

# LESSON 1

## Objective

Divide fractions by fractions.

## Common Core State Standards

- **6.NS.1** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for  $(2/3) \div (3/4)$  and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that  $(2/3) \div (3/4) = 8/9$  because  $3/4$  of  $8/9$  is  $2/3$ . (In general,  $(a/b) \div (c/d) = ad/bc$ .) How much chocolate will each person get if 3 people share  $1/2$  lb of chocolate equally? How many  $3/4$ -cup servings are in  $2/3$  of a cup of yogurt? How wide is a rectangular strip of land with length  $3/4$  mi and area  $1/2$  square mi?*

## The Number System

# Fraction Division

When students develop their understanding of division, they make the connection that the divisor is either the number of groups to form or the number in each group, and that the dividend is the quantity that is divided into groups. The same model can be used when dividing a fraction by a fraction, which is useful as a tool in algebraic processes such as factoring and simplifying compound fractions.

**Try It!** Perform the Try It! activity on the next page.

## Talk About It

Discuss the Try It! activity.

- **Ask:** *What operation can we use to solve this problem? What does it mean to divide by  $\frac{1}{8}$ ?*
- **Ask:** *How do you choose your tower height?*
- **Ask:** *What do you do if the towers do not end up equal?*
- Introduce the idea that dividing by a fraction is the same as multiplying by its reciprocal, and give students the formula  $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$ .

## Solve It

Read the problem with students. Have students perform the division. Ask students to show their work by creating a model with Fraction Tower® Equivalency Cubes. Have students write the steps involved in solving the problem.

## More Ideas

For another way to teach about dividing a fraction by a fraction—

- Use Deluxe Rainbow Fraction® Squares to represent the divisor and the dividend. Cover the dividend with Fraction Squares the size of the divisor. Count the number of divisor pieces that were used to cover the dividend exactly. That is the quotient. Give students other fractions to divide. They should check their work by solving the problems with Fraction Tower Equivalency Cubes.

## Formative Assessment

Have students try the following problem.

George wants to jog  $\frac{2}{5}$  mile. He increases his speed every  $\frac{1}{10}$  mile. How many different speeds does George run?

- A.  $\frac{1}{25}$
- B.  $\frac{1}{4}$
- C. 2
- D. 4

## Try It!

15 minutes | Groups of 3

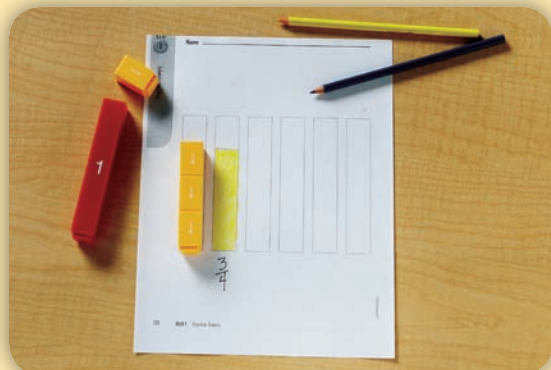
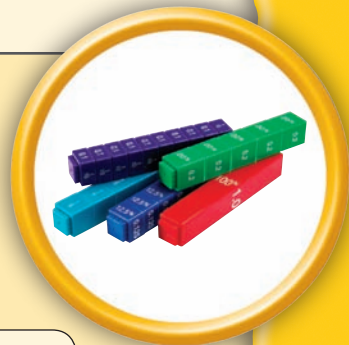
Here is a problem about dividing a fraction by a fraction.

*Caryn is planning a party. She knows that a pitcher of juice holds  $\frac{3}{4}$  gallon. Each serving is  $\frac{1}{8}$  gallon. How many servings does the pitcher hold?*

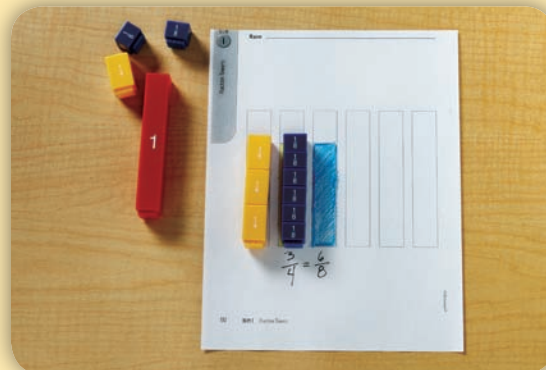
Introduce the problem. Then have students do the activity to solve the problem. Distribute Fraction Tower Equivalency Cubes, Fraction Towers (BLM 1; one per student) templates, and pencils to students.

### Materials

- Fraction Tower® Equivalency Cubes
- Fraction Towers (BLM 1; one per student)
- pencils (1 per group)



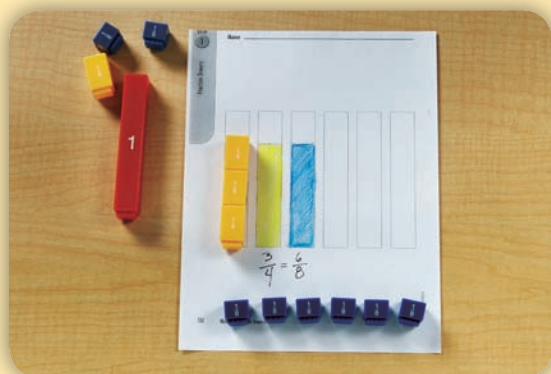
**1. Say:** Use the towers to represent the amount the pitcher holds. Let the outline of a tower equal 1 whole gallon. Have students build a tower that represents  $\frac{3}{4}$  gallon on Fraction Towers BLM 1 and shade it in. Have students write the fraction the tower represents.



**2.** Using  $\frac{1}{8}$  Fraction Tower Equivalency Cubes, have students build a tower next to the original tower that is the same height. Then, students should shade another tower on the BLM to represent this new equivalent tower. Have the students label the shaded tower with the equivalent fraction.

### Look Out!

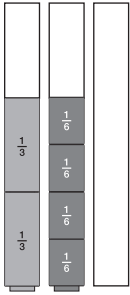
Students connect the process of division with breaking something into smaller parts. Remind them, however, that with fractions divided by fractions, the resulting quotient can be larger. Use Fraction Tower Equivalency Cubes to model fraction division. Then use the cubes to model the quotient. Compare the divisor, dividend, and quotient.



**3. Ask:** How do you know how many  $\frac{1}{8}$  gallon are in  $\frac{3}{4}$  gallon? Have students count the number of  $\frac{1}{8}$  cubes in their tower as they take the tower apart. On their shaded tower, they should show the division lines for each  $\frac{1}{8}$  cube in the tower. Then, they should number each shaded cube. **Ask:** How many servings will the pitcher hold? Have students write the division problem and quotient.

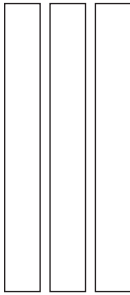
Use Fraction Towers to model the problem. Perform the division. (Check students' work.)

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



Use Fraction Towers to model the problem. Sketch the model. Perform the division.

2.  $\frac{5}{6} \div \frac{5}{12} = \underline{2}$



Use Fraction Towers to model the problem. Solve the problem.

3. Aidan has  $\frac{4}{5}$  of a gallon of juice. He wants to pour it into  $\frac{1}{10}$ -gallon jars. How many jars can he fill?

$\frac{4}{5} \div \frac{1}{10} = \underline{8}$

Divide. Simplify, if possible.

4.  $\frac{1}{2} \div \frac{1}{2} = \underline{1}$

5.  $\frac{3}{4} \div \frac{3}{8} = \underline{2}$

6.  $\frac{5}{8} \div \frac{5}{6} = \underline{\frac{3}{4}}$

7.  $\frac{2}{5} \div \frac{3}{5} = \underline{\frac{2}{3}}$

8.  $\frac{7}{10} \div \frac{4}{5} = \underline{\frac{7}{8}}$

9.  $\frac{7}{10} \div \frac{7}{8} = \underline{\frac{4}{5}}$

## Answer Key

**Challenge!** Create a story problem and draw a model to show  $\frac{5}{6} \div \frac{1}{3}$ . Divide to answer the problem. Simplify, if possible.

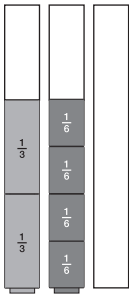
Challenge: (Sample) Jen has  $\frac{5}{6}$  of a book left to read. If she reads  $\frac{1}{3}$  of it each day, how many days will it take her to finish the book?

$$\frac{5}{6} \div \frac{1}{3} = \frac{5}{2} = 2\frac{1}{2} \text{ days}$$

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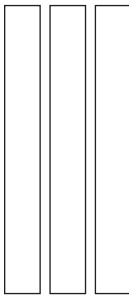
Use Fraction Towers to model the problem. Perform the division.

1.  $\frac{2}{3} \div \frac{1}{6} = \underline{\hspace{2cm}}$



Use Fraction Towers to model the problem. Sketch the model. Perform the division.

2.  $\frac{5}{6} \div \frac{5}{12} = \underline{\hspace{2cm}}$



Use Fraction Towers to model the problem. Solve the problem.

3. Aidan has  $\frac{4}{5}$  of a gallon of juice. He wants to pour it into  $\frac{1}{10}$ -gallon jars. How many jars can he fill?

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7.  $\frac{2}{5} \div \frac{3}{5} = \underline{\hspace{2cm}}$

8.  $\frac{7}{10} \div \frac{4}{5} = \underline{\hspace{2cm}}$

9.  $\frac{7}{10} \div \frac{7}{8} = \underline{\hspace{2cm}}$

Name \_\_\_\_\_

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