Chapter 12
Resource Masters
Consumable Workbooks  Many of the worksheets contained in the Chapter Resource Masters booklets are available as consumable workbooks in both English and Spanish.

<table>
<thead>
<tr>
<th>Workbook</th>
<th>MHID</th>
<th>ISBN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Guide and Intervention Workbook</td>
<td>0-07-878871-4</td>
<td>978-0-07-878871-0</td>
</tr>
<tr>
<td>Skills Practice Workbook</td>
<td>0-07-878873-0</td>
<td>978-0-07-878873-4</td>
</tr>
<tr>
<td>Practice Workbook</td>
<td>0-07-878875-7</td>
<td>978-0-07-878875-8</td>
</tr>
<tr>
<td>Word Problem Practice Workbook</td>
<td>0-07-878877-3</td>
<td>978-0-07-878877-2</td>
</tr>
</tbody>
</table>

Spanish Versions

<table>
<thead>
<tr>
<th>Workbook</th>
<th>MHID</th>
<th>ISBN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Guide and Intervention Workbook</td>
<td>0-07-878872-2</td>
<td>978-0-07-878872-7</td>
</tr>
<tr>
<td>Skills Practice Workbook</td>
<td>0-07-878874-9</td>
<td>978-0-07-878874-1</td>
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<tr>
<td>Practice Workbook</td>
<td>0-07-878876-5</td>
<td>978-0-07-878876-5</td>
</tr>
<tr>
<td>Word Problem Practice Workbook</td>
<td>0-07-878878-1</td>
<td>978-0-07-878878-9</td>
</tr>
</tbody>
</table>

Answers for Workbooks  The answers for Chapter 12 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

StudentWorks Plus™  This CD-ROM includes the entire Student Edition test along with the English workbooks listed above.

TeacherWorks Plus™  All of the materials found in this booklet are included for viewing, printing, and editing in this CD-ROM.


These masters contain a Spanish version of Chapter 12 Test Form 2A and Form 2C.
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Teacher’s Guide to Using the
Chapter 12 Resource Masters

The Chapter 12 Resource Masters includes the core materials needed for Chapter 12. 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 on the TeacherWorks Plus™ CD-ROM.

Chapter Resources

Student-Built Glossary (page 1) These masters are 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. Give this to students before beginning Lesson 12-1. Encourage them to add these pages to their mathematics study notebooks. Remind them to complete the appropriate words as they study each lesson.

Family Letter and Family Activity (pages 3–6) The letter informs your students' families of the mathematics they will be learning in this chapter. The family activity helps them to practice problems that are similar to those on the state test. A full solution for each problem is included. Spanish versions of these pages are also included. Give these to students to take home before beginning the chapter.

Anticipation Guide (pages 7–8) This master, presented in both English and Spanish, is a survey used before beginning the chapter to pinpoint what students may or may not know about the concepts in the chapter. Students will revisit this survey after they complete the chapter to see if their perceptions have changed.

Lesson Resources

Lesson Reading Guide Get Ready for the Lesson reiterates the questions from the beginning of the Student Edition lesson. Read the Lesson asks students to interpret the context of and relationships among terms in the lesson. Finally, Remember What You Learned asks students to summarize what they have learned using various representation techniques. Use as a study tool for note taking or as an informal reading assignment. It is also a helpful tool for ELL (English Language Learners).

Study Guide and Intervention This master provides vocabulary, key concepts, additional worked-out examples and Check Your Progress exercises to use as a reteaching activity. It can also be used in conjunction with the Student Edition as an instructional tool for students who have been absent.

Skills Practice This master focuses more on the computational nature of the lesson. Use as an additional practice option or as homework for second-day teaching of the lesson.

Practice This master closely follows the types of problems found in the Exercises section of the Student Edition and includes word problems. Use as an additional practice option or as homework for second-day teaching of the lesson.
Word Problem Practice  This master includes additional practice in solving word problems that apply the concepts of the lesson. Use as an additional practice or as homework for second-day teaching of the lesson.

Enrichment  These activities may extend the concepts of the lesson, offer an historical or multicultural look at the concepts, or widen students’ perspectives on the mathematics they are learning. They are written for use with all levels of students.

Graphing Calculator, Scientific Calculator, or Spreadsheet Activities  These activities present ways in which technology can be used with the concepts in some lessons of this chapter. Use as an alternative approach to some concepts or as an integral part of your lesson presentation.

Assessment Options  The assessment masters in the Chapter 12 Resource Masters offer a wide range of assessment tools for formative (monitoring) assessment and summative (final) assessment.

Student Recording Sheet  This master corresponds with the standardized test practice at the end of the chapter.

Pre-AP Rubric  This master provides information for teachers and students on how to assess performance on open-ended questions.

Quizzes  Four free-response quizzes offer assessment at appropriate intervals in the chapter.

Mid-Chapter Test  This 1-page test provides an option to assess the first half of the chapter. It parallels the timing of the Mid-Chapter Quiz in the Student Edition and includes both multiple-choice and free-response questions.

Vocabulary Test  This test is suitable for all students. It includes a list of vocabulary words and 10 questions to assess students’ knowledge of those words. This can also be used in conjunction with one of the leveled chapter tests.

Leveled Chapter Tests
- Form 1 contains multiple-choice questions and is intended for use with below grade level students.
- Forms 2A and 2B contain multiple-choice questions aimed at on grade level students. These tests are similar in format to offer comparable testing situations.
- Forms 2C and 2D contain free-response questions aimed at on grade level students. These tests are similar in format to offer comparable testing situations.
- Form 3 is a free-response test for use with above grade level students.
All of the above mentioned tests include a free-response Bonus question.

Extended-Response Test  Performance assessment tasks are suitable for all students. Sample answers and a scoring rubric are included for evaluation.

Standardized Test Practice  These three pages are cumulative in nature. It includes three parts: multiple-choice questions with bubble-in answer format, griddable questions with answer grids, and short-answer free-response questions.

Answers
- The answers for the Anticipation Guide and Lesson Resources are provided as reduced pages with answers appearing in red.
- Full-size answer keys are provided for the assessment masters.
This is an alphabetical list of new vocabulary terms you will learn in Chapter 12. As you study the chapter, complete each term’s definition or description. Remember to add the page number where you found the term. Add this page to your math study notebook to review vocabulary at the end of the chapter.

<table>
<thead>
<tr>
<th>Vocabulary Term</th>
<th>Found on Page</th>
<th>Definition/Description/Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>hypotenuse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>irrational number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>leg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pythagorean Theorem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>surface area</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dear Parent or Guardian:

We use math skills in many of the things that we do. One of the goals of this class is to show students how things they are learning in the classroom are relevant to the real world. For example, understanding the Pythagorean Theorem and surface area geography, navigation, sports, and architecture.

In Chapter 12, Extending Geometry and Measurement, your child will learn how to find squares and square roots, use the Pythagorean Theorem, and find surface areas of rectangular prisms and cylinders. In the study of this chapter, 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 practices how the math in Chapter 12 might be tested. You may also wish to log on to ca.gr6math.com for self-check quizzes and other study help.

If you have any questions or comments, feel free to contact me at school.

Sincerely,

Signature of Parent or Guardian ___________________________ Date __________
1. Andy is flying a kite as shown in the diagram. What is the height of the kite?

\[ h^2 + 6^2 = 10^2 \]
\[ h^2 + 36 = 100 \]
\[ h^2 = 64 \]
\[ h = 8 \]

The answer is **B**.

Solution

1. **Hint:** The Pythagorean Theorem states that the sum of the squares of the legs of a right triangle is equal to the square of the hypotenuse, or \( a^2 + b^2 = c^2 \).

The height of the kite is a leg of a right triangle.

2. Polly is painting all sides of the wooden block shown below as the first step in an art project.

Which of the following will help her calculate how much paint to buy?

\[ \text{A} \] the volume; 720 cubic inches  
\[ \text{B} \] the surface area; 504 square inches  
\[ \text{C} \] adding the perimeter of each face; 224 inches  
\[ \text{D} \] the sum of the edges; 112 inches

The answer is **B**.

Solution

2. The paint will cover all of the outside surfaces of the box. The measurement that corresponds with the area of all of the faces is the surface area, which is calculated by adding the areas of all of the faces.
Estimado padre o apoderado:

Usamos destrezas matemáticas en muchas de las cosas que hacemos. Uno de los objetivos de esta clase es demostrar a los alumnos lo relevante que resulta para el mundo real las cosas que estudian en el aula. Por ejemplo, comprender el teorema de Pitágoras, la geografía del área de superficie, navegación, deportes y arquitectura.

En el Capítulo 12, Álgebra y geometría: Extensión, su hijo(a) aprenderá a calcular cuadrados y raíces cuadradas, a usar el teorema de Pitágoras y a calcular el área de superficie de prismas y cilindros rectangulars. En el estudio de este capítulo, su hijo(a) completará una variedad de tareas y actividades diarias y es posible que trabaje en un proyecto del capítulo.

Al firmar esta carta y devolverla con su hijo(a), usted se compromete a ayudarlo(a) a participar en su aprendizaje. Junto con esta carta, va incluida una actividad que puede realizar con él(ella) y la cual practica lo que podrían encontrar en las pruebas de los conceptos matemáticos que aprenderán en el Capítulo 12. Además, visiten ca.gr6math.com para ver autocontroles y otras ayudas para el estudio. Si tiene cualquier pregunta o comentario, por favor contácteme en la escuela.

Cordialmente,

Firma del padre o apoderado ______________________________________ Fecha ______
1. Andy vuela una cometa como se muestra en el diagrama.

¿Cuál es la altura de la cometa?

A 4 pies  
B 8 pies  
C 12 pies  
D 16 pies

**Solución**

1. \( H1. \) Ayuda: El teorema de Pitágoras establece que la suma de los cuadrados de los catetos de un ángulo recto es igual al cuadrado de la hipotenusa \( \text{a}^2 + \text{b}^2 = \text{c}^2 \).  

La altura de la cometa es un cateto de un triángulo rectángulo.  

\[
\begin{align*}
\text{h}^2 + 6^2 &= 10^2 \\
\text{h}^2 + 36 &= 100 \\
\text{h}^2 &= 64 \\
\text{h} &= 8
\end{align*}
\]

La respuesta es B.

2. Polly pinta todos los lados de un bloque de madera como primer paso de un proyecto artístico.

¿Cuál de los siguientes le ayudará a calcular cuánta pintura debe comprar?

A el volumen; 720 pulgadas cúbicas  
B el área de superficie; 504 pulgadas cuadradas  
C sumar el perímetro de cada cara; 224 pulgadas  
D la suma de las aristas; 112 pulgadas

**Solución**

2. La pintura cubrirá toda la superficie externa del bloque. La medida que corresponde al área de todas las caras es el área de superficie, la cual se calcula sumando las áreas de todas las caras.

La respuesta es B.
### Anticipation Guide

**Extending Algebra and Geometry**

#### Step 1

**Before you begin Chapter 12**

- Read each statement.
- Decide whether you Agree (A) or Disagree (D) with the statement.
- Write A or D in the first column OR if you are not sure whether you agree or disagree, write NS (Not Sure).

<table>
<thead>
<tr>
<th>STEP 1 A, D, or NS</th>
<th>Statement</th>
<th>STEP 2 A or D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A square root of a number is one of its two equal factors.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>You can find an estimate for the square root of 45 by finding the square root of the perfect square closest to 45.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>All square roots are irrational numbers.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>The hypotenuse of a right triangle is the side opposite the right angle.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Since $10^2 = 6^2 + 8^2$, a triangle whose sides have lengths 6, 8, and 10 will be a right triangle.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Since a rectangular prism has six sides, the surface area can be found by finding the area of one side and multiplying by 6.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>If the dimensions of a rectangular prism are doubled, the surface area will also double.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>If the dimensions of a rectangular prism are doubled, the volume will triple.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>In finding the surface area of a cylinder, you are finding the area of two circles and a rectangle.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>The units for surface area are always cubic units since surface area involves three-dimensional figures.</td>
<td></td>
</tr>
</tbody>
</table>

#### Step 2

**After you complete Chapter 12**

- Reread each statement and complete the last column by entering an A or a D.
- Did any of your opinions about the statements change from the first column?
- For those statements that you mark with a D, use a piece of paper to write an example of why you disagree.
## Ejercicios preparatorios

### Álgebra y geometría: Extensión

**Antes de comenzar el Capítulo 12**

- Lee cada enunciado.
- Decide si estás de acuerdo (A) o en desacuerdo (D) con el enunciado.
- Escribe A o D en la primera columna O si no estás seguro(a) de la respuesta, escribe NS (No estoy seguro(a).

<table>
<thead>
<tr>
<th>PASO 1 A, D o NS</th>
<th>Enunciado</th>
<th>PASO 2 A o D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Una raíz cuadrada de un número es uno de sus dos factores iguales.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Puedes estimar la raíz cuadrada de 45 al extraer la raíz del cuadrado perfecto más cercano a 45.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Todas las raíces cuadradas son números irracionales.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>La hipotenusa de un triángulo rectángulo es el lado opuesto al ángulo recto.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Dado que (10^2 = 6^2 + 8^2), un triángulo con lados de 6, 8 y 10 será un triángulo rectángulo.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Dado que un prisma rectangular tiene seis lados, el área de superficie se puede hallar calculando el área de un lado y multiplicándola por 6.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Si se duplican las dimensiones de un prisma rectangular, también se duplicará el área de superficie.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Si se duplican las dimensiones de un prisma rectangular, el volumen se triplicará.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Al calcular el área de superficie de un cilindro, estás calculando las áreas de dos círculos y un rectángulo.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Las unidades para el área de superficie son siempre cúbicas, dado que el área de superficie incluye figuras tridimensionales.</td>
<td></td>
</tr>
</tbody>
</table>

**Después de completar el Capítulo 12**

- Vuelve a leer cada enunciado y completa la última columna con una A o una D.
- ¿Cambió cualquiera de tus opiniones sobre los enunciados de la primera columna?
- En una hoja de papel aparte, escribe un ejemplo de por qué estás en desacuerdo con los enunciados que marcaste con una D.
Lesson 12–1

Estimating Square Roots

Get Ready for the Lesson

Complete the Mini Lab at the top of page 636 in your textbook. Write your answers below. Use algebra tiles to estimate the square root of each number to the nearest whole number.

1. 40
2. 28
3. 85
4. 62

5. Describe another method that you could use to estimate the square root of a number.

Read the Lesson

6. Why is \(\sqrt{4}\) a rational number and \(\sqrt{2}\) an irrational number?

7. How do you read the statement \(\sqrt{64} < \sqrt{75} < \sqrt{81}\)?

8. Why are \(\sqrt{64}\) and \(\sqrt{81}\) used in Example 1?

Remember What You Learned

9. The key to estimating square roots without a calculator is to be familiar with common perfect squares. Complete the following table of common perfect squares then test yourself to see how many you can remember without using a calculator.

<table>
<thead>
<tr>
<th>Number</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example 1 Estimate $\sqrt{40}$ to the nearest whole number.

List some perfect squares.
1, 4, 9, 16, 25, 36, 49, ...

$36 < 40 < 49$  
$\sqrt{36} < \sqrt{40} < \sqrt{49}$

Find the square root of each number.
$6 < \sqrt{40} < 7$

So, $\sqrt{40}$ is between 6 and 7. Since 40 is closer to 36 than to 49, the best whole number estimate is 6.

Example 2 Use a calculator to find the value of $\sqrt{28}$ to the nearest tenth.

$\sqrt{28} \approx 5.3$

Check Since $5^2 = 25$ and 25 is close to 28, the answer is reasonable.

Exercises

Estimate each square root to the nearest whole number.
1. $\sqrt{3}$
2. $\sqrt{8}$
3. $\sqrt{26}$
4. $\sqrt{41}$
5. $\sqrt{61}$
6. $\sqrt{94}$
7. $\sqrt{152}$
8. $\sqrt{850}$

Use a calculator to find each square root to the nearest tenth.
9. $\sqrt{2}$
10. $\sqrt{27}$
11. $\sqrt{73}$
12. $\sqrt{82}$
13. $\sqrt{105}$
14. $\sqrt{395}$
15. $\sqrt{846}$
16. $\sqrt{2,298}$
Skills Practice

Estimating Square Roots

Estimate each square root to the nearest whole number.

1. \(\sqrt{5}\)  
2. \(\sqrt{10}\)  
3. \(\sqrt{21}\)

4. \(\sqrt{28}\)  
5. \(\sqrt{78}\)  
6. \(\sqrt{102}\)

7. \(\sqrt{179}\)  
8. \(\sqrt{274}\)  
9. \(\sqrt{303}\)

10. \(\sqrt{563}\)  
11. \(\sqrt{592}\)  
12. \(\sqrt{755}\)

13. \(\sqrt{981}\)  
14. \(\sqrt{1,356}\)  
15. \(\sqrt{1,688}\)

16. \(\sqrt{3,287}\)  
17. \(\sqrt{3,985}\)  
18. \(\sqrt{4,125}\)

Use a calculator to find each square root to the nearest tenth.

19. \(\sqrt{6}\)  
20. \(\sqrt{19}\)  
21. \(\sqrt{30}\)

22. \(\sqrt{77}\)  
23. \(\sqrt{114}\)  
24. \(\sqrt{125}\)

25. \(\sqrt{149}\)  
26. \(\sqrt{182}\)  
27. \(\sqrt{212}\)

28. \(\sqrt{436}\)  
29. \(\sqrt{621}\)  
30. \(\sqrt{853}\)

31. \(\sqrt{918}\)  
32. \(\sqrt{1,004}\)  
33. \(\sqrt{1,270}\)

34. \(\sqrt{5,438}\)  
35. \(\sqrt{4,215}\)  
36. \(\sqrt{5,786}\)

37. Order \(\frac{25}{7}\), 4.91, and \(\sqrt{23}\) from least to greatest.

38. Graph \(\sqrt{42}\) and \(\sqrt{62}\) on the same number line.
**12-1 Practice**

*Estimating Square Roots*

Estimate each square root to the nearest whole number.

1. \( \sqrt{8} \)  
2. \( \sqrt{19} \)  
3. \( \sqrt{47} \)  
4. \( \sqrt{70} \)

5. \( \sqrt{91} \)  
6. \( \sqrt{125} \)  
7. \( \sqrt{150} \)  
8. \( \sqrt{389} \)

9. \( \sqrt{2,468} \)  
10. \( \sqrt{899} \)  
11. \( \sqrt{4,840} \)  
12. \( \sqrt{8,080} \)

Use a calculator to find each square root to the nearest tenth.

13. \( \sqrt{6} \)  
14. \( \sqrt{21} \)  
15. \( \sqrt{53} \)  
16. \( \sqrt{79} \)

17. \( \sqrt{190} \)  
18. \( \sqrt{624} \)  
19. \( \sqrt{427} \)  
20. \( \sqrt{3,178} \)

21. \( \sqrt{0.36} \)  
22. \( \sqrt{0.81} \)  
23. \( \sqrt{1.44} \)  
24. \( \sqrt{2.25} \)

**25. ALGEBRA** What whole number is closest to \( \sqrt{a + b} \) if \( a = 24 \) and \( b = 38 \)?

**26. ALGEBRA** Evaluate \( \sqrt{x} - y \) to the nearest tenth if \( x = 10 \) and \( y = 4.5 \).

**27. QUILTING** A queen-size quilt in the shape of a square has an area of 51 square feet. What is the approximate length of one side of the quilt to the nearest tenth?

**28. PENDULUM** The formula below can be used to estimate the time it takes for a pendulum to swing back and forth once. Use the formula to find the time it takes for a pendulum with a length of 0.8 meter to swing back and forth once. Round to the nearest tenth.

\[ T = 2 \times \sqrt{L} \]

- \( T \) = time (seconds)
- \( L \) = length (meters)
1. **GEOMETRY** The diameter $d$ of a circle with area $A$ is given by the formula \[ d = \sqrt{\frac{4A}{\pi}}. \] What is the diameter of a circle with an area of 56 square inches? Use 3.14 for $\pi$ and round to the nearest tenth.

2. **FENCING** Carmen wants to buy fencing to enclose a square garden with an area of 500 square feet. How much fencing does Carmen need to buy? Round to the nearest tenth.

3. **OCEANS** The speed $v$ in feet per second of an ocean wave in shallow water of depth $d$ in feet is given by the formula \[ v = \sqrt{32d}. \] What is the speed of an ocean wave at a depth of 10 feet? Round to the nearest tenth.

4. **LIGHTING** A new flashlight has a beam whose width $w$ at a distance $d$ from the flashlight is given by the formula \[ w = 1.2\sqrt{d}. \] What is the width of the beam at a distance of 30 feet? Round to the nearest tenth.

5. **SOUND** The speed of sound in air $c$ in meters per second at a temperature $T$ in degrees Celsius is given approximately by the formula \[ c = \sqrt{402(T + 273)}. \] What is the speed of sound in air at a temperature of 25 degrees Celsius? Round to the nearest tenth.

6. **PROJECTILES** The muzzle velocity $v$ in feet per second necessary for a cannon to hit a target $x$ feet away is estimated by the formula \[ v = \sqrt{32x}. \] What muzzle velocity is required to hit a target 3,000 feet away? Round to the nearest tenth.
World Series Records

Each problem gives the name of a famous baseball player. To find who set each record, graph the points on the number line.

1. pitched 23 strikeouts in one World Series
   \[ U \text{ at } \sqrt{3}, \ X \text{ at } 3.3, \ K \text{ at } 0.75, \ O \text{ at } \frac{3}{2}, \ F \text{ at } \sqrt{6}, \ A \text{ at } \frac{7}{8} \]

2. 71 base hits in his appearances in World Series
   \[ B \text{ at } \sqrt{5}, \ R \text{ at } \sqrt{12}, \ A \text{ at } 3.75, \ G \text{ at } \frac{16}{13}, \ E \text{ at } \frac{5}{2}, \ Y \text{ at } 0.375, \ R \text{ at } \frac{13}{4}, \ I \text{ at } 1.6, \text{ and } O \text{ at } 0.7 \]

3. 10 runs in a single World Series
   \[ N \text{ at } \sqrt{60}, \ K \text{ at } \sqrt{30}, \ A \text{ at } 4.3, \ S \text{ at } 6.2, \ C \text{ at } \frac{46}{9}, \ O \text{ at } \sqrt{45}, \text{ and } J \text{ at } \sqrt{17} \]

4. batting average of 0.625 in a single World Series
   \[ E \text{ at } \sqrt{32}, \ U \text{ at } 6\frac{5}{6}, \ A \text{ at } \frac{14}{3}, \ T \text{ at } \sqrt{55}, \ B \text{ at } 5.3, \ R \text{ at } \sqrt{40}, \ H \text{ at } 7.75, \ B \text{ at } \frac{21}{5} \]

5. 42 World Series runs in his career
   \[ E \text{ at } \sqrt{140}, \ Y \text{ at } 9.6, \ I \text{ at } 8.6, \ E \text{ at } \sqrt{90}, \ A \text{ at } \frac{21}{2}, \ M \text{ at } \sqrt{70}, \ C \text{ at } 8\frac{7}{8}, \ M \text{ at } \sqrt{100}, \ N \text{ at } 10.7, \ K \text{ at } 9\frac{1}{11}, \ T \text{ at } \sqrt{120}, \ L \text{ at } 11.4 \]
Exercises

**Scientific Calculator Activity**

**Estimating Square Roots**

A scientific calculator can be used to estimate square roots. On the TI-34 II, the square root function is used by pressing the \( \text{2nd} \ [\sqrt{\text{]} \text{ key.}}\)

**Example 1**

Estimate \( \sqrt{15} \). Round to the nearest hundredth.

Enter: \( \text{2nd} \ [\sqrt{\text{]} \ 15 \text{ ENTER}} \)

So, \( \sqrt{15} \approx 3.87 \).

**Example 2**

Estimate \( \sqrt{22} \). Round to the nearest hundredth.

Enter: \( \text{2nd} \ [\sqrt{\text{]} \ 22 \text{ ENTER}} \)

So, \( \sqrt{22} \approx 4.69 \).

**Example 3**

Estimate \( \sqrt{125} \). Round to the nearest hundredth.

Enter: \( \text{2nd} \ [\sqrt{\text{]} \ 125 \text{ ENTER}} \)

So, \( \sqrt{125} \approx 11.18 \).

**Exercises**

Use a calculator to estimate each square root. Round to the nearest hundredth.

1. \( \sqrt{35} \)
2. \( \sqrt{42} \)
3. \( \sqrt{31} \)

4. \( \sqrt{126} \)
5. \( \sqrt{190} \)
6. \( \sqrt{2} \)

7. \( \sqrt{3} \)
8. \( \sqrt{8} \)
9. \( \sqrt{13} \)

10. \( \sqrt{50} \)
11. \( \sqrt{68} \)
12. \( \sqrt{57} \)

13. \( \sqrt{37} \)
14. \( \sqrt{98} \)
15. \( \sqrt{44} \)

16. \( \sqrt{87} \)
17. \( \sqrt{15} \)
18. \( \sqrt{11} \)

19. \( \sqrt{12} \)
20. \( \sqrt{14} \)
21. \( \sqrt{26} \)
Lesson Reading Guide

The Pythagorean Theorem

Get Ready for the Lesson

Read the introduction at the top of page 640 in your textbook. Write your answers below.

1. Find the area of each square.

2. How are the squares of the sides related to the areas of the squares?

3. Find the sum of the areas of the two smaller squares. How does the sum compare to the area of the larger square?

4. Use grid paper to cut out three squares with sides 5, 12, and 13 units. Form a right triangle with these squares. Compare the sum of the areas of the two smaller squares with the area of the larger square.

Read the Lesson

5. What does the symbol \( \pm \sqrt{ } \) indicate?

6. How can you find the hypotenuse of a right triangle within a rectangle when given only the dimensions of the rectangle?

7. In Examples 3 and 4 on page 680, how do you know which length is \( c \)?

Remember What You Learned

8. Summarize what you learned in this lesson by labeling the sides of the right triangle with the letters \( a, b, \) and \( c \) and then completing the table.

<table>
<thead>
<tr>
<th>You can find</th>
<th>If you know the lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>( a )</td>
<td></td>
</tr>
<tr>
<td>( b )</td>
<td></td>
</tr>
<tr>
<td>( c )</td>
<td></td>
</tr>
</tbody>
</table>
Exercises

NAME ________________________________________ DATE ______________ PERIOD _____

Study Guide and Intervention

The Pythagorean Theorem

Chapter 12

Find the missing measure of a right triangle if $a = 4$ inches and $b = 3$ inches.

$c^2 = a^2 + b^2$  
$c^2 = 4^2 + 3^2$  
$c^2 = 16 + 9$  
$c^2 = 25$  
$\sqrt{c^2} = \sqrt{25}$  
$c = 5$

The length of the hypotenuse is 5 inches.

Determine whether a triangle with side lengths of 6 meters, 9 meters, and 12 meters is a right triangle.

$c^2 = a^2 + b^2$  
$12^2 = 6^2 + 9^2$  
$144 = 36 + 81$  
$144 \neq 117$

The triangle is not a right triangle.

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

1. 2. 3.

Determine whether each triangle with the given side lengths is a right triangle. Write yes or no.

4. 15 ft, 8 ft, 17 ft

5. 5 in., 13 in., 17 in.

6. 9 yd, 40 yd, 41 yd
Skills Practice
The Pythagorean Theorem

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

1. \( \text{b m} \)  
   \( \text{20 m} \)  
   \( 7 \text{ m} \)

2. \( \text{c in.} \)  
   \( 5 \text{ in.} \)  
   \( 5 \text{ in.} \)

3. \( \text{12.4 ft} \)  
   \( 15 \text{ ft} \)  
   \( \text{a ft} \)

4. \( x \text{ cm} \)  
   \( 26 \text{ cm} \)  
   \( 20 \text{ cm} \)

5. \( \text{20.3 in.} \)  
   \( 32 \text{ in.} \)  
   \( \text{c in.} \)

6. \( \text{a yd} \)  
   \( 2.7 \text{ yd} \)  
   \( 3 \text{ yd} \)

7. \( \text{a m} \)  
   \( 11.2 \text{ m} \)  
   \( 6 \text{ m} \)

9. \( a = 15 \text{ cm}, b = 20 \text{ cm} \)
10. \( a = 2 \text{ yd}, b = 12 \text{ yd} \)
11. \( a = 13 \text{ in.}, c = 16.5 \text{ in.} \)
12. \( b = 8 \text{ mm}, c = 17 \text{ mm} \)
13. \( a = 1.3 \text{ ft}, b = 4.6 \text{ ft} \)
14. \( a = 14.7 \text{ m}, c = 23 \text{ m} \)

Determine whether each triangle with the given side lengths is a right triangle. Write yes or no.

15. 10 ft, 24 ft, 26 ft
16. 5 in., 8 in., 9 in.
17. 6 cm, 9 cm, 12 cm
18. 4.5 mm, 6.0 mm, 7.5 mm
Find the missing measure of each triangle. Round to the nearest tenth if necessary.

1. \[ \text{\text{\_cm}} \]
   \[ \text{\text{\_cm}} \]
   \[ \text{\text{\_cm}} \]

2. \[ \text{\text{\_ft}} \]
   \[ \text{\text{\_ft}} \]

3. \[ \text{\text{\_m}} \]
   \[ \text{\text{\_m}} \]
   \[ \text{\text{\_m}} \]

4. \[ a = 3.3 \text{ in.}, \quad b = 5.6 \text{ in.} \]
5. \[ b = 2.9 \text{ mm}, \quad c = 4.4 \text{ mm} \]
6. \[ a = 21 \text{ yd}, \quad c = 29 \text{ yd} \]

7. \[ a = 2\frac{1}{5} \text{ ft}, \quad c = 4\frac{2}{5} \text{ ft} \]
8. \[ b = 7\frac{1}{4} \text{ in.}, \quad c = 7\frac{3}{4} \text{ in.} \]
9. \[ a = 6\frac{1}{2} \text{ yd}, \quad b = 10 \text{ yd} \]

If a triangle has sides \( a, b, \) and \( c \) so that \( a^2 + b^2 = c^2 \), then the triangle is a right triangle. Determine whether a triangle with the given side lengths is a right triangle. Write yes or no.

10. \[ 9 \text{ cm}, \quad 12 \text{ cm}, \quad 18 \text{ cm} \]
11. \[ 7 \text{ ft}, \quad 24 \text{ ft}, \quad 25 \text{ ft} \]
12. \[ 5 \text{ in.}, \quad 12 \text{ in.}, \quad 13 \text{ in.} \]

Find the missing measure in each figure. Round to the nearest tenth if necessary.

13. \[ x \text{ m} \]
   \[ 18 \text{ m} \]
   \[ 9 \text{ m} \]
   \[ 30 \text{ m} \]

14. \[ x \text{ yd} \]
   \[ 1.8 \text{ yd} \]
   \[ 2.5 \text{ yd} \]

15. **SOCCER** Find the width of the soccer goal. Round to the nearest tenth.

16. **CONVEYOR BELT** The diagram shows the horizontal distance a conveyor belt moves a load of gravel. If the conveyor belt takes 54 seconds to move gravel from the bottom of the conveyor belt to the top at a rate of 3 feet per second, how high does the conveyor belt lift the gravel? Round to the nearest tenth.
12-2 Word Problem Practice

The Pythagorean Theorem

1. ORIGAMI Chee has a piece of paper measuring 8.5 inches by 8.5 inches. If she folds the paper diagonally in half, how long is the folded side? Round to the nearest tenth.

2. COMPUTERS In a computer catalog, a computer monitor is said to be 19 inches. This distance is the diagonal distance across the screen. If the screen is 10 inches high, what is the width of the screen? Round to the nearest tenth.

3. ANTENNAS A wire 10 meters long is supporting a utility pole. The wire is anchored to the ground and is attached to the pole 9 meters above the ground. What is the distance from the bottom of the pole to the point where the wire is attached to the ground? Round to the nearest tenth.

4. RAMPS Crystal wants to build a ramp that will rise 4 feet over a horizontal distance of 20 feet. How long will the ramp be? Round to the nearest tenth.

5. POOLS Salomon swims diagonally across his pool every day. If Salomon’s pool is 4 meters wide and 16 meters diagonally across, how long is his pool, to the nearest tenth of a meter?

6. FRAMES Rosa has a picture frame that measures 12 inches by 18 inches. What is the diagonal distance across the frame? Round to the nearest tenth.
Pythagoras in the Air

In the diagram at the right, an airplane heads north at 180 mi/h. But, the wind is blowing towards the east at 30 mi/h. So, the airplane is really traveling east of north. The middle arrow in the diagram shows the actual direction of the airplane.

The actual speed of the plane can be found using the Pythagorean Theorem.

\[
\sqrt{30^2 + 180^2} = \sqrt{900 + 32,400} = \sqrt{33,300} \approx 182.5
\]

The plane’s actual speed is about 182.5 mi/h.

Find the actual speed of each airplane. Round answers to the nearest tenth. (You might wish to draw a diagram to help you solve the problem.)

1. An airplane travels at 240 mi/h east.
   A wind is blowing at 20 mi/h toward the south.

2. An airplane travels at 620 mi/h west.
   A wind is blowing at 35 mi/h toward the south.

3. An airplane travels at 450 mi/h south.
   A wind is blowing at 40 mi/h toward the east.

4. An airplane travels at 1,200 mi/h east.
   A wind is blowing at 30 mi/h toward the north.
When solving problems, make a model to represent the given situation in order to determine the best plan for a solution.

**Example**

GIFT WRAP Rita wants to wrap a rectangular box. The box is 12 inches by 7 inches by 3 inches high. What must be the area of the paper so that she has a 1 inch overlap to neatly wrap the paper?

**Explore**
You know that the box is $12 \times 7 \times 3$ and that you need to add 1 inch to some measures for the overlap. You also know that the wrapping paper will be a rectangle.

**Plan**
Draw a sketch of the box and then make a model of the box if it were cut apart and laid flat. You need the overlap going around the box.

**Solve**
Sketch the box. Make a model of the box unfolded.

The length of the paper needed is the distance around the box plus 1 inch. So, $l = 7 + 3 + 7 + 3 + 1$ or 21 inches.

The width of the paper would be $3 + 12 + 3$ or 18 inches.

The area would be $21 \times 18$ or 378 in$^2$.

**Check**
Make a box using centimeters instead of inches. Then cut a piece of paper 18 centimeters by 21 centimeters to see if you can wrap the box neatly.

**Exercises**

1. **GARDENING** Peg wants to put a stone path 3 feet wide around her rectangular garden measuring 10 feet by 15 feet. What will be the perimeter of her garden including the stone path?

2. **DRAWING** Dante is making a full-size drawing of his favorite cartoon character. If the figure is 1 inch by 0.5 inches and his scale is $1$ inch $= $ 10 inches, how large will the full-size character be?
**Problem-Solving Investigation: Make a Model**

1. **PETS** Jack’s Pet Store has 5 pets for sale. Some are birds and some are dogs. When Jack looks at the pets, he counts 18 legs. How many of each type of pet are there?

2. **INTERIOR DESIGN** JoAnn is creating a model of a living room. The room is 20 feet by 20 feet. If the scale she is using is 1 foot = \( \frac{1}{2} \) inch, what are the dimensions of her model room?

3. **ART COMPETITION** An art competition allows for submitted work to be no larger than 11 inches by 14 inches. If Christene’s photograph is 8 inches by 10 inches, what is the largest matte she can use if she wants the border to be the same width all the way around the photo?

4. **FLOORING** James is laying carpet in an L-shaped room whose model is shown below. How much carpet does he need?

```
8 ft

8 ft

8 ft

12 ft
```

5. **SCALE MODEL** Charlotte is building a model of the Eiffel Tower. If the actual tower is 986 feet tall and Charlotte’s scale is 1 inch = 10 feet, how tall is her model?

6. **SCIENCE FAIR** Audrey wants to make a poster that is folded into three sections for her science fair project. The length of the poster is 36 inches. If she wants the middle section to be twice the length of the side sections and she wants the two side sections to be equal, what should be the length of the middle section?
Mixed Problem Solving

For Exercises 1 and 2, make a model to solve the problem.

1. ARCHITECT Mrs. Peron is designing a home for a client. The house is 45 feet by 76 feet. If she uses a scale of 1 foot = $\frac{1}{2}$ inch, what are the dimensions of the house on the blue prints?

2. SWIMMING POOL Mr. Forrester has a swimming pool that measures $3\frac{1}{3}$ yards by 8 yards. If the deck around the pool is $2\frac{2}{3}$ yards wide, what is the outside perimeter of the deck?

Use any strategy to solve Exercises 3 and 4. Some strategies are shown below.

<table>
<thead>
<tr>
<th>PROBLEM-SOLVING STRATEGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use the four-step plan.</td>
</tr>
<tr>
<td>• Draw a diagram.</td>
</tr>
<tr>
<td>• Use logical reasoning.</td>
</tr>
<tr>
<td>• Make a model.</td>
</tr>
</tbody>
</table>

3. BATTERIES A manufacturing plant can make 350 batteries in 15 minutes. How long will it take the manufacturing plant to make 3,500 batteries?

4. SHOPPING A grocery store has five cash registers. About 4 customers are checked out at each register every 20 minutes. How many customers are checked out at the store each hour?

For Exercises 5 and 6, select an appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

5. TESTS Diego scored a 95 on his first test in science class. He then scored 100 on his next 5 tests. If he scored a 91 on his seventh test, what is his test average?

6. NEWSPAPERS Candace wants to increase the number of newspapers she delivers. She currently delivers 58 newspapers. In fourteen weeks, she wants to be delivering 100 newspapers. How many newspaper deliveries must she increase each week to obtain her goal?
Word Problem Practice

Problem-Solving Investigation: Make a Model

Solve each problem using any strategy you have learned.

1. **FOOTBALL** Bill, Damon and Steve are the quarterback, center and punter on the football team, not necessarily in that order. The quarterback and Bill go on the bus with Damon after the game. Damon is not the punter. What position does Bill play?

2. **SPORTS** Janelle can walk one mile in 15 minutes. How long will it take her to walk 3 miles?

3. **WEATHER** The Loudonville Times prints the following chart showing the snowfall for each day last week. The reporter estimates that they got 10 inches of snow during the past week. Is this a reasonable estimate?

<table>
<thead>
<tr>
<th>Day</th>
<th>Snowfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>1 inch</td>
</tr>
<tr>
<td>Tuesday</td>
<td>2 inches</td>
</tr>
<tr>
<td>Wednesday</td>
<td>0.5 inches</td>
</tr>
<tr>
<td>Thursday</td>
<td>1.5 inches</td>
</tr>
<tr>
<td>Friday</td>
<td>3.75 inches</td>
</tr>
<tr>
<td>Saturday</td>
<td>0 inches</td>
</tr>
<tr>
<td>Sunday</td>
<td>0 inches</td>
</tr>
</tbody>
</table>

4. **GARDENING** The table below shows how many tomatoes Nicholas picked each day during the week. How many does he need to pick on Sunday so that he has picked a total of 20 for the week?

<table>
<thead>
<tr>
<th>Day</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>R</th>
<th>F</th>
<th>S</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of tomatoes</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

5. **PAINT** If one gallon of paint covers 150 square feet, is one gallon enough for Susie to cover a kitchen wall that is 15 feet by 8 feet? Justify your answer.

6. **SHOPPING** Avery bought a DVD for $22.99 and got $2.01 back in change. How much did Avery give the cashier?

7. **MONEY** The amount in Carly’s checkbook is $750 after writing a check for $65 and making a deposit of $100 and a deposit of $75. How much did she start with in her checkbook?

8. **VEHICLES** Jim has 15 vehicles at his garage. Some are cars and some are motorcycles. If he counts 58 wheels, how many of each type of vehicle does he have?
Lesson Reading Guide

Surface Area of Rectangular Prisms

Get Ready for the Lesson

Complete the Mini Lab at the top of page 649 in your textbook. Write your answers below.

1. Record the dimensions, volume, and surface area in a table.

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Volume</th>
<th>Surface Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Build two more prisms using all of the cubes. For each, record the dimensions, volume, and surface area.

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Volume</th>
<th>Surface Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Describe the prisms with the greatest and least surface areas.

Read the Lesson

4. How many pairs of congruent faces are there in a rectangular prism? Name them.

5. Tell how to find the surface area of a rectangular prism in words.

Remember What You Learned

6. Work with a partner. Bring a box that is a rectangular prism to class (any size, such as a crayon box) that you can cut apart to form a net. Label the surfaces front, back, top, bottom, side, side. Measure the faces and find the surface area. Use adhesive tape to form the net into a three-dimensional figure. Then exchange nets with your partner. Calculate the volume of the prism. Compare the answers found from using a net and a solid.
### Example

**Find the surface area of the rectangular prism.**

You can use the net of the rectangular prism to find its surface area. There are three pairs of congruent faces in a rectangular prism:
- top and bottom
- front and back
- two sides

**Faces**  
**Area**  
<table>
<thead>
<tr>
<th>Faces</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>top and bottom</td>
<td>((4 \cdot 3) + (4 \cdot 3) = 24)</td>
</tr>
<tr>
<td>front and back</td>
<td>((4 \cdot 2) + (4 \cdot 2) = 16)</td>
</tr>
<tr>
<td>two sides</td>
<td>((2 \cdot 3) + (2 \cdot 3) = 12)</td>
</tr>
</tbody>
</table>

Sum of the areas  
\[24 + 16 + 12 = 52\]

Alternatively, replace \(\ell\) with 4, \(w\) with 3, and \(h\) with 2 in the formula for surface area.  
\[
S = 2\ell w + 2\ell h + 2wh
\]
\[
= 2 \cdot 4 \cdot 3 + 2 \cdot 4 \cdot 2 + 2 \cdot 3 \cdot 2
\]
\[= 24 + 16 + 12\]
\[= 52\]

So, the surface area of the rectangular prism is 52 square meters.

### Exercises

**Find the surface area of each rectangular prism.**

1.  
   ![Diagram of a rectangular prism with dimensions 3 cm x 3 cm x 7 cm]

2.  
   ![Diagram of a rectangular prism with dimensions 2 in. x 8 in. x 10 in.]

3.  
   ![Diagram of a rectangular prism with dimensions 5 ft x 7 ft x 9 ft]
Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.

1. 7 cm 12 cm 6 cm
2. 7 ft 1 ft 4 ft
3. 15 in. 9 in. 7 in.

4. 10 mm 9 mm 9 mm
5. 4 cm 3 cm 8.5 cm

6. 3.7 in. 6 in. 4.3 in.
7. 6 ft 7 ft 12 ft
8. 8.3 in. 4.1 in. 4.5 in.
9. 4.1 mm 7.3 mm 6.4 mm

10. A cube has a surface area of 126 square feet. What is the area of one face?

11. Find the surface area of a rectangular prism that has a length of 8 inches, a width of 3 inches, and a height of 6 inches.
Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.

1. length = 3 ft
   width = 6 ft
   height = 2 ft

4. length = 20 cm
   width = 18 cm
   height = 25 cm

5. length = 31.5 in.
   width = 12.2 in.
   height = 24.8 in.

6. length = 5.3 mm
   width = 1.1 mm
   height = 3.4 mm

7. length = 3 m
   width = 5 m
   height = 2 m

8. length = 7.3 ft
   width = 4.8 ft
   height = 3 ft

ESTIMATION Estimate the surface area of each prism.

9. length = 8.9 mm
   width = 8.9 mm
   height = 8.9 mm

10. length = 3.8 in.
    width = 4.2 in.
    height = 8.1 in.

11. BIRTHDAY GIFT When wrapping a birthday gift for his mother, Kenji adds an additional 2.5 square feet of gift wrap to allow for overlap. How many square feet of gift wrap will Kenji use to wrap a gift 3.5 feet long, 18 inches wide, and 2 feet high?

For Exercises 12 and 13, use the following information.

A company needs to package hazardous chemicals in special plastic containers that hold 80 cubic feet of chemicals.

12. Find the whole number dimensions of the container that would use the least amount of plastic.

13. If the plastic costs $0.10 per square foot, how much would it cost to make 24 containers?
1. **PACKAGING** A packaging company needs to know how much cardboard will be required to make boxes 18 inches long, 12 inches wide, and 10 inches high. How much cardboard will be needed for each box if there is no overlap in the construction?

2. **INSULATION** Jane needs to buy insulation for the inside of a truck container. The container is a rectangular prism 15 feet long, 8 feet wide, and \(7 \frac{1}{2}\) feet high. How much insulation should Jane buy if all inside surfaces except the floor are to be insulated?

3. **ICE** Suppose the length of each edge of a cube of ice is 4 centimeters. Find the surface area of the cube.

\[ 4 \text{ cm} \]

4. **ICE** Suppose you cut the ice cube from Exercise 3 in half horizontally into two smaller rectangular prisms. Find the surface area of one of the two smaller prisms.

5. **CONTAINERS** What is the total surface area of the inside and outside of a container in the shape of a rectangular prism with length of 5 meters, width of 3 meters, and height of 2.2 meters?

6. **TOYS** Oscar is making a play block for his baby sister by gluing fabric over the entire surface of a foam block. How much fabric will Oscar need?
Pattern Puzzles

1. Make three copies of this pattern. Fold each pattern to make a pyramid. Then, put the three pyramids together to make a cube. Draw a sketch of the completed cube.

2. Make four copies of this pattern. Fold each pattern to make a solid figure. Then, put the four solids together to make a pyramid. Make a sketch of the finished pyramid.

3. Find the surface area of the cube in Exercise 1.
Get Ready for the Lesson

Complete the Mini Lab at the top of page 656 in your textbook. Write your answers below.

1. Make a net of the cylinder.

2. Name the shapes in the net.

3. How is the length of the rectangle related to the circles?

4. Explain how to find the surface area of the cylinder.

Read the Lesson

Write the formula to use to find each of the following.

5. the area of a circle _______________

6. the circumference of a circle _______________

7. the area of a rectangle _______________

8. How would you find the surface area of a cylinder with no top? Give your answer in words and symbols.

Remember What You Learned

9. Complete the table.

<table>
<thead>
<tr>
<th>Words</th>
<th>The surface area of a cylinder</th>
<th>equals</th>
<th>the area of two bases</th>
<th>plus</th>
<th>the area of the curved surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbols</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Study Guide and Intervention

Surface Area of Cylinders

Example

Find the surface area of the cylinder. Use 3.14 for \( \pi \). Round to the nearest tenth.

\[
S = 2\pi r^2 + 2\pi rh
\]

Surface area of a cylinder.

\[
S = 2 \cdot 3.14(6)^2 + 2 \cdot 3.14 (6)(20)
\]

Replace \( \pi \) with 3.14, \( r \) with 6, and \( h \) with 20.

\[
\approx 979.7
\]

Simplify.

The surface area is about 979.7 square meters.

Exercises

Find the surface area of each cylinder. Use 3.14 for \( \pi \). Round to the nearest tenth.

1. 

\[
S = 2\pi r^2 + 2\pi rh
\]

2. 

\[
S = 2\pi r^2 + 2\pi rh
\]

3. 

\[
S = 2\pi r^2 + 2\pi rh
\]
Skills Practice

Surface Area of Cylinders

Find the surface area of each cylinder. Use 3.14 for \( \pi \).
Round to the nearest tenth.

1. 8 in. 24 in.

2. 10 mm 6 mm

3. 4 m 7 m

4. 7 yd 4.8 yd

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

6. 12.6 cm 6.5 cm

7. Find the surface area of a can with a radius of 4 centimeters and a height of 11 centimeters.

8. Find the surface area of the outside of a cylindrical barrel with a diameter of 10 inches and a height of 12 inches.

9. Find the area of the curved surface of a D battery with a diameter of 3.2 centimeters and a height of 5.6 centimeters.
Practice

Surface Area of Cylinders

Find the surface area of each cylinder. Use 3.14 for \( \pi \). Round to the nearest tenth.

1. \( \text{diameter} = 15.2 \text{ mm} \) \( \text{height} = 9.4 \text{ mm} \)

2. \( \text{diameter} = 28.4 \text{ yd} \) \( \text{height} = 15.1 \text{ yd} \)

3. \( \text{radius} = 50 \text{ cm} \) \( \text{height} = 70 \text{ cm} \)

4. \( \text{diameter} = 6.4 \text{ m} \) \( \text{height} = 8.1 \text{ m} \)

5. \( \text{diameter} = 4.3 \text{ cm} \)

6. \( \text{radius} = 9 \text{ ft} \) \( \text{height} = 9 \frac{1}{2} \text{ ft} \)

ESTIMATION Estimate the area of each cylinder.

10. \( 4.2 \text{ ft} \)

11. \( 9.9 \text{ mm} \)

12. \( 2.9 \text{ yd} \)

13. FUEL STORAGE A fuel storage tank needs to be painted on the inside. If the height of the tank is 40 feet and the diameter is 120 feet, what is the surface that needs to be painted? Round to the nearest hundred square feet.

14. PAPER TOWELS Each of the three rolls of paper towels in a package are individually wrapped in plastic. The radius of each roll is 5.6 centimeters and the height is 27.9 centimeters. How much plastic is used to individually wrap the three rolls? Round to the nearest tenth.
### 12-5 Word Problem Practice
#### Surface Area of Cylinders

1. **PACKAGING** What is the area of the label on a box of oatmeal with a radius of 9.3 centimeters and a height of 16.5 centimeters? Round to the nearest tenth.

2. **TIRES** Betty wants to know the total surface area of the tread on one of her tires. If the diameter of the tire is 18 inches and the width of the tire is 5 inches, what is the total surface area of the tire’s tread? Round to the nearest tenth.

3. **CANS** A cylindrical can has a diameter of 6 inches and a height of 7.3 inches. What is the surface area of the can? Round to the nearest tenth.

4. **CANS** A cylindrical can has a height of 14 centimeters and a radius of 4.2 centimeters. Find the surface area of the can. Round to the nearest tenth.

5. **MANUFACTURING** How much sheet metal is required to make a cylindrical trash can with a diameter of 2 feet and height of $4\frac{1}{4}$ feet? Round to the nearest tenth. *(Hint: Do not include the top.)*

6. **PLUMBING** How much steel is needed to make a hollow pipe with a radius of 3 inches and a height of 15 inches? Round to the nearest tenth.
Cross Sections

In each diagram on this page, a plane cuts through a solid figure. The intersection of the plane with the solid figure is called a cross section.

Sketch the cross section formed in each diagram.

1. 2.

3. 4.

5. (pyramid with a triangular base)

6.

7. (pyramid with a triangular base)

8.
Exercises

12-5 Scientific Calculator Activity

Surface Area of a Cylinder

Find the surface area of the cylinder to the nearest tenth.

\[ A = \text{area of bases} + \text{area of curved surface} \]

\[ A = 2\pi r^2 + 2\pi rh \]

\[ A = 2 \cdot \pi \cdot 3^2 + 2 \cdot \pi \cdot 3 \cdot 12 \]

Enter: \[ 2 \times \pi \times 3 + 2 \times \pi \times 3 \times 12 \] \[ \approx 282.743388 \]

To the nearest tenth, the surface area of the cylinder is 282.7 cm\(^2\).

Exercises

Find the surface area of each cylinder to the nearest tenth.

1.  

2.  

3.  

4.  

Enter: \[ 2 \times \pi \times 3 + 2 \times \pi \times 3 \times 12 \] \[ \approx 282.743388 \]

To the nearest tenth, the surface area of the cylinder is 282.7 cm\(^2\).
Read each question. Then fill in the correct answer.

1. ⬜️ ⬜️ ⬜️ ⬜️
2. ⬜️ ⬜️ ⬜️ ⬜️
3. ⬜️ ⬜️ ⬜️ ⬜️
4. ⬜️ ⬜️ ⬜️ ⬜️
5. ⬜️ ⬜️ ⬜️ ⬜️

6. ⬜️ ⬜️ ⬜️ ⬜️
7. ⬜️ ⬜️ ⬜️ ⬜️
8. ⬜️ ⬜️ ⬜️ ⬜️
9. ⬜️ ⬜️ ⬜️ ⬜️
10. ⬜️ ⬜️ ⬜️ ⬜️
11. ⬜️ ⬜️ ⬜️ ⬜️

Pre-AP

Record your answers for Question 12 on the back of this paper.
**Rubric for Scoring Pre-AP**

(Use to score the Pre-AP question on page 665 of the Student Edition.)

**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 12 Rubric**

<table>
<thead>
<tr>
<th>Score</th>
<th>Specific Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>An accurate expression that the area of the shaded region in terms of $y$ is $36 - y^2$. An accurate expression for the area of the shaded region in terms of $y$ if the dimensions for each region were doubled is given as $144 - (2y)^2$ or $144 - 4y^2$.</td>
</tr>
<tr>
<td>3</td>
<td>The expressions are written correctly; however, they are written in terms of the area of the non-shaded region instead of the area of the shaded region.</td>
</tr>
<tr>
<td>2</td>
<td>One of the two expressions is incorrect and the other expression is written for the area of the entire figure. OR One of the two expressions is incorrect and the other expression is written for the area of the non-shaded region.</td>
</tr>
<tr>
<td>1</td>
<td>Only one of the two expressions is correct.</td>
</tr>
<tr>
<td>0</td>
<td>Response is completely incorrect.</td>
</tr>
</tbody>
</table>
12

Chapter 12 Quiz 1
(Lessons 12-1 and 12-2)

Estimate each square root to the nearest whole number.

1. $\sqrt{63}$  
2. $\sqrt{150}$

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

3.  

4.  

5. MULTIPLE CHOICE What is the side length of a right triangle if one of the sides is 28 millimeters and the hypotenuse is 35 millimeters?

A. 12  
B. 21  
C. 28.8  
D. 40.8

Score ___

NAME ________________________________________ DATE ______________ PERIOD _____

12

Chapter 12 Quiz 2
(Lesson 12-3)

1. BOOKS In how many ways can a bookstore arrange six different books in a row for a display?

2. FRAMING A portrait 14 inches by 20 inches is bordered by a mat that is 2 inches wide. The frame around the mat is $1 \frac{1}{2}$ inches wide. Find the area of the portrait with the frame and mat.

3. PARKS A picnic area at a park is 90 yards long and 60 yards wide. On a diagram of the park, 1 inch = 6 yards. What are the dimensions of the picnic area on the diagram?

4. DRAWINGS On a scale drawing, the scale is 4 centimeters: 1 meter. What is the distance in the scale drawing for a garden 8 meters by 12 meters?

5. A cafeteria vending machine contains apples, chicken sandwiches, potato salad, gelatin, lettuce salad, and pudding. Without looking, an employee selects one of the items. What is the probability that a salad is selected?
Chapter 12 Quiz 3
(Lesson 12-4)

Find the surface area of each rectangular prism.

1. 

   2. 

   3. length = 5 cm
      width = 5 cm
      height = 1 cm

   4. length = 22.4 mm
      width = 24.5 mm
      height = 20 mm

   5. Find the surface area of the rectangular prism.

Chapter 12 Quiz 4
(Lesson 12-5)

Find the surface area of each cylinder. Use 3.14 for $\pi$. Round to the nearest tenth.

1. 

   2. 

   3. 

   4. 

   5. Find the surface area of a cylindrical can that has a diameter of 3.6 inches and a height of 4 inches. Round to the nearest tenth.
PART I

Write the letter for the correct answer in the blank at the right of each question. For Questions 1-3, estimate each square root to the nearest whole number.

1. \( \sqrt{35} \)
   A. 5  B. 6  C. 7  D. 13
   1. ___

2. \( \sqrt{180} \)
   F. 12  G. 13  H. 18  J. 72
   2. ___

3. \( \sqrt{60} \)
   A. 3,600  B. 30  C. 8  D. 7
   3. ___

4. Use a calculator to find \( \sqrt{87} \) to the nearest tenth.
   F. 9  G. 9.3  H. 43.5  J. 7,569.0
   4. ___

5. Find the missing measure for the triangle.
   A. 625 m  B. 6 m  C. 6 m  D. 5 m
   5. ___

6. REMODELING How many square feet of wallpaper are needed to cover a wall that measures 14 feet by 9 feet.
   F. 23 ft\(^2\)  H. 126 ft\(^2\)
   G. 63 ft\(^2\)  J. 252 ft\(^2\)
   6. ___

PART II

Use a calculator to find each square root to the nearest tenth.

7. \( \sqrt{97} \)
   7. ___

8. \( \sqrt{106} \)
   8. ___

9. \( \sqrt{224} \)
   9. ___

10. \( \sqrt{320} \)
   10. ___

Estimate each square root to the nearest whole number.

11. \( \sqrt{290} \)
   11. ___

12. \( \sqrt{407} \)
   12. ___

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

13. \( a = 12 \text{ cm}; c = 13 \text{ cm} \)
   13. ___

14. \( a = 11 \text{ m}; c = 23 \text{ m} \)
   14. ___

15. SKATEBOARDING
   A skateboarding ramp is 4.5 meters long and 2.75 meters tall. To the nearest tenth, how long across the ground is the ramp?
   15. ___
Chapter 12 Vocabulary Test

Choose the correct term or number to complete each sentence.

1. The formula for finding the surface area of a (rectangular prism, cylinder) is \(2lw + 2lh + 2wh\).  

2. An irrational number is a number that cannot be written as a (decimal, fraction).  

3. The diagonal of a rectangle is the (leg, hypotenuse) of a right triangle.  

4. A leg is one of the two sides adjacent to the right (angle, side) of a right triangle.  

5. The (leg, hypotenuse) is the side of a right triangle that is opposite the right angle.  

6. To find the surface area of a (rectangular prism, cylinder), you must know the radius of the base.  

7. The number \(\sqrt{5}\) is (rational, irrational).  

8. The Pythagorean Theorem describes the relationship between the length of the hypotenuse and the lengths of the legs of a(n) (isosceles, right) triangle.  

9. Every positive number has (one, two) square root(s).  

10. A rectangular prism has (6, 8) surfaces.  

Define each term in your own words.

11. Pythagorean Theorem  

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

1. Use a calculator to find $\sqrt{78}$ to the nearest tenth.
   A. 7.8     B. 8.8     C. 9.0     D. 10.8

2. Estimate $\sqrt{37}$ to the nearest whole number.
   F. 9     G. 8     H. 7     J. 6

3. Estimate $\sqrt{143}$ to the nearest whole number.
   A. 10     B. 11     C. 12     D. 20,499

4. Estimate $\sqrt{899}$ to the nearest whole number.
   F. 20     G. 29     H. 30     J. 31

5. Use a calculator to find $\sqrt{43}$ to the nearest tenth.
   A. 1,849     B. 6.6     C. 6.5     D. 3.5

6. The lengths of the legs of a right triangle are 8 centimeters and 6 centimeters. Which equation would you solve to find the length of the hypotenuse?
   F. $6^2 + x^2 = 8^2$     G. $8^2 + x^2 = 6^2$     H. $6^2 + 8^2 = x^2$     J. $8^2 - 6^2 = x^2$

7. The length of the hypotenuse of a right triangle is 20 feet, and the length of one leg is 16 feet. Find the length of the other leg.
   A. 12 ft     B. 26 ft     C. 36 ft     D. 72 ft

8. Which could be the lengths of the sides of a right triangle?
   F. 30 cm, 40 cm, 50 cm     H. 6 m, 8 m, 9 m
   G. 11 ft, 12 ft, 14 ft     J. 3 cm, 4 cm, 7 cm

9. ART A rectangular picture frame is 24 inches long by 18 inches wide. A diagonal brace is nailed across the back of the frame from one corner to the other. How long is the brace?

10. The surface area of a cube is 150 square millimeters. What is the length of one side?
    F. 375 mm     G. 41.7 mm     H. 25 mm     J. 5 mm

11. Find the surface area of the rectangular prism.
    A. 136 mm$^2$     C. 68 mm$^2$
    B. 80 mm$^2$     D. 32 mm$^2$

12. CRATES Find the surface area of a crate in the shape of a rectangular prism with a length of 5 feet, a width of $3\frac{1}{2}$ feet, and a height of $2\frac{1}{2}$ feet. Round to the nearest tenth.
    F. 77.5 ft$^2$     G. 44 ft$^2$     H. 43.8 ft$^2$     J. 22 ft$^2$
13. Find the surface area of the rectangular prism at the right.
   A. $126 \text{ cm}^2$  C. $56 \text{ cm}^3$
   B. $90 \text{ cm}^2$  D. $28 \text{ cm}^2$

14. Find the surface area of a cylinder with a height of 10 feet and a base with a radius of 7 feet. Round to the nearest tenth.
   F. $307.7 \text{ ft}^2$  G. $747.7 \text{ ft}^2$  H. $2,615.6 \text{ ft}^2$  J. $2,725.5 \text{ ft}^2$

15. Find the surface area of the cylinder to the nearest tenth.
   A. $3,927.0 \text{ ft}^2$  C. $471 \text{ ft}^2$
   B. $785.4 \text{ ft}^2$  D. $157 \text{ ft}^2$

16. Find the surface area of the cylinder to the nearest tenth.
   F. $4,071.5 \text{ in}^2$  H. $282.6 \text{ in}^2$
   G. $678.2 \text{ in}^3$  J. $113.1 \text{ in}^2$

17. **CANS** A can of juice is 6 inches high, and its base has a radius of 2 inches. Find the surface area of the can. Round to the nearest tenth.
   A. $37.7 \text{ in}^2$  B. $75.4 \text{ in}^2$  C. $100.5 \text{ in}^2$  D. $118.4 \text{ in}^2$

18. **FRAMING** A picture 12 inches by 18 inches has a frame that is 2 inches wide. Find the area of the picture with the frame.
   F. $216 \text{ in}^2$  G. $252 \text{ in}^2$  H. $280 \text{ in}^2$  J. $432 \text{ in}^2$

19. Find the surface area of a cube with 9-centimeter edges.
   A. $81 \text{ cm}^2$  B. $108 \text{ cm}^2$  C. $324 \text{ cm}^2$  D. $486 \text{ cm}^2$

20. Find the surface area of the cylinder. Round to the nearest tenth.

   F. $1,005.3 \text{ cm}^2$  G. $628.3 \text{ cm}^2$  H. $408.2 \text{ cm}^2$  J. $282.7 \text{ cm}^2$

**Bonus:** A cylinder has a radius of 8 centimeters and the area of its curved surface is about 351.9 square centimeters. What is the height of the cylinder? Round to the nearest whole number.

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

1. Use a calculator to find $\sqrt{87}$ to the nearest tenth.
   A. 8.7  B. 9.3  C. 9.8  D. 12.4
   1. ____

2. Estimate $\sqrt{90}$ to the nearest whole number.
   F. 8  G. 9  H. 10  J. 11
   2. ____

3. Estimate $\sqrt{178}$ to the nearest whole number.
   A. 12  B. 13  C. 14  D. 19
   3. ____

4. Estimate $\sqrt{1,001}$ to the nearest whole number.
   F. 33  G. 32  H. 31  J. 20
   4. ____

5. Use a calculator to find $\sqrt{267}$ to the nearest tenth.
   A. 71,289  B. 17.4  C. 16.7  D. 16.3
   5. ____

6. The lengths of the legs of a right triangle are 22 feet and 19 feet. Which equation would you solve to find the length of the hypotenuse?
   F. $22^2 + x^2 = 19^2$  H. $19^2 + 22^2 = x^2$
   G. $19^2 + x^2 = 22^2$  J. $19^2 - 22^2 = x^2$
   6. ____

7. The length of one leg of a right triangle is 21 inches and the length of the hypotenuse is 35 inches. Find the length of the other leg.
   A. 12 in.  B. 14 in.  C. 28 in.  D. 1,268.5 in.
   7. ____

8. Which could be the lengths of the sides of a right triangle?
   F. 18 m, 24 m, 30 m  H. 2 cm, 3 cm, 4 cm
   G. 19 ft, 27 ft, 39 ft  J. 56 in., 112 in., 168 in.
   8. ____

9. TELEVISION A 41-foot guy wire is used to brace an antenna. The wire is anchored 9 feet from the base of the antenna. How tall is the antenna?
   A. 80 ft  B. 42 ft  C. 40 ft  D. 22 ft
   9. ____

10. Find the surface area of the cylinder to the nearest tenth.
    F. $508.9 \text{ cm}^2$  H. $1,130.4 \text{ cm}^2$
    G. $876.5 \text{ cm}^2$  J. $2,799.1 \text{ cm}^2$
    10. ____

11. TEA CUPS A cylindrical tea cup has a height of 70 millimeters, and its base has a radius of 30 millimeters. Find the surface area of the tea cup to the nearest tenth.
    A. $2,100 \text{ mm}^2$  C. $18,840 \text{ mm}^2$
    B. $16,014 \text{ mm}^2$  D. $461,814.1 \text{ mm}^2$
    11. ____
12. Find the volume of the cylinder to the nearest tenth.
   F. 204.2 cm³  H. 314 cm³
   G. 282.7 cm³  J. 1,256 cm³

13. The surface area of a cube is 486 square feet. What is the length of one side?
   A. 9 ft  C. 81 ft
   B. 27 ft  D. 243 ft

14. Find the surface area of the rectangular prism.
   F. 12,000 m²  H. 1,700 m²
   G. 3,400 m²  J. 75 m²

15. Find the surface area of a rectangular prism with a length of 60 feet, a width of 42 feet, and a height of 31 feet.
   A. 78,120 ft²  B. 11,364 ft²  C. 266 ft²  D. 134 ft²

16. Find the surface area of the rectangular prism.
   F. 274 in²  H. 137 in²
   G. 260 in²  J. 22 in²

17. Find the surface area of a cylinder with a height of 7.1 meters and a base with a radius of 2.6 meters. Round to the nearest tenth.
   A. 359.7 m²  B. 158.4 m²  C. 137.2 m²  D. 18.5 m²

18. CANS A cylindrical peach can has a height of 5.3 inches, and its base has a radius of 1.6 inches. Find the surface area of the peach can to the nearest tenth.
   F. 709.7 in²  G. 69.3 in²  H. 26.6 in²  J. 8.5 in²

19. Find the surface area of the cylinder to the nearest tenth.
   A. 776.0 mm²  C. 4,737.5 mm²
   B. 1,306.2 mm²  D. 6,371.1 mm²

20. PAINTING All of a dresser’s outer surfaces need to be painted. The height of the dresser is 53 inches, its width is 21 inches, and its length is 43 inches. What is the surface area of the dresser?
   F. 47,859 in²  G. 8,590 in²  H. 6,784 in²  J. 4,295 in²

Bonus: A cylinder has a radius of 6 centimeters and the area of its curved surface is about 150.8 square centimeters. What is the height of the cylinder? Round to the nearest whole number.
   B: __________________
Write the letter for the correct answer in the blank at the right of each question.

1. Use a calculator to find $\sqrt{94}$ to the nearest tenth.
   A. 9.4  B. 9.7  C. 10.4  D. 12.4  1. ____

2. Estimate $\sqrt{23}$ to the nearest whole number.
   F. 4  G. 5  H. 6  J. 11  2. ____

3. Estimate $\sqrt{102}$ to the nearest whole number.
   A. 10  B. 11  C. 12  D. 25  3. ____

4. Estimate $\sqrt{520}$ to the nearest whole number.
   F. 20  G. 22  H. 23  J. 24  4. ____

5. Use a calculator to find $\sqrt{173}$ to the nearest tenth.
   A. 29,929  B. 13.2  C. 13.1  D. 5.6  5. ____

6. The lengths of the legs of a right triangle are 16 feet and 30 feet. Which equation would you solve to find the length of the hypotenuse?
   F. $16^2 + x^2 = 30$  H. $30^2 + x^2 = 16$
   G. $16^2 + 30^2 = x^2$  J. $30^2 - 16^2 = x^2$  6. ____

7. The length of one leg of a right triangle is 24 meters, and the length of the hypotenuse is 25 meters. Find the length of the other leg.
   A. 49 m  B. 35 m  C. 7 m  D. 1 m  7. ____

8. Which could be the lengths of the sides of a right triangle?
   F. 7 cm, 8 cm, 10 cm  H. 12 ft, 15 ft, 20 ft
   G. 6 cm, 8 cm, 10 cm  J. 20 m, 30 m, 40 m  8. ____

9. TRAVEL The Garcias drove 24 miles east and then 7 miles north. At that point, what is the straight-line distance from their starting point?
   A. 25 mi  B. 31 mi  C. 31.25 mi  D. 625 mi  9. ____

10. Find the surface area of the cylinder to the nearest tenth.
    F. 34,482.1 cm²  H. 4,926.0 cm²
    G. 7,385.3 cm²  J. 392 cm²  10. ____

11. CANS A cylindrical waste can has a height of 20 inches, and its base has a radius of 10 inches. Find the surface area of the waste can to the nearest tenth.
    A. 12,566.4 in²  B. 6,283.2 in²  C. 1,884 in²  D. 1,570 in²  11. ____
12. Find the surface area of the cylinder to the nearest tenth.
   F. 1.281.8 yd²  H. 414.5 yd²
   G. 565.5 yd²  J. 301.6 yd²

13. The surface area of a cube is 216 square feet. What is the length of one side?
   A. 72 ft  B. 36 ft  C. 14.7 ft  D. 6 ft

14. Find the surface area of the rectangular prism.
   F. 1,250 cm²  H. 425 cm²
   G. 850 cm²  J. 80 cm²

15. A rectangular prism has a length of 40 inches, a width of 22 inches, and a height of 12 inches. Find the surface area of the prism.
   A. 10,560 in²  B. 3,248 in²  C. 1,624 in²  D. 148 in²

16. Find the surface area of the rectangular prism.
   F. 176 cm²  H. 5,112 cm²
   G. 2,556 cm²  J. 24,480 cm²

17. Find the surface area of a cylinder with a height of 19 centimeters and a base with a radius of 7 centimeters. Round to the nearest tenth.
   A. 307.7 cm²  B. 989.6 cm²  C. 1,143.0 cm²  D. 2,924.8 cm²

18. ERASERS A cylindrical eraser has a height of 15 millimeters, and its base has a radius of 9 millimeters. Find the surface area of the eraser to the nearest tenth.
   F. 508.7 mm²  G. 1,102.7 mm²  H. 1,356.5 mm²  J. 3,817.0 mm²

19. Find the surface area of the cylinder to the nearest tenth.
   A. 2,010.6 in²  C. 351.7 in²
   B. 502.7 in²  D. 301.6 in²

20. PAINTING All of a toy box’s outer surfaces need to be painted. The height of the toy box is 26 inches, its width is 28 inches, and its length is 38 inches. What is the surface area of the toy box?
   F. 2,780 in²  G. 4,104 in²  H. 5,560 in²  J. 27,664 in²

Bonus: A cylinder has a radius of 9 centimeters and the area of its curved surface is about 282.7 square centimeters. What is the height of the cylinder? Round to the nearest whole number.
   B: ____________________
Estimate each square root to the nearest whole number.

1. \( \sqrt{29} \)
2. \( \sqrt{10} \)
3. \( \sqrt{53} \)
4. \( \sqrt{78} \)

Use a calculator to find each square root to the nearest tenth.

5. \( \sqrt{90} \)
6. \( \sqrt{123} \)
7. \( \sqrt{455} \)
8. \( \sqrt{69} \)

Find the missing measure of each right triangle.
Round to the nearest tenth if necessary.

9. \( b = 7 \text{ cm}, \ c = 11 \text{ cm} \)
10. \( a = 30 \text{ ft}, \ c = 50 \text{ ft} \)

11. [Diagram of a right triangle with sides labeled]

12. [Diagram of a right triangle with sides labeled]

13. A right triangle has legs that measure 22 inches and 13 inches. Find the measure of the hypotenuse.

14. MUSIC In how many ways can a music store arrange five different CDs in a row for a display?

15. FRAMING A picture 15 inches by 24 inches is bordered by a mat that is 2 inches wide. The frame around the mat is \( 1 \frac{1}{2} \) inches wide. Find the area of the picture with the frame and mat.

16. GARDENS A garden is 14 feet long and 8 feet wide. On a diagram of the garden, \( \frac{1}{2} \) inch = 1 foot. What are the dimensions of the garden on the diagram?
For Questions 17–24, find the surface area of each solid. Use 3.14 for $\pi$. Round to the nearest tenth if necessary.

17. 

18. 

19. 

20. 

21. 

22. 

23. 

24. 

25. **STUNTS** A monster truck attempted to scale a brick wall. The highest point it reached on the wall was 3 meters. At that point, its rear wheels were 4.3 meters from the wall. How long is the monster truck? Round to the nearest hundredth.

**Bonus:** A cylinder has a radius of 10 centimeters and the area of its curved surface is about 502.7 square centimeters. What is the height of the cylinder? Round to the nearest whole number.

B: ____________________
Estimate each square root to the nearest whole number.

1. \( \sqrt{39} \)  
2. \( \sqrt{5} \)  
3. \( \sqrt{84} \)  
4. \( \sqrt{65} \)  

Use a calculator to find each square root to the nearest tenth.

5. \( \sqrt{80} \)  
6. \( \sqrt{109} \)  
7. \( \sqrt{320} \)  
8. \( \sqrt{74} \)  

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

9. \( a = 45 \text{ m}, \ b = 60 \text{ m} \)  
10. \( a = 5 \text{ ft}, \ c = 8 \text{ ft} \)  

11.  

12.  

A right triangle has legs that measure 23 centimeters and 11 centimeters. Find the measure of the hypotenuse.

13.  

MUSIC In how many ways can a music store arrange seven different DVDs in a row for a display?

14.  

FRAMING A picture 18 inches by 25 inches is bordered by a mat that is 2 inches wide. The frame around the mat mat is \( 1\frac{1}{2} \) inches wide. Find the area of the picture with the frame and mat.

15.  

GARDENS A garden is 18 feet long and 9 feet wide. On a diagram of the garden, \( \frac{1}{2} \text{ inch} = 1 \text{ foot} \). What are the dimensions of the garden on the diagram?
For Questions 17–24, find the surface area of each solid. Use 3.14 for \( \pi \). Round to the nearest tenth if necessary.


25. **STUNTS** A monster truck attempted to scale a brick wall. The highest point it reached on the wall was 3 meters. At that point, its rear wheels were 4.3 meters from the wall. How long is the monster truck? Round to the nearest hundredth.

**Bonus:** A cylinder has a radius of 11 centimeters and the area of its curved surface is about 622.0 square centimeters. What is the height of the cylinder? Round to the nearest whole number.

**B:** ________________
Estimate each square root to the nearest whole number.

1. \( \sqrt{84} \)  

2. \( \sqrt{29} \)  

3. \( \sqrt{141} \)  

4. \( \sqrt{52} \)  

Use a calculator to find each square root to the nearest tenth.

5. \( \sqrt{68} \)  

6. \( \sqrt{270} \)  

7. \( \sqrt{932} \)  

8. \( \sqrt{509} \)  

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

9. \( b = 64 \text{ m}, c = 80 \text{ m} \)  

10. \( a = 11 \text{ yd}, c = 18 \text{ yd} \)  

11. \[ \begin{align*} 
\text{5 in.} & \quad \text{8.7 in.} \\
\text{c in.} & \quad \text{c in.} 
\end{align*} \]  

12. \[ \begin{align*} 
38.7 \text{ cm} & \quad \text{21 cm} \\
\text{a cm} & \quad \text{a cm} 
\end{align*} \]  

13. A right triangle has a hypotenuse that measure 42.1 centimeters and a leg that measures 36.8 centimeters. Find the measure of the other leg.

14. MOVIES In how many ways can a media store arrange nine different DVDs in a row for a display?

15. FRAMING A picture \( 15\frac{1}{2} \text{ inches} \) by 28 inches is bordered by a mat that is 2 inches wide. The frame around the mat is \( 2\frac{1}{2} \text{ inches} \) wide. Find the area of the picture with the frame and mat.

16. GARDENS A garden is 3.5 meters long and 2.8 meters wide. On a diagram of the garden, 2 centimeters = 1 meter. What are the dimensions of the garden on the diagram?
For Questions 17–24, find the surface area of each solid. Use 3.14 for \(\pi\). Round to the nearest tenth if necessary.

17. 

\[
\text{Surface Area} = 2(8 \times 6.9 + 8 \times 4 + 6.9 \times 4) = 14.8 \times 13.8 = 210.64\text{ yd}^2
\]

18. 

\[
\text{Surface Area} = 2(2.5 \times 2.5 + 2.5 \times 2.5 + 2.5 \times 2.5) = 2 \times 7.5 = 15\text{ in.}^2
\]

19. 

\[
\text{Surface Area} = 2(0.5 \times 0.5 + 0.5 \times 2.5 + 0.5 \times 2.5) = 2 \times 5.5 = 11\text{ cm}^2
\]

20. 

\[
\text{Surface Area} = 2(0.3 \times 0.5 + 0.5 \times 0.3 + 0.3 \times 0.3) = 2 \times 1.1 = 2.2\text{ cm}^2
\]

21. 

\[
\text{Surface Area} = 2(11 \times 8.7 + 11 \times 11 + 8.7 \times 11) = 2 \times 232.3 = 464.6\text{ ft}^2
\]

22. 

\[
\text{Surface Area} = 2(12.1 \times 33 + 12.1 \times 12.1 + 33 \times 12.1) = 2 \times 611.02 = 1222.04\text{ m}^2
\]

23. 

\[
\text{Surface Area} = 2(8 \times 60 + 8 \times 8 + 60 \times 8) = 2 \times 592 = 1184\text{ mm}^2
\]

24. 

\[
\text{Surface Area} = 2(13.5 \times 8.2 + 13.5 \times 13.5 + 8.2 \times 13.5) = 2 \times 347.3 = 694.6\text{ mm}^2
\]

25. **GUY WIRES** A vertical pole is anchored to the ground by a 29\(\frac{3}{4}\)-foot guy wire. The wire is attached to the ground at a point 22\(\frac{1}{2}\) feet from the base of the pole. How tall is the pole? Round to the nearest tenth.

\[
\text{Height} = \sqrt{29.75^2 - 22.5^2} = \sqrt{888.0625 - 506.25} = \sqrt{381.8125} = 19.55\text{ ft}
\]

**Bonus:** A cylinder has a diameter of 11 centimeters and the area of its curved surface is about 414.7 square centimeters. What is the height of the cylinder? Round to the nearest whole number.

\[
\text{Height} = \frac{414.7}{\pi \times 5.5} = \frac{414.7}{17.3} = 24\text{ cm}
\]

B: ________________
1. **CARPENTRY** A carpenter is framing a house. The front of the house measures 48 feet. The width measures 36 feet. He measures diagonally across the house as shown. If the diagonal measurement is 62 feet, are the corners of the house square (right angles)? Explain your reasoning. Use a calculator.

2. a. Compare the volumes and surface areas of the three boxes pictured.

   ![Box A](image1)
   ![Box B](image2)
   ![Box C](image3)

b. Compare the volumes and surface areas of the three containers pictured.

   ![Container A](image4)
   ![Container B](image5)
   ![Container C](image6)

c. Explain why you think manufacturers frequently package their products in tall boxes, bottles, or cans.
1. Evaluate \( | -8 | - |-2| \). (Lesson 2-1)
   A 10         C 7
   B 6         D -10

2. Write 49.5\% as a decimal. (Lesson 4-7)
   F 0.0495     H 84.095
   G 0.495     J 4.95

3. Write 0.33\% as a decimal. (Lesson 6-9)
   A 0.0033     C 3.3
   B 0.033     D 33

4. Find the percent of change from 18 to 41. Round to the nearest whole percent. (Lesson 7-6)
   F 44\%         H 128\%
   G 56\%         J 228\%

5. RAFFLE In a raffle, one ticket will be drawn from a total of 200 tickets. If Maureen has 4 tickets, what is the probability that she will win? (Lesson 9-1)
   A \( \frac{1}{50} \)      C 0.2
   B 4\%      D \( \frac{1}{4} \)

6. HORSES Tionna has a display that holds 8 horse figurines. If she has 17 horse figurines, how many combinations of 8 can she create? (Lesson 9-5)
   F 40,320     H 2,312
   G 24,310     J 136

7. Suppose \( \angle 1 \) and \( \angle 2 \) are complementary. If \( m\angle 1 = 50\degree \), find \( m\angle 2 \). (Lesson 10-1)
   A 30\degree      C 50\degree
   B 40\degree      D 130\degree

8. Three sides of a triangle measure 6 meters, 4 meters, and 5 meters. Classify the triangle by its sides. (Lesson 10-4)
   F scalene     H equilateral
   G isosceles    J obtuse

9. Triangle \( RST \) has vertices \( R(0, -7) \), \( S(-4, 2) \), and \( T(1, 9) \). Find the coordinates of \( S' \) after the figure is translated 5 units right and 7 units down. (Lesson 10-9)
   A (1, -5)     B (-1, -5)     C (-9, 9)     D (-9, -5)
10. What is the base of a parallelogram with an area of 30 square miles and a height of 5 miles? (Lesson 11-1)
   F 152 mi  H 25 mi
   G 35 mi  J 6 mi

11. Find the area of a circle with a diameter of 36 millimeters. Round to the nearest tenth. (Lesson 11-4)
   A 4071.5 mm²  B 113.1 mm²
   B 1017.4 mm²  D 56.5 mm²

12. Find the volume of a rectangular prism with a length of 5 yards, a width of 7.5 yards, and a height of 9 yards. (Lesson 11-9)
   F 21.5 yd³  H 300 yd³
   G 150 yd³  J 337.5 yd³

13. Estimate $\sqrt{75}$ to the nearest whole number.
   A 8  C 38
   B 9  D 80

14. Find the missing measure of a right triangle with side lengths of $a = 5$ cm and $c = 9$ cm.
   F 56 cm  H 7.5 cm
   G 10.3 cm  J 2 cm

15. CABLE A 52-foot cable reaches from the top of a pole to a point on the ground that is 48 feet from the base of the pole. How tall is the pole? (Lesson 12-2)
   A 12 ft  C 50 ft
   B 20 ft  D 92 ft

16. Find the surface area of the cylinder. Round to the nearest tenth. (Lesson 12-5)
   F 301.6 in²  H 424.1 in²
   G 339.1 in²  J 2,120.6 in²

17. Find the area of a circle with a radius of 1.5 centimeters. Round to the nearest tenth. (Lesson 11-4)
   A 4.5 cm²  C 7.1 cm²
   B 4.7 cm²  D 9.4 cm²

18. Find the surface area in meters of a rectangular prism that is 5 meters wide, 8.5 meters long, and 2 meters high. (Lesson 12-4)
   F 15.5 m²  H 85 m²
   G 44.5 m²  J 139 m²
19. A rectangle has a width of 3.5 inches and a length of 4.25 inches. Find the perimeter of the rectangle in inches. (Lesson 3-6)

20. BAND The ratio of boys to girls in the school band is 2 to 3. If there are 90 students in the band, how many of them are boys? (Lesson 6-5)

21. Use the Fundamental Counting Principle to find the total number of outcomes when choosing a day in the month of September and tossing two coins. (Lesson 9-3)

22. Use the graph to tell what type of translation or reflection is shown. (Lessons 10-9, 10-10)

23. Find the volume of the cylinder. Round to the nearest tenth. (Lesson 11-10)

24. ATHLETICS A rectangular athletic field is 80 meters long by 60 meters wide. What is the diagonal distance across the field in meters? (Lesson 12-2)

25. WINDSTORM A strong storm blew over a billboard 27 feet tall so that it is leaning against a telephone pole 21 feet tall. (Lesson 12-2)

   a. Make a drawing to represent this situation.

   b. How far from the base of the telephone pole is the base of the billboard? Round to the nearest tenth if necessary.
1. **INTERNET** For the following table, find the number of degrees for each section of a circle graph. Then make a circle graph of the data. Round to the nearest degree.

<table>
<thead>
<tr>
<th>Internet Use</th>
<th>Counting</th>
<th>Number of Households online (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>United States</td>
<td>163</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Canada</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>5</td>
</tr>
</tbody>
</table>

For Questions 2 and 3, draw an angle having each measurement. Then classify each angle as *acute*, *right*, *obtuse*, or *straight*.

2. 60°

3. 180°

4. Use the graph to describe the translation from \(\triangle ABC\) to \(\triangle A'B'C'\).

5. Use the graph to tell what type of reflection is shown.

For Questions 6 and 7, find the *best* name to classify each quadrilateral.

6. 

7. 

8. Find \(m\angle A\) in \(\triangle ABC\) if \(m\angle B = 73^\circ\) and \(m\angle C = 48^\circ\).

9. **PLATES** Find the circumference of a circular plate that has a diameter of 14 inches. Use 3.14 for \(\pi\) and round to the nearest tenth if necessary.
10. Estimate $\sqrt{75}$ to the nearest whole number.

11. Find the missing measure of a right triangle with legs 8 meters and 13 meters long. Round to the nearest tenth if necessary.

For Questions 12–16, find the area of each figure. Round to the nearest tenth if necessary.

12. \[
\text{area of the parallelogram} = \text{base} \times \text{height}
\]

13. \[
\text{area of the triangle} = \frac{1}{2} \times \text{base} \times \text{height}
\]

14. \[
\text{area of the circle} = \pi \times \text{radius}^2
\]

15. \[
\text{area of the trapezoid} = \frac{1}{2} \times (\text{sum of the bases}) \times \text{height}
\]

16. \[
\text{area of the trapezoid} = \frac{1}{2} \times (\text{sum of the bases}) \times \text{height}
\]

17. Draw a top, a side, and a front view of the following figure.

18. Identify the shape of the base(s) of the figure. Then classify the figure.

Find the volume and surface area of each figure. Round to the nearest tenth if necessary.

19. \[
\text{volume of the rectangular prism} = \text{length} \times \text{width} \times \text{height}
\]

20. \[
\text{volume of the cylinder} = \pi \times \text{radius}^2 \times \text{height}
\]
1. 40
2. 28
3. 85
4. 62

5. Describe another method that you could use to estimate the square root of a number. Sample answer: square numbers using guess and check

6. Why is \( \sqrt{4} \) rational and \( \sqrt{2} \) an irrational number? Sample answer: \( \sqrt{4} = 2 \), and 2 can be written as a fraction: \( \frac{2}{1} \). So, \( \sqrt{4} \) is a rational number. \( \sqrt{2} = 1.4142135\ldots \), which is not an integer or a repeating or terminating decimal. It cannot be written as a fraction. So, \( \sqrt{2} \) is an irrational number.

7. How do you read the statement \( \sqrt{64} < \sqrt{75} < \sqrt{81} \)? The square root of 64 is less than the square root of 75, which is less than the square root of 81.

8. Why are \( \sqrt{64} \) and \( \sqrt{81} \) used in Example 1? Sample answer: 64 and 81 are perfect squares, and they are the closest integer perfect squares to 75. They are used to find an estimate for the square root of 75.

9. The key to estimating square roots without a calculator is to be familiar with common perfect squares. Complete the following table of common perfect squares then test yourself to see how many you can remember without using a calculator.

<table>
<thead>
<tr>
<th>Number</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
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<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square</td>
<td>25</td>
<td>36</td>
<td>49</td>
<td>64</td>
<td>81</td>
<td>100</td>
<td>121</td>
<td>144</td>
<td>169</td>
<td>196</td>
<td>225</td>
<td>256</td>
<td>400</td>
<td>625</td>
</tr>
</tbody>
</table>
Estimating Square Roots

Estimate each square root to the nearest whole number.

1. \( \sqrt{3} \) 2  
2. \( \sqrt{10} \) 3  
3. \( \sqrt{21} \) 5  

4. \( \sqrt{28} \) 5  
5. \( \sqrt{78} \) 9  
6. \( \sqrt{102} \) 10  

7. \( \sqrt{179} \) 13  
8. \( \sqrt{274} \) 17  
9. \( \sqrt{303} \) 17  

10. \( \sqrt{563} \) 24  
11. \( \sqrt{592} \) 24  
12. \( \sqrt{755} \) 27  

13. \( \sqrt{981} \) 31  
14. \( \sqrt{1,356} \) 37  
15. \( \sqrt{1,888} \) 41  

16. \( \sqrt{3,287} \) 57  
17. \( \sqrt{3,985} \) 63  
18. \( \sqrt{4,125} \) 64  

Use a calculator to find each square root to the nearest tenth.

19. \( \sqrt{6} \) 2.4  
20. \( \sqrt{15} \) 3.4  
21. \( \sqrt{30} \) 5.5  

22. \( \sqrt{77} \) 8.8  
23. \( \sqrt{114} \) 10.7  
24. \( \sqrt{125} \) 11.2  

25. \( \sqrt{149} \) 12.2  
26. \( \sqrt{152} \) 12.5  
27. \( \sqrt{212} \) 14.6  

28. \( \sqrt{436} \) 20.9  
29. \( \sqrt{621} \) 24.9  
30. \( \sqrt{853} \) 29.2  

31. \( \sqrt{918} \) 30.3  
32. \( \sqrt{1,004} \) 31.7  
33. \( \sqrt{1,270} \) 35.6  

34. \( \sqrt{5,436} \) 73.7  
35. \( \sqrt{4,215} \) 64.9  
36. \( \sqrt{5,786} \) 76.1  

37. Order \( \frac{21}{7} \), 4.91, and \( \sqrt{23} \) from least to greatest. \( \frac{25}{7} \), \( \sqrt{23} \), 4.91  

38. Graph \( \sqrt{42} \) and \( \sqrt{62} \) on the same number line.
Estimating Square Roots

Estimate each square root to the nearest whole number.

1. $\sqrt{8}$ 3
2. $\sqrt{19}$ 4
3. $\sqrt{47}$ 7
4. $\sqrt{70}$ 8
5. $\sqrt{91}$ 10
6. $\sqrt{125}$ 11
7. $\sqrt{150}$ 12
8. $\sqrt{389}$ 20
9. $\sqrt{2,468}$ 50
10. $\sqrt{889}$ 30
11. $\sqrt{4,840}$ 70
12. $\sqrt{8,080}$ 90

Use a calculator to find each square root to the nearest tenth.

13. $\sqrt{6}$ 2.4
14. $\sqrt{21}$ 4.6
15. $\sqrt{53}$ 7.3
16. $\sqrt{79}$ 8.9
17. $\sqrt{190}$ 13.8
18. $\sqrt{624}$ 25.0
19. $\sqrt{427}$ 20.7
20. $\sqrt{3,178}$ 56.4
21. $\sqrt{0.06}$ 0.6
22. $\sqrt{0.81}$ 0.9
23. $\sqrt{1.44}$ 1.2
24. $\sqrt{2.25}$ 1.5
25. ALGEBRA What whole number is closest to $\sqrt{a + b}$ if $a = 24$ and $b = 38^2$ 8
26. ALGEBRA Evaluate $\sqrt{x} - y$ to the nearest tenth if $x = 10$ and $y = 4.5$ 2.3
27. QUILTING A queen-size quilt in the shape of a square has an area of 51 square feet. What is the approximate length of one side of the quilt to the nearest tenth? 7.1 ft
28. PENDULUM The formula below can be used to estimate the time it takes for a pendulum to swing back and forth once. Use the formula to find the time it takes for a pendulum with a length of 0.8 meter to swing back and forth once. Round to the nearest tenth. 1.8 seconds

\[ T = 2 \times \sqrt{L} \]
- $T =$ time (seconds)
- $L =$ length (meters)

1. GEOMETRY The diameter $d$ of a circle with area $A$ is given by the formula $d = \frac{2\sqrt{A}}{\pi}$. What is the diameter of a circle with an area of 56 square inches? Use 3.14 for $\pi$ and round to the nearest tenth. 8.4 in.

2. FENCING Carmen wants to buy fencing to enclose a square garden with an area of 500 square feet. How much fencing does Carmen need to buy? Round to the nearest tenth. 89.4 ft

3. OCEANS The speed $v$ in feet per second of an ocean wave in shallow water of depth $d$ in feet is given by the formula $v = \sqrt{2gd}$. What is the speed of an ocean wave at a depth of 10 feet? Round to the nearest tenth. 17.9 ft/s

4. LIGHTING A new flashlight has a beam whose width $w$ at a distance $d$ from the flashlight is given by the formula $w = 1.2\sqrt{d}$. What is the width of the beam at a distance of 30 feet? Round to the nearest tenth. 6.6 ft

5. SOUND The speed of sound in air $c$ in meters per second at a temperature $T$ in degrees Celsius is given approximately by the formula $c = \sqrt{402(T + 273)}$. What is the speed of sound in air at a temperature of 25 degrees Celsius? Round to the nearest tenth. 346.1 m/s

6. PROJECTILES The muzzle velocity $v$ in feet per second necessary for a cannon to hit a target $x$ feet away is estimated by the formula $v = \sqrt{32x}$. What muzzle velocity is required to hit a target 3,000 feet away? Round to the nearest tenth. 309.8 ft/s
World Series Records

Each problem gives the name of a famous baseball player. To find who set each record, graph the points on the number line.

1. Pitched 23 strikeouts in one World Series
   \[ U \text{ at } \sqrt{3}, X \text{ at } 3.3, K \text{ at } 0.75, O \text{ at } \frac{5}{2}, P \text{ at } \sqrt{6}, A \text{ at } 3\frac{7}{8} \]
   \[ \begin{array}{ccccccccc}
   & K & O & U & F & A & X \\
   0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8
   \end{array} \]

2. 71 base hits in his appearances in World Series
   \[ B \text{ at } \sqrt{5}, R \text{ at } \sqrt{12}, A \text{ at } 3.75, G \text{ at } \frac{16}{3}, E \text{ at } \frac{5}{2}, Y \text{ at } 0.375, R \text{ at } 3\frac{3}{8}, I \text{ at } 1.6, \text{ and } O \text{ at } 0.7 \]
   \[ \begin{array}{ccccccccccc}
   & Y & O & G & I & B & E & R & R & A \\
   0 & 1 & 2 & 3 & 4
   \end{array} \]

3. 10 runs in a single World Series
   \[ N \text{ at } \sqrt{60}, K \text{ at } \sqrt{30}, A \text{ at } 4.3, S \text{ at } 6.2, C \text{ at } \frac{46}{9}, O \text{ at } \sqrt{45}, \text{ and } J \text{ at } \sqrt{17} \]
   \[ \begin{array}{cccccccc}
   & J & A & C & K & O & S & N \\
   4 & 5 & 6 & 7 & 8
   \end{array} \]

4. Batting average of 0.625 in a single World Series
   \[ E \text{ at } \sqrt{32}, U \text{ at } \sqrt{64}, A \text{ at } \frac{14}{5}, T \text{ at } \sqrt{55}, B \text{ at } 5.3, R \text{ at } \sqrt{40}, H \text{ at } 7.75, \\
   \text{ and } H \text{ at } 5\frac{1}{5} \]
   \[ \begin{array}{cccccccccc}
   & B & A & B & E & R & U & T & H \\
   4 & 5 & 6 & 7 & 8
   \end{array} \]

5. 42 World Series runs in his career
   \[ E \text{ at } \sqrt{40}, Y \text{ at } 9.6, I \text{ at } 8.6, E \text{ at } \sqrt{90}, A \text{ at } \frac{21}{2}, M \text{ at } \sqrt{76}, C \text{ at } 8\frac{7}{8}, \\
   M \text{ at } \sqrt{100}, N \text{ at } 10.7, K \text{ at } 9\frac{1}{4}, T \text{ at } \sqrt{120}, L \text{ at } 11.4 \]
   \[ \begin{array}{cccccccccccc}
   & M & I & C & K & E & Y & M & A & N & T & L & E \\
   8 & 9 & 10 & 11 & 12
   \end{array} \]

Exercises

Glencoe California Mathematics, Grade 6

1. \( \sqrt{35} \) 2. \( \sqrt{42} \) 3. \( \sqrt{51} \)
   \[ 5.92 \quad 6.48 \quad 5.57 \]

4. \( \sqrt{126} \) 5. \( \sqrt{190} \) 6. \( \sqrt{2} \)
   \[ 11.22 \quad 13.78 \quad 1.41 \]

7. \( \sqrt{3} \) 8. \( \sqrt{9} \) 9. \( \sqrt{13} \)
   \[ 1.73 \quad 3.23 \quad 3.61 \]

10. \( \sqrt{59} \) 11. \( \sqrt{48} \) 12. \( \sqrt{57} \)
   \[ 7.07 \quad 8.25 \quad 7.55 \]

13. \( \sqrt{37} \) 14. \( \sqrt{98} \) 15. \( \sqrt{44} \)
   \[ 6.08 \quad 9.90 \quad 6.63 \]

16. \( \sqrt{87} \) 17. \( \sqrt{15} \) 18. \( \sqrt{11} \)
   \[ 9.33 \quad 3.87 \quad 3.31 \]

19. \( \sqrt{12} \) 20. \( \sqrt{14} \) 21. \( \sqrt{25} \)
   \[ 3.46 \quad 3.74 \quad 5.00 \]
Find the missing measure of a right triangle if \( a = 4 \) inches and \( b = 3 \) inches.

**Pythagorean Theorem**

\[ c^2 = a^2 + b^2 \]

Replace \( a \) with 4 and \( b \) with 3.

\[ c^2 = 4^2 + 3^2 \]

\[ c^2 = 16 + 9 \]

\[ c^2 = 25 \]

Add.

\[ c = \sqrt{25} \]

Simplify.

\[ c = 5 \]

The length of the hypotenuse is 5 inches.

Determine whether a triangle with side lengths of 6 meters, 9 meters, and 12 meters is a right triangle.

**Pythagorean Theorem**

\[ c^2 = a^2 + b^2 \]

Replace \( a \) with 6, \( b \) with 9, and \( c \) with 12.

\[ 12^2 = 6^2 + 9^2 \]

\[ 144 = 36 + 81 \]

\[ 144 = 117 \]

The triangle is not a right triangle.

Find the missing measure of each right triangle. Round to the nearest tenth if necessary.

1. 9.8 in.
2. 9.0 m
3. 9.3 cm

Determine whether each triangle with the given side lengths is a right triangle. Write yes or no.

4. 15 ft, 8 ft, 17 ft
   - yes
5. 5 in., 13 in., 17 in.
   - no
6. 9 yd, 40 yd, 41 yd
   - yes

The sides of a right triangle have special names. The sides adjacent to the right angle are the legs. The side opposite the right angle is the hypotenuse. The Pythagorean Theorem describes the relationship between the length of the hypotenuse and the lengths of the legs. In a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs.
Find the missing measure of each triangle. Round to the nearest tenth if necessary.

1. 18.7 m
2. 7.1 in.
3. 8.4 ft
4. 32.8 cm
5. 37.9 in.
6. 1.3 yd
7. 9.5 m
8. 15.5 mm
9. $a = 15$ cm, $b = 20$ cm,
   $25$ cm
10. $a = 2$ in., $b = 12$ in.,
    $12.2$ in.
11. $a = 13$ in., $c = 16.5$ in.,
    $10.2$ in.
12. $b = 8$ mm, $c = 17$ mm,
    $15$ mm
13. $a = 1.3$ ft, $b = 4.6$ ft,
    $4.8$ ft
14. $a = 14.7$ m, $c = 23$ m,
    $17.7$ m

Determine whether each triangle with the given side lengths is a right triangle. Write yes or no.

15. 10 ft, 24 ft, 26 ft
    yes
16. 5 in., 8 in., 9 in.
    no
17. 6 cm, 9 cm, 12 cm
    no
18. 4.5 mm, 6.0 mm, 7.5 mm
    yes

Find the missing measure in each figure. Round to the nearest tenth if necessary.

13. $x = 18$ m
14. $x = 1.7$ yd
15. SOCCER Find the width of the soccer goal.
    Round to the nearest tenth. 10.0 ft
16. CONVEYOR BELT The diagram shows the horizontal distance a conveyor belt moves a load of gravel. If the conveyor belt takes 54 seconds to move gravel from the bottom of the conveyor belt to the top at a rate of 3 feet per second, how high does the conveyor belt lift the gravel? Round to the nearest tenth. $61.2$ ft
Pythagoras in the Air

In the diagram at the right, an airplane heads north at 180 mi/h. But, the wind is blowing towards the east at 30 mi/h. So, the airplane is really traveling east of north. The middle arrow in the diagram shows the actual direction of the airplane.

The actual speed of the plane can be found using the Pythagorean Theorem.

\[
\sqrt{30^2 + 180^2} = \sqrt{900 + 32,400} = \sqrt{33,300} \approx 182.5
\]

The plane’s actual speed is about 182.5 mi/h.

Find the actual speed of each airplane. Round answers to the nearest tenth. (You might wish to draw a diagram to help you solve the problem.)

1. An airplane travels at 240 mi/h east. A wind is blowing at 20 mi/h toward the south. **240.8 mi/h**
2. An airplane travels at 620 mi/h west. A wind is blowing at 35 mi/h toward the north. **621.0 mi/h**
3. An airplane travels at 450 mi/h south. A wind is blowing at 40 mi/h toward the east. **451.8 mi/h**
4. An airplane travels at 1,200 mi/h east. A wind is blowing at 30 mi/h toward the north. **1,200.4 mi/h**

1. ORIGAMI Chee has a piece of paper measuring 8.5 inches by 8.5 inches. If she folds the paper diagonally in half, how long is the folded side? Round to the nearest tenth. **12.0 in.**
2. COMPUTERS In a computer catalog, a computer monitor is said to be 19 inches. This distance is the diagonal distance across the screen. If the screen is 10 inches high, what is the width of the screen? Round to the nearest tenth. **16.2 in.**
3. ANTENNAS A wire 10 meters long is supporting a utility pole. The wire is anchored to the ground and is attached to the pole 9 meters above the ground. What is the distance from the bottom of the pole to the point where the wire is attached to the ground? Round to the nearest tenth. **4.4 m**
4. RAMPS Crystal wants to build a ramp that will rise 4 feet over a horizontal distance of 20 feet. How long will the ramp be? Round to the nearest tenth. **20.4 ft**
5. POOLS Salomon swims diagonally across his pool every day. If Salomon’s pool is 4 meters wide and 16 meters diagonally across, how long is his pool, to the nearest tenth of a meter? **15.5 m**
6. FRAMES Rosa has a picture frame that measures 12 inches by 18 inches. What is the diagonal distance across the frame? Round to the nearest tenth. **21.6 in.**
**Problem-Solving Investigation: Make a Model**

When solving problems, make a model to represent the given situation in order to determine the best plan for a solution.

**Example**

**Gift Wrap**

Rita wants to wrap a rectangular box. The box is 12 inches by 7 inches by 3 inches high. What must be the area of the paper so that she has a 1 inch overlap to neatly wrap the paper?

**Explore**

You know that the box is $12 \times 7 \times 3$ and that you need to add 1 inch to some measures for the overlap. You also know that the wrapping paper will be a rectangle.

**Plan**

Draw a sketch of the box and then make a model of the box if it were cut apart and laid flat. You need the overlap going around the box.

**Solve**

Sketch the box. Make a model of the box unfolded.

The length of the paper needed is the distance around the box plus 1 inch. So, $L = 7 + 3 + 7 + 3 + 1$ or 21 inches.

The width of the paper would be $3 + 12 + 3$ or 18 inches.

The area would be $21 \times 18$ or 378 in$^2$.

**Check**

Make a box using centimeters instead of inches. Then cut a piece of paper 18 centimeters by 21 centimeters to see if you can wrap the box neatly.

---

**Exercises**

1. **Gardening**

   Peg wants to put a stone path 3 feet wide around her rectangular garden measuring 10 feet by 15 feet. What will be the perimeter of her garden including the stone path? **74 ft**

2. **Drawing**

   Dante is making a full-size drawing of his favorite cartoon character. If the figure is 1 inch by 0.5 inches and his scale is 1 inch $= 10$ inches, how large will the full size character be? **10 in. by 5 in.**

3. **Interior Design**

   JoAnn is creating a model of a living room. The room is 20 feet by 20 feet. If the scale she is using is 1 foot $= \frac{1}{50}$ inch, what are the dimensions of her model room? **10 in. by 10 in.**

4. **Art Competition**

   An art competition allows for submitted work to be no larger than 11 inches by 14 inches. If Christene's photograph is 8 inches by 10 inches, what is the largest matte she can use if she wants the border to be the same width all the way around the photo? **1\frac{1}{2} in wide, so the photo and matte will be 11 in. by 13 in. together**

5. **Flooring**

   James is laying carpet in an L-shaped room whose model is shown below. How much carpet does he need? **160 ft$^2$**

6. **Scale Model**

   Charlotte is building a model of the Eiffel Tower. If the actual tower is 986 feet tall and Charlotte's scale is 1 inch $= 10$ feet, how tall is her model? **98.6 inches or 8.2 ft**

7. **Science Fair**

   Audrey wants to make a poster that is folded into three sections for her science fair project. The length of the poster is 36 inches. If she wants the middle section to be twice the length of the side sections and she wants the two side sections to be equal, what should be the length of the middle section? **18 inches**
1. **FOOTBALL**

Bill, Damon and Steve are the quarterback, center and punter on the football team, not necessarily in that order. The quarterback and Bill go on the bus with Damon after the game. Damon is not the punter. What position does Bill play?

**Punter**

2. **SPORTS**

Janelle can walk one mile in 15 minutes. How long will it take her to walk 3 miles?

**45 minutes**

3. **WEATHER**

The Loudonville Times prints the following chart showing the snowfall for each day last week. The reporter estimates that they got 10 inches of snow during the past week. Is this a reasonable estimate?

**Yes**

4. **GARDENING**

The table below shows how many tomatoes Nicholas picked each day during the week. How many does he need to pick on Sunday so that he has picked a total of 20 for the week?

**4**

5. **PAINT**

If one gallon of paint covers 150 square feet, is one gallon enough for Susie to cover a kitchen wall that is 15 feet by 8 feet? Justify your answer.

**Yes; 15 \times 8 = 120 square feet**

6. **SHOPPING**

Avery bought a DVD for $22.99 and got $2.01 back in change. How much did Avery give the cashier?

**$25.00**

7. **MONEY**

The amount in Carly’s checkbook is $750 after writing a check for $65 and making a deposit of $100 and a deposit of $75. How much did she start with in her checkbook?

**$640**

8. **VEHICLES**

Jim has 15 vehicles at his garage. Some are cars and some are motorcycles. If he counts 58 wheels, how many of each type of vehicle does he have?

**14 cars and 1 motorcycle**

---

**Problem-Solving Investigation: Make a Model**

For Exercises 1 and 2, make a model to solve the problem.

1. **ARCHITECT**

Mrs. Peron is designing a home for a client. The house is 45 feet by 76 feet. If she uses a scale of 1 foot = \(\frac{1}{2}\) inch, what are the dimensions of the house on the blue prints?

22\(\frac{1}{2}\) in. by 38 in.

2. **SWIMMING POOL**

Mr. Forrester has a swimming pool that measures \(\frac{1}{2}\) yards by 8 yards. If the deck around the pool is \(\frac{1}{3}\) yards wide, what is the outside perimeter of the deck?

44 yd

---

**Select the Operation**

For Exercises 5 and 6, select an appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

5. **TESTS**

Diego scored a 95 on his first test in science class. He then scored 100 on his next 5 tests. If he scored a 91 on his seventh test, what is his test average?

Multiplication, addition and division; 5 \times 100; 
500 + 95 + 91 = 686; 686 \div 7 = 98; test average = 98

6. **NEWSPAPERS**

Candace wants to increase the number of newspapers she delivers. She currently delivers 58 newspapers. In Eurekan weeks, she wants to be delivering 100 newspapers. How many newspaper deliveries must she increase each week to obtain her goal?

Subtraction and division; 
100 - 58 = 42; 42 \div 14 = 3; 
3 newspapers per week

---

**PROBLEM-SOLVING STRATEGIES**

- Use the four-step plan.
- Draw a diagram.
- Use logical reasoning.
- Make a model.
### Exercises

#### Example

Find the surface area of the rectangular prism.

You can use the net of the rectangular prism to find its surface area. There are three pairs of congruent faces in a rectangular prism:
- top and bottom
- front and back
- two sides

<table>
<thead>
<tr>
<th>Faces</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>top and bottom</td>
<td>(4 × 3) + (4 × 3) = 24</td>
</tr>
<tr>
<td>front and back</td>
<td>(4 × 2) + (4 × 2) = 16</td>
</tr>
<tr>
<td>two sides</td>
<td>(2 × 3) + (2 × 3) = 12</td>
</tr>
</tbody>
</table>

Sum of the areas: 24 + 16 + 12 = 52

Alternatively, replace \( r \) with 4, \( w \) with 3, and \( h \) with 2 in the formula for surface area.

\[
S = 2lw + 2lh + 2wh
\]

\[
= 2 \times 4 \times 3 + 2 \times 4 \times 2 + 2 \times 3 \times 2
\]

Follow order of operations.

\[
= 24 + 16 + 12
\]

\[
= 52
\]

So, the surface area of the rectangular prism is 52 square meters.

#### Find the surface area of each rectangular prism.

1. \( 102 \text{ cm}^2 \)
2. \( 232 \text{ in}^2 \)
3. \( 286 \text{ ft}^2 \)
Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.

1. length = 12 cm, width = 6 cm, height = 7 cm
   Surface area = 396 cm²

2. length = 7 ft, width = 1 ft, height = 4 ft
   Surface area = 78 ft²

3. length = 15 in., width = 7 in., height = 5 in.
   Surface area = 606 in²

4. length = 10 mm, width = 9 mm, height = 8 mm
   Surface area = 522 mm²

5. length = 4 cm, width = 3 cm, height = 6 cm
   Surface area = 143 cm²

6. length = 3.7 in., width = 6 in., height = 4.3 in.
   Surface area = 127.8 in²

7. length = 12 ft, width = 7 ft, height = 3 ft
   Surface area = 396 ft²

8. length = 8.3 in., width = 4.1 in., height = 4.5 in.
   Surface area = 179.7 in²

9. length = 4.1 mm, width = 7.3 mm, height = 6.4 mm
   Surface area = 205.8 mm²

10. A cube has a surface area of 126 square feet. What is the area of one face? 21 ft²

11. Find the surface area of a rectangular prism that has a length of 8 inches, a width of 5 inches, and a height of 6 inches. 180 in²

ESTIMATION Estimate the surface area of each prism.

12. length = 20 cm, width = 18 cm, height = 25 cm
   Surface area = 2,620 cm²

13. length = 31.5 in., width = 12.2 in., height = 24.8 in.
   Surface area = 2,936.1 in²

14. length = 5.3 mm, width = 1.1 mm, height = 3.4 mm
   Surface area = 55.2 mm²

15. length = 3 m, width = 5 m, height = x m
   Surface area = 52 m²

16. length = 7.3 m, width = 4.8 m, height = 3 ft
   Surface area = 114.6 ft²

17. length = 8.9 mm, width = 8.9 mm, height = x mm
   Surface area = 486 mm²

18. length = 3.8 in., width = 42 in., height = 8.1 in.
   Surface area = 160 in²

19. length = 8.5 mm, width = 8.5 mm, height = 8.5 mm
   Surface area = 245.6 mm²

20. length = 8.0 mm, width = 8.0 mm, height = 8.0 mm
   Surface area = 245.6 mm²

BIRTHDAY GIFT When wrapping a birthday gift for his mother, Kenji adds an additional 2.5 square feet of gift wrap to allow for overlap. How many square feet of gift wrap will Kenji use to wrap a gift 3.5 feet long, 18 inches wide, and 2 feet high? 33 ft²

A company needs to package hazardous chemicals in special plastic containers that hold 80 cubic feet of chemicals.

Find the whole number dimensions of the container that would use the least amount of plastic. 4 ft, 4 ft, and 5 ft

If the plastic costs $0.10 per square foot, how much would it cost to make 24 containers? $268.80
Pattern Puzzles

1. Make three copies of this pattern. Fold each pattern to make a pyramid. Then, put the three pyramids together to make a cube. Draw a sketch of the completed cube.

2. Make four copies of this pattern. Fold each pattern to make a solid figure. Then, put the four solids together to make a pyramid. Make a sketch of the finished pyramid.

3. Find the surface area of the cube in Exercise 1. 54 cm²

4. Picture an 8 cm cube and a 4 cm cube. Find the surface area of each cube.

5. What is the total surface area of the inside and outside of a container in the shape of a rectangular prism with length of 5 meters, width of 2.2 meters, and height of 1.1 meters?

6. Digital photograph: How much fabric is needed to cover a foam block? How much fabric is needed to cover an entire box?

Word Problem Practice

Surface Area of Rectangular Prisms

1. PACKAGING: A packaging company needs to know how much cardboard will be required to make boxes 18 inches long, 12 inches wide, and 10 inches high. How much cardboard will be needed for each box if there is no overlap in the construction?

2. INSULATION: Jane needs to buy insulation for the inside of a truck container. The container is a rectangular prism 15 feet long, 8 feet wide, and 7 feet high. How much insulation is needed?

3. ICE: Suppose the length of each edge of a cube of ice is 4 centimeters. Find the surface area of the cube.

4. ICE: Suppose you cut the ice cube from Exercise 3 in half horizontally into two smaller rectangular prisms. Find the surface area of one of the two smaller prisms.

5. CONTAINERS: What is the total surface area of the inside and outside of a container in the shape of a rectangular prism with length of 5 meters, width of 2.2 meters, and height of 1.1 meters?

6. TOYS: Oscar is making a play block for his baby sister by gluing fabric over the entire surface of a foam block. How much fabric will Oscar need?
12-5 Study Guide and Intervention
Surface Area of Cylinders

The diagram below shows how you can put two circles and a rectangle together to make a cylinder.

The surface area the area of the area of the of a cylinder equals two bases plus curved surface.

\[ S = 2\pi r^2 + (2\pi r)h \]

In the diagram above, the length of the rectangle is the same as the circumference of the circle. Also, the width of the rectangle is the same as the height of the cylinder.

**Example**
Find the surface area of the cylinder. Use 3.14 for \( \pi \). Round to the nearest tenth.

\[ S = 2\pi r^2 + 2\pi rh \]

\[ S = 2 \cdot 3.14(6)^2 + 2 \cdot 3.14 (6)(20) \]

\[ S = 408.2 \text{ in}^2 + 408.2 \text{ in}^2 \]

The surface area is about 816.4 square inches.

**Exercises**
Find the surface area of each cylinder. Use 3.14 for \( \pi \). Round to the nearest tenth.

1. \( r = 10 \text{ in.}, h = 20 \text{ in.} \)
   \[ 408.2 \text{ in}^2 \]

2. \( r = 3 \text{ ft}, h = 24 \text{ ft} \)
   \[ 508.7 \text{ ft}^2 \]

3. \( r = 12 \text{ cm}, h = 4.3 \text{ cm} \)
   \[ 440.2 \text{ cm}^2 \]
Find the surface area of each cylinder. Use 3.14 for \( \pi \). Round to the nearest tenth.

1. \( 1,607.7 \text{ in}^2 \) 
2. \( 602.9 \text{ mm}^2 \) 
3. \( 276.3 \text{ m}^2 \) 
4. \( 355.7 \text{ yd}^2 \) 
5. \( 107.3 \text{ ft}^2 \) 
6. \( 506.4 \text{ cm}^2 \) 
7. Find the surface area of a can with a radius of 4 centimeters and a height of 11 centimeters. \( 376.8 \text{ cm}^2 \)
8. Find the surface area of the outside of a cylindrical barrel with a diameter of 10 inches and a height of 12 inches. \( 533.8 \text{ in}^2 \)
9. Find the area of the curved surface of a D battery with a diameter of 3.2 centimeters and a height of 5.6 centimeters. \( 56.3 \text{ cm}^2 \)

ESTIMATION Estimate the area of each cylinder.

7. \( \text{diameter} = 15.2 \text{ mm} \) 
   height = 9.4 mm 
   \( 811.4 \text{ mm}^2 \) 
8. \( \text{diameter} = 28.4 \text{ yd} \) 
   height = 15.1 yd 
   \( 2,612.9 \text{ yd}^2 \) 
9. \( \text{radius} = 50 \text{ cm} \) 
   height = 70 cm 
   \( 37,680 \text{ cm}^2 \)

FUEL STORAGE A fuel storage tank needs to be painted on the inside. If the height of the tank is 40 feet and the diameter is 120 feet, what is the surface that needs to be painted? Round to the nearest hundred square feet. \( 37,680 \text{ ft}^2 \)

PAPER TOWELS Each of the three rolls of paper towels in a package are individually wrapped in plastic. The radius of each roll is 5.6 centimeters and the height is 27.9 centimeters. How much plastic is used to individually wrap the three rolls? Round to the nearest tenth. \( 3,534.4 \text{ cm}^2 \)
Cross Sections

In each diagram on this page, a plane cuts through a solid figure. The intersection of the plane with the solid figure is called a cross section.

Sketch the cross section formed in each diagram.

1. (pyramid with a triangular base)
2. (pyramid with a square base)
3. (pyramid with a triangular base)
4. (pyramid with a triangular base)
5. (pyramid with a square base)
6. (pyramid with a triangular base)
7. (pyramid with a triangular base)
8. (pyramid with a triangular base)

Word Problem Practice

Surface Area of Cylinders

1. Packaging: What is the area of the label on a box of oatmeal with a radius of 9.3 centimeters and a height of 16.5 centimeters? Round to the nearest tenth.
   - 963.7 cm²

2. Tires: Betty wants to know the total surface area of the tread on one of her tires. If the diameter of the tire is 18 inches and the width of the tire is 5 inches, what is the total surface area of the tire’s tread? Round to the nearest tenth.
   - 282.6 in²

3. Cans: A cylindrical can has a diameter of 6 inches and a height of 7.3 inches. What is the surface area of the can? Round to the nearest tenth.
   - 194.1 in²

4. Cans: A cylindrical can has a diameter of 6 inches and a height of 7.3 inches. What is the surface area of the can? Round to the nearest tenth.
   - 194.1 in²

5. Manufacturing: How much sheet metal is required to make a cylindrical trash can with a diameter of 2 feet and a height of 4 1/2 feet? Round to the nearest tenth.
   - 29.8 ft²

6. Plumbing: How much steel is needed to make a hollow pipe with a radius of 3 inches and a height of 15 inches? Round to the nearest tenth.
   - 282.6 in²
**12-5 Scientific Calculator Activity**

**Surface Area of a Cylinder**

Find the surface area of the cylinder to the nearest tenth.

\[ A = \text{area of bases} + \text{area of curved surface} \]

\[ A = 2\pi r^2 + 2\pi rh \]

Enter: \[ 
\begin{array}{c}
\pi \times 3 \times 3 \times 12 \\
282.7433388
\end{array}
\]

To the nearest tenth, the surface area of the cylinder is 282.7 cm².

**Exercises**

Find the surface area of each cylinder to the nearest tenth.

1. \(117.8 \text{ m}^2\)
2. \(1,789.2 \text{ cm}^2\)
3. \(1,504.0 \text{ in}^2\)
4. \(63,984.4 \text{ m}^2\)
## Chapter 12 Assessment Answer Key

### Quiz 1 (Lessons 12-1 and 12-2)

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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<tbody>
<tr>
<td>1.</td>
<td>8</td>
</tr>
<tr>
<td>2.</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>50 ft</td>
</tr>
<tr>
<td>4.</td>
<td>7.9 cm</td>
</tr>
<tr>
<td>5.</td>
<td>B</td>
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</tbody>
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### Quiz 2 (Lesson 12-3)

<table>
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<th>Question</th>
<th>Answer</th>
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<tbody>
<tr>
<td>1.</td>
<td>720</td>
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<tr>
<td>2.</td>
<td>567 in²</td>
</tr>
<tr>
<td>3.</td>
<td>15 in. by 10 in.</td>
</tr>
<tr>
<td>4.</td>
<td>32 cm by 48 cm</td>
</tr>
<tr>
<td>5.</td>
<td>( \frac{1}{3} )</td>
</tr>
</tbody>
</table>

### Quiz 3 (Lesson 12-4)

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
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<td>1.</td>
<td>4,168 in²</td>
</tr>
<tr>
<td>2.</td>
<td>371.52 cm²</td>
</tr>
<tr>
<td>3.</td>
<td>70 cm²</td>
</tr>
<tr>
<td>4.</td>
<td>2,973.6 mm²</td>
</tr>
<tr>
<td>5.</td>
<td>130 in²</td>
</tr>
</tbody>
</table>

### Mid-Chapter Test

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>B</td>
</tr>
<tr>
<td>2.</td>
<td>G</td>
</tr>
<tr>
<td>3.</td>
<td>C</td>
</tr>
<tr>
<td>4.</td>
<td>G</td>
</tr>
<tr>
<td>5.</td>
<td>B</td>
</tr>
<tr>
<td>6.</td>
<td>H</td>
</tr>
<tr>
<td>7.</td>
<td>9.8</td>
</tr>
<tr>
<td>8.</td>
<td>10.3</td>
</tr>
<tr>
<td>9.</td>
<td>15.0</td>
</tr>
<tr>
<td>10.</td>
<td>17.9</td>
</tr>
<tr>
<td>11.</td>
<td>17</td>
</tr>
<tr>
<td>12.</td>
<td>20</td>
</tr>
<tr>
<td>13.</td>
<td>5 cm</td>
</tr>
<tr>
<td>14.</td>
<td>20.2 m</td>
</tr>
<tr>
<td>15.</td>
<td>3.6 m</td>
</tr>
</tbody>
</table>
### Chapter 12 Assessment Answer Key

<table>
<thead>
<tr>
<th>Vocabulary Test Page 44</th>
<th>Form 1 Page 45</th>
<th>Page 46</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> rectangular prism</td>
<td><strong>1.</strong> B</td>
<td>13. A</td>
</tr>
<tr>
<td><strong>2.</strong> fraction</td>
<td><strong>2.</strong> J</td>
<td></td>
</tr>
<tr>
<td><strong>3.</strong> hypotenuse</td>
<td><strong>3.</strong> C</td>
<td>14. G</td>
</tr>
<tr>
<td><strong>4.</strong> angle</td>
<td><strong>4.</strong> H</td>
<td></td>
</tr>
<tr>
<td><strong>5.</strong> hypotenuse</td>
<td><strong>5.</strong> B</td>
<td>15. C</td>
</tr>
<tr>
<td><strong>6.</strong> cylinder</td>
<td><strong>6.</strong> H</td>
<td>16. H</td>
</tr>
<tr>
<td><strong>7.</strong> irrational</td>
<td><strong>7.</strong> A</td>
<td>17. C</td>
</tr>
<tr>
<td><strong>8.</strong> right</td>
<td><strong>8.</strong> F</td>
<td>18. H</td>
</tr>
<tr>
<td><strong>9.</strong> two</td>
<td><strong>9.</strong> C</td>
<td>19. D</td>
</tr>
<tr>
<td><strong>10.</strong> 6</td>
<td><strong>10.</strong> J</td>
<td></td>
</tr>
<tr>
<td>Sample answer: a theorem that says that in a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>11.</strong></td>
<td><strong>11.</strong> A</td>
<td>20. H</td>
</tr>
<tr>
<td>Sample answer: the sum of the areas of all the surfaces of a solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>12.</strong></td>
<td><strong>12.</strong> F</td>
<td></td>
</tr>
<tr>
<td><strong>B:</strong> 7 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Form 2A</td>
<td>Page 47</td>
<td>Form 2B</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B: 5 cm</td>
</tr>
</tbody>
</table>

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# Chapter 12 Assessment Answer Key

Form 2C  
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<table>
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<tr>
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</thead>
<tbody>
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<td>1</td>
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<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
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<tr>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>9.5</td>
</tr>
<tr>
<td>6</td>
<td>11.1</td>
</tr>
<tr>
<td>7</td>
<td>21.3</td>
</tr>
<tr>
<td>8</td>
<td>8.3</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>8.5 cm</td>
</tr>
<tr>
<td>10</td>
<td>40 ft</td>
</tr>
<tr>
<td>11</td>
<td>4.7 m</td>
</tr>
<tr>
<td>12</td>
<td>10.5 cm</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>25.6 in.</td>
</tr>
<tr>
<td>14</td>
<td>120</td>
</tr>
<tr>
<td>15</td>
<td>682 in²</td>
</tr>
<tr>
<td>16</td>
<td>7 in. by 4 in.</td>
</tr>
</tbody>
</table>

B: 8 cm

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<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>238 ft²</td>
</tr>
<tr>
<td>18</td>
<td>17.8 m²</td>
</tr>
<tr>
<td>19</td>
<td>655.6 ft²</td>
</tr>
<tr>
<td>20</td>
<td>147.8 cm²</td>
</tr>
<tr>
<td>21</td>
<td>628 mm²</td>
</tr>
<tr>
<td>22</td>
<td>56.3 ft²</td>
</tr>
<tr>
<td>23</td>
<td>440.9 in²</td>
</tr>
<tr>
<td>24</td>
<td>301.4 in²</td>
</tr>
<tr>
<td>25</td>
<td>5.24 m</td>
</tr>
</tbody>
</table>
Form 2D
Page 53

1. 6
2. 2
3. 9
4. 8
5. 8.9
6. 10.4
7. 17.9
8. 8.6
9. 75 m
10. 6.2 ft
11. 7.8 cm
12. 19.9 m
13. 25.5 m
14. 5,040
15. 800 in²
16. 9 in. by 4.5 in.

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17. 428 in²
18. 4,798.8 m²
19. 146 ft²
20. 1,822.7 mm²
21. 979.7 yd²
22. 182.1 m²
23. 2,899.9 cm²
24. 678.2 in²
25. 5.24 m

B: 9 cm
Chapter 12 Assessment Answer Key

Form 3
Page 55

1. _____ 9 _____
2. _____ 5 _____
3. _____ 12 _____
4. _____ 7 _____
5. _____ 8.2 _____
6. _____ 16.4 _____
7. _____ 30.5 _____
8. _____ 22.6 _____
9. _____ 48 m _____
10. _____ 14.2 yd _____
11. _____ 10.0 in. _____
12. _____ 32.5 cm _____
13. _____ 20.4 cm _____
14. _____ 362,880 _____

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17. _____ 229.6 yd² _____
18. _____ 37.5 in² _____
19. _____ 3,069.8 cm² _____
20. _____ 202.6 cm² _____
21. _____ 419.3 ft² _____
22. _____ 3,427.1 m² _____
23. _____ 3,416.3 mm² _____
24. _____ 633.7 mm² _____
25. _____ 19.5 ft _____
26. _____ 906.5 in² _____

B: _____ 12 cm _____

16. _____ 7 cm by 5.6 cm _____
### Chapter 12 Assessment Answer Key

**Page 57, Extended-Response Test**

**Scoring Rubric**

<table>
<thead>
<tr>
<th>Level</th>
<th>Specific Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4</strong></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><strong>3</strong></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><strong>2</strong></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><strong>1</strong></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><strong>0</strong></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 12 Assessment Answer Key
Page 57, Extended-Response Test
Sample Answers

In addition to the scoring rubric found on page A23, the following sample answers may be used as guidance in evaluating extended-response assessment items.

1. No; $\sqrt{48^2 + 36^2}$ equals 60, not 62.

2. a. Volume of A: 72 in$^3$
   Volume of B: 144 in$^3$
   Volume of C: 144 in$^3$
   $2 \times \text{Volume } A = \text{Volume } B = \text{Volume } C$
   Surface Area of A: 120 in$^2$
   Surface Area of B: 168 in$^2$
   Surface Area of C: 216 in$^2$
   Surface Area of $A + 48 = \text{Surface Area of } B$
   Surface Area of $B + 48 = \text{Surface Area of } C$

b. Volume of A: 50.3 m$^3$
   Volume of B: 100.5 m$^3$
   Volume of C: 201.1 m$^3$
   $4 \times \text{Volume } A \approx 2 \times \text{Volume } B \approx \text{Volume } C$
   Surface Area of A: 75.4 m$^2$
   Surface Area of B: 125.7 m$^2$
   Surface Area of C: 201.1 m$^2$
   Surface Area of C = Surface Area of $B \approx \text{Surface Area of } A$

c. An increase in height gives the appearance of a larger increase in surface area and volume than does an increase in width, depth, or radius.
Chapter 12 Assessment Answer Key

Standardized Test Practice

Page 58

1. O O O O

2. O O O O

3. O O O O

4. O O O O

5. O O O O

6. O O O O

7. O O O O

8. O O O O

9. O O O O

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10. O O O O

11. O O O O

12. O O O O

13. O O O O

14. O O O O

15. O O O O

16. O O O O

17. O O O O

18. O O O O
Chapter 12 Assessment Answer Key

Standardized Test Practice
Page 60

19. ______ 15.5

20. ______ 36

21. ______ 120 outcomes

22. ______ Reflection over the x-axis

23. ______ 923.2 in³

24. ______ 100 m

25a. ______

25b. ______ 17.0 ft
Chapter 12 Assessment Answer Key

Unit 5 Test
Page 61

1. United States, 245°; Japan, 53°; U.K., 33°; Canada, 23°; Australia, 8°

2. acute

3. straight

4. 7 units right and 5 units up

5. reflection over y-axis

6. quadrilateral

7. rhombus

8. 59°

9. 44.0 in.

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10. 9

11. 15.3 m

12. 32 yd²

13. 9 in²

14. 12.6 cm²

15. 360 mm²

16. 71.5 ft²

17. rectangle; rectangular pyramid

18. 4,680 cm³; 1,728 cm²

19. 61,211.2 mm³;

20. 8,710.4 mm²