How is math useful on road trips?

When traveling by car, you can calculate the gas mileage, or miles per gallon, by using division. For example, the gas mileage of a car that travels 407 miles on $18\frac{1}{2}$ gallons of gasoline is $407 \div 18\frac{1}{2}$.

In mathematics, you will divide fractions and mixed numbers to solve many real-life problems.

You will solve problems about gas mileage in Lesson 7-5.
Diagnose Readiness

Take this quiz to see if you are ready to begin Chapter 7. Refer to the lesson number in parentheses for review.

Vocabulary Review

Complete each sentence.
1. The GCF represents the ___ of a set of numbers. (Lesson 5-1)
2. \( \frac{7}{2} \) is a(n) ____ because the numerator is greater than the denominator. (Lesson 5-1)
3. 6, 9, and 12 are all ____ of 3. (Lesson 5-1)

Prerequisite Skills

Use a calculator to find each product. Round to the nearest tenth. (Lesson 3-3)
4. \( \pi \times 20 \)  
5. \( 8 \times \pi \)
6. \( 2 \times \pi \times 5 \)  
7. \( 4 \times \pi \times 9 \)

Find the GCF of each set of numbers. (Lesson 5-1)
8. 6, 24  
9. 18, 12  
10. 14, 8  
11. 10, 20

Write each mixed number as an improper fraction. (Lesson 5-3)
12. \( 2\frac{3}{4} \)  
13. \( 1\frac{6}{7} \)
14. \( 5\frac{7}{9} \)  
15. \( 3\frac{1}{8} \)

Round each fraction to 0, \( \frac{1}{2} \), or 1. (Lesson 6-1)
16. \( \frac{1}{5} \)  
17. \( \frac{4}{7} \)
18. \( \frac{11}{12} \)  
19. \( \frac{2}{15} \)
Estimating Products

SPORTS Kayla made about \( \frac{1}{3} \) of the 14 shots she attempted in a basketball game.

1. For the shots attempted, what is the nearest multiple of 3?
2. How many basketballs should be added to reflect the nearest multiple of 3?
3. Divide the basketballs into three groups each having the same number. How many basketballs are in each group?
4. About how many shots did Kayla make?

One way to estimate products is to use \textbf{compatible numbers}, which are numbers that are easy to divide mentally.

**Estimate Using Compatible Numbers**

1. Estimate \( \frac{1}{4} \times 13 \). \( \frac{1}{4} \times 13 \) means \( \frac{1}{4} \) of 13.

   Find a number close to 13 that is a multiple of 4.
   \[ \frac{1}{4} \times 13 \rightarrow \frac{1}{4} \times 12 \]
   \( 12 \) and 4 are compatible numbers since \( 12 \div 4 = 3 \).
   \[ \frac{1}{4} \times 12 = 3 \]
   So, \( \frac{1}{4} \times 13 \) is about 3.

2. Estimate \( \frac{2}{5} \times 11 \).

   Estimate \( \frac{1}{5} \times 11 \) first.
   \[ \frac{1}{5} \times 11 \rightarrow \frac{1}{5} \times 10 \]
   Use 10 since 10 and 5 are compatible numbers.
   \[ \frac{1}{5} \times 10 = 2 \]
   \( 10 \div 5 = 2 \)
   If \( \frac{1}{5} \) of 10 is 2, then \( \frac{2}{5} \) of 10 is \( 2 \times 2 \) or 4.
   So, \( \frac{2}{5} \times 11 \) is about 4.

**Your Turn** Estimate each product.

a. \( \frac{1}{5} \times 16 \)

b. \( \frac{5}{6} \times 13 \)

c. \( \frac{3}{4} \times 23 \)
**Lesson 7-1 Estimating Products**

3. **Estimate by Rounding to 0, 1/2, or 1**
   
   Estimate \( \frac{1}{3} \times \frac{7}{8} \).
   
   \[
   \frac{1}{3} \times \frac{7}{8} \rightarrow \frac{1}{2} \times 1 \\
   \frac{1}{2} \times 1 = \frac{1}{2}
   
   So, \( \frac{1}{3} \times \frac{7}{8} \) is about \( \frac{1}{2} \).

**Your Turn** Estimate each product.

- d. \( \frac{5}{8} \times \frac{9}{10} \)
- e. \( \frac{5}{6} \times \frac{9}{10} \)
- f. \( \frac{5}{6} \times \frac{1}{9} \)

**EXAMPLE**

4. **Estimate With Mixed Numbers**
   
   **GEOMETRY** Estimate the area of the rectangle.
   
   Round each mixed number to the nearest whole number.
   
   \[
   11\frac{3}{4} \times 8\frac{1}{6} \rightarrow 12 \times 8 = 96
   
   Round \( 11\frac{3}{4} \) to 12. Round \( 8\frac{1}{6} \) to 8.
   
   So, the area is about 96 square feet.

**Skill and Concept Check**

1. **Writing Math** Explain how to use compatible numbers to estimate \( \frac{2}{3} \times 8 \).

2. **OPEN ENDED** Write an example of two mixed numbers whose product is about 6.

3. **NUMBER SENSE** Is \( \frac{2}{3} \times 20 \) greater than 14 or less than 14? Explain.

**GUIDED PRACTICE**

Estimate each product.

- 4. \( \frac{1}{8} \times 15 \)
- 5. \( \frac{3}{4} \times 21 \)
- 6. \( \frac{1}{4} \times \frac{8}{9} \)
- 7. \( \frac{5}{8} \times \frac{1}{9} \)
- 8. \( 6\frac{2}{3} \times 4\frac{1}{5} \)
- 9. \( 2\frac{9}{10} \times 10\frac{3}{4} \)

10. **PAINTING** A wall measures \( 8\frac{1}{2} \) feet by \( 12\frac{3}{4} \) feet. If a gallon of paint covers about 150 square feet, will one gallon of paint be enough to cover the wall? Explain.
Estimate each product.

11. $\frac{1}{4} \times 21$  
12. $\frac{2}{3} \times 10$  
13. $\frac{5}{7} \times \frac{3}{4}$  
14. $\frac{5}{6} \times \frac{8}{9}$  
15. $\frac{5}{7} \times \frac{1}{9}$  
16. $\frac{1}{10} \times \frac{7}{8}$  
17. $\frac{11}{12} \times \frac{3}{8}$  
18. $\frac{2}{5} \times \frac{9}{10}$  
19. $\frac{4}{3} \times \frac{2}{3} \times \frac{3}{4}$  
20. $\frac{6}{4} \times \frac{5}{4} \times \frac{4}{9}$  
21. $\frac{5}{8} \times \frac{9}{12}$  
22. $\frac{2}{9} \times \frac{8}{6}$

23. Estimate $\frac{3}{8} \times \frac{1}{11}$.

24. Estimate $\frac{5}{9}$ of $7\frac{7}{8}$.

25. **VOLUNTEERING** The circle graph shows the fraction of teens who volunteer. Suppose 100 teens were surveyed. About how many teens do not volunteer?

26. **SPORTS** Barry Zito of the Oakland Athletics won about $\frac{4}{5}$ of the games for which he was the pitcher of record in 2002. If he was the pitcher of record for 28 games, about how many games did he win? Explain.

27. **CRITICAL THINKING** Which point on the number line could be the graph of the product of the numbers graphed at C and D?

28. **MULTIPLE CHOICE** Which is the best estimate of the area of the rectangle?

- A: 15 in²  
- B: 20 in²  
- C: 24 in²  
- D: 16 in²

29. **SHORT RESPONSE** Ruby has budgeted $\frac{1}{4}$ of her allowance for savings. If she receives $25$ a month, about how much will she put in savings?

30. **BAKING** Viho needs $2\frac{1}{4}$ cups of flour for making cookies, $1\frac{2}{3}$ cups for almond bars, and $3\frac{1}{2}$ cups for cinnamon rolls. How much flour does he need in all? (Lesson 6-6)

Subtract. Write in simplest form. (Lesson 6-5)

31. $10\frac{3}{8} - 7\frac{1}{8}$  
32. $\frac{5}{6} - \frac{3}{8}$  
33. $\frac{8}{3} - \frac{3}{6}$  
34. $\frac{6}{3} - \frac{4}{3}$

**GETTING READY FOR THE NEXT LESSON**

**PREREQUISITE SKILL** Find the GCF of each set of numbers. (Lesson 5-1)

35. 6, 9  
36. 8, 6  
37. 10, 4  
38. 15, 9  
39. 24, 16
Lesson 7-2a Hands-On Lab: Multiplying Fractions

What You’ll LEARN
Multiply fractions using models.

ACTIVITY
Work with a partner.

Find \( \frac{1}{3} \times \frac{1}{2} \) using a model.

To find \( \frac{1}{3} \times \frac{1}{2} \), find \( \frac{1}{3} \) of \( \frac{1}{2} \).

One sixth of the square is shaded green. So, \( \frac{1}{3} \times \frac{1}{2} = \frac{1}{6} \).

Your Turn
Find each product using a model.

a. \( \frac{1}{4} \times \frac{1}{2} \)  
b. \( \frac{1}{3} \times \frac{1}{4} \)  
c. \( \frac{1}{2} \times \frac{1}{5} \)

Writing Math

1. Describe how you would change the model to find \( \frac{1}{2} \times \frac{1}{3} \).
   Is the product the same as \( \frac{1}{3} \times \frac{1}{2} \)? Explain.
**ACTIVITY**

Work with a partner.

2. Find $\frac{3}{5} \times \frac{2}{3}$ using a model. Write in simplest form.

To find $\frac{3}{5} \times \frac{2}{3}$, find $\frac{3}{5}$ of $\frac{2}{3}$.

- Begin with a square to represent 1.
- Shade $\frac{2}{5}$ of the square yellow.
- Shade $\frac{3}{5}$ of the square blue.

Six out of 15 parts are shaded green. So, $\frac{3}{5} \times \frac{2}{3} = \frac{6}{15}$ or $\frac{2}{5}$.

**Your Turn**

Find each product using a model. Then write in simplest form.

- d. $\frac{3}{4} \times \frac{2}{3}$
- e. $\frac{2}{5} \times \frac{5}{6}$
- f. $\frac{4}{5} \times \frac{3}{8}$

---

2. Draw a model to show that $\frac{2}{3} \times \frac{5}{6} = \frac{10}{18}$. Then explain how the model shows that $\frac{10}{18}$ simplifies to $\frac{5}{9}$.

3. Explain the relationship between the numerators of the problem and the numerator of the product. What do you notice about the denominators of the problem and the denominator of the product?

4. **MAKE A CONJECTURE** Write a rule you can use to multiply fractions.
Multiplying Fractions

**EARTH SCIENCE** The model represents the part of Earth that is covered by water and the part that is covered by the Pacific Ocean. The overlapping area represents $\frac{1}{2}$ of $\frac{7}{10}$ or $\frac{1}{2} \times \frac{7}{10}$.

1. What part of Earth’s surface is covered by the Pacific Ocean?
2. What is the relationship between the numerators and denominators of the factors and the numerator and denominator of the product?

### Key Concept: Multiply Fractions

**Words** To multiply fractions, multiply the numerators and multiply the denominators.

**Symbols**

- **Arithmetic**
  \[
  \frac{2}{5} \times \frac{1}{2} = \frac{2 \times 1}{5 \times 2}
  \]
- **Algebra**
  \[
  \frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}, \text{ where } b \text{ and } d \text{ are not 0.}
  \]

### Example

**Find** $\frac{1}{3} \times \frac{1}{4}$.

\[
\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4} = \frac{1}{12}
\]

- Multiply the numerators.
- Multiply the denominators.
- Simplify.

### Your Turn

Multiply. Write in simplest form.

a. $\frac{2}{5} \times \frac{3}{5}$

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

c. $\frac{2}{3} \times \frac{5}{6}$

**am I ever going to use this?**

For strategies in reading this lesson, visit msmath1.net/reading.
To multiply a fraction and a whole number, first write the whole number as a fraction.

**EXAMPLE**

**Multiply Fractions and Whole Numbers**

2 Find $\frac{3}{5} \times 4$.  Estimate $\frac{1}{2} \times 4 = 2$

\[
\frac{3}{5} \times 4 = \frac{3}{5} \times \frac{4}{1}
\]

Write 4 as $\frac{4}{1}$.

\[
= \frac{3 \times 4}{5 \times 1} = \frac{12}{5}
\]

Simplify or $2\frac{2}{5}$.

Simplify. Compare to the estimate.

**Your Turn**

Multiply. Write in simplest form.

d. $\frac{2}{3} \times 6$

e. $\frac{3}{4} \times 5$

f. $3 \times \frac{1}{2}$

If the numerators and the denominators have a common factor, you can simplify **before** you multiply.

**EXAMPLE**

**Simplify Before Multiplying**

3 Find $\frac{3}{4} \times \frac{5}{6}$.  Estimate $\frac{1}{2} \times 1 = \frac{1}{2}$

The numerator 3 and the denominator 6 have a common factor, 3.

\[
\frac{3}{4} \times \frac{5}{6} = \frac{1 \times 5}{4 \times 6} = \frac{\cancel{1} \times 5}{\cancel{4} \times \cancel{6} 2} = \frac{5}{8}
\]

Simplify. Compare to the estimate.

**Your Turn**

Multiply. Write in simplest form.

g. $\frac{3}{4} \times \frac{4}{9}$

h. $\frac{5}{6} \times \frac{9}{10}$

i. $\frac{3}{5} \times 10$

**EXAMPLE**

**Evaluate Expressions**

4 ALGEBRA Evaluate $ab$ if $a = \frac{2}{3}$ and $b = \frac{3}{8}$.

\[
a \times b = \frac{2}{3} \times \frac{3}{8}
\]

Replace $a$ with $\frac{2}{3}$ and $b$ with $\frac{3}{8}$.

\[
= \frac{1 \times 2}{3 \times 8} = \frac{\cancel{1} \times \cancel{2}}{\cancel{3} \times \cancel{8} 4} = \frac{2}{4} = \frac{1}{2}
\]

The GCF of 2 and 8 is 2. The GCF of 3 and 3 is 3. Divide both the numerator and the denominator by 2 and then by 3.

Simplify.

**Your Turn**

j. Evaluate $\frac{3}{4} c$ if $c = \frac{2}{5}$.

k. Evaluate $5a$ if $a = \frac{3}{10}$.
1. Draw a model to show why $\frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$.

2. OPEN ENDED Write an example of multiplying two fractions where you can simplify before you multiply.

3. NUMBER SENSE Natalie multiplied $\frac{2}{3}$ and 22 and got 33. Is this answer reasonable? Why or why not?

4. Writing Math Without multiplying, tell whether the product of $\frac{5}{9}$ and $\frac{4}{7}$ is a fraction or a mixed number. Explain.

GUIDED PRACTICE

Multiply. Write in simplest form.

5. $\frac{1}{8} \times \frac{1}{2}$  
6. $\frac{4}{5} \times 10$  
7. $\frac{1}{3} \times \frac{3}{4}$  
8. $\frac{3}{10} \times \frac{5}{6}$  
9. $\frac{3}{4} \times 12$  
10. $\frac{3}{5} \times \frac{5}{6}$

11. ALGEBRA Evaluate $xy$ if $x = \frac{1}{4}$ and $y = \frac{5}{6}$.

12. HOBBIES Suppose you are building a model car that is $\frac{1}{12}$ the size of the actual car. How long is the model if the actual car is shown at the right?

Practice and Applications

Multiply. Write in simplest form.

13. $\frac{1}{3} \times \frac{2}{5}$  
14. $\frac{1}{8} \times \frac{3}{4}$  
15. $\frac{3}{4} \times 2$  
16. $\frac{2}{3} \times 4$  
17. $\frac{2}{3} \times \frac{1}{4}$  
18. $\frac{3}{5} \times \frac{5}{7}$  
19. $\frac{4}{9} \times \frac{3}{8}$  
20. $\frac{2}{5} \times \frac{5}{6}$  
21. $\frac{3}{4} \times \frac{5}{8}$  
22. $\frac{5}{6} \times 15$  
23. $\frac{1}{2} \times \frac{4}{9}$  
24. $\frac{7}{8} \times \frac{2}{3}$  
25. $\frac{1}{2} \times \frac{1}{3} \times \frac{1}{4}$  
26. $\frac{2}{3} \times \frac{3}{4} \times \frac{2}{3}$  
27. $\frac{1}{2} \times \frac{2}{5} \times \frac{15}{16}$  
28. $\frac{2}{3} \times \frac{9}{10} \times \frac{5}{9}$

ALGEBRA Evaluate each expression if $a = \frac{3}{5}$, $b = \frac{1}{2}$, and $c = \frac{1}{3}$.

29. $ab$  
30. $bc$  
31. $\frac{1}{3}a$  
32. $ac$

33. LIFE SCIENCE About $\frac{7}{10}$ of the human body is water. How many pounds of water are in a person weighing 120 pounds?
34. **MALLS** The area of a shopping mall is 700,000 square feet. About \(\frac{1}{9}\) of the area is for stores that are food related. About how many square feet in the mall are for food-related stores?

35. **GEOGRAPHY** Michigan’s area is 96,810 square miles. Water makes up about \(\frac{2}{5}\) of the area of the state. About how many square miles of water does Michigan have?

36. **FLAGS** In a recent survey, \(\frac{4}{5}\) of Americans said they were displaying the American flag. Five-eighths of these displayed the flag on their homes. What fraction of Americans displayed a flag on their home?

37. **CRITICAL THINKING** Find \(\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \ldots \times \frac{99}{100}\).

38. **MULTIPLE CHOICE** Evaluate \(ab\) if \(a = \frac{7}{8}\) and \(b = \frac{2}{3}\).

39. **SHORT RESPONSE** On a warm May day, \(\frac{6}{7}\) of the students at West Middle School wore short-sleeved T-shirts, and \(\frac{2}{3}\) of those students wore shorts. What fraction of the students wore T-shirts and shorts to school?

40. Estimate each product. (Lesson 7-1)

41. \(\frac{8}{9} \times 5\frac{1}{6}\)

42. \(\frac{1}{7} \times 3\frac{5}{6}\)

43. \(\frac{4}{9} \times \frac{8}{9}\)

44. **HEALTH** Joaquin is 65\(\frac{1}{2}\) inches tall. Juan is 61\(\frac{3}{4}\) inches tall. How much taller is Joaquin than Juan? (Lesson 6-6)

45. **SPORTS** The table shows the finishing times for four runners in a 100-meter race. In what order did the runners cross the finish line? (Lesson 3-2)

<table>
<thead>
<tr>
<th>Runner</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarah</td>
<td>14.31 s</td>
</tr>
<tr>
<td>Camellia</td>
<td>13.84 s</td>
</tr>
<tr>
<td>Fala</td>
<td>13.97 s</td>
</tr>
<tr>
<td>Debbie</td>
<td>13.79 s</td>
</tr>
</tbody>
</table>

46. **PREREQUISITE SKILL** Write each mixed number as an improper fraction. (Lesson 5-3)

\[
\begin{align*}
46. \quad & 4\frac{1}{2} \\
47. \quad & 3\frac{1}{4} \\
48. \quad & 5\frac{2}{3} \\
49. \quad & 2\frac{5}{7} \\
50. \quad & 9\frac{3}{4} \\
51. \quad & 6\frac{5}{8}
\end{align*}
\]
Multipli ng Mixed Numbers

EXERCISE Jasmine walks 3 days a week, \(2\frac{1}{2}\) miles each day. The number line shows the miles she walks in a week.

1. How many miles does Jasmine walk in a week?
2. Write a multiplication sentence that shows the total miles walked in a week.
3. Write the multiplication sentence using improper fractions.

Use a number line and improper fractions to find each product.
4. \(2 \times 1\frac{1}{3}\)
5. \(2 \times 2\frac{1}{4}\)
6. \(3 \times 1\frac{3}{4}\)

7. Describe how multiplying mixed numbers is similar to multiplying fractions.

Multiplying mixed numbers is similar to multiplying fractions.

**Key Concept: Multiply Mixed Numbers**

To multiply mixed numbers, write the mixed numbers as improper fractions and then multiply as with fractions.

**EXAMPLE**

Multiply a Fraction and a Mixed Number

Find \(\frac{1}{4} \times 4\frac{4}{5}\).

**Estimate** Use compatible numbers \(\rightarrow \frac{1}{4} \times 4 = 1\)

\[
\frac{1}{4} \times 4\frac{4}{5} = \frac{1}{4} \times \frac{24}{5}
\]

Write \(4\frac{4}{5}\) as \(\frac{24}{5}\).

\[
\frac{1}{4} \times \frac{24}{5} = \frac{1 \times 6}{4 \times 5} = \frac{6}{20} \quad \text{Divide 24 and 4 by their GCF, 4.}
\]

\[
\frac{6}{20} = \frac{6}{5} \quad \text{or} \quad 1\frac{1}{5} \quad \text{Simplify. Compare to the estimate.}
\]

**Your Turn** Multiply. Write in simplest form.

a. \(\frac{2}{3} \times 2\frac{1}{2}\)  
   b. \(\frac{3}{8} \times 3\frac{1}{3}\)  
   c. \(3\frac{1}{2} \times \frac{1}{3}\)
Multiply Mixed Numbers

**BAKING** Jessica is making \(2\frac{1}{2}\) batches of chocolate chip cookies for a bake sale. If one batch uses \(2\frac{1}{4}\) cups of flour, how much flour will she need?

**Estimate** \(3 \times 2 = 6\)

Each batch uses \(2\frac{1}{4}\) cups of flour. So, multiply \(2\frac{1}{2}\) by \(2\frac{1}{4}\).

\[
2\frac{1}{2} \times 2\frac{1}{4} = \frac{5}{2} \times \frac{9}{4}
\]

First, write mixed numbers as improper fractions.

\[
= \frac{5}{2} \times \frac{9}{4}
\]

Then, multiply the numerators and multiply the denominators.

\[
= \frac{45}{8} \text{ or } 5\frac{5}{8}
\]

Simplify.

Jessica will need \(5\frac{5}{8}\) cups of flour. Compare this to the estimate.

Evaluate Expressions

**ALGEBRA** If \(c = 1\frac{7}{8}\) and \(d = 3\frac{1}{3}\), what is the value of \(cd\)?

\[
\begin{align*}
    cd &= 1\frac{7}{8} \times 3\frac{1}{3} \\
    &= \frac{15}{8} \times \frac{10}{3} \\
    &= \frac{25}{4} \text{ or } 6\frac{1}{4}
\end{align*}
\]

Divide the numerator and denominator by 3 and by 2.

**Skill and Concept Check**

1. **Writing Math** Describe how to multiply mixed numbers.

2. **OPEN ENDED** Write a problem that can be solved by multiplying mixed numbers. Explain how to find the product.

3. **NUMBER SENSE** Without multiplying, tell whether the product \(2\frac{1}{2} \times \frac{2}{3}\) is located on the number line at point A, B, or C. Explain your reasoning.

**GUIDED PRACTICE**

Multiply. Write in simplest form.

4. \(\frac{1}{2} \times 2\frac{3}{8}\)

5. \(1\frac{1}{2} \times \frac{2}{3}\)

6. \(2 \times 6\frac{1}{4}\)

7. \(1\frac{3}{4} \times 2\frac{4}{5}\)

8. \(3\frac{1}{3} \times 1\frac{1}{5}\)

9. \(\frac{3}{8} \times 1\frac{1}{4}\)

10. **ALGEBRA** If \(x = \frac{9}{10}\) and \(y = 1\frac{1}{3}\), find \(xy\).
Multiply. Write in simplest form.
11. \(\frac{1}{2} \times 2\frac{1}{3}\)  
12. \(\frac{3}{4} \times 2\frac{5}{6}\)  
13. \(1\frac{7}{8} \times \frac{4}{5}\)  
14. \(1\frac{4}{5} \times \frac{5}{6}\)
15. \(1\frac{1}{3} \times 1\frac{1}{4}\)  
16. \(3\frac{1}{5} \times 3\frac{1}{6}\)  
17. \(3\frac{3}{4} \times 2\frac{2}{5}\)  
18. \(4\frac{1}{2} \times 2\frac{5}{6}\)
19. \(6\frac{2}{3} \times 3\frac{3}{10}\)  
20. \(3\frac{3}{5} \times 5\frac{5}{12}\)  
21. \(\frac{3}{4} \times 2\frac{1}{2} \times \frac{4}{5}\)  
22. \(1\frac{1}{2} \times \frac{2}{3} \times \frac{3}{5}\)

**ALGEBRA** Evaluate each expression if \(a = \frac{2}{3}\), \(b = 3\frac{1}{2}\), and \(c = 1\frac{3}{4}\).
23. \(ab\)  
24. \(\frac{1}{2}c\)  
25. \(bc\)  
26. \(\frac{1}{8}a\)

**MUSIC** For Exercises 27–30, use the following information.
A dot following a music note (••) means that the note gets \(1\frac{1}{2}\) times as many beats as the same note without a dot (•).

How many beats does each note get?
27. dotted whole note  
28. dotted quarter note  
29. dotted eighth note  
30. dotted half note

31. **CRITICAL THINKING** Is the product of two mixed numbers always, sometimes, or never less than 1? Explain.

32. **MULTIPLE CHOICE** To find the area of a parallelogram, multiply the length of the base by the height. What is the area of this parallelogram?

A. \(5\frac{3}{4} \text{ ft}^2\)  
B. \(6\frac{1}{4} \text{ ft}^2\)  
C. \(6\frac{3}{4} \text{ ft}^2\)  
D. \(8\frac{1}{4} \text{ ft}^2\)

33. **SHORT RESPONSE** A bag of apples weighs \(3\frac{1}{2}\) pounds.
How much do \(1\frac{1}{2}\) bags weigh?

Multiply. Write in simplest form. (Lesson 7-2)
34. \(\frac{5}{7} \times \frac{3}{4}\)  
35. \(\frac{2}{3} \times \frac{1}{6}\)  
36. \(\frac{3}{8} \times \frac{2}{5}\)  
37. \(\frac{1}{2} \times \frac{4}{7}\)

38. **RECREATION** There are about 7 million pleasure boats in the United States. About \(\frac{2}{3}\) of these boats are motorboats. About how many motorboats are in the United States? (Lesson 7-1)

**PREREQUISITE SKILL** Multiply. Write in simplest form. (Lesson 7-2)
39. \(\frac{1}{4} \times \frac{3}{8}\)  
40. \(\frac{2}{7} \times \frac{3}{4}\)  
41. \(\frac{1}{2} \times \frac{1}{6}\)  
42. \(\frac{2}{5} \times \frac{5}{6}\)
1. **Explain** how to multiply fractions. (Lesson 7-2)

2. **State** the first step you should do when multiplying mixed numbers. (Lesson 7-3)

**Skills and Applications**

<table>
<thead>
<tr>
<th>Estimate each product. (Lesson 7-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. $\frac{1}{3} \times 22$</td>
</tr>
<tr>
<td>4. $\frac{8}{9} \times \frac{2}{15}$</td>
</tr>
<tr>
<td>5. $\frac{3}{2} \times \frac{5}{9}$</td>
</tr>
<tr>
<td>6. $\frac{1}{9} \times 44$</td>
</tr>
<tr>
<td>7. $7\frac{3}{4} \times 3\frac{1}{8}$</td>
</tr>
<tr>
<td>8. $11\frac{12}{15} \times \frac{3}{5}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiply. Write in simplest form. (Lesson 7-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. $\frac{1}{4} \times \frac{4}{9}$</td>
</tr>
<tr>
<td>10. $\frac{3}{5} \times \frac{2}{9}$</td>
</tr>
<tr>
<td>11. $\frac{5}{8} \times \frac{4}{7}$</td>
</tr>
<tr>
<td>12. $\frac{6}{7} \times \frac{14}{15}$</td>
</tr>
</tbody>
</table>

13. **ALGEBRA** Evaluate $ab$ if $a = \frac{5}{6}$ and $b = \frac{1}{2}$. (Lesson 7-2)

<table>
<thead>
<tr>
<th>Multiply. Write in simplest form. (Lesson 7-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. $\frac{3}{8} \times 2\frac{2}{3}$</td>
</tr>
<tr>
<td>15. $1\frac{4}{5} \times 3$</td>
</tr>
<tr>
<td>16. $12\frac{1}{2} \times \frac{1}{5}$</td>
</tr>
<tr>
<td>17. $3\frac{3}{8} \times 1\frac{4}{9}$</td>
</tr>
</tbody>
</table>

18. **GEOMETRY** To find the area of a parallelogram, use the formula $A = bh$, where $b$ is the length of the base and $h$ is the height. Find the area of the parallelogram. (Lesson 7-3)

<table>
<thead>
<tr>
<th>Standardized Test Practice</th>
</tr>
</thead>
</table>

19. **MULTIPLE CHOICE** What is the product of $4\frac{1}{2}$ and $2\frac{2}{3}$? (Lesson 7-3)

   - A. $1\frac{11}{16}$
   - B. $7\frac{1}{6}$
   - C. $8\frac{1}{3}$
   - D. 12

20. **MULTIPLE CHOICE** Which expression is equal to $\frac{21}{48}$? (Lesson 7-2)

   - A. $\frac{1}{2} \times \frac{11}{48}$
   - B. $\frac{3}{48} \times \frac{7}{48}$
   - C. $\frac{7}{12} \times \frac{3}{4}$
   - D. $\frac{10}{6} \times \frac{11}{8}$
**The Game Zone: Multiplying Fractions**

**Players:** two, three, or four  
**Materials:** poster board, straightedge, 2 number cubes

**GET READY!**

**Players:** two, three, or four  
**Materials:** poster board, straightedge, 2 number cubes

**GET SET!**

- Draw a large game board on your poster board like the one shown.

**GO!**

- Place the game board on the floor.
- Each player rolls the number cubes. The person with the highest total starts.
- The first player rolls the number cubes onto the game board. If a number cube rolls off the board or lands on a line, roll it again.
- The player then multiplies the two numbers on which the number cubes land and simplifies the product. Each correct answer is worth 1 point.
- Then the next player rolls the number cubes and finds the product.

**Who Wins?** The first player to score 10 points wins.
**Dividing Fractions**

There are 8 pieces of candy that are given away 2 at a time. How many people will get candy?

1. How many 2s are in 8? Write as a division expression.

Suppose there are two granola bars divided equally among 8 people. What part of a granola bar will each person get?

2. What part of 8 is in 2? Write as a division expression.

**ACTIVITY**

**Work with a partner.**

Find \(1 \div \frac{1}{5}\) using a model.

**STEP 1**

Make a model of the dividend, 1.

- Think: How many \(\frac{1}{5}\)s are in 1?

**STEP 2**

Rename 1 as \(\frac{5}{5}\) so the numbers have common denominators. So, the problem is \(\frac{5}{5} \div \frac{1}{5}\). Redraw the model to show \(\frac{5}{5}\).

- How many \(\frac{1}{5}\)s are in \(\frac{5}{5}\)?

**STEP 3**

Circle groups that are the size of the divisor \(\frac{1}{5}\).

- There are five \(\frac{1}{5}\)s in \(\frac{5}{5}\).

So, \(1 \div \frac{1}{5} = 5\).

**Your Turn**

Find each quotient using a model.

- a. \(2 \div \frac{1}{5}\)
- b. \(3 \div \frac{1}{3}\)
- c. \(3 \div \frac{2}{3}\)
- d. \(2 \div \frac{3}{4}\)

**Terms**

In a division problem, the **dividend** is the number being divided. The **divisor** is the number being divided into another number.
A model can also be used to find the quotient of two fractions.

**Activity**

**Work with a partner.**

1. Find \( \frac{3}{4} \div \frac{3}{8} \) using a model.

**Step 1**

Rename \( \frac{3}{4} \) as \( \frac{6}{8} \) so the fractions have common denominators. So, the problem is \( \frac{6}{8} \div \frac{3}{8} \). Draw a model of the dividend, \( \frac{6}{8} \).

**Step 2**

Circle groups that are the size of the divisor, \( \frac{3}{8} \).

There are two \( \frac{3}{8} \)'s in \( \frac{6}{8} \).

So, \( \frac{3}{4} \div \frac{3}{8} = 2 \).

**Your Turn**

Find each quotient using a model.

- e. \( \frac{4}{10} \div \frac{1}{5} \)
- f. \( \frac{3}{4} \div \frac{1}{2} \)
- g. \( \frac{4}{5} \div \frac{1}{5} \)
- h. \( \frac{1}{6} \div \frac{1}{3} \)

**Writing Math**

Use *greater than*, *less than*, or *equal to* to complete each sentence. Then give an example to support your answer.

1. When the dividend is equal to the divisor, the quotient is \(? \) 1.
2. When the dividend is greater than the divisor, the quotient is \(? \) 1.
3. When the dividend is less than the divisor, the quotient is \(? \) 1.
4. You know that multiplication is commutative because the product of \( 3 \times 4 \) is the same as \( 4 \times 3 \). Is division commutative? Give examples to explain your answer.
Dividing Fractions

What You’ll LEARN
Divide fractions.

NEW Vocabulary
reciprocal

Work with a partner.
Kenji and his friend Malik made 4 pizzas. They estimate that a $\frac{1}{2}$-pizza will serve one person.

1. How many $\frac{1}{2}$-pizza servings are there?
2. The model shows $4 \div \frac{1}{2}$. What is $4 \div \frac{1}{2}$?

Draw a model to find each quotient.
3. $3 \div \frac{1}{4}$
4. $2 \div \frac{1}{6}$
5. $4 \div \frac{1}{2}$

The Mini Lab shows that $4 \div \frac{1}{2} = 8$. Notice that dividing by $\frac{1}{2}$ gives the same result as multiplying by 2.

$$4 \div \frac{1}{2} = 8 \quad \text{Notice that } \frac{1}{2} \times 2 = 1.$$ 

The numbers $\frac{1}{2}$ and 2 have a special relationship. Their product is 1. Any two numbers whose product is 1 are called reciprocals.

EXAMPLES
Find Reciprocals

1. Find the reciprocal of 5.
   Since $5 \times \frac{1}{5} = 1$, the reciprocal of 5 is $\frac{1}{5}$.

2. Find the reciprocal of $\frac{2}{3}$.
   Since $\frac{2}{3} \times \frac{3}{2} = 1$, the reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$.

You can use reciprocals to divide fractions.

Key Concept: Divide Fractions

Words To divide by a fraction, multiply by its reciprocal.

Symbols

Arithmetic

$\frac{1}{2} \div \frac{2}{3} = \frac{1}{2} \times \frac{3}{2}$

Algebra

$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$, where $b$, $c$, and $d \neq 0$
Divide by a Fraction

3. Find \( \frac{1}{8} \div \frac{3}{4} \).

\[
\frac{1}{8} \div \frac{3}{4} = \frac{1}{8} \times \frac{4}{3} \\
= \frac{1 \times 4}{8 \times 3} \\
= \frac{1}{6}
\]

Multiply by the reciprocal, \( \frac{4}{3} \).
Divide 8 and 4 by the GCF, 4.
Multiply numerators.
Multiply denominators.

Your Turn

Divide. Write in simplest form.

a. \( \frac{1}{4} \div \frac{3}{8} \)  

b. \( \frac{2}{3} \div \frac{3}{8} \)  

c. \( 4 \div \frac{3}{4} \)  

Divide Fractions to Solve a Problem

4. **PAINTBALL** It costs $5 to play paintball for one-half hour. How many five-dollar bills do you need to play paintball for 3 hours?

Divide 3 by \( \frac{1}{2} \) to find the number of half hours in 3 hours.

\[
3 \div \frac{1}{2} = \frac{3}{1} \times \frac{2}{1} \\
= \frac{6}{1} \text{ or } 6
\]

Multiply by the reciprocal of \( \frac{1}{2} \).
Simplify.

So, you need 6 five-dollar bills or $30 to play for 3 hours.

Divide by a Whole Number

5. **GRID-IN TEST ITEM** A neighborhood garden that is \( \frac{2}{3} \) of an acre is to be divided into 4 equal-size areas. What is the size of each area?

Read the Test Item

You need to find the size of each area. To do so, divide \( \frac{2}{3} \) into 4 equal parts.

\[
\frac{2}{3} \div 4 = \frac{2}{3} \times \frac{1}{4} \\
= \frac{1 \times 1}{2 \times 3} \\
= \frac{1}{6}
\]

Multiply by the reciprocal.
Divide 2 and 4 by the GCF, 2.
Simplify.

Each area is \( \frac{1}{6} \) acre.
1. **Draw** a model that shows \(2 \div \frac{1}{3} = 6\).

2. **Writing Math.** Explain why \(\frac{1}{2} \div \frac{2}{3} = \frac{1}{2} \times \frac{3}{2} = \frac{3}{4}\). Use a model in your explanation.

3. **OPEN ENDED** Write two fractions that are reciprocals of each other.

4. **FIND THE ERROR** Ryan and Joshua are solving \(\frac{2}{3} \div 4\). Who is correct? Explain.

   **Ryan:**
   
   \[
   \frac{2}{3} \div 4 = \frac{2}{3} \times \frac{1}{4} = \frac{8}{3} \text{ or } 2\frac{2}{3}
   \]

   **Joshua:**
   
   \[
   \frac{2}{3} \div 4 = \frac{2}{3} \times \frac{1}{4} = \frac{2}{12} \text{ or } \frac{1}{6}
   \]

**GUIDED PRACTICE**

Find the reciprocal of each number.

5. \(\frac{2}{3}\)  
6. \(\frac{1}{7}\)  
7. \(\frac{2}{5}\)  
8. 4

Divide. Write in simplest form.

9. \(\frac{1}{4} \div \frac{1}{2}\)  
10. \(\frac{5}{6} \div \frac{1}{3}\)  
11. \(\frac{4}{5} \div 2\)  
12. \(2 \div \frac{1}{3}\)  
13. \(\frac{5}{8} \div \frac{3}{4}\)  
14. \(\frac{3}{4} \div \frac{2}{5}\)

15. **FOOD** Mrs. Cardona has \(\frac{2}{3}\) of a pan of lasagna left for dinner. She wants to divide the lasagna into 6 equal pieces for her family. What part of the original pan of lasagna will each person get?

**Practice and Applications**

Find the reciprocal of each number.

16. \(\frac{1}{4}\)  
17. \(\frac{1}{10}\)  
18. \(\frac{5}{6}\)  
19. \(\frac{2}{5}\)

20. \(\frac{7}{9}\)  
21. 8  
22. 1  
23. \(\frac{3}{8}\)

Divide. Write in simplest form.

24. \(\frac{1}{8} \div \frac{1}{2}\)  
25. \(\frac{1}{2} \div \frac{2}{3}\)  
26. \(\frac{1}{3} \div \frac{1}{9}\)  
27. \(\frac{1}{4} \div \frac{1}{8}\)

28. \(\frac{5}{8} \div \frac{1}{4}\)  
29. \(\frac{3}{4} \div \frac{2}{3}\)  
30. \(\frac{3}{4} \div \frac{9}{10}\)  
31. \(3 \div \frac{3}{4}\)

32. \(2 \div \frac{3}{5}\)  
33. \(\frac{2}{3} \div \frac{2}{5}\)  
34. \(\frac{5}{6} \div 5\)  
35. \(\frac{5}{8} \div 2\)

36. If you divide \(\frac{1}{2}\) by \(\frac{1}{8}\), what is the quotient?

37. If you divide \(\frac{6}{7}\) by 3, what is the quotient?
ALGEBRA Find the value of each expression if \( a = \frac{2}{3}, \ b = \frac{3}{4}, \) and \( c = \frac{1}{2} \).

38. \( a \div b \) 39. \( b \div c \) 40. \( a \div c \) 41. \( c \div b \)

42. DOGS Maria works at a kennel and uses 30-pound bags of dog food to feed the dogs. If each dog gets \( \frac{2}{5} \) pound of food, how many dogs can she feed with one bag?

43. WRITE A PROBLEM Write two real-life problems that involve the fraction \( \frac{1}{2} \) and the whole number 3. One problem should involve multiplication, and the other should involve division.

44. MULTI STEP Lena has painted \( \frac{3}{4} \) of a room. She has used \( 1\frac{1}{2} \) gallons of paint. How much paint will she need to finish the job?

45. CRITICAL THINKING Solve mentally.

\[ \text{a. } \frac{2,345}{1,015} \times \frac{12}{11} \div \frac{2,345}{1,015} \]

\[ \text{b. } \frac{2,345}{11} \times \frac{12}{1,015} \div \frac{2,345}{1,015} \]

46. MULTIPLE CHOICE The table shows the weight factors of other planets relative to Earth. For example, an object on Jupiter is 3 times heavier than on Earth. About how many times heavier is an object on Venus than on Mercury?

<table>
<thead>
<tr>
<th>Planet</th>
<th>Weight Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>( \frac{1}{3} )</td>
</tr>
<tr>
<td>Venus</td>
<td>( \frac{9}{10} )</td>
</tr>
<tr>
<td>Jupiter</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: www.factmonster.com

47. MULTIPLE CHOICE Which of the following numbers, when divided by \( \frac{1}{2} \), gives a result less than \( \frac{1}{2} \)?

\[ \text{F. } \frac{2}{8} \quad \text{G. } \frac{7}{12} \quad \text{H. } \frac{2}{3} \quad \text{I. } \frac{5}{24} \]

Multiply. Write in simplest form. (Lesson 7-3)

48. \( 2\frac{2}{3} \times 3\frac{1}{3} \) 49. \( 1\frac{5}{6} \times 2\frac{3}{4} \) 50. \( 3\frac{3}{7} \times 2\frac{3}{8} \) 51. \( 4\frac{4}{9} \times 5\frac{1}{4} \)

52. VOLUNTEERING According to a survey, nine in 10 teens volunteer at least once a year. Of these, about \( \frac{1}{3} \) help clean up their communities. What fraction of teens volunteer by helping clean up their communities? (Lesson 7-2)

**PREREQUISITE SKILL** Write each mixed number as an improper fraction. Then find the reciprocal of each. (Lesson 5-3)

53. \( 1\frac{2}{3} \) 54. \( 1\frac{5}{9} \) 55. \( 4\frac{1}{2} \) 56. \( 3\frac{3}{4} \) 57. \( 6\frac{4}{5} \)
Dividing Mixed Numbers

**What You’ll LEARN**
Divide mixed numbers.

**REVIEW Vocabulary**
mixed number: the sum of a whole number and a fraction (Lesson 5-3)

**DESIGNER** Suppose you are going to cut pieces of fabric $1\frac{3}{4}$ yards long from a bolt containing $5\frac{1}{2}$ yards of fabric.

1. To the nearest yard, how long is each piece?
2. To the nearest yard, how long is the fabric on the bolt?
3. About how many pieces can you cut?

When you multiply mixed numbers, you write each mixed number as an improper fraction. The same is true with division.

**EXAMPLE**

Divide by a Mixed Number

1. Find $5\frac{1}{2} \div 1\frac{3}{4}$.
   - **Estimate** $6 \div 2 = 3$
   - $5\frac{1}{2} \div 1\frac{3}{4} = \frac{11}{2} \div \frac{7}{4}$
   - Write mixed numbers as improper fractions.
   - $= \frac{11}{2} \times \frac{4}{7}$
   - Multiply by the reciprocal.
   - $= \frac{22}{7}$ or $3\frac{1}{7}$
   - Divide 2 and 4 by the GCF, 2.
   - Compare to the estimate.

**Your Turn**
Divide. Write in simplest form.

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

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

c. $\frac{5}{9} \div 2\frac{1}{3}$

**EXAMPLE**

Evaluate Expressions

2. **ALGEBRA** Find $m \div n$ if $m = 1\frac{3}{4}$ and $n = \frac{2}{5}$.
   - $m \div n = \frac{13}{4} \div \frac{2}{5}$
   - Replace $m$ with $1\frac{3}{4}$ and $n$ with $\frac{2}{5}$.
   - $= \frac{7}{4} \div \frac{2}{5}$
   - Write the mixed number as an improper fraction.
   - $= \frac{7}{4} \times \frac{5}{2}$
   - Multiply by the reciprocal.
   - $= \frac{35}{8}$ or $4\frac{3}{8}$
   - Simplify.

**When am I ever going to use this?**

Estimation

$1\frac{3}{4} \div \frac{2}{5} = 2 + \frac{1}{2}$

Compare the actual quotient to the estimate.
Lesson 7-5  Dividing Mixed Numbers

Solve Problems with Mixed Numbers

WEATHER  A tornado traveled 100 miles in $1\frac{1}{2}$ hours. How many miles per hour did it travel?  

Estimate  $100 \div 2 = 50$

$$100 \div 1\frac{1}{2} = \frac{100}{1} \div \frac{3}{2}$$  
Write the mixed number as an improper fraction.

$$= \frac{100}{1} \times \frac{2}{3}$$  
Multiply by the reciprocal.

$$= \frac{200}{3}$$  
Simplify.

$$= 66\frac{2}{3}$$  
Compare to the estimate.

So, the tornado traveled $66\frac{2}{3}$ miles per hour.

How far would the tornado travel in $\frac{1}{2}$ hour at the same speed?  

Estimate  $\frac{1}{2}$ of 70 = 35

$$\frac{1}{2} \times 66\frac{2}{3} = \frac{1}{2} \times \frac{200}{3}$$  
Write the mixed number as an improper fraction.

$$= \frac{1}{2} \times \frac{100}{3}$$  
Divide 2 and 100 by their GCF, 2.

$$= \frac{100}{3} \text{ or } 33\frac{1}{3}$$  
Simplify.

So, the tornado would travel $33\frac{1}{3}$ miles in $\frac{1}{2}$ hour.

Skill and Concept Check

1. **OPEN END** Write about a real-life situation that is represented by $12\frac{3}{4} \div 2\frac{1}{2}$.

2. **Which One Doesn’t Belong?** Identify the expression whose quotient is less than 1. Explain your reasoning.

   $$\begin{align*}
   2\frac{1}{2} &+ 1\frac{1}{3} \\
   4\frac{1}{3} &+ 2\frac{2}{5} \\
   2\frac{1}{8} &+ 3\frac{1}{3} \\
   3\frac{1}{2} &+ 1\frac{3}{5}
   \end{align*}$$

GUIDED PRACTICE

Divide. Write in simplest form.

3. $3\frac{1}{2} \div 2$

4. $8 \div 1\frac{1}{3}$

5. $3\frac{1}{5} \div 2\frac{7}{3}$

6. **ALGEBRA** What is the value of $c \div d$ if $c = \frac{3}{8}$ and $d = 1\frac{1}{2}$?

7. **BAKING** Jay is cutting a roll of cookie dough into slices that are $\frac{3}{8}$ inch thick. If the roll is $10\frac{1}{2}$ inches long, how many slices can he cut?
Divide. Write in simplest form.

8. \( \frac{5}{2} \div 2 \)  
9. \( \frac{4}{6} \div 10 \)  
10. \( 3 \div 4\frac{1}{2} \)  

11. \( 6 \div 2\frac{1}{4} \)  
12. \( 15 \div 3\frac{1}{8} \)  
13. \( 18 \div 2\frac{2}{5} \)  

14. \( 6\frac{1}{2} \div \frac{3}{4} \)  
15. \( 7\frac{4}{5} \div \frac{1}{5} \)  
16. \( \frac{11}{12} \div 3\frac{1}{2} \)  

17. \( 1\frac{1}{4} \div \frac{5}{6} \)  
18. \( 6\frac{1}{2} \div 3\frac{1}{4} \)  
19. \( 8\frac{3}{4} \div 2\frac{1}{6} \)  

20. \( 3\frac{3}{5} \div 1\frac{4}{5} \)  
21. \( 3\frac{3}{4} \div 5\frac{5}{8} \)  
22. \( 4\frac{2}{3} \div 2\frac{2}{9} \)  

23. \( 6\frac{3}{5} \div 2\frac{3}{4} \)  
24. \( 4\frac{3}{8} \div 1\frac{2}{3} \)  
25. \( 5\frac{1}{3} \div 2\frac{2}{5} \)  

26. **FOOD** How many \( \frac{1}{4} \)-pound hamburgers can be made from \( 2\frac{1}{2} \) pounds of ground beef?

27. **MEASUREMENT** Suppose you are designing the layout for your school yearbook. If a student photograph is \( 1\frac{3}{8} \) inches wide, how many photographs will fit across a page that is \( 6\frac{7}{8} \) inches wide?

**ALGEBRA** Evaluate each expression if \( a = \frac{4}{5} \), \( b = \frac{2}{3} \), \( c = 6 \), and \( d = 1\frac{1}{2} \).

28. \( 12 \div a \)  
29. \( b \div 1\frac{2}{9} \)  
30. \( a \div b \)  
31. \( a \div c \)  
32. \( c \div d \)  
33. \( c \div (ab) \)

34. **SLED DOG RACING** In 2001, Doug Swingley won the Iditarod Trail Sled Dog Race for the fourth time. He completed the 1,100-mile course in \( 9\frac{5}{6} \) days. How many miles did he average each day?

**Mathline** Find the winning time of the Iditarod for the current year. What was the average number of miles per day? Visit msmath1.net/data_update to learn more.

**OCEANS** For Exercises 35 and 36, use the following information. A tsunami is a tidal wave in the Pacific Ocean. Suppose a tsunami traveled 1,400 miles from a point in the Pacific Ocean to the Alaskan coastline in \( 2\frac{1}{2} \) hours.

35. How many miles per hour did the tsunami travel?
36. How far would the tsunami travel in \( 1\frac{1}{2} \) hours at the same speed?
**TRAVEL** For Exercises 37 and 38, use the following information.
The Days drove their car from Nashville, Tennessee, to Orlando, Florida. They filled the gas tank before leaving home. They drove 407 miles before filling the gas tank with $18 \frac{1}{2}$ gallons of gasoline.

37. How many miles per gallon did they get on that portion of their trip?
38. How much did they pay for the gasoline if it cost $1.12$ per gallon?

39. **CRITICAL THINKING** Tell whether $\frac{8}{10} \div 1 \frac{2}{3}$ is greater than or less than $\frac{8}{10} \div 1 \frac{3}{4}$. Explain your reasoning.

**Spiral Review with Standardized Test Practice**

40. **SHORT RESPONSE** The width of 10 blooms in a test of a new marigold variety are shown. What is the average (mean) bloom width?

<table>
<thead>
<tr>
<th>Marigold Bloom Width (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3 \frac{1}{4}$</td>
</tr>
<tr>
<td>$3 \frac{1}{4}$</td>
</tr>
</tbody>
</table>

41. **MULTIPLE CHOICE** There are $18 \frac{2}{3}$ cups of juice to be divided among a group of children. If each child gets $\frac{2}{3}$ cup of juice, how many children are there?

A 25  B 26  C 27  D 28

**MEASUREMENT** For Exercises 42 and 43, use the graphic at the right and the information below. (Lesson 7-4)

One U.S. ton equals $\frac{9}{10}$ metric ton. So, you can use $t \div \frac{9}{10}$ to convert $t$ metric tons to U.S. tons.

42. Write a division expression to represent the U.S. tons of gold that were produced in South Africa. Then simplify.

43. How many U.S. tons of gold were produced in Europe?

**Multiply. Write in simplest form.** (Lesson 7-3)

44. $\frac{4}{5} \times 1 \frac{3}{4}$
45. $\frac{2\frac{5}{8}}{2} \times \frac{2}{7}$
46. $1 \frac{1}{8} \times 5 \frac{1}{3}$
47. $3 \frac{1}{3} \times 2 \frac{1}{2}$

**getting ready for the next lesson**

**PREREQUISITE SKILL** What number should be added to the first number to get the second number? (Lesson 6-6)

48. $8 \frac{1}{2}$, 10
49. 9, $12 \frac{1}{2}$
50. $1 \frac{2}{3}, 2 \frac{1}{3}$
51. $7 \frac{3}{4}, 9 \frac{1}{4}$
What You’ll LEARN
Solve problems by looking for a pattern.

Look for a Pattern

Emelia, do you know what time your brother’s bus will get here? He said he would be on the first bus after 8:00 P.M.

Buses arrive at the terminal every 50 minutes. The first bus arrives at 3:45 P.M. We can figure out when his bus will get here by looking for a pattern.

Explore
We know that the first bus arrives at 3:45 P.M. and they arrive every 50 minutes. We need to find the first bus after 8:00 P.M.

Plan
Let’s start with the time of the first bus and look for a pattern.

<table>
<thead>
<tr>
<th>Time</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:45 P.M.</td>
<td>4:35 P.M.</td>
</tr>
<tr>
<td>4:35 P.M.</td>
<td>5:25 P.M.</td>
</tr>
<tr>
<td>5:25 P.M.</td>
<td>6:15 P.M.</td>
</tr>
<tr>
<td>6:15 P.M.</td>
<td>7:05 P.M.</td>
</tr>
<tr>
<td>7:05 P.M.</td>
<td>7:55 P.M.</td>
</tr>
<tr>
<td>7:55 P.M.</td>
<td>8:45 P.M.</td>
</tr>
</tbody>
</table>

So, the first bus to arrive after 8:00 P.M. will be the 8:45 P.M. bus.

Examine
Write the times using fractions.

50 minutes $= \frac{50}{60}$ or $\frac{5}{6}$ of an hour

The first bus would arrive at $3\frac{3}{4}$. Add 6 groups of $\frac{5}{6}$.

$3\frac{3}{4} + 6\left(\frac{5}{6}\right) = 3\frac{3}{4} + 5 + 8\frac{3}{4}$, which is 8:45 P.M.

Analyze the Strategy

1. **Describe** another pattern that you could use to find the time the bus arrives.
2. **Explain** when you would use the look for a pattern strategy to solve a problem.
3. **Write** a problem that can be solved by looking for a pattern. Then write the steps you would take to find the solution to your problem.
Apply the Strategy

Solve. Use the look for a pattern strategy.

4. **NUMBER SENSE** Describe the pattern below. Then find the missing number.
   30, 300, ___, 30,000

5. **GEOMETRY** Draw the next two figures in the sequence.

Mixed Problem Solving

Solve. Use any strategy.

6. **GEOMETRY** Use the pattern below to find the perimeter of the eighth figure.

   Figure 1  Figure 2  Figure 3

7. **MONEY** In 1997, Celina earned $18,000 per year, and Roger earned $14,500. Each year Roger received a $1,000 raise, and Celina received a $500 raise. In what year will they earn the same amount of money? How much will it be?

8. **HEIGHT** Fernando is 2 inches taller than Jason. Jason is 1.5 inches shorter than Kendra and 1 inch taller than Nicole. Hao, who is 5 feet 10 inches tall, is 2.5 inches taller than Fernando. How tall is each student?

9. **PHYSICAL SCIENCE** A cup of marbles hangs from a rubber band. The length of the rubber band is measured as shown in the graph. Predict the approximate length of the rubber band if 5 marbles are in the cup.

10. **MONEY** What was the price of the sweatshirt before taxes?

<table>
<thead>
<tr>
<th>Sweatshirt Price</th>
<th>Tax</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td>$2.50</td>
<td>$42.49</td>
</tr>
</tbody>
</table>

11. **NUMBER THEORY** The numbers below are called triangular numbers. Find the next three triangular numbers.

   1 3 6

12. **STANDARDIZED TEST PRACTICE**

    Jody and Lazaro are cycling in a 24-mile race. Jody is cycling at an average speed of 8 miles per hour. Lazaro is cycling at an average speed of 6 miles per hour. Which of the following statements is not true?

    - If Lazaro has a 6-mile head start, they will finish at the same time.
    - Lazaro will finish the race one hour after Jody.
    - Jody is 4 miles ahead of Lazaro after two hours.
    - Jody will finish the race one hour after Lazaro.
**What You’ll LEARN**
Recognize and extend sequences.

**NEW Vocabulary**
sequence

---

**am I ever going to use this?**

**MUSIC** The diagram shows the most common notes used in music. The names of the first four notes are whole note, half note, quarter note, and eighth note.

![Diagram showing the most common notes in music]

1. What are the names of the next three notes?
2. Write the fraction that represents each of the next three notes.
3. Identify the pattern in the numbers.

A sequence is a list of numbers in a specific order. By determining the pattern, you can find additional numbers in the sequence. The numbers $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}$ are an example of a sequence.

![Pattern diagram]

The next number in this sequence is $\frac{1}{8} \times \frac{1}{2}$ or $\frac{1}{16}$.

---

**EXAMPLE**

**Extend a Sequence by Adding**

1. Describe the pattern in the sequence 16, 24, 32, 40, … .
   Then find the next two numbers in the sequence.

   $16, 24, 32, 40, …$  
   
   
   $+8, +8, +8$  
   
   Each number is 8 more than the number before it.

   In this sequence, 8 is added to each number. The next two numbers are $40 + 8$, or 48, and $48 + 8$, or 56.

---

**Your Turn**

Describe each pattern. Then find the next two numbers in each sequence.

a. $1\frac{1}{2}, 3, 4\frac{1}{2}, 6, …$  
   b. 20, 16, 12, 8, …  
   c. $27\frac{1}{2}, 25, 22\frac{1}{2}, 20, …$
In some sequences, the numbers are found by multiplying.

**EXAMPLE**  Extend a Sequence by Multiplying

Describe the pattern in the sequence $5, 15, 45, 135, \ldots$. Then find the next two numbers in the sequence.

$5, 15, 45, 135, \ldots$

$\times 3 \quad \times 3 \quad \times 3$

Each number is multiplied by 3.

The next two numbers in the sequence are 405 and 1,215.

**EXAMPLE**  Use Sequences to Solve a Problem

**SPORTS** The NCAA basketball tournament starts with 64 teams. The second round consists of 32 teams, and the third round consists of 16 teams. How many teams are in the fifth round?

Write the sequence. Find the fifth number.

$64, 32, 16, 8, 4$

$\times \frac{1}{2} \quad \times \frac{1}{2} \quad \times \frac{1}{2} \quad \times \frac{1}{2}$

There are 4 teams in the fifth round.

**Your Turn** Describe each pattern. Then find the next two numbers in each sequence.

- d. $3, 12, 48, 192, \ldots$
- e. $125, 25, 5, 1, \ldots$

---

**Skill and Concept Check**

1. **Writing Math** Tell how the numbers are related in the sequence $9, 3, 1, \frac{1}{3}$.

2. **OPEN ENDED** Write a sequence in which $1\frac{1}{4}$ is added to each number.

3. **FIND THE ERROR** Meghan and Drake are finding the missing number in the sequence $3, 4\frac{1}{2}, \ldots, 7\frac{1}{2}, \ldots$ Who is correct? Explain.

   - **Meghan**
     - $3, 4\frac{1}{2}, 5\frac{1}{2}, \ldots$
   - **Drake**
     - $3, 4\frac{1}{2}, 6, 7\frac{1}{2}, \ldots$

**GUIDED PRACTICE**

Describe each pattern. Then find the next two numbers in the sequence.

- d. $7\frac{1}{2}, 6, 4\frac{1}{2}, 3, \ldots$
- e. $3, 6, 12, 24, \ldots$
- f. $32, 8, 2, \frac{1}{2}, \ldots$

- 7. Find the missing number in the sequence 13, 21, $\ldots$, 37.
Describe each pattern. Then find the next two numbers in the sequence.

8. 2, 3\(\frac{1}{2}\), 5, 6\(\frac{1}{2}\), …
9. 20, 16, 12, 8, …
10. 90, 75, 60, 45, …
11. 8, 16, 32, 64, …
12. 12, 6, 3, 1\(\frac{1}{2}\), …
13. 162, 54, 18, 6, …

Find the missing number in each sequence.

14. 7, __, 16, 20\(\frac{1}{2}\), …
15. 30, __, 19, 13\(\frac{1}{2}\), …
16. __, 16, 4, 1, …
17. __, 1, 3, 9, …

18. **TOOLS** Mr. Black’s drill bit set includes the following sizes (in inches).

\[
\ldots, \frac{13}{64}, \frac{7}{32}, \frac{15}{64}, \frac{1}{4}, \ldots
\]

What are the next two smaller bits?

19. **CRITICAL THINKING** The largest square at the right represents 1.
   a. Find the first ten numbers of the sequence represented by the model. The first number is \(\frac{1}{2}\).
   b. Estimate the sum of the first ten numbers without actually adding. Explain.

---

**Extra Practice**
See pages 609, 630.

**Spiral Review with Standardized Test Practice**

20. **MULTIPLE CHOICE** What number is missing from the sequence 14, 56, __, 896, 3,584?
   A) 284  B) 194  C) 334  D) 224

21. **SHORT RESPONSE** What is the next term in the sequence \(x, x^2, x^3, x^4, \ldots\)?

22. Find \(2\frac{4}{5} \div \frac{7}{10}\). (Lesson 7-5)

23. **FOOD** Each serving of an apple pie is \(\frac{1}{10}\) of the pie. If \(\frac{1}{2}\) of the pie is left, how many servings are left? (Lesson 7-4)

---

**COOKING UP A MYSTERY!**

**Math and Science** It’s time to complete your project. Use the volcano you’ve created and the data you have gathered about volcanoes to prepare a class demonstration. Be sure to include a graph of real volcanic eruptions with your project.

msmath1.net/webquest

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msmath1.net/self_check_quiz
Vocabulary and Concept Check

Determine whether each sentence is true or false. If false, replace the underlined word or number to make a true sentence.

1. Any two numbers whose product is 1 are called **opposites**.
2. When dividing by a fraction, **multiply** by its reciprocal.
3. To multiply fractions, multiply the numerators and **add** the denominators.
4. A list of numbers in a specific order is called a **sequence**.
5. Any whole number can be written as a fraction with a denominator of 1.
6. The reciprocal of $\frac{8}{3}$ is $\frac{3}{8}$.
7. To divide mixed numbers, first write each mixed number as a **decimal**.
8. The missing number in the sequence 45, 41, 37, ____, 29, 25 is 32.

Lesson-by-Lesson Exercises and Examples

**7-1 Estimating Products** (pp. 256–258)

Estimate each product.

9. $\frac{1}{5} \times 21$
10. $10 \times 2\frac{3}{4}$
11. $\frac{5}{6} \times 13$
12. $7\frac{3}{4} \times \frac{1}{4}$
13. $4\frac{5}{6} \times 8\frac{3}{10}$
14. $\frac{3}{7} \times \frac{11}{12}$
15. Estimate $\frac{5}{6}$ of 35.

**Example 1** Estimate $\frac{1}{7} \times 41$.

$\frac{1}{7} \times 41 \rightarrow \frac{1}{7} \times 42$

42 and 7 are compatible numbers since $42 \div 7 = 6$.

$\frac{1}{7} \times 42 = 6$

$\frac{1}{7}$ of 42 is 6.

So, $\frac{1}{7} \times 41$ is about 6.

**7-2 Multiplying Fractions** (pp. 261–264)

Multiply. Write in simplest form.

16. $\frac{1}{3} \times \frac{1}{4}$
17. $\frac{3}{5} \times \frac{2}{9}$
18. $\frac{7}{8} \times \frac{4}{21}$
19. $\frac{5}{6} \times 9$

**Example 2** Find $\frac{3}{10} \times \frac{4}{9}$.

$\frac{3}{10} \times \frac{4}{9} = \frac{1 \cdot 2}{5 \cdot 3}$

Divide the numerator and denominator by the GCF.

$= \frac{2}{15}$

Simplify.
7-3  **Multiplying Mixed Numbers**  (pp. 265–267)

Multiply. Write in simplest form.

- 20. \( \frac{3}{2} \times 4 \frac{1}{2} \)
- 21. \( 6 \frac{5}{8} \times 4 \)
- 22. \( \frac{1}{5} \times 1 \frac{2}{3} \)
- 23. \( 3 \frac{3}{4} \times 1 \frac{1}{5} \)
- 24. \( 3 \frac{1}{8} \times \) \( 2 \frac{2}{5} \)
- 25. \( 2 \frac{1}{4} \times 6 \frac{2}{3} \)

**Example 3**

Find \( \frac{3}{2} \times 4 \frac{2}{3} \).

- Write the numbers as improper fractions.
- Divide 2 and 14 by their GFC, 2.
- Simplify.

7-4  **Dividing Fractions**  (pp. 272–275)

Divide. Write in simplest form.

- 26. \( \frac{2}{3} \div \frac{4}{5} \)
- 27. \( \frac{1}{8} \div \frac{3}{4} \)
- 28. \( 5 \div \frac{4}{9} \)
- 29. \( \frac{3}{8} \div 6 \)

7-5  **Dividing Mixed Numbers**  (pp. 276–279)

Divide. Write in simplest form.

- 30. \( 2 \frac{4}{5} \div 5 \frac{3}{5} \)
- 31. \( 8 \div 2 \frac{1}{2} \)
- 32. **PIZZA**  Bret has 1 \( \frac{1}{2} \) pizzas. The pizzas are to be divided evenly among 6 friends. How much of a pizza will each friend get?

**Example 5**

Find \( 5 \frac{1}{2} \div 1 \frac{5}{6} \).

- Rewrite as improper fractions.
- Multiply by the reciprocal.
- Divide by the GCF.
- Simplify.

7-6  **Patterns and Functions: Sequences**  (pp. 282–284)

Describe each pattern. Then find the next two numbers in the sequence.

- 33. 6, 12, 24, 48, …
- 34. 20, 17 \( \frac{1}{2} \), 15, 12 \( \frac{1}{2} \), …
- 35. 5000, 1000, 200, 40, …
- 36. 11, 21, 31, 41, …

**Example 6**

Describe the pattern. Then find the next two numbers in the sequence 625, 125, 25, 5, ….

Each number is multiplied by \( \frac{1}{5} \).

\[ 5 \times \frac{1}{5} = 1 \]
\[ 1 \times \frac{1}{5} = \frac{1}{5} \]

The next two numbers are 1 and \( \frac{1}{5} \).
1. **Explain** how to multiply a fraction and a whole number.

2. **Define** sequence.

3. **Compare and contrast** dividing two fractions and multiplying two fractions.

---

**Skills and Applications**

Estimate each product.

4. \(38 \times \frac{1}{4}\)  
5. \(\frac{7}{8} \times \frac{5}{6}\)  
6. \(\frac{1}{6} \times 22\)

Multiply. Write in simplest form.

7. \(\frac{9}{10} \times \frac{5}{8}\)  
8. \(6 \times \frac{5}{24}\)  
9. \(\frac{7}{12} \times \frac{3}{28}\)

10. \(1\frac{4}{5} \times 2\frac{2}{3}\)  
11. \(\frac{1}{6} \times 3\frac{3}{8}\)  
12. \(3\frac{1}{5} \times 1\frac{1}{4}\)

**GEOMETRY** Find the area of each rectangle.

13.  
14. 

Divide. Write in simplest form.

15. \(\frac{1}{8} \div \frac{3}{4}\)  
16. \(\frac{2}{5} \div 4\)  
17. \(6 \div 1\frac{4}{5}\)

18. \(\frac{5}{4} \div 1\frac{1}{2}\)  
19. \(\frac{8}{3} \div 2\frac{1}{2}\)  
20. \(3\frac{5}{8} \div 4\)

21. **KITES** Latanya works at a kite store. To make a kite tail, she needs \(2\frac{1}{4}\) feet of fabric. If Latanya has \(29\frac{1}{4}\) feet of fabric, how many kite tails can she make?

Describe each pattern. Then find the next two numbers in the sequence.

22. 14, 19, 24, 29, …  
23. 243, 81, 27, …  
24. 71, 60, 49, 38, …

---

**Standardized Test Practice**

25. **SHORT RESPONSE** There are 24 students in Annie’s math class. If the total number of students at her school is \(21\frac{3}{8}\) times the number of students in her math class, how many students attend Annie’s school?
Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

1. Marta recorded the number of seeds she planted in flowerpots and the plants that grew.

<table>
<thead>
<tr>
<th>Number of Seeds (s)</th>
<th>Number of Plants (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Which expression describes the relationship between the number of seeds \( s \) and the number of plants \( p \)? (Lesson 1-5)

- **A** \( p = s + 1 \)
- **B** \( p = s + 1 \)
- **C** \( p = s + 1 \)
- **D** \( p = 2s \)

2. A city has radio stations with the frequencies 100.8, 101.7, 101.3, and 100.1. Which shows the frequencies ordered from least to greatest? (Lesson 3-2)

- **A** 100.8, 101.7, 101.3, 100.1
- **B** 100.1, 100.8, 101.3, 101.7
- **C** 100.1, 101.3, 101.7, 100.8
- **D** 101.7, 101.3, 100.8, 100.1

3. What is the circumference of the coin below? Use 3.14 for \( \pi \) and round to the nearest tenth. (Lesson 4-6)

- **A** 462.0 mm
- **B** 152.4 mm
- **C** 76.2 mm
- **D** 38.1 mm

4. Blaine finished 17 out of 30 questions. Which is the best estimate of the fraction of questions he finished? (Lesson 6-1)

- **A** \( \frac{1}{4} \)
- **B** \( \frac{3}{4} \)
- **C** \( \frac{1}{2} \)
- **D** \( \frac{7}{8} \)

5. Kelly uses \( 9\frac{1}{8} \) inches of yarn to make a tassel. Which is the best estimate for the amount of yarn that she will need for 16 tassles? (Lesson 7-1)

- **A** 10 in.
- **B** 80 in.
- **C** 150 in.
- **D** 180 in.

6. Which model shows \( \frac{1}{2} \) of \( \frac{1}{2} \)? (Lesson 7-2)

7. What is the value of \( 2\frac{1}{4} \times 3\frac{1}{3} \)? (Lesson 7-3)

- **A** \( \frac{3}{1} \)
- **B** \( \frac{6}{12} \)
- **C** \( \frac{7}{12} \)
- **D** \( \frac{9}{13} \)

8. Which rule can be used to find the next number in the sequence below? (Lesson 7-6)

- **A** Add 9.
- **B** Divide by 3.
- **C** Multiply by 6.
- **D** Subtract 9.

**TEST-TAKING TIP**

Round each mixed number down to a whole number and then multiply. Then round each up to a whole number and then multiply. The answer is between the two products.
Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

9. A roller coaster car holds 4 people. How many people can ride at the same time if there are 50 cars? (Prerequisite Skill, p. 590)

10. The stem-and-leaf plot shows the average lengths of fifteen species of poisonous snakes in Texas.

```
Stem | Leaf       
2    | 0 0 4 4 4 6 6 |
3    | 6 6 6 6 6 6   |
4    | 2 2 8        |
5    | 0 6 | 6 | 6 |
6    | 0 3 | 6 |
```

What is the length of the longest poisonous snake? (Lesson 2-5)

11. Melanie rented a mountain bike for 2 days from Speedy’s Bike Rentals. What did it cost to rent the mountain bike each day? (Lesson 4-3)

<table>
<thead>
<tr>
<th>Type of Bike</th>
<th>Cost for 2 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>mountain bike</td>
<td>$42.32</td>
</tr>
<tr>
<td>racing bike</td>
<td>$48.86</td>
</tr>
</tbody>
</table>

12. Write $1\frac{5}{6}$ as an improper fraction. (Lesson 5-3)

13. A recipe for a two-layer, 8-inch cake calls for a box of cake mix, 2 eggs, and $1\frac{1}{3}$ cups of water. How much of each ingredient is needed to make a three-layer, 8-inch cake? (Lesson 7-3)

14. Colin is walking on a track that is $\frac{1}{10}$ mile long. How many laps should he walk if he wants to walk a total distance of 2 miles? (Lesson 7-4)

15. The pizzas below are to be divided equally among 3 people.

What fraction of a whole pizza will each person get? (Lesson 7-5)

16. If the pattern below continues, what is the perimeter of the sixth square? (Lesson 7-6)

<table>
<thead>
<tr>
<th>Square</th>
<th>Side Length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
</tr>
</tbody>
</table>

Record your answers on a sheet of paper. Show your work.

17. Mr. Williams and Ms. Ling each teach science to 50 students. Two-fifths of Mr. Williams’ students signed up for a field trip to the museum. About two-thirds of Ms. Ling’s students signed up for the same trip. (Lessons 7-1 and 7-2)

   a. About how many of Ms. Ling’s students signed up to go to the museum?
   
   b. How many of Mr. Williams’ students signed up to go to the museum?
   
   c. One fourth of the students who attended the trip from Mr. Williams’ class bought souvenirs. What fraction of his total students attended the trip and bought souvenirs?