**5-2****Greatest Common Factor** (pages 203–206)

The **greatest common factor (GCF)** of two or more numbers is the greatest number that is a factor of each number.

<b>Finding the Greatest Common Factor</b>	<p>To find the GCF of two or more numbers:</p> <ul style="list-style-type: none"> <li>• Method 1: List the factors of each number and then identify the common factors. The greatest of these common factors is the GCF.</li> <li>• Method 2: Write the prime factorization of each number, or divide by prime numbers until the quotient is prime. Then identify all common prime factors and find their product, which is the GCF.</li> </ul>
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**EXAMPLES**

- A** Find the GCF of 12, 20, and 36 by listing factors.

factors of 12: 1, 2, 3, 4, 6, 12

factors of 20: 1, 2, 4, 5, 10, 20

factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36

The greatest of the common factors is 4, which is the GCF of 12, 20, and 36.

- B** Find the GCF of 27 and 90 by using prime factorization.

prime factorization of 27:  $3 \times 3 \times 3$

prime factorization of 90:  $2 \times 3 \times 3 \times 5$

The common prime factors are 3 and 3. Their product is 9. The GCF of 27 and 90 is 9.

**Try These Together**

1. Find the GCF of 12 and 16 by listing factors.

*HINT: Circle the factors common to 12 and 16. Then choose the greatest of those circled.*

2. Find the GCF of  $15 = 3 \times 5$  and  $50 = 2 \times 5^2$  by listing common prime factors.

*HINT: There is only one common prime factor.*

**PRACTICE**

Find the GCF of each set of numbers by listing factors.

3. 54, 81

4. 72, 90

5. 132, 144

6. 20, 36, 44

Find the GCF of each set of numbers by listing common prime factors.

7.  $9 = 3^2$   
 $36 = 2^2 \times 3^2$

8.  $45 = 3^2 \times 5$   
 $81 = 3^4$

Find the GCF of each set of numbers by writing prime factorizations.

9. 12, 48

10. 36, 54

11. 60, 42

12. **Life Science** The smallest adult male gorillas weigh about 135 kilograms. The smallest adult female gorillas weigh about 70 kilograms. What is the greatest common factor of these two numbers?

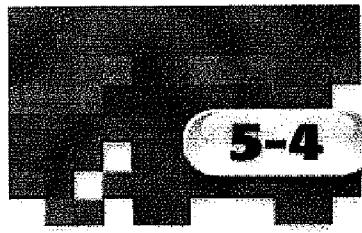
13. **Standardized Test Practice** Find the greatest common factor of 96 and 360.

A 5

B 12

C 36

D 24

**5-4****Decimals and Fractions** (pages 210–213)

Any fraction can be written as a decimal by using division.

<b>Write a Fraction as a Decimal</b>	Use paper and pencil to write $\frac{4}{5}$ as a decimal. $\frac{4}{5}$ means $4 \div 5$ . Divide 4 by 5, and the quotient is the decimal you want to find, 0.8.
<b>Repeating Decimals</b>	Decimals like 0.333333... are called <b>repeating decimals</b> because the digits repeat. <b>Bar notation</b> can be used to indicate that decimals repeat. $0.666666... = 0.\overline{6}$ , $0.277777... = 0.2\overline{7}$ , $0.737373... = 0.\overline{73}$ Bar notation is useful because some fractions, when written as decimals, are repeating decimals. For example, $\frac{2}{3} = 0.\overline{6}$ .

**EXAMPLES**

Express the fractions as decimals. Use bar notation for repeating decimals.

A  $\frac{3}{5}$

$$\frac{3}{5} = 3 \div 5$$

$$\begin{array}{r} 0.6 \\ 5 \overline{)3.0} \\ \underline{-30} \\ 0 \end{array} \quad \begin{array}{l} \text{Divide 3 by 5.} \\ \text{Therefore, } \frac{3}{5} = 0.6. \end{array}$$

B  $\frac{3}{11}$

$$\frac{3}{11} = 3 \div 11$$

$$\begin{array}{r} 0.2727 \dots \\ 11 \overline{)3.00} \\ \underline{-22} \\ 80 \\ \underline{-77} \\ 30 \\ \underline{-22} \\ 8 \end{array}$$

Divide 3 by 11. The digits 2 and 7 will repeat since 8 and 3 will continue to alternate as the remainders.

Therefore,  $\frac{3}{11} = 0.\overline{27}$ .

**Try These Together**

Express each fraction or mixed number as a decimal. If the decimal is a repeating decimal, use bar notation.

1.  $\frac{1}{6}$

HINT: Divide 1 by 6.

2.  $4\frac{7}{8}$

HINT: The whole number is written to the left of the decimal point.

**PRACTICE**

Express each fraction or mixed number as a decimal. If the decimal is a repeating decimal, use bar notation.

3.  $\frac{3}{6}$

4.  $\frac{2}{9}$

5.  $\frac{12}{25}$

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

7.  $8\frac{4}{9}$

8.  $7\frac{1}{4}$

9. **Standardized Test Practice** Suppose that  $\frac{1}{8}$  of D'andre's class scored As on their science exam. Express this fraction as a decimal.

A 0.215

B 0.125

C 0.252

D 0.115

**5-5****Fractions and Percents** (pages 216–219)

A **percent** is a ratio that compares a number to 100. Fractions and percents are ratios that represent the same number.

<b>Expressing a Ratio as a Percent</b>	$\frac{n}{100} = n\%$ To express a ratio as a percent, first write the ratio as a fraction with a denominator of 100. Then rewrite $\frac{n}{100}$ as $n\%$ .
<b>Expressing a Fraction as a Percent</b>	To express a fraction as a percent, multiply both numerator and denominator by the same factor to rewrite the fraction as an equivalent fraction with a denominator of 100.

**EXAMPLES**

- A** Express as a percent: 37 students out of 100.

Write the ratio as a fraction:  $\frac{37}{100}$ .

$\frac{37}{100}$  is 37%.

- B** Express  $\frac{7}{25}$  as a percent.

To rewrite  $\frac{7}{25}$  as an equivalent fraction with a denominator of 100, multiply both numerator and denominator by 4, since  $100 \div 25$  is 4.

$$\frac{7 \times 4}{25 \times 4} = \frac{28}{100}, \frac{28}{100} \text{ is } 28\%.$$

$$\frac{7}{25} = 28\%$$

**Try These Together**

1. Express as a percent: 32.5 square miles in 100.

*HINT: Write as a fraction with a denominator of 100.*

2. Express  $\frac{3}{5}$  as a percent.

*HINT: Recall that  $\frac{n}{100} = n\%$ .*

**PRACTICE**

**Express each ratio or fraction as a percent.**

3. 62 out of 100

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

5.  $\frac{12}{100}$

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

7. \$55 per \$100

8.  $\frac{13}{20}$

9. **Computers** 78 out of 100 computers at Tina's school have CD-ROM drives. Express 78 out of 100 as a percent.

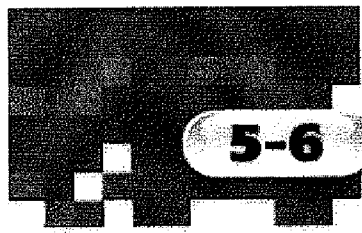
10. **Standardized Test Practice** In Enrique's school, 61 out of every 100 students eat a hot lunch. Express this ratio as a percent.

**A** 3.9%

**B** 6.1%

**C** 61%

**D** 39%

**5-6****Percents and Decimals** (pages 220–223)

Any decimal can also be written as a fraction. You can use this to express any decimal as a percent.

<b>Writing a Decimal as a Percent</b>	To write 0.32 as a percent, multiply the decimal by 100 and add the percent symbol. So, $0.32 = 0.\underline{32} = 32\%$ .
<b>Writing a Percent as a Decimal</b>	To write a percent as a decimal, divide the percent by 100 and remove the percent symbol. $64\% = \underline{64} = 0.64$ .

**EXAMPLES**

**A** Write 0.72 as a percent.

$0.72 = 72\%$  *Multiply the decimal by 100 and add the percent symbol.*

**B** Write 57% as a decimal.

$57\% = 0.57$  *Divide the percent by 100 and remove the percent symbol.*

**Try These Together**

**Express each decimal as a percent.**

1. 0.25

2. 0.76

*HINT: Multiply by 100 and add the percent symbol.*

**PRACTICE**

**Express each decimal as a percent.**

3. 0.54

4. 0.67

5. 0.1

6. 0.08

7. 0.42

8. 0.17

**Express each percent as a decimal.**

9. 48%

10. 75%

11. 9%

12. 23%

13. 35%

14. 99.8%

15. 4%

16. 15.1%

17. What decimal is equivalent to 39.5%?

18. Write the percent that is equivalent to 0.652.

19. **Recycling** In a recent year, the aluminum recycling rate was 62.8%. Write this percent as a decimal.



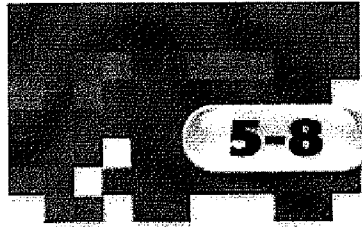
20. **Standardized Test Practice** In the mid-1990s, 48% of the working people in the world were employed in agriculture. How is this percent written as a decimal?

**A** 0.048

**B** 48

**C** 4.8

**D** 0.48



**5-8**

**Comparing and Ordering Rational Numbers**

(pages 227-231)

To compare fractions, rewrite each fraction using the same denominator. Then you only need to compare the numerators.

<p><b>Finding the Least Common Denominator</b></p>	<p>A <b>common denominator</b> is a common multiple of the denominators of two or more fractions. The <b>least common denominator (LCD)</b> is the least common multiple (LCM) of the denominators of two or more fractions.</p> <p>To compare two fractions:</p> <ul style="list-style-type: none"> <li>• find the LCM of the denominators, then</li> <li>• rewrite each fraction using this LCM as the LCD. Compare the numerators.</li> </ul>
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**EXAMPLES**

**A** Find the LCD for  $\frac{5}{6}$  and  $\frac{9}{10}$ .  
*The LCM of 6 and 10 is 30, so the LCD for  $\frac{5}{6}$  and  $\frac{9}{10}$  is 30.*

**B** Is  $\frac{5}{6} <, >, \text{ or } = \frac{9}{10}$ ?  
*Rewrite each fraction with the LCD of 30.*  
*Multiply the numerator and denominator of  $\frac{5}{6}$  by 5.*  
*Multiply the numerator and denominator of  $\frac{9}{10}$  by 3.*

$$\frac{5}{6} = \frac{25}{30} \quad \frac{9}{10} = \frac{27}{30}$$

*Since  $\frac{25}{30} < \frac{27}{30}$ ,  $\frac{5}{6} < \frac{9}{10}$ .*

**Try These Together**

1. Find the LCD for  $\frac{3}{4}$  and  $\frac{2}{3}$ .  
*HINT: Find the LCM of 4 and 3.*

2. Is  $\frac{5}{8} <, >, \text{ or } = 0.4$ ?  
*HINT: Write both rational numbers as fractions with the same denominator or as decimals.*

**PRACTICE**

**Find the LCD for each pair of fractions.**

3.  $\frac{5}{12}, \frac{3}{8}$

4.  $\frac{2}{5}, \frac{4}{7}$

5.  $\frac{4}{15}, \frac{1}{3}$

6.  $\frac{1}{6}, \frac{1}{9}$

7.  $\frac{1}{6}, \frac{5}{7}$

8.  $\frac{19}{30}, \frac{7}{10}$

9.  $\frac{9}{16}, \frac{1}{4}$

10.  $\frac{5}{36}, \frac{11}{24}$

**Replace each  $\bullet$  with  $<, >, \text{ or } =$  to make a true sentence.**

11.  $\frac{8}{9} \bullet \frac{5}{6}$

12.  $\frac{2}{3} \bullet \frac{8}{13}$

13.  $\frac{5}{6} \bullet 0.75$

14.  $\frac{3}{5} \bullet \frac{5}{8}$

15.  $\frac{2}{7} \bullet 0.25$

16.  $0.7 \bullet \frac{14}{20}$

17.  $\frac{5}{11} \bullet \frac{13}{22}$

18.  $\frac{15}{48} \bullet \frac{3}{8}$



19. **Standardized Test Practice** What is the least common denominator for  $\frac{1}{8}$  and  $\frac{5}{6}$ ?

**A** 36

**B** 24

**C** 18

**D** 45

**6-2****Adding and Subtracting Fractions** (pages 244–247)

To add or subtract fractions, the denominators must be the same.

**Adding and Subtracting Fractions with Unlike Denominators**

To add or subtract fractions:

- Rename the fractions with a common denominator as necessary.
- Add or subtract the numerators and use the common denominator in the sum or difference.
- Simplify if necessary.

**EXAMPLES**

**A** Add  $\frac{3}{4} + \frac{5}{6}$ .

Remember that the least common denominator of 4 and 6 is their least common multiple (12).

Multiply to rename with the LCD:

$$\frac{3 \times 3}{4 \times 3} + \frac{5 \times 2}{6 \times 2}$$

Add  $\frac{9}{12} + \frac{10}{12} = \frac{19}{12}$  and simplify:  $1\frac{7}{12}$ .

**B** Subtract  $\frac{2}{3} - \frac{1}{6}$ .

The LCD is 6.

$$\frac{2}{3} - \frac{1}{6} = \frac{2 \times 2}{3 \times 2} - \frac{1}{6} \quad \text{Multiply.}$$

$$= \frac{4}{6} - \frac{1}{6}$$

$$= \frac{3}{6} \quad \text{Subtract.}$$

$$= \frac{1}{2} \quad \text{Simplify.}$$

**Try These Together**

**1.** Add  $\frac{1}{8} + \frac{5}{8}$ .

*HINT: These have a common denominator already.*

**2.** Subtract  $\frac{5}{16} - \frac{1}{4}$ .

*HINT: The LCD is 16.*

**PRACTICE**

Add or subtract. Write each sum or difference in simplest form.

**3.**  $\frac{5}{7} - \frac{2}{3}$

**4.**  $\frac{1}{6} + \frac{3}{4}$

**5.**  $\frac{7}{18} + \frac{2}{9}$

**6.**  $\frac{15}{27} - \frac{1}{3}$

Solve each equation. Write the solution in simplest form.

**7.**  $\frac{1}{7} + \frac{2}{3} = y$

**8.**  $b = \frac{1}{4} + \frac{7}{10}$

**9.**  $\frac{6}{15} + \frac{1}{2} = g$

**10.**  $h = \frac{5}{9} - \frac{1}{4}$

**11. Cooking** A recipe calls for  $\frac{1}{2}$  pound of chocolate chips and  $\frac{1}{4}$  pound of butterscotch chips. How many pounds of chips does it call for all together?

**12. Standardized Test Practice** Mr. Jensen is a flight attendant.  $\frac{1}{4}$  of his

uniforms are black and  $\frac{5}{14}$  of his uniforms are red. What fraction of his uniforms are black or red?

**A**  $\frac{9}{20}$

**B**  $\frac{2}{3}$

**C**  $\frac{6}{18}$

**D**  $\frac{17}{28}$

**6-3****Adding and Subtracting Mixed Numbers**

(pages 248–251)

You can add or subtract mixed numbers with steps similar to those you used for adding or subtracting fractions.

**Adding and Subtracting Mixed Numbers**

To add or subtract mixed numbers:

- Add or subtract the fraction parts, renaming them if necessary.
- Add or subtract the whole numbers and simplify.

**EXAMPLE**Subtract  $3\frac{1}{4} - 2\frac{5}{8}$ .

$$3\frac{1}{4} - 2\frac{5}{8} = 3\frac{2}{8} - 2\frac{5}{8}$$

The LCD is 8.

$$= 2\frac{8}{8} + \frac{2}{8} - 2\frac{5}{8}$$

Rename, since you cannot subtract  $\frac{5}{8}$  from  $\frac{2}{8}$ .

$$= 2\frac{10}{8} - 2\frac{5}{8}$$

$$= \frac{5}{8}$$

Subtract.  $\frac{10}{8} - \frac{5}{8} = \frac{5}{8}$ ,  $2 - 2 = 0$ **Try These Together**

1. Complete:  $2\frac{1}{5} = 1\frac{\square}{5}$ .

2. Complete:  $4\frac{5}{8} = 3\frac{\square}{8}$ .

HINT:  $2\frac{1}{5}$  is  $1 + 1 + \frac{1}{5}$ . How many fifths is 1?

HINT: How many eighths is 1?

**PRACTICE****Complete.**

3.  $8\frac{1}{6} = 7\frac{\square}{6}$

4.  $6\frac{10}{7} = 7\frac{\square}{7}$

5.  $5\frac{2}{3} = 4\frac{\square}{3}$

6.  $8\frac{7}{5} = \square\frac{2}{5}$

**Add or subtract. Write each sum or difference in simplest form.**

7.  $3\frac{5}{8} + 1\frac{1}{8}$

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

9.  $2\frac{4}{9} + 4\frac{1}{3}$

10.  $5\frac{1}{4} - 3\frac{2}{7}$

11. **Standardized Test Practice** Dierdre cut off and discarded  $3\frac{1}{8}$  inches

from a  $12\frac{1}{2}$ -inch-long piece of wrapping paper to wrap a gift. How long was the piece of wrapping paper she used?

A  $16\frac{3}{8}$  inches

B  $9\frac{3}{8}$  inches

C  $15\frac{5}{8}$  inches

D  $10\frac{1}{8}$  inches

**6-4****Multiplying Fractions and Mixed Numbers**

(pages 254–257)

You can multiply fractions and mixed numbers that have the same or different denominators.

<b>Multiplying Fractions</b>	To multiply fractions, multiply the numerators and then multiply the denominators. $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$ ( $b$ and $d$ are not equal to 0.)
<b>Multiplying Mixed Numbers</b>	To multiply mixed numbers, rename each mixed number as an improper fraction. Then multiply the fractions.

**EXAMPLES**

**A**  $\frac{3}{4} \times \frac{2}{9}$

$$\frac{3}{4} \times \frac{2}{9} = \frac{\overset{1}{\cancel{3}}}{2\cancel{4}} \times \frac{2^{\cancel{1}}}{\overset{1}{\cancel{9}}_3}$$

The GCF of 3 and 9 is 3.  
The GCF of 2 and 4 is 2.

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

**B**  $1\frac{1}{4} \times 3\frac{2}{5}$

$$1\frac{1}{4} \times 3\frac{2}{5} = \frac{5}{4} \times \frac{17}{5}$$

Rename the mixed numbers as improper fractions.

$$= \frac{1}{4} \times \frac{17}{1}$$

The GCF of 5 and 5 is 5.

$$= \frac{17}{4} \text{ or } 4\frac{1}{4}$$

**Try These Together**

1.  $\frac{1}{4} \times \frac{3}{5}$

*HINT: Multiply numerators and then multiply denominators.*

2.  $\frac{5}{8} \times \frac{4}{5}$

*HINT: Divide numerators and denominators by any GCFs to simplify before you multiply.*

**PRACTICE**

**Multiply.** Write each product in simplest form.

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

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

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

6.  $2\frac{1}{2} \times 1\frac{3}{4}$

7.  $\frac{9}{10} \times \frac{6}{7}$

8.  $\frac{6}{13} \times \frac{1}{2}$

9.  $\frac{5}{8} \times \frac{2}{5}$

10.  $3\frac{2}{3} \times 2\frac{1}{3}$

**Solve each equation.** Write the solution in simplest form.

11.  $1\frac{2}{5} \times 2 = r$

12.  $2\frac{1}{4} \times \frac{4}{9} = s$

13.  $4\frac{1}{2} \times \frac{1}{12} = t$

- 14. Standardized Test Practice** For a science experiment, Evan needs 3 pieces of string that are each  $5\frac{1}{2}$  inches long. How many inches of string does he need total?

**A**  $66\frac{1}{4}$

**B**  $33\frac{1}{4}$

**C**  $15\frac{1}{2}$

**D**  $16\frac{1}{2}$

**6-6****Dividing Fractions and Mixed Numbers**

(pages 264–266)

To divide by a fraction, multiply by its multiplicative inverse or reciprocal.

**Dividing by a Fraction**You can rewrite  $\frac{a}{b} \div \frac{c}{d}$  as  $\frac{a}{b} \times \frac{d}{c}$ , where  $b$ ,  $c$ , and  $d \neq 0$ .**EXAMPLES****A** Find  $\frac{2}{7} \div \frac{3}{5}$ .

$$\begin{aligned}\frac{2}{7} \div \frac{3}{5} &= \frac{2}{7} \times \frac{5}{3} \\ &= \frac{10}{21}\end{aligned}$$

 $\frac{5}{3}$  is the multiplicative inverse of  $\frac{3}{5}$ .

Multiply.

**B** Find  $3\frac{1}{2} \div 5\frac{4}{9}$ .

$$\begin{aligned}3\frac{1}{2} \div 5\frac{4}{9} &= \frac{7}{2} \div \frac{49}{9} \\ &= \frac{7}{2} \times \frac{9}{49} \\ &= \frac{9}{14}\end{aligned}$$

Rewrite the improper fractions as mixed numbers.

The GCF of 7 and 49 is 7.

Multiply.

**Try These Together**1. Find  $\frac{3}{8} \div 3$ .HINT: Rewrite  $\div 3$  as  $\times \frac{1}{3}$ .2. Find  $\frac{2}{5} \div \frac{2}{3}$ .HINT: Rewrite  $\div \frac{2}{3}$  as  $\times \frac{3}{2}$ .**PRACTICE**

Divide. Write each quotient in simplest form.

3.  $\frac{5}{7} \div \frac{4}{7}$

4.  $\frac{8}{11} \div \frac{3}{4}$

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

6.  $4\frac{4}{7} \div \frac{4}{5}$

Solve each equation.

7.  $r = \frac{4}{7} \div 2$

8.  $\frac{8}{9} \div 3\frac{1}{4} = s$

9.  $t = \frac{5}{6} \div \frac{2}{3}$

10.  $w = \frac{1}{3} \div \frac{1}{2}$

**11. Standardized Test Practice** Taina has  $3\frac{1}{9}$  yards of material that she wants to split into 4 pieces of equal length for a project. How long will each piece be?

**A**  $\frac{7}{9}$  yd

**B**  $1\frac{2}{7}$  yd

**C**  $3\frac{1}{36}$  yd

**D**  $\frac{3}{4}$  yd

# Changing Customary Units (pages 267-269)

Customary units of weight are the **ounce, pound, and ton.**

$$1 \text{ pound (lb)} = 16 \text{ ounces (oz)}$$

$$1 \text{ ton (T)} = 2,000 \text{ pounds}$$

Customary units of liquid capacity are the **cup, pint, quart, and gallon.**

$$1 \text{ cup (c)} = 8 \text{ fluid ounces (fl oz)}$$

$$1 \text{ pint (pt)} = 2 \text{ cups}$$

$$1 \text{ quart (qt)} = 2 \text{ pints}$$

$$1 \text{ gallon (gal)} = 4 \text{ quarts}$$

### Converting Units

- When you change from a larger unit to a smaller unit, multiply. There will be a greater number of smaller units than larger units.
- When you change from a smaller unit to a larger unit, divide. There will be fewer larger units than smaller units.

### EXAMPLES

**A** Change 5 cups to pints.

*Cup is a smaller unit than pint. Divide.*

$$5 \div 2 = 2\frac{1}{2}$$

$$5 \text{ cups} = 2\frac{1}{2} \text{ pints}$$

**B** Change 32 pounds to ounces.

*Pound is larger than ounce. Multiply.*

$$32 \times 16 = 512$$

$$32 \text{ pounds} = 512 \text{ ounces}$$

### Try These Together

1.  $8 \text{ qt} = \underline{\quad} \text{ gal}$

*HINT: Quart is smaller than gallon.*

2.  $2\frac{1}{2} \text{ c} = \underline{\quad} \text{ fl oz}$

*HINT: Cup is larger than fluid ounce.*

### PRACTICE

**Complete.**

3.  $3\frac{2}{5} \text{ T} = \underline{\quad} \text{ lb}$

4.  $5 \text{ qt} = \underline{\quad} \text{ pt}$

5.  $8 \text{ lb} = \underline{\quad} \text{ oz}$

6.  $8,000 \text{ lb} = \underline{\quad} \text{ T}$

7.  $5\frac{1}{4} \text{ gal} = \underline{\quad} \text{ qt}$

8.  $6 \text{ pt} = \underline{\quad} \text{ qt}$

9.  $5\frac{3}{4} \text{ pt} = \underline{\quad} \text{ c}$

10.  $12 \text{ qt} = \underline{\quad} \text{ gal}$

11.  $16 \text{ fl oz} = \underline{\quad} \text{ c}$

**12. Space Exploration** During liftoff, the space shuttle's three main engines each use 1,000 lbs of fuel every second. How many tons of fuel do the three engines use together in one second?

**13. Food** A fast food restaurant sells 16-ounce drinks. How many cups are in a 16-ounce drink?

**14. Standardized Test Practice** Mauri's little sister weighed exactly 7 pounds when she was born. How many ounces did she weigh?

**A** 70

**B** 56

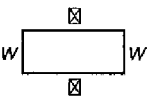

**C** 112

**D** 23

**6-8**

**Perimeter and Area** (pages 270-273)

The distance around a geometric figure is called its **perimeter**. The **area** ( $A$ ) of a closed figure is the number of square units needed to cover its surface.

<p><b>Finding the Perimeter of a Rectangle</b></p>	<p>The perimeter of a rectangle is the sum of the measures of the sides. It can also be expressed as 2 times the length (<math>\ell</math>) plus 2 times the width (<math>w</math>).  <math>P = \ell + w + \ell + w</math> or <math>P = 2\ell + 2w</math></p>	
<p><b>Area of Rectangles</b></p>	<p>The area (<math>A</math>) of a rectangle equals the product of its length (<math>\ell</math>) and width (<math>w</math>).  <math>A = \ell w</math></p>	

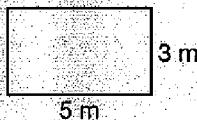
**EXAMPLES**

**A** Find the perimeter of a rectangle with a length of 4 yards and a width of 3 yards.  
 $P = 2\ell + 2w$   
 $P = 2(4) + 2(3)$  Replace  $\ell$  with 4 and  $w$  with 3.  
 $P = 14$  yd

**B** Find the area of a rectangle with a length of 20 cm and a width of 4 cm.  
 $A = \ell w$  Write the formula for area.  
 $A = 20 \times 4$  Replace  $\ell$  with 20 and  $w$  with 4.  
 $A = 80$  Multiply.  
 The area is  $80 \text{ cm}^2$ .

**Try These Together**

1. Find the perimeter of the figure.



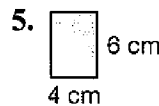
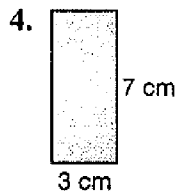
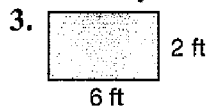
*HINT: Use the formula for the perimeter of a rectangle.*

2. Find the area of a rectangle with a length of 15 in. and a width of 12 in.

*HINT: The area of a rectangle is length times width.*

**PRACTICE**

Find the perimeter and area of each rectangle.



6. rectangle:  $\ell = 12$  inches  
 $w = 4$  inches

7. rectangle:  $\ell = 3$  cm  
 $w = 2$  cm

8. rectangle:  $\ell = 8$  feet  
 $w = 5$  feet

9. **Standardized Test Practice** The Angtuaco family is putting sod in their backyard. Their backyard is in the shape of a rectangle with a width of 60 feet and a length of 100 feet. How many square feet of sod will they need to cover their backyard?

**A** 120  $\text{ft}^2$

**B** 600  $\text{ft}^2$

**C** 6,000  $\text{ft}^2$

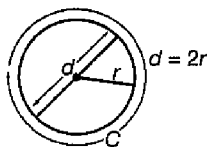
**D** 1,200  $\text{ft}^2$

# Circles and Circumferences

(pages 275–277)

A **circle** is the set of all points in a plane that are the same distance from a given point called the **center**. The **diameter** ( $d$ ) is the distance across the circle through its center. The **radius** ( $r$ ) is the distance from the center to any point on the circle. The **circumference** ( $C$ ) is the distance around the circle.

### Finding the Circumference of a Circle



The circumference of a circle is equal to  $\pi$  times its diameter or  $\pi$  times twice the radius.

$$C = \pi d$$

or

$$C = 2\pi r$$

You can use 3.14 or  $\frac{22}{7}$  as approximate values for  $\pi$ .

### EXAMPLES

- A** Find the circumference of a circle with a diameter of 9 inches.

$$C = \pi d$$

$$C \approx 3.14 \times 9 \quad \text{Replace } \pi \text{ with 3.14 and } d \text{ with 9.}$$

$$C \approx 28.26 \text{ inches}$$

- B** Find the circumference of a circle with a radius of 5 feet.

$$C = 2\pi r$$

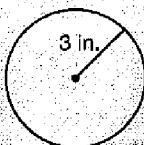
$$C \approx 2 \times 3.14 \times 5 \quad \text{Replace } \pi \text{ with 3.14 and } r \text{ with 5.}$$

$$C \approx 31.4 \text{ feet}$$

### Try These Together

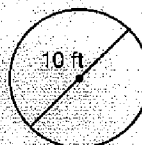
Find the circumference of each circle.

1.



HINT: Replace  $r$  with 3.

2.



HINT: Replace  $d$  with 10.

### PRACTICE

Find the circumference of each circle. Use 3.14 or  $\frac{22}{7}$  for  $\pi$ . Round to the nearest tenth if necessary.

3.  $d = 18$  cm

4.  $d = 24$  m

5.  $r = 7$  in.

6.  $r = 4$  ft

7. **Recreation** A plastic disc for throwing through the air has a diameter of 12 inches. What is its circumference?

8. **Standardized Test Practice** Find the circumference of a circle whose radius is 15 centimeters.

**A** 47.1 cm

**B** 94.2 cm

**C** 23.6 cm

**D** 65.3 cm

**7-3****Solving Proportions** (pages 297–300)

You can show that two ratios are equivalent with an equation called a **proportion**. When two ratios form a proportion, the **cross products** are equal. You can solve a proportion by using cross products to find a missing term.

**EXAMPLES**

- A** Can you form a proportion with the ratios  $\frac{1}{2}$  and  $\frac{5}{10}$ ?

$$\frac{1}{2} = \frac{5}{10} \quad \text{Set the ratios equal to each other.}$$

$$\begin{array}{c} \textcircled{1} \times \textcircled{5} \\ \textcircled{2} = \textcircled{10} \end{array} \quad 1 \times 10 = 10 \text{ and } 2 \times 5 = 10$$

Since the cross products are equal, the ratios form a proportion.

**B** Solve  $\frac{u}{64} = \frac{3}{16}$ .

$$u \times 16 = 64 \times 3 \quad \text{Find the cross products.}$$

$$16u = 192$$

$$\frac{16u}{16} = \frac{192}{16} \quad \text{Divide each side by 16.}$$

$$u = 12 \quad \text{The solution is 12.}$$

**Try These Together**

Solve each proportion.

1.  $\frac{2}{3} = \frac{x}{9}$

Hint:  $2 \cdot 9 = 3x$ .

2.  $\frac{3}{y} = \frac{1}{4}$

Hint: Find the cross products.

**PRACTICE**

Solve each proportion.

3.  $\frac{10}{16} = \frac{5}{n}$

4.  $\frac{j}{2} = \frac{1}{4}$

5.  $\frac{8}{6} = \frac{p}{3}$

6.  $\frac{15}{18} = \frac{5}{k}$

7.  $\frac{z}{40} = \frac{8}{80}$

8.  $\frac{6}{12} = \frac{3}{f}$

9.  $\frac{7}{3} = \frac{q}{21}$

10.  $\frac{r}{6} = \frac{5}{30}$

11. Find the value of  $x$  that makes  $\frac{x}{15} = \frac{8}{20}$  a proportion.

12. **Surveys** A survey at Lincoln Middle School found that 6 of every 10 students prefer math class to science class. If there are 400 students at the school, how many of them would you expect to prefer math class to science class?

13. **Standardized Test Practice** A factory can produce 1,500 cans of juice in 3 hours. How many cans of juice can they produce in 8 hours?

**A** 2,000

**B** 4,000

**C** 8,000

**D** 6,000

# Fractions, Decimals, and Percents (pages 312–315)

You can use a proportion to express a fraction as a percent. To write a percent as a fraction, begin with a fraction that has a denominator of 100.

Then write the fraction in simplest form. Recall that  $\frac{n}{100} = n\%$ .

## EXAMPLES

**A** Write  $\frac{4}{5}$  as a percent.

$$\frac{4}{5} = \frac{n}{100} \quad \text{Write a proportion}$$

$$400 = 5n \quad \text{Multiply to find the cross products.}$$

$$\frac{400}{5} = \frac{5n}{5} \quad \text{Divide each side by 5.}$$

$$80 = n$$

$$\frac{4}{5} = 80\%$$

**B** Write 24% as a fraction in simplest form.

*Estimate: 24% is about 25%, which is  $\frac{1}{4}$ .*

$$24\% = \frac{24}{100}$$

$$= \frac{24 \div 4}{100 \div 4} \quad \text{The GCF is 4.}$$

$$= \frac{6}{25}$$

$$24\% = \frac{6}{25} \quad \text{Compare to the estimate.}$$

## Try These Together

Write each fraction as a percent.

1.  $\frac{2}{5}$

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

*HINT: Solve a proportion in which the fraction is equal to  $\frac{n}{100}$ .*

## PRACTICE

Write each fraction as a percent.

3.  $\frac{3}{10}$

4.  $\frac{3}{4}$

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

6.  $\frac{15}{20}$

7.  $\frac{4}{16}$

8.  $\frac{3}{5}$

Write each percent as a fraction in simplest form.

9. 20%

10. 85%

11. 25%

12. 62.5%

13. 87.5%

14. 30%

15. 15%

16. 37.5%

17. **Hobbies** At a hot air balloon festival, 60% of the hot air balloons were partially colored red. Write the percent of hot air balloons that were partially colored red as a fraction in simplest form.

18. **Standardized Test Practice** A store advertised a sale where every item was  $\frac{1}{8}$  off. What is this fraction written as a percent?

**A** 2.5%

**B** 12.5%

**C** 22.5%

**D** 37.5%

# 7-8

## The Percent Proportion (pages 323–325)

The **percent proportion** is  $\frac{a}{b} = \frac{p}{100}$ , where  $a$  represents the **part**,  $b$  represents the **base**, and  $p$  represents the **percent**. Using the proportion  $\frac{1}{2} = \frac{50}{100}$ , you can see how to use the percent proportion to solve the three basic types of percent equations.

<b>Find the Percent</b>	1 is what percent of 2?	$\frac{1}{2} = \frac{p}{100}$
<b>Find the Part</b>	What number is 50% of 2?	$\frac{a}{2} = \frac{50}{100}$
<b>Find the Base</b>	1 is 50% of what number?	$\frac{1}{b} = \frac{50}{100}$

### EXAMPLES

**A** 32 is 40% of what number?

$$\frac{32}{b} = \frac{40}{100}$$

Write the percent proportion replacing  $a$  with 32 and  $p$  with 40.

$32 \times 100 = b \times 40$  Find the cross products.

$$\frac{3,200}{40} = \frac{40b}{40}$$

Divide each side by 40.

$$80 = b$$

So, 32 is 40% of 80.

**B** 30 is what percent of 150?

$$\frac{30}{150} = \frac{p}{100}$$

Write the percent proportion replacing  $a$  with 30 and  $b$  with 150.

$30 \times 100 = 150 \times p$  Find the cross products.

$$\frac{3,000}{150} = \frac{150p}{150}$$

Divide each side by 150.

$$20 = p$$

So, 30 is 20% of 150.

### Try These Together

Find each number. Round to the nearest tenth if necessary.

- 6 is what percent of 12?
- What number is 68% of 90?

### PRACTICE

Find each number. Round to the nearest tenth if necessary.

- What percent of 24 is 6?
- 8% of what number is 10?
- What number is 60% of 20?
- What percent of 400 is 60?
- Find 110% of 16.
- What percent of 40 is 8?
- 15 is 30% of what number?
- What percent of 96 is 12?
- What number is 12% of 50?
- 90 is 45% of what number?

**13. Standardized Test Practice** During a flu epidemic, 3 of the 20 students in Marina's class were absent with the flu. What percent of the students in Marina's class were absent?

**A** 10%

**B** 5%

**C** 20%

**D** 15%

# Area of Triangles and Trapezoids (pages 489–492)

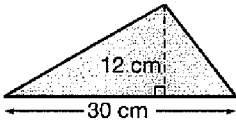
You can use the following formulas to find the area of triangles and trapezoids.

<b>Area of a Triangle</b>	The area ( $A$ ) of a triangle equals half of the product of its base ( $b$ ) and height ( $h$ ), or $A = \frac{1}{2}bh$ .
<b>Area of a Trapezoid</b>	The area ( $A$ ) of a trapezoid equals half the product of the height ( $h$ ) and the sum of the bases ( $b_1 + b_2$ ), or $A = \frac{1}{2}h(b_1 + b_2)$ .

### EXAMPLES

Find the area of each figure.

**A**



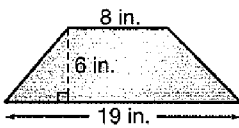
$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2} \times 30 \times 12$$

$$A = 15 \times 12$$

$$A = 180 \text{ cm}^2$$

**B**



$$A = \frac{1}{2}h(b_1 + b_2)$$

$$A = \frac{1}{2}(6)(8 + 19)$$

$$A = (3)(27)$$

$$A = 81 \text{ in}^2$$

### Try These Together

Find the area of each triangle or trapezoid to the nearest tenth.

1. base: 4 in.  
height: 9 in.

*HINT: Substitute values carefully.*

2. bases: 8 cm, 2 cm  
height: 14 cm

*HINT: Do not forget to add the bases.*

### PRACTICE

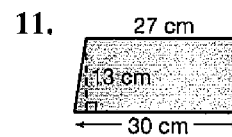
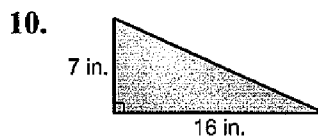
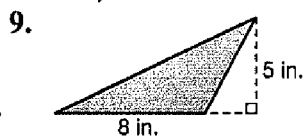
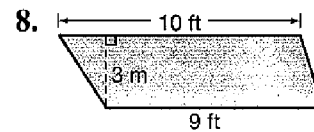
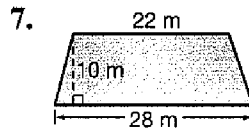
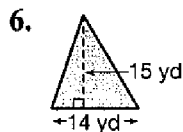
Find the area of each triangle or trapezoid to the nearest tenth.

3. base: 1.2 cm  
height: 1.8 cm

4. base: 23 yd  
height: 8 yd

5. bases: 5 ft, 13 ft  
height: 9 ft

Find the area of each figure to the nearest tenth.



12. **Standardized Test Practice** What is the area of a trapezoid with bases of 9 centimeters and 11 centimeters and a height of 4 centimeters?

**A** 40 cm<sup>2</sup>

**B** 80 cm<sup>2</sup>

**C** 160 cm<sup>2</sup>

**D** 396 cm<sup>2</sup>

# 11-6 Area of Circles (pages 493–495)

You can use the formula below to find the area of a circle. You can use your calculator for calculations involving  $\pi$ .

<b>Area of a Circle</b>	The area ( $A$ ) of a circle equals the product of pi ( $\pi$ ) and the square of its radius ( $r$ ), or $A = \pi r^2$ .
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### EXAMPLES

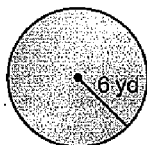
- A** Find the area of the circle to the nearest tenth.

$$A = \pi r^2$$

$$A = \pi \times 6^2$$

$$A = \pi \times 36$$

$$A \approx 113.1 \text{ yd}^2$$



- B** Find the length of the radius of a circle with an area of  $96 \text{ m}^2$ .

$$A = \pi r^2 \quad \text{Use the formula for the area of a circle.}$$

$$96 = \pi r^2 \quad \text{Substitute the area.}$$

$$\frac{96}{\pi} = \frac{\pi r^2}{\pi} \quad \text{Divide each side by } \pi.$$

$$30.6 \approx r^2 \quad \text{Use a calculator.}$$

$$\sqrt{30.6} \approx r, \text{ so } 5.5 \approx r$$

The radius is about 5.5 m.

### Try These Together

Find the area of each circle to the nearest tenth.

1. diameter: 5 in.

2. diameter: 8 m

*HINT: Use the diameter length to find the radius before you use the area formula.*

### PRACTICE

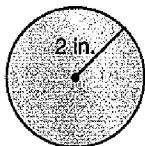
Find the area of each circle to the nearest tenth.

3. radius: 19 cm

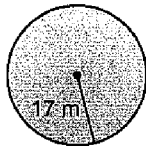
4. radius: 11.3 m

5. radius: 16 yd

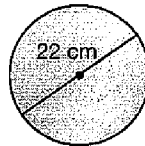
6.



7.



8.



Find the length of the radius of each circle given the following areas. Round to the nearest tenth.

9.  $18 \text{ yd}^2$     10.  $60 \text{ m}^2$     11.  $75 \text{ m}^2$     12.  $23 \text{ cm}^2$     13.  $48 \text{ in}^2$     14.  $32 \text{ cm}^2$

15. **Music** The diameter of a compact disc (CD) is 12 centimeters. The diameter of its hole is 1.5 centimeters. What is the area of one side of a CD?

16. **Standardized Test Practice** What is the area of a circle with a diameter of 18 meters?

**A**  $2.4 \text{ m}^2$

**B**  $5.7 \text{ m}^2$

**C**  $254.5 \text{ m}^2$

**D**  $1,017.8 \text{ m}^2$

**12-3****Volume of Cylinders** (pages 524–527)

A stack of coins is a model of a **cylinder**. A cylinder is a solid figure that has two congruent, parallel circles as its bases. Use the formula below to find the volume of a cylinder.

**Volume of a Cylinder**

Find the volume ( $V$ ) of a cylinder by multiplying the area of the base ( $\pi r^2$ ) by the height ( $h$ ).  
 $V = Bh$  or  $V = \pi r^2 h$

**EXAMPLE**

Find the volume of a cylinder with a diameter of 8 centimeters and a height of 10 centimeters.

The diameter of the cylinder is 8 cm. Therefore, the radius is 4 cm.

Estimate:  $4^2 \times 3 \times 10 = 480$

$$V = \pi r^2 h$$

$$V \approx 3.14 \times 4^2 \times 10 \quad \text{Substitute the values for } \pi, r, \text{ and } h.$$

$$V \approx 502.4$$

The cylinder has a volume of about 502 cubic centimeters.

**Try These Together**

**Find the volume of each cylinder to the nearest tenth.**

1. diameter, 2 m; height, 5 m

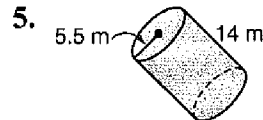
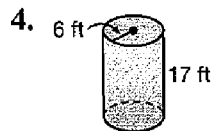
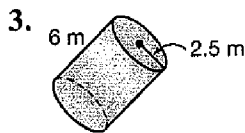
*HINT: Change the diameter to the radius and then find the area of the base. Multiply the area of the base by the height.*

2. radius, 8 in.; height, 14 in.

*HINT: Find the area of the base and then multiply it by the height.*

**PRACTICE**

**Find the volume of each cylinder to the nearest tenth.**



6. **Packaging** The diameter of a can of tuna is 3 inches and the height is 2 inches. Find the approximate volume of the can.

7. **Standardized Test Practice** Stella has a can full of water that is 6 cm tall and 8 cm in diameter. She wants to pour the water into a can that is 4 cm in diameter. How tall must the can be?

**A** 12 cm

**B** 3 cm

**C** 24 cm

**D** 18 cm