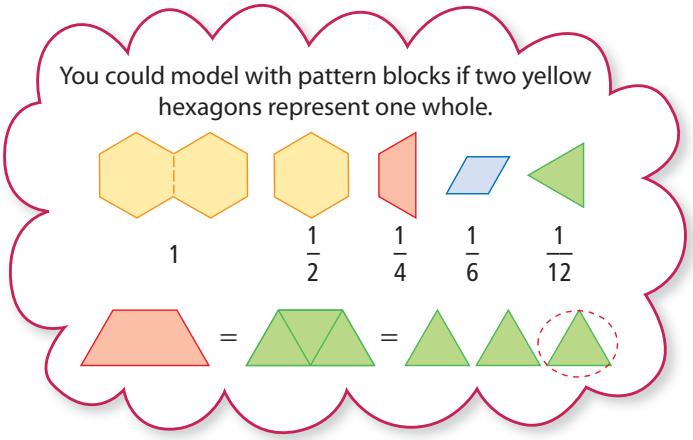
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$

$\frac{1}{4} \div 3 = \frac{1}{12}$

Strategies

Model It

You could model with pattern blocks if two yellow hexagons represent one whole.



If you divide a fraction by a natural number greater than 1, the quotient is less than the original fraction.
$\frac{1}{12} < \frac{1}{4}$

Show You Know

Determine each quotient using models.

a) $\frac{3}{4} \div 3$ **b)** $\frac{5}{6} \div 2$

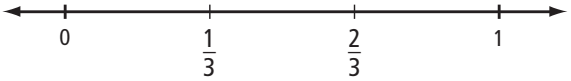
Example 2: Divide Using Diagrams

Determine $\frac{2}{3} \div 4$. Express the quotient in lowest terms.

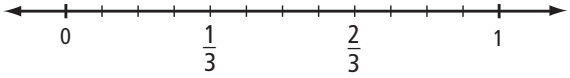
Strategies
Draw a Diagram

Solution

Draw and label a number line that shows thirds.

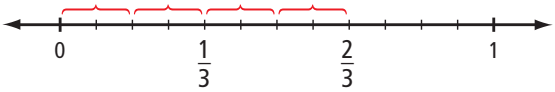


To model division by 4, cut each third into four equal parts.



There are 12 parts in the whole, so each part is $\frac{1}{12}$.

Use brackets to cut $\frac{2}{3}$ into four equal parts.

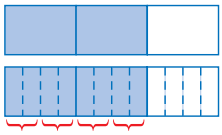


Each of the four parts is $\frac{2}{12}$.

$\frac{2}{12} = \frac{1}{6}$

So, $\frac{2}{3} \div 4 = \frac{1}{6}$.

You could draw a rectangle instead of a number line.



So $\frac{2}{3} \div 4 = \frac{2}{12}$

Show You Know

Determine each quotient using a diagram. Express the quotient in lowest terms.

a) $\frac{1}{2} \div 5$ **b)** $\frac{3}{5} \div 3$

Example 3: Apply Division With Fractions

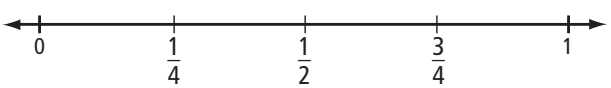
Mustafa used $\frac{3}{4}$ of a jar of pasta sauce on six servings of pasta. He used the same amount of sauce on each serving. What fraction of the jar of pasta sauce did he use on each serving?

Solution

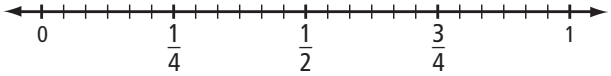
Determine $\frac{3}{4} \div 6$.

The $\frac{3}{4}$ of a jar is shared equally among six servings.

Draw and label a number line that shows quarters.

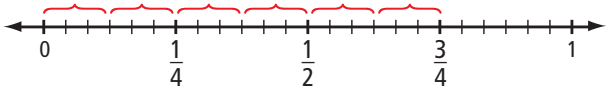


To model division by 6, cut each quarter into six equal parts.



There are 24 parts in the whole.
Each part is $\frac{1}{24}$.

Use brackets to cut $\frac{3}{4}$ into six equal parts.



Each of the six parts is $\frac{3}{24}$.

So, $\frac{3}{4} \div 6 = \frac{3}{24}$ or $\frac{1}{8}$

Mustafa used $\frac{1}{8}$ of a jar of pasta sauce on each serving.

ME

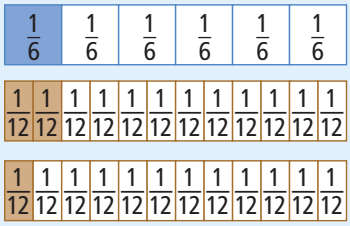
If $\frac{3}{4}$ of a jar is shared among six servings, the fraction of the jar for each serving must be less than $\frac{3}{4}$.
$\frac{1}{8} < \frac{3}{4}$

Show You Know

Four students equally shared $\frac{1}{2}$ of a cake. What fraction of the cake did each student eat?

Key Ideas

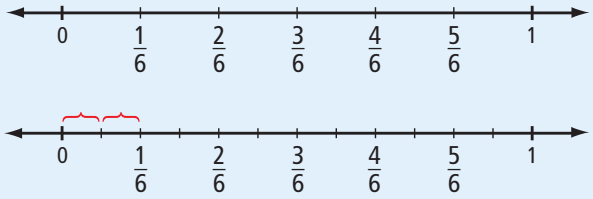
- You can show the division of a fraction by a whole number using models and diagrams.



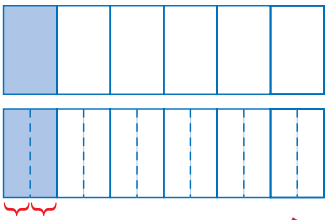
Each of the two equal parts of $\frac{1}{6}$ is $\frac{1}{12}$.

You could model with pattern blocks. If two hexagons represent one whole, then one rhombus represents one sixth.

$\frac{1}{6} \div 2 = \frac{1}{12}$



You could draw a rectangle instead of a number line.



$\frac{1}{6} \div 2 = \frac{1}{12}$

Communicate the Ideas

1. Lana decided to model the division $\frac{2}{3} \div 3$ using a fraction strip divided into sixths. Could you use this fraction strip to solve the problem? Explain.

2. a) If you use four hexagons to represent one whole, show how you can model $\frac{3}{4} \div 6$ using pattern blocks.

b) Can you model $\frac{3}{4} \div 6$ by using two hexagons to represent one whole? Explain.

3. a) Model the division $\frac{1}{2} \div 2$ using manipulatives or diagrams.

b) Which method did you choose? Explain why you chose it.

Check Your Understanding

Practise

For help with #4 and #5, refer to Examples 1 and 2 on pages 205–206.

4. Determine each quotient using manipulatives or diagrams.

a) $\frac{1}{4} \div 2$ **b)** $\frac{1}{3} \div 3$

c) $\frac{1}{5} \div 2$ **d)** $\frac{5}{6} \div 4$

5. Determine each quotient.

a) $\frac{3}{5} \div 2$ **b)** $\frac{1}{5} \div 3$

c) $\frac{1}{2} \div 4$ **d)** $\frac{2}{3} \div 6$

Apply

For help with #6 to #8, refer to Example 3 on pages 206–207.

6. Two different South Indian fish curries, called dhopa and molee curry, both include coconut.

a) Dhopa requires $\frac{1}{2}$ a coconut to make two servings. What fraction of a coconut is in each serving?

b) Molee curry requires $\frac{1}{2}$ a coconut to make four servings. What fraction of a coconut is in each serving?

7. A pitcher of orange juice is $\frac{2}{3}$ full. If four students equally share the juice, what fraction of the full pitcher does each student get?

8. The areas of Alberta, Saskatchewan, and Manitoba are approximately equal. The sum of their areas is about $\frac{1}{5}$ of the area of Canada. Express the area of each of these provinces as a fraction of the area of Canada.

9. Ingrid runs three laps of a track in $\frac{1}{4}$ h. On average, how much time does she take to run one lap? Express your answer

a) as a fraction of an hour

b) in minutes

10. Mark uses $\frac{1}{3}$ of a tank of gasoline in a five-day work week driving to work and back. On average, what fraction of a tank does he use for each round trip?

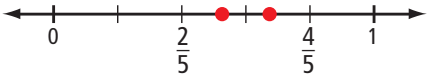
11. Iqaluit has frost on about $\frac{3}{4}$ of the days in a year. It has frost on five times as many days as Vancouver. On what fraction of the days of the year does Vancouver have frost?

12. It takes $\frac{4}{5}$ of a roll of ribbon to wrap six packages. What fraction of a roll does it take to wrap three packages?

13. Create your own word problem that involves the division of a proper fraction by a whole number. Make sure that you can solve your problem. Give your problem to a classmate to solve.

Extend

14. Two fractions are equally spaced between $\frac{2}{5}$ and $\frac{4}{5}$. Determine the two fractions.



15. a) Model the division $\frac{2}{3} \div 4 = \frac{1}{6}$ using manipulatives or diagrams.

b) Explain how your method shows that $\frac{2}{3} \div \frac{1}{6} = 4$.

MATH LINK

The Montane Cordillera and Boreal Cordillera ecozones have approximately equal areas. The total area of these two ecozones equals about $\frac{1}{10}$ of the area of Canada. What fraction of the area of Canada does each of these ecozones cover?