Consumable Workbooks

Many of the worksheets contained in the Chapter Resource Masters booklets are available as consumable workbooks in both English and Spanish.

- **Study Guide and Intervention Workbook**: 0-07-860085-5
- **Study Guide and Intervention Workbook (Spanish)**: 0-07-860091-X
- **Practice: Skills Workbook**: 0-07-860086-3
- **Practice: Skills Workbook (Spanish)**: 0-07-860092-8
- **Practice: Word Problems Workbook**: 0-07-860087-1
- **Practice: Word Problems Workbook (Spanish)**: 0-07-860093-6
- **Reading to Learn Mathematics Workbook**: 0-07-861057-5

**Answers for Workbooks** The answers for Chapter 10 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

**Spanish Assessment Masters** Spanish versions of forms 2A and 2C of the Chapter 10 Test are available in the *Glencoe Mathematics: Applications and Concepts Spanish Assessment Masters, Course 1* (0-07-860095-2).
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Teacher’s Guide to Using the Chapter 10 Resource Masters

The Fast File Chapter Resource system allows you to conveniently file the resources you use most often. The Chapter 10 Resource Masters includes the core materials needed for Chapter 10. These materials include worksheets, extensions, and assessment options. The answers for these pages appear at the back of this booklet.

All of the materials found in this booklet are included for viewing and printing in the Glencoe Mathematics: Applications and Concepts, Course 1, TeacherWorks CD-ROM.

Vocabulary Builder Pages vii-viii include a student study tool that presents up to twenty of the key vocabulary terms from the chapter. Students are to record definitions and/or examples for each term. You may suggest that students highlight or star the terms with which they are not familiar.

When to Use Give these pages to students before beginning Lesson 10-1. Encourage them to add these pages to their mathematics study notebook. Remind them to add definitions and examples as they complete each lesson.

Family Letter and Family Activity Page ix is a letter to inform your students’ families of the requirements of the chapter. The family activity on page x helps them understand how the mathematics students are learning is applicable to real life.

When to Use Give these pages to students to take home before beginning the chapter.

Study Guide and Intervention There is one Study Guide and Intervention master for each lesson in Chapter 10.

When to Use Use these masters as reteaching activities for students who need additional reinforcement. These pages can also be used in conjunction with the Student Edition as an instructional tool for students who have been absent.

Practice: Skills There is one master for each lesson. These provide practice that more closely follows the structure of the Practice and Applications section of the Student Edition exercises.

When to Use These provide additional practice options or may be used as homework for second day teaching of the lesson.

Practice: Word Problems There is one master for each lesson. These provide practice in solving word problems that apply the concepts of the lesson.

When to Use These provide additional practice options or may be used as homework for second day teaching of the lesson.

Reading to Learn Mathematics One master is included for each lesson. The first section of each master asks questions about the opening paragraph of the lesson in the Student Edition. Additional questions ask students to interpret the context of and relationships among terms in the lesson. Finally, students are asked to summarize what they have learned using various representation techniques.

When to Use This master can be used as a study tool when presenting the lesson or as an informal reading assessment after presenting the lesson. It is also a helpful tool for ELL (English Language Learner) students.
**Enrichment**  There is one extension master for each lesson. These activities may extend the concepts in the lesson, offer an historical or multicultural look at the concepts, or widen students' perspectives on the mathematics they are learning. These are not written exclusively for honors students, but are accessible for use with all levels of students.

**When to Use**  These may be used as extra credit, short-term projects, or as activities for days when class periods are shortened.

**Assessment Options**

The assessment masters in the *Chapter 10 Resources Masters* offer a wide range of assessment tools for intermediate and final assessment. The following lists describe each assessment master and its intended use.

**Chapter Assessment**

**Chapter Tests**

- **Form 1** contains multiple-choice questions and is intended for use with basic level students.

- **Forms 2A and 2B** contain multiple-choice questions aimed at the average level student. These tests are similar in format to offer comparable testing situations.

- **Forms 2C and 2D** are composed of free-response questions aimed at the average level student. These tests are similar in format to offer comparable testing situations. Grids with axes are provided for questions assessing graphing skills.

- **Form 3** is an advanced level test with free-response questions. Grids without axes are provided for questions assessing graphing skills.

All of the above tests include a free-response Bonus question.

- **The Extended-Response Assessment** includes performance assessment tasks that are suitable for all students. A scoring rubric is included for evaluation guidelines. Sample answers are provided for assessment.

- **A Vocabulary Test**, suitable for all students, includes a list of the vocabulary words in the chapter and ten questions assessing students' knowledge of those terms. This can also be used in conjunction with one of the chapter tests or as a review worksheet.

**Intermediate Assessment**

- Four free-response **quizzes** are included to offer assessment at appropriate intervals in the chapter.

- A **Mid-Chapter Test** provides an option to assess the first half of the chapter. It is composed of both multiple-choice and free-response questions.

**Continuing Assessment**

- The **Cumulative Review** provides students an opportunity to reinforce and retain skills as they proceed through their study of *Glencoe Mathematics: Applications and Concepts*, Course 1. It can also be used as a test. This master includes free-response questions.

- The **Standardized Test Practice** offers continuing review of pre-algebra concepts in various formats, which may appear on the standardized tests that they may encounter. This practice includes multiple-choice, short response, grid-in, and extended response questions. Bubble-in and grid-in answer sections are provided on the master.

**Answers**

- Page A1 is an answer sheet for the Standardized Test Practice questions that appear in the Student Edition on pages 422–423. This improves students' familiarity with the answer formats they may encounter in test taking.

- Detailed rubrics for assessing the extended response questions on page 423 are provided on page A2.

- The answers for the lesson-by-lesson masters are provided as reduced pages with answers appearing in red.

- Full-size answer keys are provided for the assessment masters in this booklet.
This is an alphabetical list of new vocabulary terms you will learn in Chapter 10. As you study the chapter, complete each term’s definition or description. Remember to add the page number where you found the term. Add these pages to your math study notebook to review vocabulary at the end of the chapter.

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<tr>
<th>Vocabulary Term</th>
<th>Found on Page</th>
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<td>scale model</td>
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<tr>
<td>unit rate</td>
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</table>
Dear Parent or Guardian:

Ratios, rates, percents, and proportions help us to make decisions. We can use them to make models of objects and to determine distances on a map. We can also use them to make budget decisions, to determine the better buy at a grocery store, and to calculate sales tax.

In Chapter 10: Ratio, Proportion, and Percent, your child will learn how to express ratios and rates as fractions, to solve proportions, and to solve problems by drawing a diagram. Your child will also learn how to express percents as fractions and decimals and to find the percent of a number. Your child will complete a variety of daily classroom assignments and activities and possibly produce a chapter project.

By signing this letter and returning it with your child, you agree to encourage your child by getting involved. Enclosed is an activity you can do with your child that also relates the math we will be learning in Chapter 10 to the real world. You may also wish to log on to the Online Study Tools for self-check quizzes, Parent and Student Study Guide pages, and other study help at www.msmath1.net. If you have any questions or comments, feel free to contact me at school.

Sincerely,

Signature of Parent or Guardian ___________________________ DATE __________
Family Activity

Cars, Trucks, and Percents

Work with a family member to answer the following questions. Ask ten family members or friends what kind of cars they drive: sports utility, truck, sedan, van, convertible, or other. Record the results in the space below.

1. a. What percent of these people drive sports utility vehicles?

   b. Express the percent as a decimal.

2. a. What percent of these people drive trucks?

   b. Express the percent as a decimal.

3. a. What percent of these people drive sedans?

   b. Express the percent as a decimal.

4. a. What percent of these people drive vans?

   b. Express the percent as a decimal.
A ratio is a comparison of two numbers by division. A common way to express a ratio is as a fraction in simplest form. Ratios can also be written in other ways. For example, the ratio $\frac{2}{3}$ can be written as 2 to 3, 2 out of 3, or 2:3.

**EXAMPLE 1** Refer to the diagram at the right.

1. Write the ratio that compares the number of circles to the number of triangles.

   \[
   \frac{\text{circles}}{\text{triangles}} \rightarrow \frac{4}{5} \quad \text{The GCF of 4 and 5 is 1.}
   \]

   So, the ratio of circles to triangles is $\frac{4}{5}$, 4 to 5, or 4:5.

   For every 4 circles, there are 5 triangles.

2. Write the ratio that compares the number of circles to the total number of figures.

   \[
   \frac{\text{circles}}{\text{total figures}} \rightarrow \frac{2}{4} = \frac{1}{2} \quad \text{The GCF of 4 and 10 is 2.}
   \]

   The ratio of circles to the total number of figures is $\frac{2}{5}$, 2 to 5, or 2:5.

   For every two circles, there are five total figures.

A rate is a ratio of two measurements having different kinds of units. When a rate is simplified so that it has a denominator of 1, it is called a unit rate.

**EXAMPLE 3** Write the ratio 20 students to 5 computers as a unit rate.

\[
\frac{20 \text{ students}}{5 \text{ computers}} \rightarrow \frac{4 \text{ students}}{1 \text{ computer}} \quad \text{Divide the numerator and the denominator by 5 to get a denominator of 1.}
\]

The ratio written as a unit rate is 4 students to 1 computer.

**EXERCISES**

Write each ratio as a fraction in simplest form.

1. 2 guppies out of 6 fish
2. 12 puppies to 15 kittens
3. 5 boys out of 10 students

Write each ratio as a unit rate.

4. 6 eggs for 3 people
5. $12 for 4 pounds
6. 40 pages in 8 days
Write each ratio as a fraction in simplest form.

1. 3 sailboats to 6 motorboats
2. 4 tulips to 9 daffodils
3. 5 baseballs to 25 softballs
4. 2 days out of 8 days
5. 6 poodles out of 18 dogs
6. 10 yellow eggs out of 12 colored eggs
7. 12 sheets of paper out of 28
8. 18 hours out of 24 hours
9. 16 elms out of 20 trees
10. 15 trumpets to 9 trombones
11. 5 ducks to 30 geese
12. 14 lions to 10 tigers
13. 6 sodas out of 16 drinks
14. 20 blue jays out of 35 birds

Write each ratio as a unit rate.

15. 14 hours in 2 weeks
16. 36 pieces of candy for 6 children
17. 8 teaspoons for 4 cups
18. 8 tomatoes for $2
19. $28 for 4 hours
20. 150 miles in 3 hours
21. $18 for 3 CDs
22. 48 logs on 6 trucks

23. Write the ratio 21 wins to 9 losses as a fraction in simplest form.

24. Write the ratio $12 dollars for 3 tickets as a unit rate.
## Practice: Word Problems

### Ratios

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<th><strong>2. GARDENING</strong></th>
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<tr>
<td>In the NFL 2001–2002 season, the Miami Dolphins won 11 games and the Oakland Raiders won 10 games. What is the ratio of wins for the Dolphins to wins for the Raiders?</td>
<td>Rod has 10 rosebushes, 2 of which produce yellow roses. Write the ratio ( \frac{2 \text{ yellow rosebushes}}{10 \text{ rosebushes}} ) in simplest form.</td>
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<th><strong>4. AGES</strong></th>
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<td>Nancy and Lisa played 20 sets of tennis. Nancy won 12 of them. Write the ratio of Nancy’s wins to the total number of sets in simplest form.</td>
<td>Oscar is 16 years old and his sister Julia is 12 years old. What will be the ratio of Oscar’s age to Julia’s age in 2 years? Write as a fraction in simplest form.</td>
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<th><strong>6. WORKING</strong></th>
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<td>Four friends paid a total of $32 for movie tickets. What is the ratio ( \frac{32 \text{ dollars}}{4 \text{ people}} ) written as a unit rate?</td>
<td>At a warehouse, the employees can unload 18 trucks in 6 hours. What is the unit rate for unloading trucks?</td>
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<th><strong>8. SHOPPING</strong></th>
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<tr>
<td>A reindeer can run 96 miles in 3 hours. At this rate, how far can a reindeer run in 1 hour? Explain.</td>
<td>Jenny wants to buy cereal that comes in large and small boxes. The 32-ounce box costs $4.16, and the 14-ounce box costs $2.38. Which box is less expensive per ounce? Explain.</td>
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</table>
Pre-Activity  Read the introduction at the top of page 380 in your textbook. Write your answers below.

1. Write a sentence that compares the number of navy socks to the number of white socks. Use the word less in your sentence.

2. Write a sentence that compares the number of black socks to the number of white socks. Use the word half in your sentence.

3. Write a sentence comparing the number of white socks to the total number of socks. Use a fraction in your sentence.

Reading the Lesson

4. A ratio compares amounts of two different things by division. Tell what different things are compared in the examples in your textbook.

Example 1 [Blank]

Example 2 [Blank]

5. Write the ratio of 2 pens out of a total of 3 pens 4 different ways.

[Blank]  [Blank]  [Blank]  [Blank]

6. What is the denominator in a unit rate?

Helping You Remember

7. Go to your local grocery store and make a list of unit rates that are used to price items in the store. Also, compare prices for different brands of a certain product. How can you find out which brand provides the best value? Does the store help you to make the comparison? If so, how?
1. Use a centimeter ruler to measure the width and the length of each rectangle. Then express the ratio of the width to the length as a fraction in simplest form.

2. Similar figures have the same shape, but not necessarily the same size. Two rectangles are similar if the ratio of the width to the length is the same for each. Which rectangles in Exercise 1 are similar?

3. For centuries artists and architects have used a shape called the **golden rectangle** because people seem to find it most pleasant to look at. In a golden rectangle, the ratio of the width to the length is a little less than \( \frac{5}{8} \). Which rectangle in Exercise 1 is most nearly a golden rectangle?
**Study Guide and Intervention**

**Solving Proportions**

A proportion is an equation stating that two ratios are equivalent. For example, the ratios \( \frac{1}{2} \) and \( \frac{3}{6} \) are equivalent, so the equation \( \frac{1}{2} = \frac{3}{6} \) is a proportion. In order for two ratios to form a proportion, their cross products must be equal.

When one value in a proportion is unknown, you can use cross products to solve the proportion.

**EXAMPLE 1** Solve \( \frac{2}{5} = \frac{4}{n} \).

\[
2 \times n = 5 \times 4 \\
2n = 20 \\
2n = \frac{20}{2} = 10 \\
\frac{2n}{2} = \frac{20}{2} \\
n = 10
\]

The solution is 10.

**EXAMPLE 2** Solve \( \frac{3}{4} = \frac{b}{12} \).

\[
3 \times 12 = 4 \times b \\
36 = 4b \\
36 = \frac{4b}{4} \\
9 = b
\]

The solution is 9.

**EXERCISES**

Determine whether each pair of ratios form a proportion. Explain your reasoning.

1. \( \frac{3}{5}, \frac{6}{10} \)  
2. \( \frac{2}{9}, \frac{4}{16} \)

Solve each proportion.

3. \( \frac{2}{3} = \frac{8}{n} \)  
4. \( \frac{3}{4} = \frac{12}{x} \)  
5. \( \frac{2}{4} = \frac{y}{8} \)

6. \( \frac{3}{5} = \frac{b}{15} \)  
7. \( \frac{1.2}{9} = \frac{c}{1.5} \)  
8. \( \frac{d}{16} = \frac{3}{8} \)

9. \( \frac{x}{2.6} = \frac{1.5}{1.3} \)  
10. \( \frac{2}{y} = \frac{6}{9} \)  
11. \( \frac{0.1}{2.6} = \frac{0.5}{z} \)
Practice: Skills

Solving Proportions

Solve each proportion.

1. \( \frac{2}{5} = \frac{8}{x} \)
2. \( \frac{2}{7} = \frac{4}{y} \)
3. \( \frac{3}{5} = \frac{b}{30} \)

4. \( \frac{2}{9} = \frac{c}{36} \)
5. \( \frac{4}{5} = \frac{d}{25} \)
6. \( \frac{20}{4} = \frac{10}{f} \)

7. \( \frac{g}{2} = \frac{28}{14} \)
8. \( \frac{2}{x} = \frac{10}{25} \)
9. \( \frac{4}{3} = \frac{h}{18} \)

10. \( \frac{10}{30} = \frac{2}{r} \)
11. \( \frac{t}{18} = \frac{3}{6} \)
12. \( \frac{2}{3} = \frac{6}{m} \)

13. \( \frac{9}{2} = \frac{s}{6} \)
14. \( \frac{n}{36} = \frac{2}{6} \)
15. \( \frac{4}{u} = \frac{12}{21} \)

16. \( \frac{5}{6} = \frac{m}{12} \)
17. \( \frac{d}{27} = \frac{4}{9} \)
18. \( \frac{5}{8} = \frac{15}{q} \)

19. \( \frac{15}{27} = \frac{5}{k} \)
20. \( \frac{4}{x} = \frac{20}{30} \)
21. \( \frac{b}{3} = \frac{24}{9} \)

22. \( \frac{z}{35} = \frac{4}{7} \)
23. \( \frac{6}{c} = \frac{24}{28} \)
24. \( \frac{6}{8} = \frac{x}{24} \)

25. \( \frac{14}{16} = \frac{b}{8} \)
26. \( \frac{8}{r} = \frac{24}{27} \)
27. \( \frac{16}{36} = \frac{t}{9} \)

28. \( \frac{1.2}{2.4} = \frac{2.4}{n} \)
29. \( \frac{0.5}{1.8} = \frac{s}{9} \)
30. \( \frac{1.6}{w} = \frac{8}{16} \)

31. What is the solution of \( \frac{3}{5} = \frac{2}{k} \)? Round to the nearest tenth.

32. Find the solution of \( \frac{4.3}{3} = \frac{n}{2.2} \) to the nearest tenth.
### Practice: Word Problems

#### Solving Proportions

1. **SCHOOL** The ratio of boys to girls in history class is 4 to 5. How many girls are in the class if there are 12 boys in the class? Explain.

2. **FACTORIES** A factory produces 6 motorcycles in 9 hours. Write a proportion and solve it to find how many hours it takes to produce 16 motorcycles.

3. **READING** James read 4 pages in a book in 6 minutes. How long would you expect him to take to read 6 pages?

4. **COOKING** A recipe that will make 3 pies calls for 7 cups of flour. Write a proportion and solve it to find how many pies can be made with 28 cups of flour.

5. **TYPING** Sara can type 90 words in 4 minutes. About how many words would you expect her to type in 10 minutes?

6. **BASKETBALL** The Lakewood Wildcats won 5 of their first 7 games this year. There are 28 games in the season. About how many games would you expect the Wildcats to win this season? Explain your reasoning.

7. **FOOD** Two slices of Dan’s Famous Pizza have 230 Calories. How many Calories would you expect to be in 5 slices of the same pizza?

8. **SHOPPING** Andy paid $1.40 for 4 grapefruits. Write a proportion and solve it to find how many grapefruits he can purchase for $2.10.
Reading to Learn Mathematics

Solving Proportions

Pre-Activity  Complete the Mini Lab at the top of page 386 in your textbook. Write your answers below.

1. Complete each ratio so that the ratios comparing the areas are equivalent.
   a. \[ \frac{\text{hexagon}}{\text{diamond}} = \frac{?}{?} \]
   b. \[ \frac{\text{triangle}}{\text{triangle}} = \frac{?}{?} \]

2. How did you find which figure made the ratios equivalent?

3. Suppose a green block equals 2, a blue block equals 4, a yellow block equals 6, and a red block equals 3. Write a pair of equivalent ratios.

4. What relationship exists in these equivalent ratios?

Reading the Lesson

5. Look at the arithmetic example in the Key Concept box on page 386. What is the significance of the two instances of \( \times 3 \)?

6. If two ratios are equivalent, and therefore form a proportion, what do you know about the cross products?

7. Look at the final sentence in Example 3 on page 387—“So, 375 students can be expected to prefer gel toothpaste.” Why is it important to use \textit{can be expected} in this answer?

Helping You Remember

8. Work with a partner. Study Example 1 on page 387. Write a proportion that needs to be solved for an unknown value. Exchange proportions and solve for the unknown value. Explain how you arrived at your solution.
Ada

Did you know that a woman wrote the first description of a computer programming language? She was the daughter of a famous English lord and was born in 1815. She had a deep understanding of mathematics and was fascinated by calculating machines. Her interests led her to create the first algorithm. In 1843, she translated a French version of a lecture by Charles Babbage. In her notes to the translation, she outlined the fundamental concepts of computer programming. She died in 1852. In 1979, the U.S. Department of Defense named the computer language Ada after her.

To find out this woman’s full name, solve the proportion for each letter.

1. \( \frac{7}{A} = \frac{28}{40} \)
2. \( \frac{5}{4} = \frac{B}{36} \)
3. \( \frac{1}{3} = \frac{C}{15} \)
4. \( \frac{5}{D} = \frac{35}{63} \)
5. \( \frac{2}{5} = \frac{E}{20} \)
6. \( \frac{2}{18} = \frac{L}{27} \)
7. \( \frac{6}{N} = \frac{12}{14} \)
8. \( \frac{9}{11} = \frac{O}{44} \)
9. \( \frac{2}{8} = \frac{R}{4} \)
10. \( \frac{5}{V} = \frac{25}{30} \)
11. \( \frac{7}{4} = \frac{Y}{28} \)

Now look for each solution below. Write the corresponding letter on the line above the solution. If you have calculated correctly, the letters will spell her name.

<table>
<thead>
<tr>
<th>10</th>
<th>9</th>
<th>10</th>
<th>45</th>
<th>49</th>
<th>1</th>
<th>36</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>36</th>
<th>6</th>
<th>8</th>
<th>3</th>
<th>10</th>
<th>5</th>
<th>8</th>
</tr>
</thead>
</table>
Scale drawings and scale models are used to represent objects that are too large or too small to be drawn or built at actual size. The scale gives the ratio that compares the measurements on the drawing or model to the measurements of the real object. The measurements on a drawing or model are proportional to the measurements of the actual object.

**EXAMPLE 1**  
**RACE CARS** A model of a race car has a width of 3.5 inches. The scale is 1 inch = 2 feet. Find the actual width of the race car.

Let \( w \) represent the actual width.

\[
\begin{align*}
\text{Scale} & \\
\text{model width} & \rightarrow \frac{1}{2} \quad & \text{Race Car} & \\
\text{actual width} & \rightarrow \frac{3.5}{w} & \leftarrow \text{model width} & \\
& \quad & \leftarrow \text{actual width} & \\
1 \times w & = 2 \times 3.5 & \text{Find the cross products.} & \\
w & = 7 & \text{Multiply.} & \\
\end{align*}
\]

The actual width of the race car is 7 feet.

**EXAMPLE 2**  
**HIKING** On a map, the distance between Round Lake and June Lake is 6 inches. The scale on the map is 3 inches = 5 miles. Find the actual distance between the two lakes.

Let \( d \) represent the actual distance.

\[
\begin{align*}
\text{Map Scale} & \\
\text{map distance} & \rightarrow \frac{3}{5} \quad & \text{Actual Distance} & \\
\text{actual distance} & \rightarrow \frac{6}{d} & \leftarrow \text{map distance} & \\
& \quad & \leftarrow \text{actual distance} & \\
3 \times d & = 5 \times 6 & \text{Find the cross products.} & \\
3d & = 30 & \text{Multiply.} & \\
\frac{3d}{3} & = \frac{30}{3} & \text{Divide.} & \\
\frac{3}{3} & = \frac{30}{3} & d & = 10 & \\
\end{align*}
\]

The distance between the two lakes is 10 miles.

**EXERCISES**  
**DRAFTING** For Exercises 1–4, use the following information.

On a set of drawings, the scale is 2 inch = 4 feet. Find the actual measurements.

<table>
<thead>
<tr>
<th>Object</th>
<th>Drawing</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. door</td>
<td>4 inches</td>
<td></td>
</tr>
<tr>
<td>2. wall</td>
<td>6 inches</td>
<td></td>
</tr>
<tr>
<td>3. tree</td>
<td>12 inches</td>
<td></td>
</tr>
<tr>
<td>4. computer</td>
<td>1 inch</td>
<td></td>
</tr>
</tbody>
</table>

5. **MAPS** A map has a scale of 2 inches = 7 miles. The distance between Pirate’s Cove and Midnight Lagoon on the map is 12 inches. What is the actual distance between the two places?
DRAFTING  On a set of drawings, the scale is 2 inches 5 3 feet. Find the actual measurements.

<table>
<thead>
<tr>
<th>Object</th>
<th>Drawing</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>table</td>
<td>4 inches</td>
<td></td>
</tr>
<tr>
<td>wall</td>
<td>10 inches</td>
<td></td>
</tr>
<tr>
<td>road</td>
<td>18 inches</td>
<td></td>
</tr>
<tr>
<td>door</td>
<td>5 inches</td>
<td></td>
</tr>
<tr>
<td>computer</td>
<td>1 inch</td>
<td></td>
</tr>
<tr>
<td>lamp</td>
<td>0.5 inch</td>
<td></td>
</tr>
</tbody>
</table>

LIZARDS  Models of lizards were made using the given scales. Find the actual measurements.

Scale: 1 inch = $\frac{1}{2}$ inch

<table>
<thead>
<tr>
<th>Object</th>
<th>Drawing</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiptail Lizard</td>
<td>body length</td>
<td>6 inches</td>
</tr>
<tr>
<td></td>
<td>tail length</td>
<td>12 inches</td>
</tr>
</tbody>
</table>

Scale: 2 inches = 3 inches

<table>
<thead>
<tr>
<th>Desert Iguana</th>
<th>Model</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>body length</td>
<td>9 inches</td>
<td></td>
</tr>
<tr>
<td>tail length</td>
<td>18 inches</td>
<td></td>
</tr>
</tbody>
</table>

Scale: 4 inches = 5 inches

<table>
<thead>
<tr>
<th>Ground Gecko</th>
<th>Model</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>body length</td>
<td>3.6 inches</td>
<td></td>
</tr>
<tr>
<td>tail length</td>
<td>2 inches</td>
<td></td>
</tr>
</tbody>
</table>

MAPS  A map has a scale of 3 inches = 7 miles. Find the actual distance between the cities with the map distances given.

13. 8.4 inches between Fall City and Summit

14. 2 inches between Potter and Green River
## Practice: Word Problems
### Scale Drawings and Models

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. MAPS</strong> On a map with a scale of 1 inch = 9 miles, the distance between two towns is 3 inches. What is the actual distance between the two towns?</td>
<td><strong>2. BLUEPRINTS</strong> On an architect’s blueprint, the front of a building measures 27 inches. The scale of the blueprint is 1 inch = 2 feet. How wide will the front of the actual building be?</td>
</tr>
<tr>
<td><strong>3. MODELS</strong> The model of an airplane has a wingspan of 20 inches. The model has a scale of 1 inch = 4 feet. What is the wingspan of the actual airplane?</td>
<td><strong>4. ARCHITECTURE</strong> The drawing for a building has a scale of 1 inch = 3 feet. The building in the drawing has a height of 14 inches. How tall will the actual building be?</td>
</tr>
<tr>
<td><strong>5. ROCKETS</strong> A model of the Saturn V rocket has a scale of 1 inch = 12 feet. If the model rocket is 30 inches tall, how tall was the actual Saturn V rocket?</td>
<td><strong>6. CARS</strong> Ron took a photograph of his car and then measured the length of the car in the photograph. The length was 4(\frac{1}{2}) inches. If the scale of the photograph is 1 inch = 4 feet, how long is Ron’s actual car?</td>
</tr>
<tr>
<td><strong>7. MODELS</strong> A model of a 4-cylinder gasoline engine is built on a scale of 1 inch = 6 inches. If the length of the model engine is 9 inches, how long is the actual engine?</td>
<td><strong>8. PHOTOGRAPHY</strong> A photo lab technician is going to reduce a photograph that is 9 inches wide using a scale of 1 inch = (\frac{2}{3}) inch. How wide will the reduced photo be?</td>
</tr>
</tbody>
</table>
Pre-Activity  
Read the introduction at the top of page 391 in your textbook. Write your answers below.

1. Explain how you would use a ruler to find the number of miles between any two cities on the map.

2. Use the method you described in Exercise 1 to find the actual distance between Haletown and Jasper.

3. What is the actual distance between Kimball and Signal Mountain?

Reading the Lesson

4. Look up the word _scale_ in a dictionary. Write the meaning that matches the way the word is used in this lesson.

5. Look at Example 1 at the bottom of page 391. Then tell what is happening at each step of the process below.

\[
\begin{align*}
\frac{1}{8} & = \frac{23}{h} \\
1 \times h & = 8 \times 23 \\
h & = 184
\end{align*}
\]

6. Look at Example 2 at the top of page 392. What do you need to know in order to solve for \( d \), the actual distance?

7. Bring a map or set of maps to school (for example, maps of the world as found in an almanac). Using the scale on the map, practice measuring distances between objects on the map.

Helping You Remember

8. Make a scale drawing of some object with which you are familiar. Take the actual measurements of the object. Decide on a scale. Create the drawing. Be sure to put the scale somewhere on your drawing so a reader will be able to tell the size of the actual object.
Planning a Room

Before moving furniture into a room, many people plan an arrangement by making a scale drawing. This makes it possible to find the best arrangement for the room without actually moving heavy furniture.

For each piece of furniture, actual measurements are given. Compute scale measurements using the scale $\frac{1}{2}$ inch = 1 foot.

1. bed: $6\frac{1}{2}$ feet long, 3 feet wide

2. bedside table: $1\frac{1}{2}$ feet long, $1\frac{1}{2}$ feet wide

3. bookcase: $3\frac{1}{2}$ feet long, 1 foot wide

4. desk: 42 inches long, 18 inches wide

5. chest of drawers: 39 inches long, 18 inches wide

6. Use your answers from Exercises 1–5. Show how the furniture might be arranged in the bedroom shown below.
Ratios like 41 out of 100, 25 out of 100, or 2 out of 100 can be written as percents. A percent (%) is a ratio that compares a number to 100. Since the word percent means *out of one hundred*, you can use a 10 × 10 grid to model percents.

**EXAMPLES**

1. **Model 10%**.
   10% means 10 out of 100.
   So, shade 10 of the 100 squares.

2. **Model 78%**.
   78% means 78 out of 100.
   So, shade 78 of the 100 squares.

You can use what you know about decimal models and percents to identify the percent of a model that is shaded.

**EXAMPLES**

Identify each percent that is modeled.

3. There are 30 out of 100 squares shaded. So, the model shows 30%.

4. There are 43 out of 100 squares shaded. So, the model shows 43%.

**EXERCISES**

Model each percent.

1. 20%

2. 55%

3. 12%

Identify each percent that is modeled.

4.

5.

6.
Model each percent.

1. 15%
2. 50%
3. 75%
4. 80%
5. 21%
6. 48%

Identify each percent that is modeled.

7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 

© Glencoe/McGraw-Hill
1. **FOOTBALL** In the 2001–2002 season, the Dallas Cowboys football team won 45% of their games. Make a model to show 45%.

2. **LANDSCAPING** Jacob is making a 10 foot by 10 foot patio in his backyard using paving stones that are 1 foot square. The shaded area of the model indicates the finished part of the patio. What percent of the patio has Jacob finished?

3. **ART** Lydia is making a collage using 100 photographs arranged in a square pattern. The shaded area in the model indicates the part of the collage already covered by photos. What percent of the collage is finished?

4. **ENERGY** In the year 2000, nuclear energy accounted for 8% of the energy used in the U.S. Make a model to show 8%.

5. **GAMES** The figure shows the starting position for a game played on a 10 by 10 board. The shaded squares contain game pieces. What percent of the squares on the board contain game pieces?

6. **MUSIC** In the school chorus, 52% of the girls sing soprano and 44% sing alto. Which of these two sections of the chorus has more girls? Explain using models.
Pre-Activity  Read the introduction at the top of page 395 in your textbook. Write your answers below.

1. What ratio compares the number of students who prefer grape flavored lollipops to the total number of students?

2. What decimal represents this ratio?

3. Use a decimal model to represent this ratio.

Reading the Lesson

4. Explain why a \( \frac{10}{1100} \) grid is a good way to model percents.

5. Complete the table.

<table>
<thead>
<tr>
<th>75%</th>
<th>37 out of 100</th>
</tr>
</thead>
</table>

6. Look at the model in Example 3 on page 396. What is another way to model 25%?

Helping You Remember

7. Look at the nutrition facts on any food label. Which item contains the highest percent of daily value per serving? Make a model to represent that amount. Label the model to indicate what the model shows.
We the People

Who are the people of the United States? The graphs at the right show just a small part of the data gathered in the 2000 Census of the Population. Using the data shown on these graphs, decide whether each statement is true or false.

1. About 12% of all the people counted in the census responded that they are black.

2. About 5% of all the people counted in the census identified their national origin as Cuban.

3. About 58% of the Hispanic Americans counted in the census identified their national origin as Mexican.

4. The number of people who identified themselves as white is about 120 million.

5. How well can you picture data? In the space at the right, sketch a circle graph to show the data below.

<table>
<thead>
<tr>
<th>Americans’ Region of Residence, 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
</tr>
<tr>
<td>Midwest</td>
</tr>
<tr>
<td>South</td>
</tr>
<tr>
<td>West</td>
</tr>
</tbody>
</table>
EXAMPLE 1 Write 15% as a fraction in simplest form.

15% means 15 out of 100.

\[
15\% = \frac{15}{100}
\]

Write the percent as a fraction with a denominator of 100.

\[
= \frac{3 \times 5}{20} \quad \text{or} \quad \frac{3}{20}
\]

Simplify. Divide the numerator and denominator by the GCF, 5.

EXAMPLE 2 Write 180% as a fraction in simplest form.

180% means 180 out of 100.

\[
180\% = \frac{180}{100}
\]

Write the percent as a fraction with a denominator of 100.

\[
= \frac{4}{5} \quad \text{or} \quad 1\frac{4}{5}
\]

Simplify.

You can also write fractions as percents. To write a fraction as a percent, write it as a fraction with a denominator of 100. Then simplify.

EXAMPLE 3 Write \(\frac{2}{5}\) as a percent.

Set up a proportion.

\[
\frac{2}{5} = \frac{n}{100}
\]

Write the cross products. Multiply.

\[
2 \times 100 = 5 \times n
\]

\[
200 = 5n
\]

Divide each side by 5.

\[
\frac{200}{5} = \frac{5n}{5}
\]

\[
40 = n
\]

So, \(\frac{2}{5}\) is equivalent to 40%.

EXAMPLE 4 Write \(\frac{9}{8}\) as a percent.

Set up a proportion.

\[
\frac{9}{8} = \frac{p}{100}
\]

Write the cross products. Multiply.

\[
9 \times 100 = 8 \times p
\]

\[
900 = 8p
\]

Divide each side by 8.

\[
\frac{900}{8} = \frac{8p}{8}
\]

\[
112.5 = p
\]

So, \(\frac{9}{8}\) is equivalent to 112.5%.

**EXERCISES**

Write each percent as a fraction in simplest form.

1. 20%
2. 35%
3. 70%
4. 60%
5. 150%
6. 225%

Write each fraction as a percent.

7. \(\frac{3}{10}\)
8. \(\frac{2}{100}\)
9. \(\frac{8}{5}\)
10. \(\frac{1}{5}\)
11. \(\frac{10}{8}\)
12. \(\frac{13}{100}\)
Practice: Skills

Percents and Fractions

Write each percent as a fraction in simplest form.

1. 40%  2. 30%  3. 55%  4. 75%  5. 140%  6. 175%  7. 24%  8. 68%  9. 44%  10. 92%  11. 110%  12. 155%  13. 18%  14. 74%  15. 43%

Write each fraction as a percent.

16. \(\frac{4}{5}\)  17. \(\frac{3}{20}\)  18. \(\frac{7}{10}\)  19. \(\frac{3}{5}\)  20. \(\frac{3}{2}\)  21. \(\frac{5}{4}\)  22. \(\frac{6}{5}\)  23. \(\frac{9}{20}\)  24. \(\frac{13}{20}\)  25. \(\frac{17}{20}\)  26. \(\frac{9}{5}\)  27. \(\frac{11}{10}\)  28. \(\frac{19}{20}\)  29. \(\frac{13}{10}\)  30. \(\frac{21}{100}\)
### Practice: Word Problems

#### Percents and Fractions

<table>
<thead>
<tr>
<th></th>
<th><strong>TOYS</strong> The Titanic Toy Company has a 4% return rate on its products. Write this percent as a fraction in simplest form.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td><strong>MUSIC</strong> There are 4 trombones out of 25 instruments in the Landers town band. What percent of the instruments are trombones?</td>
</tr>
<tr>
<td>3</td>
<td><strong>SHOPPING</strong> Alicia’s favorite clothing store is having a 30% off sale. What fraction represents the 30% off sale?</td>
</tr>
<tr>
<td>4</td>
<td><strong>FOOD</strong> At Ben’s Burger Palace, 45% of the customers order large soft drinks. What fraction of the customers order large soft drinks?</td>
</tr>
<tr>
<td>5</td>
<td><strong>BASKETBALL</strong> In the 2001–2002 NBA season, Shaquille O’Neal of the Los Angeles Lakers made 60% of his field goals. What fraction of his field goals did Shaquille make?</td>
</tr>
<tr>
<td>6</td>
<td><strong>SCHOOL</strong> In Janie’s class, 7 out of 25 students have blue eyes. What percent of the class has blue eyes?</td>
</tr>
<tr>
<td>7</td>
<td><strong>TESTS</strong> Michael answered ( \frac{17}{20} ) questions correctly on his test. What percent of the questions did Michael answer correctly?</td>
</tr>
<tr>
<td>8</td>
<td><strong>RESTAURANTS</strong> On Saturday afternoon, ( \frac{41}{50} ) telephone calls taken at The Overlook restaurant were for dinner reservations. What percent of the telephone calls were for dinner reservations?</td>
</tr>
</tbody>
</table>
Pre-Activity  \textit{Read the introduction at the top of page 400 in your textbook. Write your answers below.}

1. What was the second most popular reason?

2. What percent represents this section of the graph?

3. Based on the meaning of 22\%, make a conjecture as to how you would write this percent as a fraction.

Reading the Lesson

4. Write the two steps to use to write a percent as a fraction.

5. Look at the graphic at the top of page 400. What is the sum of the percents? Look at the table at the top of page 401. What is the sum of the percents? Why is this important?

6. Look at Example 2 on page 400. Why is 125\% written a mixed number?

Helping You Remember

7. Write a fraction as a percent using the steps shown in Examples 4 and 5 on page 401. Choose any fraction you like different from those in the Examples.

<table>
<thead>
<tr>
<th>Step</th>
<th>Equation(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set up a proportion.</td>
<td></td>
</tr>
<tr>
<td>Write the cross</td>
<td></td>
</tr>
<tr>
<td>products.</td>
<td></td>
</tr>
<tr>
<td>Multiply.</td>
<td></td>
</tr>
<tr>
<td>Divide.</td>
<td></td>
</tr>
<tr>
<td>Conclusion.</td>
<td>So, ______ is equivalent to ______.</td>
</tr>
</tbody>
</table>
Percent and the Hundred Chart

The chart at the right shows all the whole numbers from 1 through 100.

This page challenges you to connect percents to what you know about number theory—factors, multiples, divisibility, and so on. Whenever you can, use a pattern in the chart to make your work easier.

For example, the multiples of 5 make up two columns of the chart—the fifth column and the tenth. So, 20 out of 100 numbers, or 20% of the numbers, are multiples of 5.

Use the hundred chart above. Find the percent of the numbers that:

1. are even numbers.
2. are odd numbers.
3. are multiples of 9.
4. are multiples of 11.
5. are divisible by 5.
6. are divisible by 3.
7. are divisible by 2 and divisible by 5.
8. are divisible by 2 and divisible by 3.
9. contain only even digits.
10. contain only odd digits.
11. have digits whose sum is 10.
12. have digits whose sum is 5.
13. contain the digit 0.
14. contain the digit 5.
15. are factors of 100.
16. are factors of 101.
17. are prime.
18. are composite.
To write a percent as a decimal, first rewrite the percent as a fraction with a denominator of 100. Then write the fraction as a decimal.

**EXAMPLE 1** Write 23% as a decimal.

\[
23\% = \frac{23}{100} = 0.23
\]

Rewrite the percent as a fraction with a denominator of 100. Write the fraction as a decimal.

**EXAMPLE 2** Write 127% as a decimal.

\[
127\% = \frac{127}{100} = 1.27
\]

Rewrite the percent as a fraction with a denominator of 100. Write the fraction as a decimal.

**EXAMPLE 3** Write 0.8% as a decimal.

\[
0.8\% = \frac{0.8}{100} = 0.008
\]

Rewrite the percent as a fraction with a denominator of 100. Multiply by \(\frac{10}{10}\) to eliminate the decimal in the numerator. Write the fraction as a decimal.

To write a decimal as a percent, first write the decimal as a fraction with a denominator of 100. Then write the fraction as a percent.

**EXAMPLE 4** Write 0.441 as a percent.

\[
0.441 = \frac{441}{1000} = \frac{441 \div 10}{1000 \div 10} = \frac{44.1}{100} = 44.1\%
\]

Write the decimal as a fraction. Divide by 10 to get a denominator of 100. Write the fraction as a percent.

**EXERCISES**

Write each percent as a decimal.

1. 39%  
2. 57%  
3. 82%

4. 135%  
5. 112%  
6. 0.4%

Write each decimal as a percent.

7. 0.86  
8. 0.36  
9. 0.65

10. 0.2  
11. 0.148  
12. 0.217
Write each percent as a decimal.

1. 5%  
2. 8%  
3. 37%  
4. 12%  
5. 29%  
6. 54%  
7. 48%  
8. 79%  
9. 0.1%  
10. 0.6%  
11. 0.2%  
12. 0.5%  
13. 123%  
14. 102%  
15. 135%  
16. 310%

Write each decimal as a percent.

17. 0.3  
18. 0.7  
19. 0.19  
20. 0.74  
21. 0.66  
22. 0.52  
23. 0.21  
24. 0.81  
25. 0.13  
26. 0.362  
27. 0.528  
28. 0.245  
29. 0.194  
30. 0.334  
31. 0.426  
32. 0.059
<table>
<thead>
<tr>
<th></th>
<th><strong>COMMUTING</strong> According to the 2000 U.S. census, 76% of U.S. workers commute to work by driving alone. Write 76% as a decimal.</th>
<th><strong>BASEBALL</strong> Barry Bonds’s batting average for the 2002 season was 0.370. Write 0.370 as a percent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td><strong>ELECTIONS</strong> In the 2002 U.S. midterm elections, 39% of eligible adults voted. What is 39% written as a decimal?</td>
<td><strong>BASKETBALL</strong> In the 2001–2002 season, Jason Kidd of the New Jersey Nets had a field goal average of 0.391. What is 0.391 written as a percent?</td>
</tr>
<tr>
<td>5.</td>
<td><strong>SPORTS</strong> When asked to choose their favorite sport, 27% of U.S. adults who follow sports selected professional football. What decimal is equivalent to 27%?</td>
<td><strong>AGE</strong> Lawrence is 18 years old and his brother Luther is 12 years old. This means that Lawrence is 1.5 times older than Luther. What percent is equivalent to 1.5?</td>
</tr>
<tr>
<td>7.</td>
<td><strong>WATER</strong> About 5% of the surface area of the U.S. is water. What decimal represents the amount of the U.S. surface area taken up by water?</td>
<td><strong>POPULATION</strong> China accounts for 0.207 of the world’s population. What percent of the world’s population lives in China?</td>
</tr>
</tbody>
</table>
Pre-Activity  Read the introduction at the top of page 404 in your textbook. Write your answers below.

1. What percent does the circle graph represent?

2. What fraction represents the section of the graph labeled rent?

3. Write the fraction from Exercise 2 as a decimal.

Reading the Lesson

Complete each of the following sentences.

4. To rewrite a fraction with a denominator of 100 as a decimal, move the decimal point of the numerator ________ places to the ________.

5. To rewrite a fraction with a denominator of ________, move the decimal point of the numerator 3 places to the left.

6. Look at Example 3 on page 404. Why does the denominator change from 100 to 1,000?

Helping You Remember

7. Look at Example 5 on page 405. Explain why the first fraction has a denominator of 1,000. Then explain what happens at the next step.
Percent and Per Mill

A percent is a ratio that compares a number to 100.

\[
\frac{83}{100} = 83 \text{ percent} = 83\% = 0.83
\]

A ratio that compares a number to 1,000 is called a per mill. Just like percent, the ratio per mill has a special symbol, ‰.

\[
\frac{83}{1,000} = 83 \text{ per mill} = 83‰ = 0.083
\]

Throughout the world, the ratio that is used most commonly is percent. However, in some countries, you will find both ratios in use.

Express per mill as a decimal.

1. 325‰
2. 71‰
3. 6‰
4. 900‰
5. 20‰
6. 100‰

Express each per mill as a fraction in simplest form.

7. 47‰
8. 400‰
9. 100‰
10. 25‰
11. 150‰
12. 30‰

Express each fraction as a per mill.

13. \(\frac{729}{1,000}\)
14. \(\frac{58}{100}\)
15. \(\frac{7}{10}\)
16. \(\frac{1}{2}\)
17. \(\frac{3}{4}\)
18. \(\frac{5}{8}\)
19. \(\frac{4}{5}\)
20. \(\frac{17}{20}\)
21. \(\frac{1}{3}\)

22. CHALLENGE In the United States, you will sometimes find the mill used as a monetary unit. What amount of money do you think is represented by 1 mill?
Study Guide and Intervention

Percent of a Number

One way to find the percent of a number is to write the percent as a fraction and then multiply. Another way is to write the percent as a decimal and then multiply.

**EXAMPLE 1** Find 70% of 40.

**Method 1** Write the percent as a fraction.

\[70\% = \frac{70}{100} \text{ or } \frac{7}{10}\]

\[\frac{7}{10} \text{ of } 40 = \frac{7}{10} \times 40 \text{ or } 28\]

So, 70% of 40 is 28. Use a model to check the answer.

The model confirms that 70% of 40 is 28.

**EXAMPLE 2** Find 120% of 25.

**Method 1** Write the percent as a fraction.

\[120\% = \frac{120}{100} \text{ or } \frac{6}{5}\]

\[\frac{6}{5} \text{ of } 25 = \frac{6}{5} \times 25 \text{ or } 30\]

So, 120% of 25 is 30.

**EXERCISES**

Find the percent of each number.

1. 10% of 120
2. 60% of 25
3. 75% of 24
4. 90% of 40
5. 120% of 20
6. 150% of 2
7. 15% of 40
8. 30% of 70
9. 150% of 6
10. 165% of 20
11. 8% of 15
12. 6% of 6
Practice: Skills
Percent of a Number

Find the percent of each number.

1. 25% of 16
2. 50% of 70
3. 10% of 30

4. 60% of 40
5. 75% of 20
6. 20% of 90

7. 30% of 110
8. 50% of 140
9. 25% of 80

10. 4% of 100
11. 75% of 36
12. 90% of 120

13. 125% of 40
14. 8% of 25
15. 150% of 22

16. 110% of 50
17. 125% of 60
18. 0.4% of 5

19. 6.5% of 40
20. 0.5% of 14
21. 0.1% of 29

22. 130% of 80
23. 4.5% of 60
24. 0.5% of 34

25. 14.5% of 60
26. 14% of 30
27. 24% of 15

28. 140% of 30
29. 6% of 55
30. 160% of 22
## Practice: Word Problems
### Percent of a Number

1. **SCHOOL** There are 520 students at Northridge High School. 80% of these students take the bus. How many students take the bus?

2. **AGE** Theresa is 60% as old as her sister Mala, who is 20 years old. How old is Theresa?

3. **TIPPING** Charlie wants to leave a 15% tip for a meal that costs $40. How much should Charlie leave for a tip?

4. **SALES TAX** Charmaine wants to buy a shirt for $15. If the sales tax is 4% of $15, how much will she pay in sales tax?

5. **FOOTBALL** In the 2001–2002 regular season, the Green Bay Packers won 75% of their games. There were 16 regular season games. How many games did Green Bay win?

6. **BASEBALL** During the 2002 World Series, Rich Aurilia of the San Francisco Giants had a batting average of 250 or 25%. He was at bat 32 times. How many hits did he get?

7. **RUNNING** Thomas finished the race in 120 minutes. James took 95.5% as long as Thomas to finish the race. How long did it take James to finish the race?

8. **SHOPPING** A DVD player that normally costs $160 is on sale for 70% of its normal price. What is the sale price of the DVD player?
Pre-Activity  Read the introduction at the top of page 409 in your textbook. Write your answers below.

1. What percent of the cars were traveling 20 miles per hour over the speed limit?

2. Write a multiplication sentence that involves a percent that could be used to find the number of cars out of 300 that were traveling 20 miles an hour over the speed limit.

Reading the Lesson

3. What are two different methods you can use to find the percent of a number?

4. Complete the statement: 12% of 48 has the same meaning as 12% _____ 48.

Helping You Remember

5. Work with a partner. Make up a problem in which you can find the percent of a number as in Examples 1 and 2. One person uses Method 1, writing the percent as a fraction. The other person uses Method 2, writing the percent as a decimal. Compare your results. Make up another problem and have each person use the other method. Again, compare your results. Do you prefer one method over the other? Explain.
Estimating Sales Tax

Many states charge a sales tax on purchases. To be sure that you have enough money, you should be able to estimate the amount of sales tax and the total cost of an item. For example, this is how you can estimate the total cost of the purchase shown at the right.

First, round the price and the rate.

<table>
<thead>
<tr>
<th>Price</th>
<th>Rate</th>
<th>Rounded Price</th>
<th>Rounded Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10.95</td>
<td>6.75%</td>
<td>$11</td>
<td>7%</td>
</tr>
</tbody>
</table>

Multiply the rounded numbers.

\[ 11 \text{ dollars} \times 7\text{¢ per dollar} = 77\text{¢} = 80\text{¢} \]

7% means 7¢ per 100¢, or 7¢ per dollar.

So, the total cost is close to $11 + 80¢, or $11.80.

Estimate the total cost of each purchase.

1. $6.98
   - sales tax rate: 5%

2. $11.97
   - sales tax rate: 5.75%

3. $19.88
   - sales tax rate: 4.255%

4. $29.95
   - sales tax rate: 6\(\frac{1}{2}\)%

5. $79.00
   - sales tax rate: 3\(\frac{1}{4}\)%

6. $117.99
   - sales tax rate: 6.25%

Will $50 be enough money to make such purchase?

7. $48.95
   - sales tax rate: 3%

8. $46.99
   - sales tax rate: 4.75%

9. $46.99
   - sales tax rate: 8\(\frac{1}{4}\)%

10. **CHALLENGE** The price marked on a cassette tape is $8.99. With the sales tax, the total cost of the tape is $9.37. Estimate the sales tax rate.
The table below shows some commonly used percents and their fraction equivalents.

<table>
<thead>
<tr>
<th>Percent-Fraction Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% = $\frac{1}{5}$</td>
</tr>
<tr>
<td>30% = $\frac{3}{10}$</td>
</tr>
<tr>
<td>40% = $\frac{2}{5}$</td>
</tr>
<tr>
<td>80% = $\frac{4}{5}$</td>
</tr>
<tr>
<td>25% = $\frac{1}{4}$</td>
</tr>
<tr>
<td>$33\frac{1}{3}$% = $\frac{1}{3}$</td>
</tr>
</tbody>
</table>

### Examples

**Estimate each percent.**

1. **20% of 58**
   - 20% is $\frac{1}{5}$.
   - Round 58 to 60 since it is divisible by 5.
   - $\frac{1}{5} \times 60 = \frac{1}{5} \times \frac{120}{1} = 12$
   - So, 20% of 58 is about 12.

2. **76% of 25.**
   - 76% is close to 75% or $\frac{3}{4}$.
   - Round 25 to 24 since it is divisible by 4.
   - $\frac{3}{4} \times 24 = \frac{3}{4} \times \frac{24}{1} = 18$
   - So, 76% of 25 is about 18.

**Example 3**

Estimate the percent of the figure that is shaded.

2 out of 9 circles are shaded.

- $\frac{2}{9}$ is about $\frac{3}{9}$ or $\frac{1}{3}$
- $\frac{1}{3} = 33\frac{1}{3}$%

So, about $33\frac{1}{3}$% of the figure is shaded.

### Exercises

**Estimate each percent.**

1. 49% of 8
2. 62% of 20
3. 40% of 51

4. 24% of 27
5. 81% of 32
6. 19% of 46

**Estimate the percent that is shaded in each figure.**

7. 
8. 
9. 
Estimate each percent.

1. 58% of 5
2. 41% of 10
3. 75% of 17

4. 50% of 39
5. 24% of 13
6. 82% of 24

7. 19% of 31
8. 73% of 61
9. 62% of 34

10. 49% of 71
11. 38% of 42
12. 27% of 81

13. 79% of 16
14. 52% of 118
15. 19% of 94

16. 33% of 61
17. 91% of 82
18. 67% of 241

Estimate the percent of the figure that is shaded.

19. [Diagram]
20. [Diagram]
21. [Diagram]
### Practice: Word Problems

**Estimating with Percents**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. SCHOOL</strong></td>
<td>At Westside High School, 24% of the 225 sixth grade students walk to school. About how many of the sixth grade students walk to school?</td>
</tr>
<tr>
<td><strong>2. BASKETBALL</strong></td>
<td>In the 2002 regular season the WNBA Cleveland Rockers won 31.25% of their games. They had 32 games in their regular season. About how many games did they win?</td>
</tr>
<tr>
<td><strong>3. SALES TAX</strong></td>
<td>The sales tax rate in Lacon is 9%. About how much tax would you pay on an item that costs $61?</td>
</tr>
<tr>
<td><strong>4. SPORTS</strong></td>
<td>The concession stand at a football game served 178 customers. Of those, about 52% bought a hot dog. About how many customers bought a hot dog?</td>
</tr>
<tr>
<td><strong>5. READING</strong></td>
<td>Max has completed 39% of his reading assignment. If there are 303 pages in the assignment, about how many pages has Max read?</td>
</tr>
<tr>
<td><strong>6. SHOPPING</strong></td>
<td>A store is having a 20% sale. That means the customer pays 80% of the regular price. About how much would you pay for an item that regularly sells for $44.99?</td>
</tr>
<tr>
<td><strong>7. SLEEP</strong></td>
<td>A recent study shows that people spend about 31% of their time asleep. About how much time will a person spend asleep during an average 78 year lifetime?</td>
</tr>
<tr>
<td><strong>8. BIOLOGY</strong></td>
<td>The human body is 72% water, on average. About how much water will be in a person that weighs 138 pounds?</td>
</tr>
</tbody>
</table>
Pre-Activity  Read the introduction at the top of page 415 in your textbook. Write your answers below.

1. What would be the cost of the notebook at 10% off?

2. What would be the cost of the pencils at 25% off? Round to the nearest cent.

3. Explain how you might estimate the cost of the notebook at 10% off and the cost of the pencils at 25% off.

Reading the Lesson

4. Write the fraction for each percent.

<table>
<thead>
<tr>
<th>Percent</th>
<th>Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>33(\frac{1}{3})%</td>
<td></td>
</tr>
<tr>
<td>66(\frac{2}{3})%</td>
<td></td>
</tr>
</tbody>
</table>

5. Complete the sentence.
When you estimate with percents, you round to numbers that are ____________.

Helping You Remember

6. Work with a partner. Using the fractions and percents in the table you completed for Exercise 4, take turns saying either a fraction or percent. If you say a fraction, your partner writes the corresponding percent. If you say a percent, your partner writes the corresponding fraction. Make sure your partner cannot see the table above. Continue with your practice until you can remember all the fractions and percents.
Using 100%, 10%, and 1%

Many people think of 100%, 10%, and 1% as key percents.

100% is the whole. 100% of 24 = $1 \times 24$, or 24.

10% is one tenth of the whole. 10% of 24 = $0.1 \times 24$, or 2.4.

1% is one hundredth of the whole. 1% of 24 = $0.01 \times 24$, or 0.24.

Find the percent of each number.

1. 100% of 8,000
2. 10% of 8,000
3. 1% of 8,000
4. 10% of 640
5. 100% of 720
6. 1% of 290
7. 1% of 50
8. 100% of 33
9. 10% of 14
10. 100% of 2
11. 1% of 9
12. 10% of 7

This is how you can use the key percents to make some computations easier.

3% of 610 = __?__.
1% of 610 = 6.1,
so 3% of 610 = $3 \times 6.1$, or 18.3.

5% of 24 = __?__.
10% of 24 = 2.4,
so 5% of 24 = $\frac{1}{2}$ of 2.4, or 1.2.

Find the percent of each number.

13. 2% of 140
14. 8% of 2,100
15. 4% of 9
16. 20% of 233
17. 70% of 90
18. 30% of 4,110
19. 5% of 160
20. 5% of 38
21. 50% of 612
22. 25% of 168
23. 2.5% of 320
24. 2.5% of 28
Write the letter for the correct answer in the blank at the right of each question.

Write each ratio as a fraction in simplest form.

1. 20 out of 35 people
   A. \( \frac{20}{35} \)  
   B. \( \frac{35}{20} \)  
   C. \( \frac{8}{14} \)  
   D. \( \frac{4}{7} \)  
   1. ____

2. 6 DVDs to 4 tapes
   F. \( \frac{3}{2} \)  
   G. \( \frac{2}{3} \)  
   H. \( \frac{6}{4} \)  
   I. \( \frac{4}{6} \)  
   2. ____

Write each ratio as a unit rate.

3. 6 miles in 2 hours
   A. 3 miles  
   B. 3 miles per hour  
   C. \( \frac{1}{3} \) mile  
   D. \( \frac{1}{3} \) mile per hour  
   3. ____

4. $2.40 for a dozen pencils
   F. $2.40 per dozen pencils  
   G. $20 per pencil  
   H. $0.20 per pencil  
   I. $2 per pencil  
   4. ____

Solve each proportion.

5. \( \frac{m}{32} = \frac{6}{8} \)
   A. 192  
   B. 48  
   C. 24  
   D. 43.7  
   5. ____

6. \( \frac{3}{2} = \frac{21}{y} \)
   F. 7  
   G. 31.5  
   H. 63  
   I. 14  
   6. ____

ARCHITECTURE For Questions 7 and 8, use the following information.
On a set of architectural drawings, the scale is 1 inch = 8 feet.

7. If the length of the living room is 3 inches on the drawing, what is the actual length of the living room?
   A. 8 feet  
   B. 16 feet  
   C. 24 feet  
   D. \( \frac{3}{8} \) inches  
   7. ____

8. If the length of the dining room is 2 inches on the drawing, find the actual length of the dining room.
   F. 8 feet  
   G. 16 feet  
   H. \( \frac{1}{4} \) inch  
   I. 4 feet  
   8. ____

9. Identify the percent that is modeled.
   A. 10%  
   B. 20%  
   C. 2%  
   D. 80%  
   9. ____
10. In which model is 48% of the figure shaded?

A.  
B.  
C.  
D.  

11. Write 60% as a fraction in simplest form.

A. \(\frac{60}{100}\)  
B. \(\frac{30}{50}\)  
C. \(\frac{15}{25}\)  
D. \(\frac{3}{5}\)  

12. Write \(\frac{3}{20}\) as a percent.

A.  
B.  
C.  
D.  

13. **MONEY** What percent of a dollar is a dime?

A. 1%  
B. 5%  
C. 10%  
D. 0.10%  

14. Write 15% as a decimal.

A.  
B.  
C.  
D.  

15. Write 0.02 as a percent.

A.  
B.  
C.  
D.  

16. Which is a true statement?

A.  
B.  
C.  
D.  

17. Find 10% of 25.

A.  
B.  
C.  
D.  

18. **LAWN** James made $120 last week mowing lawns. He put 15% of that amount into his savings account. How much did James put into his savings account?

A. $18  
B. $1.80  
C. $180  
D. $12.50  

Estimate each percent.

19. 25% of 395

A. 10  
B. 100  
C. 1,000  
D. 1,600  

20. 48% of 60

A.  
B.  
C.  
D.  

**Bonus** What percent of the rectangle is shaded?
Write the letter for the correct answer in the blank at the right of each question.

Write each ratio as a fraction in simplest form.
1. 42 girls out of 56 people
   A. \( \frac{4}{3} \)  B. \( \frac{42}{56} \)  C. \( \frac{6}{8} \)  D. \( \frac{3}{4} \)  1. ____

2. 15 apples to 10 oranges
   F. \( \frac{2}{3} \)  G. \( \frac{3}{2} \)  H. \( \frac{15}{10} \)  I. \( \frac{10}{15} \)  2. ____

Write each ratio as a unit rate.
3. 350 kilometers in 5 hours
   A. 70 kilometers  B. \( \frac{70 \text{ kilometers}}{1 \text{ hour}} \)  C. \( \frac{1}{7} \text{ kilometer}{1 \text{ hour}} \)  D. \( \frac{350 \text{ kilometers}}{5 \text{ hours}} \)  3. ____

4. $80 for 10 tickets
   F. \( \frac{80}{10 \text{ tickets}} \)  G. 8 tickets  H. \( \frac{8}{1 \text{ ticket}} \)  I. \( \frac{8 \text{ tickets}}{1 \$} \)  4. ____

Solve each proportion.
5. \( \frac{18}{27} = \frac{x}{18} \)
   A. 12  B. 324  C. \( \frac{2}{3} \)  D. 27  5. ____

6. \( \frac{28}{y} = \frac{4}{7} \)
   F. 16  G. 50  H. 49  I. 196  6. ____

ARCHITECTURE For Questions 7 and 8, use the following information.
On a set of architectural drawing plans, the scale is 1 inch = 8 feet.

7. Find the actual length of a room if the length of the room measures 3 inches on the plans.
   A. 6 feet  B. 24 feet  C. 5 feet  D. 22 inches  7. ____

8. Find the actual width of a room if the width is \( 1\frac{3}{4} \) inches on the plans.
   F. \( 3\frac{1}{2} \) feet  G. 22 feet  H. 6 feet  I. 14 feet  8. ____

9. Identify the percent modeled at the right.
   A. 60%  B. 49%  C. 51%  D. 40%  9. ____
10. In which model is 27% of the figure shaded?

F.  

G.  

H.  

I.  

11. Write 154% as a fraction in simplest form.

A. \( \frac{100}{154} \)  

B. \( \frac{50}{77} \)  

C. \( \frac{27}{50} \)  

D. \( \frac{27}{50} \)  

12. Write \( \frac{17}{20} \) as a percent.

F. 85%  

G. 17%  

H. 34%  

I. 95%  

13. MONEY What percent of a dollar is a quarter?

A. 0.025%  

B. 0.25%  

C. 2.5%  

D. 25%  

14. Write 141% as a decimal.

F. 14.1  

G. 1.41  

H. 0.141  

I. 141  

15. Write 0.054 as a percent.

A. 5.4%  

B. 54%  

C. 0.00054%  

D. 0.54%  

16. Which percent is greater than 0.4?

F. 29%  

G. 42%  

H. 39%  

I. 25%  

Find the percent of each number.

17. 12% of 84

A. 1,008  

B. 7  

C. 10.08  

D. 100.8  

18. 30% of 242

F. 726  

G. 7.26  

H. 72.6  

I. 8.07  

Estimate each percent.

19. 49% of 598

A. 3  

B. 30  

C. 300  

D. 3,000  

20. 21% of 387

F. 80  

G. 0.8  

H. 800  

I. 8  

Bonus A 300-gram candle burns 45% of its weight. Find the mass of the remaining candle.

B: ________________
Write the letter for the correct answer in the blank at the right of each question. Write each ratio as a fraction in simplest form.

1. 64 red cars out of 80 cars
   A. \(\frac{64}{80}\)        B. \(\frac{80}{64}\)        C. \(\frac{5}{4}\)        D. \(\frac{4}{5}\)

2. 16 pens to 12 brushes
   F. \(\frac{16}{12}\)        G. \(\frac{4}{3}\)        H. \(\frac{12}{16}\)        I. \(\frac{3}{4}\)

Write each ratio as a unit rate.

3. 180 miles on 10 gallons
   A. 1.8 miles        B. \(\frac{18 \text{ miles}}{1 \text{ gallon}}\)        C. \(\frac{\frac{1}{18} \text{ mile}}{1 \text{ gallon}}\)        D. \(\frac{180 \text{ miles}}{10 \text{ gallons}}\)

4. $120 for 12 calculators
   F. \(\frac{$10}{1 \text{ calculator}}\)        G. \(\frac{10 \text{ calculators}}{$12}\)        H. \(\frac{$120}{12 \text{ calculators}}\)        I. 10 calculators

Solve each proportion.

5. \(\frac{m}{8} = \frac{15}{20}\)
   A. 6        B. 60        C. 10.7        D. 1.5

6. \(\frac{18}{54} = \frac{10}{x}\)
   F. 30        G. 3        H. 540        I. 5.4

MAP For Questions 7 and 8, use the following information.
On a map of California the scale is 2 inches = 100 kilometers.

7. Find the actual distance between two cities if the distance on the map is \(5\frac{1}{2}\) inches.
   A. 11 kilometers        B. 275 kilometers        C. 550 kilometers        D. 200 kilometers

8. Find the actual length of a river if the length on the map is \(1\frac{1}{4}\) inches.
   F. 0.025 kilometer        G. 125 kilometers        H. 2.5 kilometers        I. 62.5 kilometers

9. Identify the percent modeled at the right.
   A. 70%        B. 30%        C. 28%        D. 72%
10. In which model is 64% of the figure shaded?

F.  
G.  
H.  
I.  

10. ____

11. Write 172% as a fraction in simplest form.

A. \( \frac{172}{100} \)  
B. \( \frac{8}{25} \)  
C. \( \frac{25}{18} \)  
D. \( \frac{18}{25} \)  

11. ____

12. Write \( \frac{17}{25} \) as a percent.

F. 17%  
G. 34%  
H. 50%  
I. 68%  

12. ____

13. **MONEY** What percent of a dollar is a dime?

A. 10%  
B. 1%  
C. 0.01%  
D. 0.001%  

13. ____

14. Write 3.8% as a decimal.

F. 0.038  
G. 380  
H. 0.38  
I. 38  

14. ____

15. Write 2.4 as a percent.

A. 2.4%  
B. 24%  
C. 0.024%  
D. 240%  

15. ____

16. Which percent is greater than 0.19?

F. 25%  
G. 18%  
H. 0.2%  
I. 10%  

16. ____

Find the percent of each number.

17. 15% of 30

A. 45  
B. 450  
C. 2  
D. 4.5  

17. ____

18. 125% of 400

F. 4  
G. 50  
H. 500  
I. 320  

18. ____

Estimate each percent.

19. 24% of 398

A. 10  
B. 100  
C. 1,000  
D. 0.1  

19. ____

20. 48% of 159

F. 80  
G. 8  
H. 0.8  
I. 8,000  

20. ____

**Bonus** A 500-gram candle burns off 35% of its mass. Find the mass of the remaining candle.

B: ___________________
Write each ratio as a fraction in simplest form.

1. 16 blue-eyed people out of 50 people
   \[ \frac{16}{50} \]

2. 18 rectangles to 4 circles
   \[ \frac{18}{4} \]

Write each ratio as a unit rate.

3. 424 kilometers in 8 hours
   \[ \frac{424}{8} \]

4. $60 for 12 months
   \[ \frac{60}{12} \]

Solve each proportion.

5. \[ \frac{c}{25} = \frac{16}{200} \]
   \[ c = 4 \]

6. \[ \frac{10}{15} = \frac{18}{x} \]
   \[ x = \frac{27}{5} \]

7. \[ \frac{18}{m} = \frac{27}{30} \]
   \[ m = \frac{10}{3} \]

MAPS For Questions 8 and 9, use the following information.
On a map, the scale is 1 centimeter = 10 miles.

8. The distance on a map between two cities is 1.6 centimeters. Find the actual distance.
   \[ \text{Distance} = \frac{1.6}{10} = 0.16 	ext{ miles} \]

9. The distance on a map between two cities is 3.8 centimeters. Find the actual distance.
   \[ \text{Distance} = \frac{3.8}{10} = 0.38 	ext{ miles} \]

10. Model 45%.
    \[ \boxed{\text{Model 45%}} \]
11. Identify the percent modeled at the right.

12. Write 82% as a fraction in simplest form.

13. Write \( \frac{4}{5} \) as a percent.

14. Write 6% as a decimal.

15. Write 0.046 as a percent.

Find the percent of each number.

16. 30% of 80

17. 51% of 63

18. 3% of 500

Estimate each percent.

19. 48% of 61

20. 74% of 21

Bonus  SHIP  The mast on a model ship is \( 6\frac{7}{8} \) inches tall.  

B:  

The scale is \( \frac{1}{8} \) inch = 1 foot. Find the length of the actual mast on the ship.
Write each ratio as a fraction in simplest form.

1. $25 out of every $500 collected

2. 12 children to 20 adults

Write each ratio as a unit rate.

3. 240 miles on 8 gallons of gasoline

4. 180 students for 6 classes

Solve each proportion.

5. \( \frac{m}{18} = \frac{30}{27} \)

6. \( \frac{6}{d} = \frac{18}{21} \)

7. \( \frac{14}{16} = \frac{7}{f} \)

MAPS For Questions 8 and 9, use the following information.
On a map, the scale is 1 centimeter = 10 kilometers.

8. The distance on a map between Montgomery and Indian Hill is 2.3 centimeters. Find the actual distance.

9. The distance on a map between two cities is 0.75 centimeter. Find the actual distance.

10. Model 85%. 

1.
11. Identify the percent modeled at the right.

12. Write 12% as a fraction in simplest form.

13. Write $\frac{3}{5}$ as a percent.

14. Write 9% as a decimal.

15. Write 0.931 as a percent.

Find the percent of each number.

16. 15% of 140

17. 64% of 25

18. 110% of 55

Estimate each percent.

19. 41% of 203

20. 52% of 248

Bonus Bicycle. Marko buys a bike marked $400. He receives a 20% employee discount and pays 8% sales tax on the discounted price. How much does Marko pay for the bike?
Write each ratio as a fraction in simplest form.
1. 60 fish to 440 frogs
2. 35 shots made out of 55 attempted

Write each ratio as a unit rate.
3. 162 heartbeats in 60 seconds
4. 135 push-ups in 6 minutes

Solve each proportion.
5. \( \frac{z}{14} = \frac{48}{168} \)
6. \( \frac{60}{y} = \frac{80}{120} \)
7. \( \frac{6.4}{1.6} = \frac{b}{0.4} \)

CONSTRUCTION For Questions 8–10, use the following information.
On a scale drawing of a swimming pool, \( \frac{1}{8} \) inch = 4 feet.
Find the actual length of each dimension.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Drawing Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>( \frac{5}{8} ) inches</td>
</tr>
<tr>
<td>width</td>
<td>( \frac{3}{4} ) inch</td>
</tr>
<tr>
<td>depth</td>
<td>( \frac{3}{16} ) inch</td>
</tr>
</tbody>
</table>

Identify each percent modeled.

11. [Diagram]
12. [Diagram]
Write each percent as a decimal and as a fraction in simplest form.

13. Model 29%.

14. 6%

15. 0.8%

16. 230%

Write each fraction or decimal as a percent.

17. \(\frac{16}{25}\)

18. \(\frac{28}{50}\)

19. 0.15

Find the percent of each number.

20. 35% of 105

21. 6% of 300

22. 96% of 85

Estimate each percent.

23. 32% of 19

24. 76% of 123

25. **SALES TAX** The sales tax is 8.5%. Estimate how much tax will be charged for a purchase totaling $42.99.

**Bonus** **SHIRT** A sweatshirt is on sale for $15. This is 80% of the regular price. What was the regular price of the sweatshirt?

B: ____________
1. **a.** Tell in your own words the meaning of **ratio**.

   b. Give an example of a ratio. Write the ratio in four ways.

   c. Tell in your own words the meanings of **rate** and **unit rate**. Give an example of a unit rate and an example of a rate that is not a unit rate.

   d. Tell in your own words the meaning of **proportion**.

   e. Write a word problem that uses a scale drawing and proportions.

   f. Solve the word problem in part e. Explain each step.

2. A store is marking merchandise down for the back-to-school sale. Clothing is to be marked down 30%. School supplies are to be on sale for \( \frac{1}{4} \) off, and sporting goods prices will be reduced 20%.

   a. Tell how to write a percent as a fraction and as a decimal.

   b. Find the sale price of a $35 basketball in two ways.

   c. Estimate the sale price of a jacket regularly priced $40. Explain your reasoning.

   d. Find the sale price of the jacket in part c.

   e. Tell how to write a fraction as a percent.

   f. Write \( \frac{1}{4} \) as a percent. Show your work.

   g. On which item would a customer save more money, the $35 basketball or a $32 book for school? Explain your reasoning.
Choose the correct term to complete each sentence.

1. A unit rate is a ratio that always has a (denominator, numerator) of 1.

2. Equivalent ratios are ratios that have the same (denominator, value)

3. A (proportion, rate) is an equation showing that two ratios are equivalent.

4. A (scale, percent) gives the ratio that compares the measurements on a scale drawing of an object to the measurements of the real object.

5. A (cross product, ratio) is a comparison of two numbers by division.

6. A (unit rate, rate) best tells the quantity per unit measure.

7. A scale drawing is a drawing of an object in which the measurements are (proportional, identical) to the measurements on the actual object.

8. 50 miles in 2 hours is an example of a (rate, scale).

9. In order for two ratios to form a proportion, their (cross products, unit rates) must be equal.

10. A (percent, rate) is a ratio that compares a number to 100.

In your own words, define the term.

11. cross product
Chapter 10 Quiz
(Lessons 10-1 and 10-2)

Write each ratio as a fraction in simplest form.
1. 12 cats to 15 dogs
2. 4 eggs to 22 ounces
3. 16 girls out of 40 students

Write each ratio as a unit rate.
4. 75 miles in 60 minutes
5. $11.97 for 3 rental DVDs

Solve each proportion.
6. \( \frac{a}{6} = \frac{5}{10} \)
7. \( \frac{6}{x} = \frac{9}{1.5} \)
8. \( \frac{3}{4} = \frac{c}{6} \)
9. \( \frac{4}{5} = \frac{20}{z} \)

10. GROCERIES Suppose you buy 3 pounds of bananas for $0.99. How many pounds can you buy for $4.95?

Chapter 10 Quiz
(Lessons 10-3 and 10-4)

BRIDGE On a scale model of the Golden Gate Bridge, the scale is 1 inch = 100 meters. Find the actual measurements.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Model Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. width</td>
<td>( \frac{1}{4} ) inch</td>
</tr>
<tr>
<td>2. length</td>
<td>27 inches</td>
</tr>
</tbody>
</table>

For Questions 3 and 4, model each percent.
3. 72%
4. 12%

5. Identify the percent modeled.
Chapter 10 Quiz
(Lessons 10-5 and 10-6)

Write each percent as a fraction in simplest form.
1. 5%

2. 130%

Write each fraction as a percent.
3. \( \frac{9}{20} \)

4. \( \frac{5}{2} \)

Write each percent as a decimal.
5. 21%

6. 0.4%

Write each decimal as a percent.
7. 0.35

8. 0.812

Replace each \( \bullet \) with <, >, or = to make a true sentence.
9. 13% \( \bullet \) 1.3%

10. 5.1% \( \bullet \) 15%

Find the percent of each number.
1. 20% of 150

2. 0.4% of 88

Estimate each percent.
3. 69% of 140

4. 26% of 119

5. MULTIPLE-CHOICE TEST ITEM Which of the following is a reasonable percent for the percent of the figure that is shaded?
A. 25%
B. 30%
C. 50%
D. 65%
Chapter 10 Mid-Chapter Test
(Lessons 10-1 through 10-4)

Write the letter for the correct answer in the blank at the right of each question.

1. Write the ratio $45$ boys out of $60$ students as a fraction in simplest form.
   A. $\frac{4}{3}$  B. $\frac{3}{4}$  C. $\frac{3}{7}$  D. $\frac{45}{60}$
   1. ____

2. Write the ratio $180$ miles on $10$ gallons of gas as a unit rate.
   F. $18$ miles  G. $\frac{18}{18 \text{ gallons}}$  H. $\frac{18 \text{ miles}}{1 \text{ gallon}}$  I. $\frac{18 \text{ gallons}}{1 \text{ mile}}$
   2. ____

For Questions 3 and 4, solve each proportion.

3. $\frac{m}{80} = \frac{15}{20}$
   A. $6$  B. $60$  C. $1,200$  D. $\frac{1}{60}$
   3. ____

4. $\frac{18}{54} = \frac{10}{x}$
   F. $30$  G. $3$  H. $540$  I. $\frac{1}{3}$
   4. ____

5. Identify the percent modeled.
   A. $20\%$  B. $80\%$  C. $64\%$  D. $36\%$
   5. ____

For Questions 6 and 7, solve each proportion.

6. $\frac{18}{m} = \frac{50}{100}$
   6. __________

7. $\frac{27}{36} = \frac{x}{16}$
   7. __________

STATES For Questions 8 and 9, use the following information.
On a map of Texas, the scale is $4$ inches $= 100$ miles.

8. The distance between two cities is $2\frac{1}{2}$ inches. Find the actual distance.
   8. __________

   9. __________

10. Model $42\%$.
   10. __________
Chapter 10 Cumulative Review  
(Chapters 1–10)

1. Find the value of $4a \div 5 + b - 2c$ if $a = 10$, $b = 3$, and $c = 4$.  (Lesson 1-6)  

2. **SCHOOL** Thirty students take a math test. The highest score is 97 points, and the range is 29. What is the lowest score? (Lesson 2-7)  

3. **SHOPPING** Pete buys a CD for $12.39. If he pays with a $20 bill, how much change will he get back? (Lesson 3-5)  

4. Evaluate $d \div c$ if $c = 4$ and $d = 28.5$. (Lesson 4-3)  

5. Write 3.065 as mixed number in simplest form. (Lesson 5-6)  

6. Find $6\frac{11}{12} - 2\frac{1}{6}$. Write in simplest form. (Lesson 6-5)  

**Multiply or divide. Write in simplest form.**  
7. $\frac{2}{5} \times \frac{7}{8}$ (Lesson 7-2)  

8. $\frac{6}{7} \div \frac{9}{14}$ (Lesson 7-4)  

9. Write the opposite of $-8$. (Lesson 8-1)  

10. Rewrite $5 \times 74 \times 20$ so that it is easy to calculate mentally. Then mentally find the product. (Lesson 9-1)  

**Solve each equation.**  
11. $3 = m + 5$ (Lesson 9-2)  

12. $15 = -3n$ (Lesson 9-4)  

13. Complete the function table. (Lesson 9-6)  

<table>
<thead>
<tr>
<th>Input($x$)</th>
<th>Output($x - 3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

14. Write the ratio **30 shots made out of 45 attempted** as a fraction in simplest form. (Lesson 10-1)  

15. Solve $\frac{6}{z} = \frac{30}{35}$. (Lesson 10-2)  

16. Write $\frac{19}{50}$ as a percent. (Lesson 10-5)  

17. Write 0.29% as a decimal. (Lesson 10-6)  

18. Find 80% of 320. (Lesson 10-7)
1. The line graph shows Ravi’s savings from January through May. What is the best prediction for Ravi’s July balance? (Lesson 2-4)

   - A. $300
   - B. $350
   - C. $400
   - D. $500

2. Twenty out of twenty-five students in Martin’s class own a pet. What is the fraction of the class that own pets? Write in simplest form. (Lesson 5-2)

   - F. $\frac{20}{25}$
   - G. $\frac{80}{100}$
   - H. $\frac{4}{5}$
   - I. $\frac{4}{9}$

3. Find $7\frac{1}{8} - 3\frac{5}{24}$ in simplest form. (Lesson 6-6)

   - A. $3\frac{11}{12}$
   - B. $4\frac{11}{12}$
   - C. $3\frac{22}{24}$
   - D. $4\frac{1}{4}$

4. What number is missing from the sequence 128, 64, 32, _, 8? (Lesson 7-6)

   - F. 10
   - G. 24
   - H. 16
   - I. 12

5. Which list is in order from greatest to least? (Lesson 8-1)

   - A. 3, 0, −4, −2
   - B. −4, 3, −2, 0
   - C. 3, 0, −2, −4,
   - D. −4, −2, 0, 3

6. There are 4 more white roses in a bouquet than there are red roses. If there are 8 white roses, how many red roses are in the bouquet? (Lesson 9-2)

   - F. −4
   - G. 4
   - H. 12
   - I. −12

For Questions 7 and 8, solve each equation.

7. $7 = n - 1$ (Lesson 9-3)

   - A. 8
   - B. −8
   - C. 6
   - D. −6

8. $4m - 7 = 9$ (Lesson 9-5)

   - F. $\frac{1}{2}$
   - G. $-\frac{1}{2}$
   - H. 4
   - I. −4
9. Five of the first 25 presidents were born in March. What percent of the first 25 presidents were born in March? (Lesson 10-5)

A. 20%  
B. 5%  
C. 25%  
D. 50%  

9. A  B  C  D

Part 2: Short Response/Grid In

Instructions: Enter your grid in answers by writing each digit of the answer in a column box and then shading in the appropriate circle that corresponds to that entry. Write answers to short answer questions in the space provided.

10. What is the least common multiple of 4 and 14? (Lesson 5-4)

10. 11.  

11. A board that is 10\(\frac{1}{2}\) feet long will be cut into pieces that are each \(\frac{7}{8}\) feet long. How many pieces of board will there be? (Lesson 7-5)

11. 

12. Find the product of 4 and \(-7\). (Lesson 8-4)

12. 

13. Solve \(\frac{n}{25} = \frac{16}{30}\). (Lesson 10-2)

13. 

Part 3: Extended Response

Instructions: Write your answers below or to the right of the questions.

14. a. Identify the percent that is modeled. (Lesson 10-4)

14. 

b. Write this percent as a fraction in simplest form. Explain each step of your solution. (Lesson 10-5)

b. 

c. Write this percent as a decimal. Explain your solution. (Lesson 10-6)
Standardized Test Practice

Part 1: Multiple Choice
Select the best answer from the choices given and fill in the corresponding oval.

1. (A) (B) (C) (D)
2. (F) (G) (H) (I)
3. (A) (B) (C) (D)
4. (F) (G) (H) (I)
5. (A) (B) (C) (D)
6. (F) (G) (H) (I)
7. (A) (B) (C) (D)

Part 2: Short Response/Grid in
Solve the problem and write your answer in the blank.
For grid in questions, also enter your answer by writing each number or symbol in a box. Then fill in the corresponding circle for that number or symbol.

8. ____________ (grid in)
9. ____________
10. ____________
11. ____________ (grid in)
12. ____________
13. ____________
14. ____________ (grid in)
15. ____________ (grid in)
16. ____________ (grid in)
17. ____________
18. ____________ (grid in)
19. ____________ (grid in)
20. ____________

Part 3: Extended Response
Record your answer for Question 21 on the back of this paper.
General Scoring Guidelines

- If a student gives only a correct numerical answer to a problem but does not show how he or she arrived at the answer, the student will be awarded only 1 credit. All extended response questions require the student to show work.
- A fully correct answer for a multiple-part question requires correct responses for all parts of the question. For example, if a question has three parts, the correct response to one or two parts of the question that required work to be shown is not considered a fully correct response.
- Students who use trial and error to solve a problem must show their method. Merely showing that the answer checks or is correct is not considered a complete response for full credit.

Exercise 21 Rubric

<table>
<thead>
<tr>
<th>Score</th>
<th>Specific Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>A proportion equivalent to ( \frac{2}{32} = \frac{1}{x} ) is written. The proportion is correctly solved to determine that one foot on the model represents 16 ft. Another proportion is used to determine that a branch that is 4 ft long should be ( \frac{1}{4} ) ft or 3 in. on the model.</td>
</tr>
<tr>
<td>3</td>
<td>The proportions are correct, but one computational error is made in solving one of the proportions. <strong>OR</strong> One of the proportions and its solution are correct. The other proportion is incorrect, but the solution of the given proportion is correct.</td>
</tr>
<tr>
<td>2</td>
<td>One of the proportions and its solution are correct, but the other proportion and its solution is incorrect. <strong>OR</strong> Both of the proportions are correct, but the solutions are incorrect.</td>
</tr>
<tr>
<td>1</td>
<td>Only one of the proportions is correct, and neither solution is correct. <strong>OR</strong> One or both of the solutions is correct, but the proportions are not given.</td>
</tr>
<tr>
<td>0</td>
<td>Response is completely incorrect.</td>
</tr>
</tbody>
</table>
Name ________________________ Date ______________ Period _____

Study Guide and Intervention

Ratios

A ratio is a comparison of two numbers by division. A common way to express a ratio is as a fraction in simplest form. Ratios can also be written in other ways. For example, the ratio \(\frac{2}{3}\) can be written as 2 to 3, 2 out of 3, or 2:3.

Examples

Refer to the diagram at the right.

1. Write the ratio that compares the number of circles to the number of triangles.
   \(\frac{4}{5}\) The GCF of 4 and 5 is 1.
   So, the ratio of circles to triangles is \(\frac{4}{5}\) and \(\frac{5}{4}\).
   For every 4 circles, there are 5 triangles.

2. Write the ratio that compares the number of circles to the total number of figures.
   \(\frac{2}{5}\) The GCF of 4 and 10 is 2.
   \(\frac{2}{10} = \frac{1}{5}\)
   The ratio of circles to the total number of figures is \(\frac{2}{5}\), 2 to 5, or 2:5.
   For every two circles, there are five total figures.

A rate is a ratio of two measurements having different kinds of units. When a rate is simplified so that it has a denominator of 1, it is called a unit rate.

Example

Write the ratio 20 students to 5 computers as a unit rate.

\[
\frac{20 \text{ students}}{5 \text{ computers}} = \frac{4 \text{ students}}{1 \text{ computer}}
\]

The ratio written as a unit rate is 4 students to 1 computer.

Exercises

Write each ratio as a fraction in simplest form.

1. 2 puppies out of 6 fish
   \(\frac{2}{6} = \frac{1}{3}\)

2. 12 puppies to 15 kittens
   \(\frac{12}{15} = \frac{4}{5}\)

3. 5 boys out of 10 students
   \(\frac{5}{10} = \frac{1}{2}\)

Write each ratio as a unit rate.

4. 2 eggs for 3 people
   \(\frac{2}{3} \text{ eggs per person}\)

5. \$12 for 4 pounds
   \(\frac{12}{4} = \frac{3}{1} \text{ dollars per pound}\)

6. 40 pages in 8 days
   \(\frac{40}{8} = 5 \text{ pages per day}\)

Ratios

Write each ratio as a fraction in simplest form.

1. 3 sailboats to 6 motorboats
   \(\frac{3}{6} = \frac{1}{2}\)

2. 4 tulips to 9 daffodils
   \(\frac{4}{9}\)

3. 5 baseballs to 25 softballs
   \(\frac{5}{25} = \frac{1}{5}\)

4. 2 days out of 8 days
   \(\frac{2}{8} = \frac{1}{4}\)

5. 6 poodles out of 18 dogs
   \(\frac{6}{18} = \frac{1}{3}\)

6. 10 yellow eggs out of 12 colored eggs
   \(\frac{10}{12} = \frac{5}{6}\)

7. 12 sheets of paper out of 28
   \(\frac{12}{28} = \frac{3}{7}\)

8. 18 hours out of 24 hours
   \(\frac{18}{24} = \frac{3}{4}\)

9. 16 elms out of 20 trees
   \(\frac{16}{20} = \frac{4}{5}\)

10. 15 trumpets to 9 trombones
    \(\frac{15}{9} = \frac{5}{3}\)

11. 5 ducks to 30 geese
    \(\frac{5}{30} = \frac{1}{6}\)

12. 14 lions to 10 tigers
    \(\frac{14}{10} = \frac{7}{5}\)

13. 6 sodas out of 16 drinks
    \(\frac{6}{16} = \frac{3}{8}\)

14. 20 blue jays out of 35 birds
    \(\frac{20}{35} = \frac{4}{7}\)

Write each ratio as a unit rate.

15. 14 hours in 2 weeks
    \(\frac{14}{2} = 7 \text{ hours per week}\)

16. 36 pieces of candy for 6 children
    \(\frac{36}{6} = 6 \text{ pieces of candy per child}\)

17. 8 teaspoons for 4 cups
    \(\frac{8}{4} = 2 \text{ tsp per cup}\)

18. 5 tomatoes for \$2
    \(\frac{5}{2} = 2.5 \text{ tomatoes per dollar}\)

19. \$28 for 4 hours
    \(\frac{28}{4} = \$7 \text{ per hour}\)

20. 150 miles in 3 hours
    \(\frac{150}{3} = 50 \text{ miles per hour}\)

21. \$18 for 3 CDs
    \(\frac{18}{3} = \$6 \text{ per CD}\)

22. 48 logs on 6 trucks
    \(\frac{48}{6} = 8 \text{ logs per truck}\)

23. Write the ratio 21 wins to 9 losses as a fraction in simplest form.
    \(\frac{21}{9} = \frac{7}{3}\)

24. Write the ratio \$12 dollars for 3 tickets as a unit rate.
    \(\frac{12}{3} = \$4 \text{ per ticket}\)
Pre-Activity
Read the introduction at the top of page 380 in your textbook. Write your answers below.

1. Write a sentence that compares the number of navy socks to the number of white socks. Use the word less in your sentence. Sample answer: There are 10 less navy socks than white socks.

2. Write a sentence that compares the number of black socks to the number of white socks. Use the word half in your sentence. Sample answer: There are half as many black socks than there are white socks.

3. Write a sentence comparing the number of white socks to the total number of socks. Use a fraction in your sentence. Sample answer: Of the socks in the drawer, \( \frac{3}{5} \) are white socks.

Reading the Lesson

4. A ratio compares amounts of two different things by division. Tell what different things are compared in the examples in your textbook.
   - Example 1: number of footballs to the number of tennis balls
   - Example 2: number of pretzels to the total number of snacks

5. Write the ratio of 2 pens out of a total of 3 pens 4 different ways.
   - \( \frac{2}{3} \)
   - 2 to 3
   - 2 out of 3
   - 2:3

6. What is the denominator in a unit rate? 1

Helping You Remember

7. Go to your local grocery store and make a list of unit rates that are used to price items in the store. Also, compare prices for different brands of a certain product. How can you find out which brand provides the best value? Does the store help you to make the comparison? If so, how?

See students’ work.

Practice: Word Problems

Ratios

1. FOOTBALL In the NFL 2001–2002 season, the Miami Dolphins won 11 games and the Oakland Raiders won 10 games. What is the ratio of wins for the Dolphins to wins for the Raiders?
   - 11:10

2. GARDENING Rod has 10 rosebushes, 2 of which produce yellow roses. Write the ratio 2 yellow rosebushes out of 10 rosebushes in simplest form.
   - \( \frac{1}{5} \)

3. TENNIS Nancy and Lisa played 20 sets of tennis. Nancy won 12 of them. Write the ratio of Nancy’s wins to the total number of sets in simplest form.
   - \( \frac{3}{5} \)

4. AGES Oscar is 16 years old and his sister Julia is 12 years old. What will be the ratio of Oscar’s age to Julia’s age in 2 years? Write as a fraction in simplest form.
   - \( \frac{9}{7} \)

5. MOVIES Four friends paid a total of $32 for movie tickets. What is the ratio $32 for 4 people written as a unit rate?
   - $8 per person

6. WORKING At a warehouse, the employees can unload 18 trucks in 6 hours. What is the unit rate for unloading trucks?
   - 3 trucks per hour

7. ANIMALS A reindeer can run 96 miles in 3 hours. At this rate, how far can a reindeer run in 1 hour? Explain.
   - 32 mi; Sample answer: If it takes a reindeer 3 hours to run 96 mi, it must take \( \frac{3}{3} \) = 1 h to run 96 ÷ 3 = 32 mi.

8. SHOPPING Jenny wants to buy cereal that comes in large and small boxes. The 32-ounce box costs $4.16, and the 14-ounce box costs $2.38. Which box is less expensive per ounce? Explain. The larger box is less expensive. It costs $0.13 per oz., and the smaller box costs $0.17 per oz.
**10-1 Enrichment**

**Ratios and Rectangles**

1. Use a centimeter ruler to measure the width and the length of each rectangle. Then express the ratio of the width to the length as a fraction in simplest form.

   - **A:** width = 2 cm, length = 4 cm, ratio = \(\frac{1}{2}\)
   - **B:** width = 3 cm, length = 5 cm, ratio = \(\frac{3}{5}\)
   - **C:** width = 4 cm, length = 6 cm, ratio = \(\frac{2}{3}\)
   - **D:** width = 6 cm, length = 9 cm, ratio = \(\frac{2}{3}\)
   - **E:** width = 4.8 cm, length = 4.8 cm, ratio = \(\frac{1}{1}\)

2. Similar figures have the same shape, but not necessarily the same size. Two rectangles are similar if the ratio of the width to the length is the same for each. Which rectangles in Exercise 1 are similar? **C and D**

3. For centuries artists and architects have used a shape called the golden rectangle because people seem to find it most pleasant to look at. In a golden rectangle, the ratio of the width to the length is a little less than \(\frac{5}{8}\). Which rectangle in Exercise 1 is most nearly a golden rectangle? **B**

**10-2 Study Guide and Intervention**

**Solving Proportions**

A proportion is an equation stating that two ratios are equivalent. For example, the ratios \(\frac{1}{2}\) and \(\frac{3}{6}\) are equivalent, so the equation \(\frac{1}{2} = \frac{3}{6}\) is a proportion. In order for two ratios to form a proportion, their cross products must be equal.

When one value in a proportion is unknown, you can use cross products to solve the proportion.

**EXAMPLE 1**

Solve \(\frac{2}{3} = \frac{n}{7}\).

- Cross products
- Multiply
- Divide each side by 2.
- The solution is 10.

**EXAMPLE 2**

Solve \(\frac{3}{4} = \frac{6}{12}\).

- Cross products
- Multiply
- Divide each side by 4.
- The solution is 9.

**EXERCISES**

Determine whether each pair of ratios form a proportion. Explain your reasoning.

1. \(\frac{3}{6} = \frac{5}{10}\)
   - Yes; the cross products are equal.

2. \(\frac{2}{9} = \frac{4}{16}\)
   - No; the cross products are not equal.

Solve each proportion.

3. \(\frac{2}{3} = \frac{8}{n}\)
   - \(n = 12\)

4. \(\frac{3}{4} = \frac{12}{x}\)
   - \(x = 16\)

5. \(\frac{2}{4} = \frac{x}{8}\)
   - \(x = 4\)

6. \(\frac{3}{5} = \frac{b}{15}\)
   - \(b = 9\)

7. \(\frac{12}{9} = \frac{c}{15}\)
   - \(c = 20\)

8. \(\frac{d}{16} = \frac{3}{6}\)
   - \(d = 8\)

9. \(\frac{x}{26} = \frac{15}{13}\)
   - \(x = 30\)

10. \(\frac{2}{5} = \frac{6}{y}\)
    - \(y = 15\)

11. \(\frac{81}{26} = \frac{0.5}{x}\)
    - \(x = 13\)
1. SCHOOL The ratio of boys to girls in history class is 4 to 5. How many girls are in the class if there are 12 boys in the class? Explain.
   15 girls; Sample answer: If the ratio is 4 boys for every 5 girls in the class, the equivalent ratio must be 12 boys to an unknown number of girls, \( \frac{4}{5} = \frac{12}{g} \). Since \( 12 = 3 \times 4 \), \( g = 3 \times 5 \) or 15.

2. FACTORIES A factory produces 6 motorcycles in 9 hours. Write a proportion and solve it to find how many hours it takes to produce 16 motorcycles.
   \( \frac{6}{9} = \frac{16}{x} \); 24 h

3. READING James read 4 pages in a book in 6 minutes. How long would you expect him to take to read 6 pages?
   9 min

4. COOKING A recipe that will make 3 pies calls for 7 cups of flour. Write a proportion and solve it to find how many pies can be made with 28 cups of flour.
   \( \frac{3}{7} = \frac{p}{28} \); 12 pies

5. TYPING Sara can type 90 words in 4 minutes. About how many words would you expect her to type in 10 minutes?
   225 words

6. BASKETBALL The Lakewood Wildcats won 5 of their first 7 games this year. There are 28 games in the season. About how many games would you expect the Wildcats to win this season? Explain your reasoning.
   20 games; Sample answer: If they have already won 5 out of 7 games, they will probably continue to win in the same proportion for the remainder of the season, \( \frac{5}{7} = \frac{x}{28} \).

7. FOOD Two slices of Dan’s Famous Pizza have 230 Calories. How many Calories would you expect to be in 5 slices of the same pizza?
   575 Calories

8. SHOPPING Andy paid $1.40 for 4 grapefruits. Write a proportion and solve it to find how many grapefruits he can purchase for $2.10.
   \( \frac{1.40}{4} = \frac{2.10}{x} \); 6 grapefruits
Ada

Did you know that a woman wrote the first description of a computer programming language? She was the daughter of a famous English lord and was born in 1815. She had a deep understanding of mathematics and was fascinated by calculating machines. Her interests led her to create the first algorithm. In 1841, she translated a French version of a lecture by Charles Babbage. In her notes to the translation, she outlined the fundamental concepts of computer programming. She died in 1852. In 1979, the U.S. Department of Defense named the computer language **Ada** after her.

To find out this woman’s full name, solve the proportion for each letter.

1. \( \frac{7}{A} = \frac{28}{40} \)
2. \( \frac{5}{B} = \frac{36}{40} \)
3. \( \frac{1}{C} = \frac{15}{18} \)
4. \( \frac{4}{D} = \frac{35}{63} \)
5. \( \frac{2}{E} = \frac{20}{30} \)
6. \( \frac{3}{F} = \frac{27}{18} \)
7. \( \frac{6}{G} = \frac{12}{14} \)
8. \( \frac{9}{H} = \frac{44}{11} \)
9. \( \frac{8}{I} = \frac{4}{32} \)
10. \( \frac{5}{J} = \frac{25}{30} \)

Reading the Lesson

5. Look at the arithmetic example in the Key Concept box on page 386. What is the significance of the two instances of \( \times 3 \)? **Sample answer:** The numerator and denominator in the first ratio are multiplied by the same number to get the equivalent ratio.

6. If two ratios are equivalent, and therefore form a proportion, what do you know about the cross products? **They are equal.**

7. Look at the final sentence in Example 3 on page 387—”So, 375 students can be expected to prefer gel toothpaste.” Why is it important to use can be expected in this answer? **Sample answer:** Because this is a prediction; there is no way of knowing for sure the preference of all 500 students unless each one is questioned individually.

Helping You Remember

8. Work with a partner. Study Example 1 on page 387. Write a proportion that needs to be solved for an unknown value. Exchange proportions and solve for the unknown value. Explain how you arrived at your solution. **See students’ work.**
**Scale Drawings and Models**

Scale drawings and scale models are used to represent objects that are too large or too small to be drawn or built at actual size. The scale gives the ratio that compares the measurements on the drawing or model to the measurements of the real object. The measurements on a drawing or model are proportional to the measurements of the actual object.

**Example 1**

**RACE CARS** A model of a race car has a width of 3.5 inches. The scale is 1 inch = 2 feet. Find the actual width of the race car.

Let $w$ represent the actual width.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Race Car</th>
</tr>
</thead>
<tbody>
<tr>
<td>model width $\rightarrow \frac{1}{2} = 3.5 \rightarrow$ model width</td>
<td>actual width $\rightarrow \frac{w}{2} = 3.5 \rightarrow$ actual width</td>
</tr>
</tbody>
</table>

$1 \times w = 2 \times 3.5$ Find the cross products.

$w = 7$ Multiply.

The actual width of the race car is 7 feet.

**Example 2**

**HIKING** On a map, the distance between Round Lake and June Lake is 6 inches. The scale on the map is 3 inches = 5 miles. Find the actual distance between the two lakes.

Let $d$ represent the actual distance.

<table>
<thead>
<tr>
<th>Map Scale</th>
<th>Actual Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>map distance $\rightarrow \frac{3}{5} = 6 \rightarrow$ map distance</td>
<td>actual distance $\rightarrow \frac{3d}{5} = 6 \rightarrow$ actual distance</td>
</tr>
</tbody>
</table>

$3d = 5 \times 6$ Find the cross products.

$3d = 30$ Multiply.

$\frac{3d}{3} = 10$ Divide.

$d = 10$ The distance between the two lakes is 10 miles.

**Exercises**

**DRAFTING** For Exercises 1–4, use the following information.

On a set of drawings, the scale is 2 inches = 4 feet. Find the actual measurements.

<table>
<thead>
<tr>
<th>Object</th>
<th>Drawing</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. door</td>
<td>4 inches</td>
<td>8 ft</td>
</tr>
<tr>
<td>2. wall</td>
<td>6 inches</td>
<td>12 ft</td>
</tr>
<tr>
<td>3. tree</td>
<td>12 inches</td>
<td>24 ft</td>
</tr>
<tr>
<td>4. computer</td>
<td>1 inch</td>
<td>2 ft</td>
</tr>
</tbody>
</table>

5. **MAPS** A map has a scale of 3 inches = 7 miles. The distance between Pirate's Cove and Midnight Lagoon on the map is 12 inches. What is the actual distance between the two places? 42 mi

<table>
<thead>
<tr>
<th>Object</th>
<th>Drawing</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. table</td>
<td>4 inches</td>
<td>6 ft</td>
</tr>
<tr>
<td>2. wall</td>
<td>10 inches</td>
<td>15 ft</td>
</tr>
<tr>
<td>3. road</td>
<td>18 inches</td>
<td>27 ft</td>
</tr>
<tr>
<td>4. door</td>
<td>5 inches</td>
<td>7.5 ft</td>
</tr>
<tr>
<td>5. computer</td>
<td>1 inch</td>
<td>1.5 ft</td>
</tr>
<tr>
<td>6. lamp</td>
<td>0.5 inch</td>
<td>0.75 ft</td>
</tr>
</tbody>
</table>

**LIZARDS** Models of lizards were made using the given scales. Find the actual measurements.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Whiptail Lizard</th>
<th>Model</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch $\rightarrow \frac{1}{2}$</td>
<td>body length</td>
<td>6 inches</td>
<td>3 in.</td>
</tr>
<tr>
<td>2 inches $\rightarrow 3$ inches</td>
<td>tail length</td>
<td>12 inches</td>
<td>6 in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scale</th>
<th>Desert Iguana</th>
<th>Model</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inches $\rightarrow 3$ inches</td>
<td>body length</td>
<td>9 inches</td>
<td>13.5 in.</td>
</tr>
<tr>
<td>2 inches $\rightarrow 3$ inches</td>
<td>tail length</td>
<td>18 inches</td>
<td>27 in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ground Gecko</th>
<th>Model</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 inches $\rightarrow 5$ inches</td>
<td>body length</td>
<td>3.6 inches</td>
<td>4.5 in.</td>
</tr>
<tr>
<td>4 inches $\rightarrow 5$ inches</td>
<td>tail length</td>
<td>2 inches</td>
<td>2.5 in.</td>
</tr>
</tbody>
</table>
**Reading to Learn Mathematics**

**Scale Drawings and Models**

**Pre-Activity**
Read the introduction at the top of page 391 in your textbook. Write your answers below.

1. Explain how you would use a ruler to find the number of miles between any two cities on the map. Sample answer: Use a ruler to measure the distance between any two cities and then multiply that measure by 14.

2. Use the method you described in Exercise 1 to find the actual distance between Haletown and Jasper. About 7 miles.

3. What is the actual distance between Kimball and Signal Mountain? About 21 mi.

**Reading the Lesson**

4. Look up the word scale in a dictionary. Write the meaning that matches the way the word is used in this lesson. Sample answer: the proportion that a map, model, etc. bears to the thing that it represents; ratio between the dimensions of a representation and that of the object.

5. Look at Example 1 at the bottom of page 391. Then tell what is happening at each step of the process below.

   1. Write the proportion.
   2. Find the cross products.
   3. Multiply.

6. Look at Example 2 at the top of page 392. What do you need to know in order to solve for \( d \), the actual distance? You need to know the scale and the distance on the map.

7. Bring a map or set of maps to school (for example, maps of the world as found in an almanac). Using the scale on the map, practice measuring distances between objects on the map.

8. Make a scale drawing of some object with which you are familiar. Take the actual measurements of the object. Decide on a scale. Create the drawing. Be sure to put the scale somewhere on your drawing so a reader will be able to tell the size of the actual object.

**Helping You Remember**

NAME ________________________________________ DATE ______________ PERIOD _____

**Practice: Word Problems**

**Scale Drawings and Models**

1. Maps On a map with a scale of 1 inch = 9 miles, the distance between two towns is 3 inches. What is the actual distance between the two towns? 27 mi.

2. Blueprints On an architect’s blueprint, the height of a building measures 1 inch = 2 feet. The actual height of the building is 14 feet. How tall was the actual building? 11 ft.

3. Models The model of an airplane has a wingspan of 20 inches. The model has a scale of 1 inch = 4 feet. What is the wingspan of the actual airplane? 80 ft.

4. Architecture The drawing for a building has a scale of 1 inch = 3 feet. The building in the drawing has a height of 16 feet. How tall will the actual building be? 48 ft.

5. Maps A map of the Saturn V rocket has a scale of 1 inch = 12 feet. If the model rocket is 30 inches tall, how tall was the actual Saturn V rocket? 360 ft.

6. Car’s Ron took a photograph of his car and measured the length of the car in the photograph. The length was 4 2/3 inches. If the scale of the photograph is 1 inch = 4 feet, how long is Ron’s actual car? 18 ft.

7. Photography A photo lab technician is going to reduce a photograph that is 9 inches wide using a scale of 1 inch = 2 inches wide. How wide will the reduced photo be? 6 in.

8. Models A model of the Saturn V rocket engine is built on a scale of 1 inch = 6 inches. If the length of the model engine is 9 inches, how long is the actual engine? 54 in.
Planning a Room

Before moving furniture into a room, many people plan an arrangement by making a scale drawing. This makes it possible to find the best arrangement for the room without actually moving heavy furniture.

For each piece of furniture, actual measurements are given. Compute scale measurements using the scale $\frac{1}{2}$ inch = 1 foot.

1. bed: $6\frac{1}{2}$ feet long, 3 feet wide, $3\frac{3}{4}$ in. long, $1\frac{1}{2}$ in. wide
2. bedside table: $1\frac{1}{2}$ feet long, $1\frac{1}{2}$ feet wide, $3\frac{3}{4}$ in. long, $3\frac{3}{4}$ in. wide
3. bookcase: $3\frac{1}{2}$ feet long, 1 foot wide, $1\frac{3}{4}$ in. long, $1\frac{1}{4}$ in. wide
4. desk: 42 inches long, 18 inches wide, $1\frac{3}{4}$ in. long, $\frac{3}{4}$ in. wide
5. chest of drawers: 39 inches long, 18 inches wide, $\frac{5}{8}$ in. long, $\frac{3}{4}$ in. wide

6. Use your answers from Exercises 1–5. Show how the furniture might be arranged in the bedroom shown below.

Arrangements may vary.

Model each percent.

1. 20%
2. 55%
3. 12%
4. 60%
5. 45%
6. 70%

You can use what you know about decimal models and percents to identify the percent of a model that is shaded.
Practice: Word Problems
Modeling Percents

1. FOOTBALL In the 2001–2002 season, the Dallas Cowboys football team won 45% of their games. Make a model to show 45%.

2. LANDSCAPING Jacob is making a 10 foot by 10 foot patio in his backyard using paving stones that are 1 foot square. The shaded area of the model indicates the finished part of the patio. What percent of the patio has Jacob finished?

3. ART Lydia is making a collage using 100 photographs arranged in a square pattern. The shaded area in the model indicates the part of the collage already covered by photos. What percent of the collage is finished?

4. ENERGY In the year 2000, nuclear energy accounted for 8% of the energy used in the U.S. Make a model to show 8%.

5. GAMES The figure shows the starting position for a game played on a 10 by 10 board. The shaded squares contain game pieces. What percent of the squares on the board contain game pieces?

6. MUSIC In the school chorus, 52% of the girls sing soprano and 44% sing alto. Which of these two sections of the chorus has more girls? Explain using models.

Model each percent. 1–6. Sample answers given.

1. 15%
2. 50%
3. 75%
4. 80%
5. 21%
6. 48%

Identify each percent that is modeled.

7. 20%
8. 60%
9. 90%
10. 55%
11. 40%
12. 15%
13. 25%
14. 50%
15. 35%
We the People

Who are the people of the United States? The graphs at the right show just a small part of the data gathered in the 2000 Census of the Population. Using the data shown on these graphs, decide whether each statement is true or false.

1. About 12% of all the people counted in the census responded that they are black. **true**

2. About 5% of all the people counted in the census identified their national origin as Cuban. **false**

3. About 58% of the Hispanic Americans counted in the census identified their national origin as Mexican. **true**

4. The number of people who identified themselves as white is about 120 million. **false**

5. How well can you picture data? In the space at the right, sketch a circle graph to show the data below.

**Americans’ Region of Residence, 2000**

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>19%</td>
</tr>
<tr>
<td>Midwest</td>
<td>23%</td>
</tr>
<tr>
<td>South</td>
<td>35%</td>
</tr>
<tr>
<td>West</td>
<td>23%</td>
</tr>
</tbody>
</table>

**Hispanic or Latino Americans: National Origin, 2000**

- Mexico: 58%
- Other: 28%
- Puerto Rico: 4%
- Cuba: 4%
- Other Races: 8%
- Asian and Pacific Islander: 4%
- American Indian, Eskimo, and Aleut: 1%

**Population of the United States, 2000**

- White: 75%
- Black: 12%
- Other Races: 8%
- Asian and Pacific Islander: 4%
- American Indian, Eskimo, and Aleut: 1%

---

**Pre-Activity** Read the introduction at the top of page 395 in your textbook. Write your answers below.

1. What ratio compares the number of students who prefer grape flavored lollipops to the total number of students? **45 out of 100**

2. What decimal represents this ratio? **0.45**

3. Use a decimal model to represent this ratio. **Sample answer:**

**Reading the Lesson**

4. Explain why a 10 × 10 grid is a good way to model percents. **Sample answer:** Because a 10 × 10 grid contains 100 squares and because percent means “out of 100,” the number of squares shaded in on a 10 × 10 grid indicates a certain percent.

5. Complete the table.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Number out of 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>75%</td>
<td>75 out of 100</td>
</tr>
<tr>
<td>37%</td>
<td>37 out of 100</td>
</tr>
</tbody>
</table>

6. Look at the model in Example 3 on page 396. What is another way to model 25%? **Sample answer:** Shade 2 and a half rows of 10.

**Helping You Remember**

7. Look at the nutrition facts on any food label. Which item contains the highest percent of daily value per serving? Make a model to represent that amount. Label the model to indicate what the model shows. **See students’ work.**
10-5
Study Guide and Intervention
Percents and Fractions

To write a percent as a fraction, write it as a fraction with a denominator of 100. Then simplify.

EXAMPLE 1
Write 15% as a fraction in simplest form.

15% means 15 out of 100.

\[ \frac{15}{100} \]

Write the percent as a fraction with a denominator of 100.

\[ \frac{15}{100} = \frac{\cancel{15}}{\cancel{100}} = \frac{3}{20} \]

Simplify. Divide the numerator and denominator by the GCF, 5.

EXAMPLE 2
Write 180% as a fraction in simplest form.

180% means 180 out of 100.

\[ \frac{180}{100} \]

Write the percent as a fraction with a denominator of 100.

\[ \frac{180}{100} = \frac{\cancel{180}}{\cancel{100}} = 1\frac{4}{5} \]

Simplify.

You can also write fractions as percents. To write a fraction as a percent, write a proportion and solve.

EXAMPLE 3
Write \( \frac{2}{5} \) as a percent.

\[ \frac{2}{5} \]

Set up a proportion.

\[ \frac{2}{5} = \frac{n}{100} \]

Write the cross products.

\[ 2 \times 100 = 5 \times n \]

Multiply.

\[ 200 = 5n \]

Divide each side by 5.

\[ \frac{200}{5} = \frac{5n}{5} \]

\[ 40 = n \]

So, \( \frac{2}{5} \) is equivalent to 40%.

EXAMPLE 4
Write \( \frac{9}{8} \) as a percent.

\[ \frac{9}{8} \]

Set up a proportion.

\[ \frac{9}{8} = \frac{p}{100} \]

Write the cross products.

\[ 9 \times 100 = 8 \times p \]

Multiply.

\[ 900 = 8p \]

Divide each side by 8.

\[ \frac{900}{8} = \frac{8p}{8} \]

\[ 112.5 = p \]

So, \( \frac{9}{8} \) is equivalent to 112.5%.

EXERCISES

Write each percent as a fraction in simplest form.

1. 20% \( \frac{1}{5} \)
2. 35\% \( \frac{7}{20} \)
3. 70\% \( \frac{7}{10} \)
4. 60\% \( \frac{3}{5} \)
5. 150\% \( \frac{1\frac{1}{2}}{2} \)
6. 225\% \( \frac{2\frac{1}{4}}{2} \)

Write each fraction as a percent.

7. \( \frac{3}{10} \) 30\%
8. \( \frac{2}{100} \) 2\%
9. \( \frac{8}{5} \) 160\%
10. \( \frac{1}{5} \) 20\%
11. \( \frac{10}{8} \) 125\%
12. \( \frac{13}{100} \) 13\%
13. \( \frac{9}{50} \) 18\%
14. \( \frac{37}{50} \) 74\%
15. \( \frac{43}{100} \) 43\%
16. \( \frac{4}{5} \) 80\%
17. \( \frac{3}{20} \) 15\%
18. \( \frac{7}{10} \) 70\%
19. \( \frac{3}{5} \) 60\%
20. \( \frac{3}{2} \) 150\%
21. \( \frac{5}{4} \) 125\%
22. \( \frac{6}{5} \) 120\%
23. \( \frac{9}{30} \) 45\%
24. \( \frac{13}{20} \) 65\%
25. \( \frac{17}{20} \) 85\%
26. \( \frac{9}{5} \) 180\%
27. \( \frac{11}{10} \) 110\%
28. \( \frac{19}{20} \) 95\%
29. \( \frac{3}{10} \) 130\%
30. \( \frac{21}{100} \) 21\%
Pre-Activity  
*Read the introduction at the top of page 400 in your textbook.*  
Write your answers below.

1. **What was the second most popular reason?**  
*a great role model*  
2. **What percent represents this section of the graph?**  
22%  
3. **Based on the meaning of 22%, make a conjecture as to how you would write this percent as a fraction.**  
Since 22% means 22 out of 100, write 22 out of 100 as the fraction \( \frac{22}{100} \). Then write the fraction in simplest form. In simplest form, \( \frac{11}{50} \). So, 22% can be written as \( \frac{11}{50} \).  

Reading the Lesson  
4. **Write the two steps to use to write a percent as a fraction.**  
Write the percent as a fraction with a denominator of 100. Then simplify.  
5. **Look at the graphic at the top of page 400. What is the sum of the percents? Look at the table at the top of page 401. What is the sum of the percents? Why is this important?**  
100; 100; Sample answer: The sum of the percents is always 100. Otherwise you know that something is missing or that there is something extra.  
6. **Look at Example 2 on page 400. Why is 125% written a mixed number?**  
Sample answer: Because the percent is greater than 100; as shown in the models, 100 fills one \( \frac{10}{10} \) form and 25 fills one fourth of a second \( \frac{10}{10} \) form.

Helping You Remember  
7. **Write a fraction as a percent using the steps shown in Examples 4 and 5 on page 401. Choose any fraction you like different from those in the Examples.**  
See students’ work.
### Percent and the Hundred Chart

The chart at the right shows all the whole numbers from 1 through 100.

This page challenges you to connect percents to what you know about number theory—factors, multiples, divisibility, and so on. Whenever you can, use a pattern in the chart to make your work easier.

For example, the multiples of 5 make up two columns of the chart—the fifth column and the tenth. So, 20 out of 100 numbers, or 20% of the numbers, are multiples of 5.

<table>
<thead>
<tr>
<th>1</th>
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</table>

### Use the hundred chart above. Find the percent of the numbers that:

1. are even numbers. 50%
2. are odd numbers. 50%
3. are multiples of 9. 11%
4. are multiples of 11. 9%
5. are divisible by 5. 20%
6. are divisible by 3. 33%
7. are divisible by 2 and divisible by 5. 10%
8. are divisible by 2 and divisible by 3. 16%
9. contain only even digits. 24%
10. contain only odd digits. 30%
11. have digits whose sum is 10. 9%
12. have digits whose sum is 5. 6%
13. contain the digit 0. 10%
14. contain the digit 5. 19%
15. are factors of 100. 9%
16. are factors of 101. 1%
17. are prime. 25%
18. are composite. 74%

### Exercises

Write each percent as a decimal.

1. 39% 0.39
2. 57% 0.57
3. 82% 0.82
4. 135% 1.35
5. 112% 1.12
6. 84% 0.84

Write each decimal as a percent.

7. 0.86 86%
8. 0.36 36%
9. 0.65 65%
10. 0.2 20%
11. 0.148 14.8%
12. 0.217 21.7%
10-6 Practice: Word Problems
Percents and Decimals

1. **COMMUTING** According to the 2000 U.S. census, 76% of U.S. workers commute to work by driving alone. Write 76% as a decimal. **0.76**

2. **BASEBALL** Barry Bonds’s batting average for the 2002 season was 0.370. Write 0.370 as a percent. **37.0% or 37%**

3. **ELECTIONS** In the 2002 U.S. midterm elections, 39% of eligible adults voted. What is 39% written as a decimal? **0.39**

4. **BASKETBALL** In the 2001–2002 season, Jason Kidd of the New Jersey Nets had a field goal average of 0.391. What is 0.391 written as a percent? **39.1%**

5. **SPORTS** When asked to choose their favorite sport, 27% of U.S. adults who follow sports selected professional football. What decimal is equivalent to 27%? **0.27**

6. **AGE** Lawrence is 18 years old and his brother Luther is 12 years old. This means that Lawrence is 1.5 times older than Luther. What percent is equivalent to 1.5? **150%**

7. **WATER** About 5% of the surface area of the U.S. is water. What decimal represents the amount of the U.S. surface area taken up by water? **0.05**

8. **POPULATION** China accounts for 0.207 of the world’s population. What percent of the world’s population lives in China? **20.7%**
Percent and Per Mill

A **percent** is a ratio that compares a number to 100.

83 \( \frac{83}{100} \) percent = 83\%

0.83

A ratio that compares a number to 1,000 is called a **per mill**. Just like percent, the ratio per mill has a special symbol, \( \‰ \).

83 per mill \( \frac{83}{1000} \)‰ = 83‰

0.083

Throughout the world, the ratio that is used most commonly is percent. However, in some countries, you will find both ratios in use.

Express per mill as a decimal.

1. 325‰ = 0.325
2. 71‰ = 0.071
3. 6‰ = 0.006
4. 900‰ = 0.9
5. 20‰ = 0.02
6. 100‰ = 0.1

Express each per mill as a fraction in simplest form.

7. 47‰ = \( \frac{47}{1000} \)
8. 400‰ = \( \frac{4}{5} \)
9. 100‰ = \( \frac{1}{10} \)
10. 25‰ = \( \frac{1}{40} \)
11. 150‰ = \( \frac{3}{20} \)
12. 30‰ = \( \frac{3}{100} \)

Express each fraction as a per mill.

13. \( \frac{729}{1000} \) = 729‰
14. \( \frac{58}{100} \) = 580‰
15. \( \frac{7}{10} \) = 700‰
16. \( \frac{1}{2} \) = 500‰
17. \( \frac{3}{4} \) = 750‰
18. \( \frac{5}{8} \) = 625‰
19. \( \frac{4}{5} \) = 800‰
20. \( \frac{17}{20} \) = 850‰
21. \( \frac{1}{3} \) = 333\( \frac{1}{3} \)‰

**Challenge**

In the United States, you will sometimes find the **mill** used as a monetary unit. What amount of money do you think is represented by 1 mill? $0.001
Find the percent of each number.

1. 25% of 16
2. 50% of 70
3. 10% of 30
4. 60% of 40
5. 75% of 20
6. 20% of 90
7. 30% of 110
8. 50% of 140
9. 25% of 80
10. 4% of 100
11. 75% of 36
12. 90% of 120
13. 125% of 40
14. 8% of 25
15. 150% of 22
16. 110% of 50
17. 125% of 60
18. 0.4% of 5
19. 6.5% of 40
20. 0.5% of 14
21. 0.1% of 29
22. 130% of 80
23. 4.5% of 60
24. 0.5% of 34
25. 14.5% of 60
26. 14% of 30
27. 24% of 15
28. 140% of 30
29. 6% of 55
30. 160% of 22

The model confirms that 70% of 40 is 28.

So, 70% of 40 is 28. Use a model to check the answer.

So, 120% of 25 is 30.

So, 120% of 25 is 30.
### Pre-Activity

Read the introduction at the top of page 409 in your textbook. Write your answers below.

1. What percent of the cars were traveling 20 miles per hour over the speed limit? 5%

2. Write a multiplication sentence that involves a percent that could be used to find the number of cars out of 300 that were traveling 20 miles an hour over the speed limit. \( 5\% \times 300 \)

### Reading the Lesson

3. What are two different methods you can use to find the percent of a number? Write the percent as a fraction and then multiply, or write the percent as a decimal and then multiply.

4. Complete the statement: 12% of 48 has the same meaning as \( 12\% \times 48 \).

### Helping You Remember

5. Work with a partner. Make up a problem in which you can find the percent of a number as in Examples 1 and 2. One person uses Method 1, writing the percent as a fraction. The other person uses Method 2, writing the percent as a decimal. Compare your results. Make up another problem and have each person use the other method. Again, compare your results. Do you prefer one method over the other? Explain. See students’ work.
Estimating Sales Tax

Many states charge a sales tax on purchases. To be sure that you have enough money, you should be able to estimate the amount of sales tax and the total cost of an item. For example, this is how you can estimate the total cost of the purchase shown at the right.

First, round the price and the rate. Multiply the rounded numbers. So, the total cost is close to $11 + 80¢, or $11.80.

Estimate the total cost of each purchase. Estimates may vary.

1. $9.95
   sales tax rate: 5% $7.35
   sales tax rate: 5.75% $12.72
   sales tax rate: 4.25% $20.80

2. $29.95
   sales tax rate: 6 1/2% $32.10
   sales tax rate: 8 3/4% $86.40
   sales tax rate: 6.25% $127.20

3. $48.95
   sales tax rate: 3% no
   sales tax rate: 4.75% yes
   sales tax rate: 8 3/4% no

Will $50 be enough money to make such purchase?

4. $46.99
5. $46.99
6. $46.99

Will $50 be enough money to make such purchase?

10. CHALLENGE The price marked on a cassette tape is $8.99. With the sales tax, the total cost of the tape is $9.37. Estimate the sales tax rate.
   a little more than 4%
10-8 Practice: Skills
Estimating with Percents

Estimate each percent. 1–18. Sample answers given.

1. 58% of 5  
\[ \frac{3}{5} \times 5 = 3 \]

2. 41% of 10  
\[ \frac{2}{5} \times 10 = 4 \]

3. 75% of 17  
\[ \frac{3}{4} \times 16 = 12 \]

4. 50% of 39  
\[ \frac{1}{2} \times 40 = 20 \]

5. 24% of 13  
\[ \frac{1}{4} \times 12 = 3 \]

6. 82% of 24  
\[ \frac{4}{5} \times 25 = 20 \]

7. 19% of 31  
\[ \frac{1}{5} \times 30 = 6 \]

8. 73% of 61  
\[ \frac{3}{4} \times 60 = 45 \]

9. 62% of 34  
\[ \frac{3}{5} \times 35 = 21 \]

10. 49% of 71  
\[ \frac{1}{2} \times 70 = 35 \]

11. 38% of 42  
\[ \frac{2}{5} \times 40 = 16 \]

12. 27% of 81  
\[ \frac{1}{4} \times 80 = 20 \]

13. 79% of 18  
\[ \frac{4}{5} \times 15 = 12 \]

14. 52% of 118  
\[ \frac{1}{2} \times 120 = 60 \]

15. 19% of 94  
\[ \frac{1}{5} \times 95 = 19 \]

16. 33% of 61  
\[ \frac{1}{3} \times 60 = 20 \]

17. 91% of 82  
\[ \frac{9}{10} \times 80 = 72 \]

18. 67% of 241  
\[ \frac{2}{3} \times 240 = 160 \]

19. –21. Sample answers given. Estimate the percent of the figure that is shaded.

19. [Diagram]

20. [Diagram]

21. [Diagram]

about 50%  
about 75%  
about 50%

10-8 Practice: Word Problems
Estimating with Percents

1. SCHOOL At Westside High School, 24% of the 225 sixth grade students walk to school. About how many of the sixth grade students walk to school?  
Sample answer:  
\[ \frac{1}{4} \times 220 = 55 \text{ students} \]

2. BASKETBALL In the 2002 regular season the WNBA Cleveland Rockers won 31.25% of their games. They had 32 games in their regular season. About how many games did they win?  
Sample answer:  
\[ \frac{3}{10} \times 30 = 9 \text{ games} \]

3. SALES TAX The sales tax rate in Lacon is 9%. About how much tax would you pay on an item that costs $61?  
Sample answer:  
\[ \frac{1}{10} \times 60 = 6 \]

4. SPORTS The concession stand at a football game served 178 customers. Of those, about 52% bought a hot dog. About how many customers bought a hot dog?  
Sample answer:  
\[ \frac{1}{2} \times 180 = 90 \text{ customers} \]

5. READING Max has completed 39% of his reading assignment. If there are 303 pages in the assignment, about how many pages has Max read?  
Sample answer:  
\[ \frac{2}{5} \times 300 = 120 \text{ pages} \]

6. SHOPPING A store is having a 20% sale. That means the customer pays 80% of the regular price. About how much would you pay for an item that regularly sells for $44.99?  
Sample answer:  
\[ \frac{4}{5} \times 45 = 36 \]

7. SLEEP A recent study shows that people spend about 31% of their time asleep. About how much time will a person spend asleep during an average 78 year lifetime?  
Sample answer:  
\[ \frac{3}{10} \times 80 = 24 \text{ years} \]

8. BIOLOGY The human body is 72% water, on average. About how much water will be in a person that weighs 138 pounds?  
Sample answer:  
\[ \frac{7}{10} \times 140 = 98 \text{ lb water} \]
Pre-Activity Read the introduction at the top of page 415 in your textbook. Write your answers below.

1. What would be the cost of the notebook at 10% off? 3.78
2. What would be the cost of the pencils at 25% off? Round to the nearest cent. $1.49
3. Explain how you might estimate the cost of the notebook at 10% off and the cost of the pencils at 25% off. Sample answer: To find the sale price of the notebook, round $4.20 to $4. Then use mental math to subtract 10% of $4, which is $0.40 from $4 to get an estimate of $3.60.

Reading the Lesson
4. Write the fraction for each percent.

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<th>Percent</th>
<th>Fraction</th>
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<tbody>
<tr>
<td>20%</td>
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<td>60%</td>
<td>$\frac{3}{5}$</td>
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<td>80%</td>
<td>$\frac{4}{5}$</td>
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<td>1%</td>
<td>$\frac{1}{100}$</td>
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<td>33%</td>
<td>$\frac{1}{3}$</td>
</tr>
<tr>
<td>66%</td>
<td>$\frac{2}{3}$</td>
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</tbody>
</table>

5. Complete the sentence.
When you estimate with percents, you round to numbers that are ________ easy to multiply

Helping You Remember
6. Work with a partner. Using the fractions and percents in the table you completed for Exercise 4, take turns saying either a fraction or percent. If you say a fraction, your partner writes the corresponding percent. If you say a percent, your partner writes the corresponding fraction. Make sure your partner cannot see the table above. Continue with your practice until you can remember all the fractions and percents. See students’ work.

Using 100%, 10%, and 1%
Many people think of 100%, 10%, and 1% as key percents.
100% is the whole. 100% of 24 = 1 \times 24, or 24.
10% is one tenth of the whole. 10% of 24 = 0.1 \times 24, or 2.4.
1% is one hundredth of the whole. 1% of 24 = 0.01 \times 24, or 0.24.

Find the percent of each number.
1. 100% of 8,000 8,000
2. 10% of 8,000 800
3. 1% of 8,000 80
4. 10% of 640 64
5. 100% of 720 720
6. 1% of 290 2.9
7. 1% of 50 0.5
8. 100% of 33 33
9. 10% of 14 1.4
10. 100% of 2 2
11. 1% of 9 0.09
12. 10% of 7 0.7

This is how you can use the key percents to make some computations easier.
3% of 610 = 0.03 \times 610 = 18.3, 5% of 24 = 0.05 \times 24 = 1.2.
1% of 610 = 0.01 \times 610 = 6.1, 10% of 24 = 0.1 \times 24 = 2.4.

Find the percent of each number.
13. 2% of 140 2.8
14. 8% of 2,100 168
15. 4% of 9 0.36
16. 20% of 233 46.6
17. 70% of 90 63
18. 30% of 4,110 1,233
19. 5% of 160 8
20. 5% of 38 1.9
21. 50% of 612 306
22. 25% of 168 42
23. 2.5% of 320 8
24. 2.5% of 28 0.7
Chapter 10 Assessment Answer Key

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<table>
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<td>9. <strong>C</strong></td>
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(continued on the next page)
Chapter 10 Assessment Answer Key

Form 2A (continued)  
Page 534

10. __H__
11. __C__
12. __F__
13. __D__
14. __G__
15. __A__
16. __G__
17. __C__
18. __H__
19. __C__
20. __F__

B: ______165 g_____

Form 2B  
Page 535

10. __G__
1. __D__
2. __G__
3. __B__
4. __F__
5. __A__
6. __F__
7. __B__
8. __I__
9. __C__

B: ______325 g_____

Page 536

11. __D__
12. __I__
13. __A__
14. __F__
15. __D__
16. __F__
17. __D__
18. __H__
19. __B__
20. __F__
Chapter 10 Assessment Answer Key

Form 2C
Page 537

1. \( \frac{8}{25} \)

2. \( \frac{9}{2} \)

3. \( \frac{53 \text{ km}}{1 \text{ h}} \)

4. \( \frac{5}{1 \text{ month}} \)

5. \( 2 \)

6. \( 27 \)

7. \( 20 \)

8. \( 16 \text{ miles} \)

9. \( 38 \text{ miles} \)

Sample answer:

10. [Diagram of a grid with shaded portions]

Page 538

11. \( 15\% \)

12. \( \frac{41}{50} \)

13. \( 80\% \)

14. \( 0.06 \)

15. \( 4.6\% \)

16. \( 24 \)

17. \( 32.13 \)

18. \( 15 \)

19. \( 50\% \times 60 = 30 \)

20. \( 75\% \times 20 = 15 \)

B: \( 55 \text{ feet} \)
Chapter 10 Assessment Answer Key

Form 2D
Page 539

1. \[ \frac{1}{20} \]

2. \[ \frac{3}{5} \]

3. \[ \frac{30 \text{ miles}}{1 \text{ gal}} \]

4. \[ \frac{30 \text{ students}}{1 \text{ class}} \]

5. 20

6. 7

7. 8

8. 23 km

9. 7.5 km

Sample answer:

10. 

11. 44%

12. \[ \frac{3}{25} \]

13. 60%

14. 0.09

15. 93.1%

16. 21

17. 16

18. 60.5

19. \[ 40\% \times 200 = 80 \]

20. \[ 50\% \times 250 = 125 \]

B: \$345.60
Chapter 10 Assessment Answer Key

Form 3
Page 541

1. \( \frac{3}{22} \)

2. \( \frac{7}{11} \)

2.7 heartbeats

3. \( \frac{1}{s} \)

22.5 push-ups

4. \( \frac{1}{min} \)

5. 4

6. 90

7. 1.6

8. 52 ft

9. 24 ft

10. 6 ft

11. 37%

12. 76%

Page 542

13. Sample answer:

14. \( 0.06; \frac{3}{50} \)

15. \( 0.008; \frac{1}{125} \)

16. \( 2.3; 2\frac{3}{10} \)

17. 64%

18. 56%

19. 15%

20. 36.75

21. 18

22. 81.6

23. \( 30\% \times 20 = 6 \)

24. \( 75\% \times 120 = 90 \)

25. \( 10\% \times 40 = 4 \)

B: \( $18.75 \)

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Mathematics: Applications and Concepts, Course 1
## Chapter 10 Assessment Answer Key

### Page 543, Extended Response Assessment Scoring Rubric

<table>
<thead>
<tr>
<th>Level</th>
<th>Specific Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>The student demonstrates a <strong>thorough understanding</strong> of the mathematics concepts and/or procedures embodied in the task. The student has responded correctly to the task, used mathematically sound procedures, and provided clear and complete explanations and interpretations. The response may contain minor flaws that do not detract from the demonstration of a thorough understanding.</td>
</tr>
<tr>
<td>3</td>
<td>The student demonstrates an <strong>understanding</strong> of the mathematics concepts and/or procedures embodied in the task. The student's response to the task is essentially correct with the mathematical procedures used and the explanations and interpretations provided demonstrating an essential but less than thorough understanding. The response may contain minor errors that reflect inattentive execution of the mathematical procedures or indications of some misunderstanding of the underlying mathematics concepts and/or procedures.</td>
</tr>
<tr>
<td>2</td>
<td>The student has demonstrated only a <strong>partial understanding</strong> of the mathematics concepts and/or procedures embodied in the task. Although the student may have used the correct approach to obtaining a solution or may have provided a correct solution, the student's work lacks an essential understanding of the underlying mathematical concepts. The response contains errors related to misunderstanding important aspects of the task, misuse of mathematical procedures, or faulty interpretations of results.</td>
</tr>
<tr>
<td>1</td>
<td>The student has demonstrated a <strong>very limited understanding</strong> of the mathematics concepts and/or procedures embodied in the task. The student's response to the task is incomplete and exhibits many flaws. Although the student has addressed some of the conditions of the task, the student reached an inadequate conclusion and/or provided reasoning that was faulty or incomplete. The response exhibits many errors or may be incomplete.</td>
</tr>
<tr>
<td>0</td>
<td>The student has provided a <strong>completely incorrect</strong> solution or uninterpretable response, or no response at all.</td>
</tr>
</tbody>
</table>
Chapter 10 Assessment Answer Key

Page 543, Extended Response Assessment
Sample Answers

In addition to the scoring rubric found on page A28, the following sample answers may be used as guidance in evaluating extended response assessment items.

1. a. A ratio is the comparison of two numbers by division.

   b. 3 out of 4, 3:4, 3 to 4, \( \frac{3}{4} \)

   c. A rate is a ratio that compares two different units of measure. A unit rate is a rate that is in the per unit form. A unit rate is written with a denominator of 1. An example of a unit rate is 50 miles in 1 hour or 50 miles per hour. An example of rate that is not a unit rate is 50 miles in 2 hours.

   d. A proportion is a statement that two ratios are equivalent.

   e. A scale drawing of the classroom has a scale of 2 inches = 5 feet. The width of the classroom in the drawing is 14 inches. What is the width of the actual classroom?

   f. 2 inches = 5 feet

   \[
   \frac{2}{5} = \frac{14}{w}
   \]

   Write the proportion.

   \[
   2w = 70
   \]

   Write the cross products.

   \[
   w = 35
   \]

   Solve for \( w \).

   The classroom is 35 feet wide.

2. a. To write a percent as a fraction, write it with a denominator of 100 and simplify.

   To write a percent as a decimal, rewrite the percent as a fraction with a denominator of 100. Then write the fraction as a decimal, or move the decimal point two places to the left.

   b. \( 20\% = \frac{1}{5} = 0.20 \)

   \[
   0.20 \times 35 = 7 \quad \text{or} \quad \frac{1}{5} \times 35 = 7
   \]

   The sale price is \$35 - \$7 = \$28.

   c. \( 30\% \) is about \( \frac{1}{3} \), \$40 is about 39,

   \[
   \frac{1}{3} \times 39 = 13, \quad 40 - 13 = 27
   \]

   The sale price of the jacket is about \$27.

   d. \( 30\% \) of 40 = 0.30 \times 40 = 12,

   \[
   40 - 12 = 28
   \]

   e. To write a fraction as a percent, write a proportion with a fraction equal to \( \frac{n}{100} \). Then solve for \( n \) and write as \( n\% \).

   f. \( \frac{1}{4} = \frac{n}{100} \); \( 4n = 100; \) \( n = 25; \) \( \frac{1}{4} = 25\% \)

   g. \( 20\% \) of 35 = \$7; \( \frac{1}{4} \) of \$32 = \$8.

   A customer would save more money on the book, since \$8 > \$7.
Chapter 10 Assessment Answer Key

Vocabulary Test/Review
Page 544
1. denominator
2. value
3. proportion
4. scale
5. ratio
6. unit rate
7. proportional
8. rate
9. cross products
10. percent
11. The product of the numerator of one fraction and the denominator of the other fraction in a proportion; a proportion has two equal cross products.

Quiz (Lessons 10-3 and 10-4)
Page 545
1. 25 m
2. 2,700 m
3. Sample answer:

Quiz (Lessons 10-5 and 10-6)
Page 546
1. 1/20
2. 1 3/10
3. 45%
4. 250%
5. 0.21
6. 0.004
7. 35%
8. 81.2%
9. >
10. <

Quiz (Lessons 10-7 and 10-8)
Page 546
1. 30
2. 0.352
3. 70% \times 140 = 98
4. 25% \times 120 = 30
5. C

Sample answer:

Sample answer:

Sample answer:
Chapter 10 Assessment Answer Key

Mid-Chapter Test
Page 547

1. B

2. H

3. B

4. F

5. C

6. 36

7. 12

8. $62\frac{1}{2}$ mi

9. 125 mi

Sample answer:

10. [Grid Image]

Cumulative Review
Page 548

1. 3

2. 68

3. $7.61$

4. $7.125$

5. $3\frac{13}{200}$

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

7. $\frac{7}{20}$

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

9. 8 or +8

10. $(5 \times 20) \times 74; 7,400$

11. −2

12. −5

13. −4, −3, −1

14. $\frac{2}{3}$

15. 7

16. 38%

17. 0.0029

18. 256
Chapter 10 Assessment Answer Key

Standardized Test Practice

Page 549

1. A B C D

2. F G H I

3. A B C D

4. F G H I

5. A B C D

6. F G H I

7. A B C D

8. F G H I

9. A B C D

10. 28

11. 1 2

12. \(-28\)

13. \(13\frac{1}{3}\)

14. a. 64%

b. \(\frac{16}{25} \times 64\% = \frac{64}{100} = \frac{16}{25}\)

c. 0.64; 64\% = \frac{64}{100} = 0.64