

## 2.1 Fractions and Estimation

**Essential Question** How can you use estimation to check that your answer is reasonable?

### 1 ACTIVITY: Using Models for Fractions

Work with a partner. Use the model for the whole to draw a model for the given fractions.

Whole	Model for the Whole	Fractions	Model for Fraction
a. Sample: Circle		$\frac{5}{8}$	
b. Circle		$\frac{3}{4}, \frac{5}{12}, \frac{4}{6}$	
c. Rectangle		$\frac{3}{5}, \frac{4}{5}, \frac{7}{10}$	
d. Counters		$\frac{1}{2}, \frac{3}{8}, \frac{3}{4}$	
e. Piece of paper		$\frac{7}{8}, \frac{1}{8}, \frac{1}{4}$	

### 2 ACTIVITY: Estimating Sums and Differences

Work with a partner. Add or subtract. Then check your answer by using one of the models in Activity 1 to estimate the sum or difference.

a. Sample:

$$\begin{aligned} \frac{1}{6} + \frac{1}{4} &= \frac{2}{12} + \frac{3}{12} \\ &= \frac{2+3}{12} \\ &= \frac{5}{12} \end{aligned}$$

Write with common denominator.

Add numerators.

Simplify.



Sum is less than one half.

b.  $\frac{1}{3} + \frac{1}{4}$

c.  $\frac{5}{8} + \frac{1}{3}$

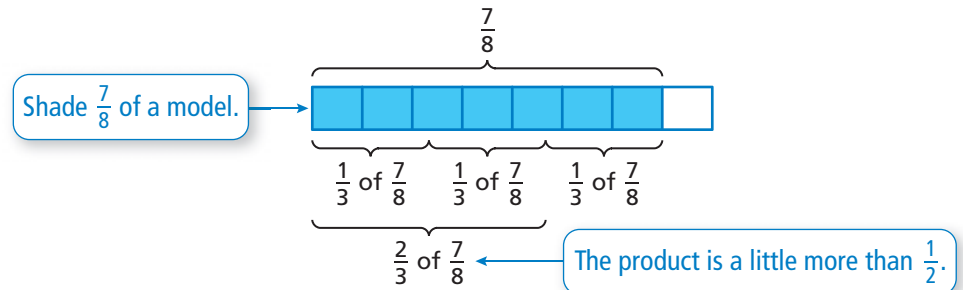
d.  $\frac{7}{8} - \frac{1}{3}$

e.  $\frac{2}{3} - \frac{4}{9}$

### 3 ACTIVITY: Estimating Products

Work with a partner. Use a fraction model to choose  $0$ ,  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , or  $1$  as the best estimate of the product.

a. Sample:  $\frac{2}{3} \times \frac{7}{8}$



∴ So, the best estimate is  $\frac{1}{2}$ .

b.  $\frac{1}{5} \times \frac{3}{10}$

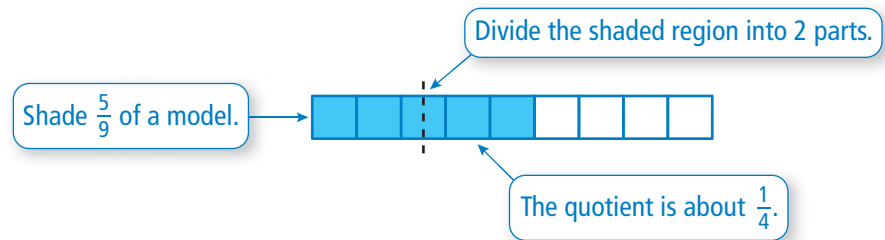
c.  $\frac{3}{4} \times \frac{5}{7}$

d.  $\frac{7}{8} \times \frac{7}{8}$

### 4 ACTIVITY: Estimating Quotients

Work with a partner. Use a fraction model to choose  $0$ ,  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , or  $1$  as the best estimate of the quotient.

a. Sample:  $\frac{5}{9} \div 2$



∴ So, the best estimate is  $\frac{1}{4}$ .

b.  $\frac{3}{5} \div 3$

c.  $\frac{1}{2} \div 8$

d.  $\frac{5}{6} \div 2$

## What Is Your Answer?

5. **IN YOUR OWN WORDS** How can you use estimation to check that your answer is reasonable? Give some examples.

### Practice

Use what you learned about estimation to complete Exercises 7–14 on page 48.

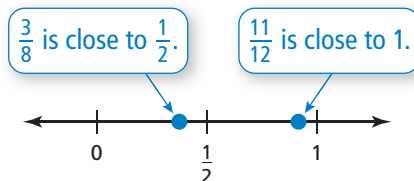
## EXAMPLE 1 Estimating Products

### Key Vocabulary

underestimate, p. 47  
overestimate, p. 47  
compatible numbers,  
p. 47

Estimate the product by rounding to 0,  $\frac{1}{2}$ , or 1.

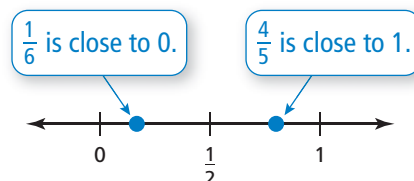
a.  $\frac{3}{8} \times \frac{11}{12}$



$$\frac{3}{8} \times \frac{11}{12} \approx \frac{1}{2} \times 1 = \frac{1}{2}$$

∴  $\frac{3}{8} \times \frac{11}{12}$  is about  $\frac{1}{2}$ .

b.  $\frac{4}{5} \times \frac{1}{6}$



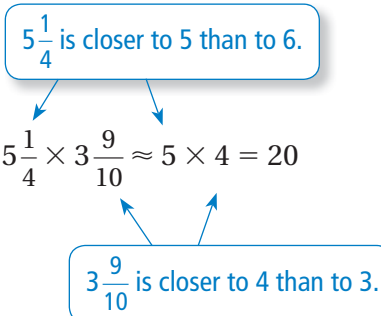
$$\frac{4}{5} \times \frac{1}{6} \approx 1 \times 0 = 0$$

∴  $\frac{4}{5} \times \frac{1}{6}$  is about 0.

## EXAMPLE 2 Estimating with Mixed Numbers

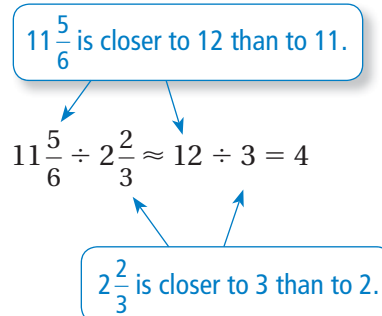
Estimate the product or quotient by rounding each mixed number to the nearest whole number.

a.  $5\frac{1}{4} \times 3\frac{9}{10}$



∴  $5\frac{1}{4} \times 3\frac{9}{10}$  is about 20.

b.  $11\frac{5}{6} \div 2\frac{2}{3}$



∴  $11\frac{5}{6} \div 2\frac{2}{3}$  is about 4.

### Reading

The symbol  $\approx$  means "approximately equal to."

### On Your Own

Estimate the product or quotient.

1.  $\frac{1}{9} \times \frac{4}{5}$

2.  $\frac{9}{10} \times \frac{5}{12}$

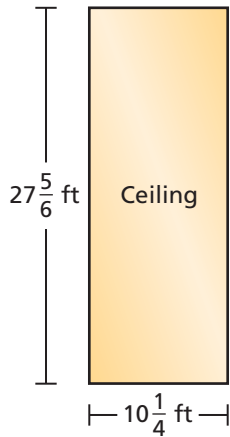
3.  $2\frac{7}{8} \times 6\frac{1}{3}$

4.  $24\frac{1}{5} \div 3\frac{1}{2}$

Now You're Ready  
Exercises 7–22

An **underestimate** is an estimate that is less than the exact answer while an **overestimate** is greater than the exact answer.

### EXAMPLE 3 Using an Overestimate



One gallon of paint covers 350 square feet. Is 1 gallon of paint enough to cover the rectangular ceiling? Explain.

$$\begin{aligned}
 A &= \ell w && \text{Write the formula for the area of a rectangle.} \\
 &= 27\frac{5}{6} \times 10\frac{1}{4} && \text{Substitute for } \ell \text{ and } w. \\
 &\approx 28 \times 11 && \text{Round } 27\frac{5}{6} \text{ up to } 28. \text{ Round } 10\frac{1}{4} \text{ up to } 11. \\
 &= 308 && \text{Multiply.}
 \end{aligned}$$

Because 308 is an overestimate and is less than 350, 1 gallon of paint is enough.

#### On Your Own

5. In Example 3, a hallway wall is  $9\frac{3}{4}$  feet by  $64\frac{1}{3}$  feet. Are 2 gallons of paint enough to cover the wall? Explain.

**Compatible numbers** are numbers that are easy to compute mentally.

### EXAMPLE 4 Using a Compatible Number

#### Reading

The term "range" refers to the region where a Florida panther lives.



The range of a male Florida panther is about  $3\frac{3}{4}$  times the range of a female Florida panther. The range of a male is about 275 square miles. Estimate the range of a female Florida panther.

$$\begin{aligned}
 275 \div 3\frac{3}{4} &\approx 275 \div 4 && \text{Round } 3\frac{3}{4} \text{ to the nearest whole number, } 4. \\
 &\approx 280 \div 4 && 280 \text{ is close to } 275 \text{ and is divisible by } 4. \\
 &= 70 && \text{Divide.}
 \end{aligned}$$

275 is not evenly divisible by 4.

So, the range of a female Florida panther is about 70 square miles.

#### On Your Own

6. There are about 100 Florida panthers in South Florida. A scientist wants  $\frac{3}{8}$  of the panthers fitted with tracking collars. Estimate the number of panthers to be fitted with collars.

**Now You're Ready**  
Exercises 24–31

## 2.1 Exercises

### Vocabulary and Concept Check

Tell whether you would use *rounding* or *compatible numbers* to estimate the product or quotient. Explain your reasoning.

1.  $2\frac{1}{6} \times 5\frac{11}{12}$

2.  $7\frac{3}{4} \div 1\frac{7}{9}$

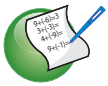
3.  $\frac{2}{5} \times \frac{7}{8}$

4.  $34 \div 8\frac{2}{3}$

5. Copy and complete the table to estimate the quotient  $77 \div 4\frac{2}{5}$ .

How to Round	Estimate
Round 77 to the nearest hundred.	<input type="text"/> $\div 4 =$ <input type="text"/>
Round 77 to the nearest ten.	<input type="text"/> $\div 4 =$ <input type="text"/>
Round 77 to the nearest compatible number.	<input type="text"/> $\div 4 =$ <input type="text"/>

6. **NUMBER SENSE** In Exercise 5, the quotient  $77 \div 4\frac{2}{5}$  equals  $17\frac{1}{2}$ . What do you notice about the estimates in the table?



### Practice and Problem Solving

Estimate the product or quotient.

1 2 7.  $\frac{4}{7} \times \frac{1}{6}$

8.  $\frac{9}{10} \times \frac{5}{9}$

9.  $\frac{1}{5} \times \frac{7}{8}$

10.  $\frac{8}{15} \times \frac{5}{6}$

11.  $\frac{3}{4} \times \frac{1}{3}$

12.  $\frac{2}{3} \times \frac{1}{7}$

13.  $\frac{11}{8} \div 3$

14.  $\frac{7}{9} \div 2$

15.  $\frac{5}{13} \times \frac{4}{5}$

16.  $\frac{1}{10} \times \frac{3}{16}$

17.  $\frac{5}{6} \times \frac{7}{12}$

18.  $\frac{3}{4} \times \frac{7}{9}$


19.  $8\frac{3}{4} \times 2\frac{1}{2}$

20.  $14\frac{11}{15} \times 4\frac{3}{7}$

21.  $42\frac{2}{9} \div 6\frac{6}{7}$

22.  $19\frac{1}{2} \div 4\frac{7}{8}$

23. **ERROR ANALYSIS** Describe and correct the error in estimating the product.

  $\frac{5}{12} \times \frac{9}{10} \approx 0 \times 1 = 0$

Use compatible numbers to estimate the product or quotient.

4 24.  $61 \div 4\frac{3}{8}$

25.  $48 \div 6\frac{7}{12}$

26.  $151 \times \frac{2}{5}$

27.  $203 \times \frac{6}{7}$

28.  $152 \div 6\frac{3}{11}$

29.  $135 \div 19\frac{7}{10}$

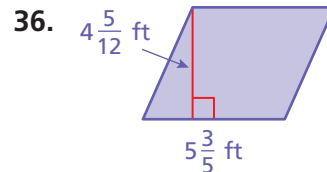
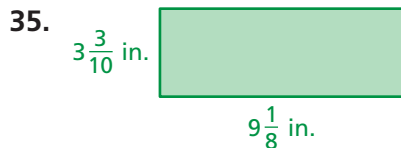
30.  $155 \div 7\frac{2}{9}$

31.  $177 \div 8\frac{5}{6}$

32. **FLOWERS** You plant 25 flower bulbs in a garden. About  $\frac{3}{4}$  of the flowers bloom. Estimate the number of flowers that bloom.

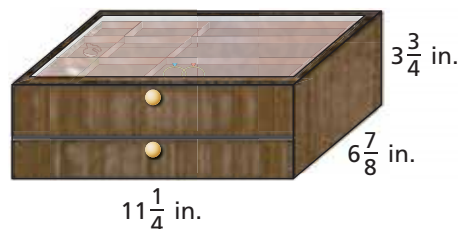
33. **RACECAR** The height of a racecar is  $46\frac{7}{8}$  inches. A model of the racecar is  $2\frac{7}{9}$  inches tall. About how many times greater is the height of the racecar than the height of the model?
34. **BREAD** A recipe for a loaf of bread calls for  $3\frac{1}{4}$  cups of flour. About how many loaves of bread can you make with 25 cups of flour?

**GEOMETRY** Estimate the area of the rectangle or parallelogram. Did you overestimate or underestimate the area? Explain.



Estimate the value of the expression.

37.  $6\frac{1}{4} \times 9\frac{3}{7} \div 2\frac{7}{8}$       38.  $11\frac{2}{3} \div 3\frac{7}{12} \times 6\frac{2}{5}$       39.  $100\frac{3}{8} \div \left(3\frac{5}{6} \times 5\frac{2}{9}\right)$
40. **WALLPAPER** You cover a wall that is  $8\frac{5}{8}$  feet by  $17\frac{1}{4}$  feet with wallpaper. One roll of wallpaper covers 60 square feet. Are 3 rolls of wallpaper enough to cover the wall? Explain.
41. **Geometry** Find a low estimate and a high estimate for the surface area of the jewelry box. Explain how you found your answers.



## Fair Game Review what you learned in previous grades & lessons

Evaluate the expression.

42.  $\frac{2 \times 18}{3}$       43.  $\frac{4 \times 45}{5}$       44.  $\frac{5 \times 14}{6}$       45.  $\frac{3 \times 12}{8}$
46. **MULTIPLE CHOICE** Which expression does *not* need the Commutative Property of Addition or the Commutative Property of Multiplication to simplify?
- (A)  $18 + (x + 3)$       (B)  $6(9x)$   
 (C)  $(4 \cdot x) \cdot 11$       (D)  $5 + 10x + 7$