

Chapter 12

Resource Masters



Mathematics

Applications and Concepts

Course 2



New York, New York Columbus, Ohio Chicago, Illinois Peoria, Illinois Woodland Hills, California

12-1

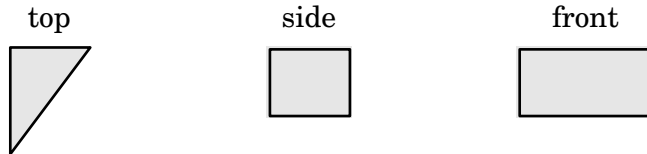
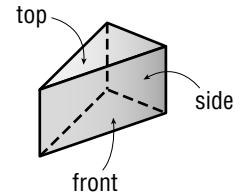
Study Guide and Intervention

Drawing Three-Dimensional Figures

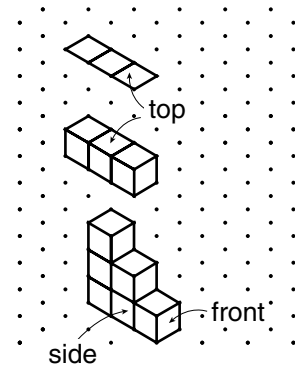
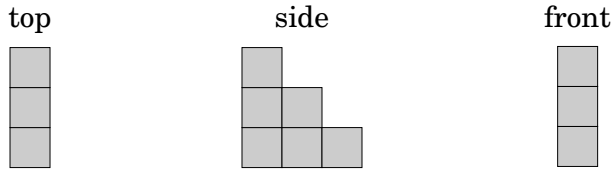
A solid is a three-dimensional figure.

EXAMPLE 1 Draw a top, a side, and a front view of the solid at the right.

The top view is a triangle. The side and front views are rectangles.



EXAMPLE 2 Draw the solid using the top, side, and front views shown below.



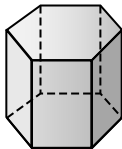
Step 1 Use the top view to draw the base of the figure, a 1-by-3 rectangle.

Step 2 Add edges to make the base a solid figure.

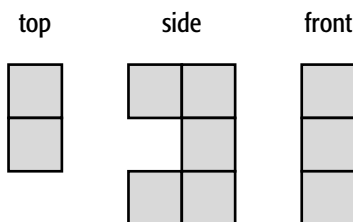
Step 3 Use the side and front views to complete the figure.

EXERCISES

1. Draw a top, a side, and front view of the solid.



2. Draw the solid using the top, side, and front views shown. Use isometric dot paper.



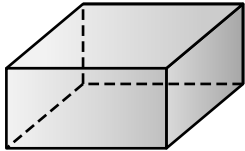
12-1

Practice: Skills

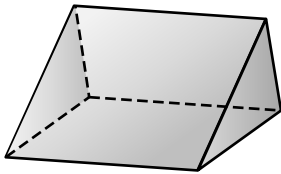
Drawing Three-Dimensional Figures

Draw a top, a side, and a front view of each solid.

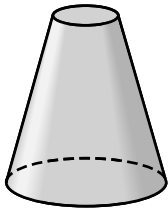
1.



2.

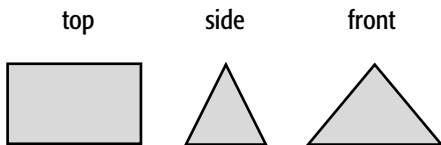


3.

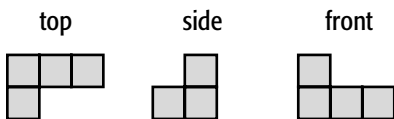


Draw each solid using the top, side, and front views shown. Use isometric dot paper.

4.



5.



12-1**Practice: Word Problems*****Drawing Three-Dimensional Figures***

- 1. ARCHITECTURE** The Transamerica Pyramid, built from 1969 to 1972, towers above the San Francisco skyline.

Draw the top, side, and front views of the Transamerica building.

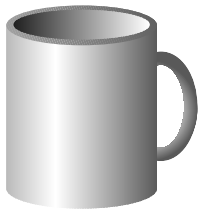


- 2. MONUMENTS** Since its completion in 1965, Eero Saarinen's 630-foot Gateway Arch has stood above St. Louis.

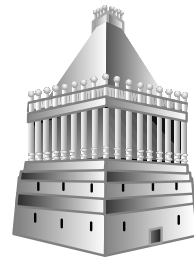


Draw the top, side, and front views of the Gateway Arch.

- 3. GRAPHICS** Dan is creating a computer-generated image of a coffee cup. To do this, he needs to enter the top, side, and front views of the cup. Draw the views that Dan should enter.



- 4. HISTORY** The Mausoleum at Halicarnassus is one of the Seven Wonders of the Ancient World. Draw a top view, a side view, and a front view of the mausoleum without the chariot statue at the top.



12-1**Reading to Learn Mathematics*****Drawing Three-Dimensional Figures***

Pre-Activity *Read the introduction at the top of page 514 in your textbook.
Write your answers below.*

1. Which view of the Washington Monument is shown in the comic?
2. Find a photograph of the Washington Monument and draw a side view.

Reading the Lesson

3. A two-dimensional figure has two dimensions. What are they?
4. A three-dimensional figure has three dimensions. What are they?
5. Label the dimensions of each figure.



6. Circle or underline the word that makes the sentence true.
A (rectangle, cube) is a three-dimensional figure.

Helping You Remember

7. Make models of a two-dimensional figure and a three-dimensional figure.
Use any material you like—for example, paper, cardboard, toothpicks, gumdrops.

12-1

Enrichment

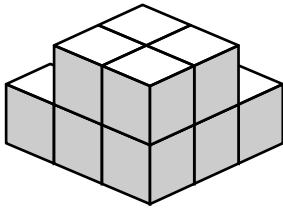
Counting Cubes

The figures on this page have been built by gluing cubes together. Use your visual imagination to count the total number of cubes as well as the number of cubes with glue on 1, 2, 3, 4, or 5, or 6 faces.

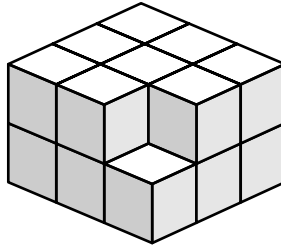
Complete this chart for the figures below.

Figure	Total Number of Cubes	Number of Faces with Glue on Them					
		1 face	2 faces	3 faces	4 faces	5 faces	6 faces
1							
2							
3							
4							
5							
6							

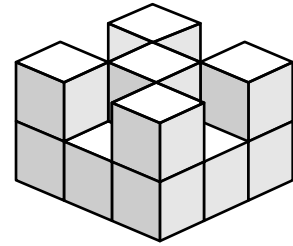
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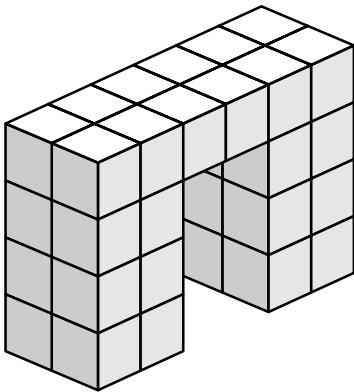
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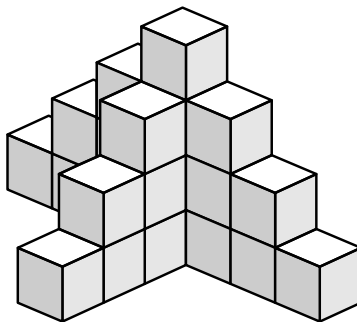
3.



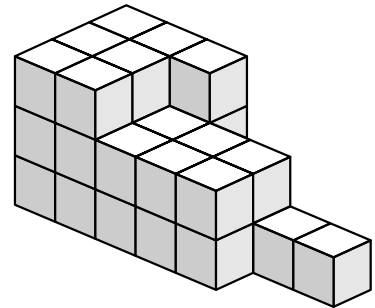
4.



5.



6.

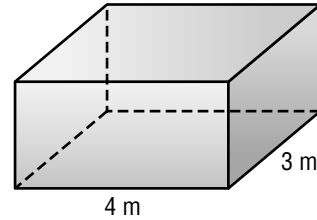


12-2

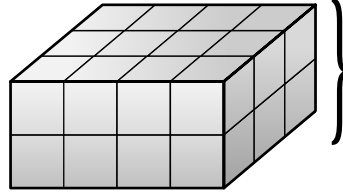
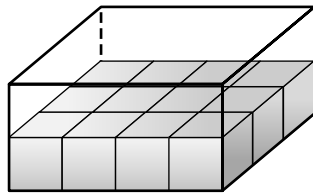
Study Guide and Intervention

Volume of Rectangular Prisms

The **volume** of a solid is the measure of space occupied by it. It is measured in cubic units such as cubic centimeters (cm^3) or cubic inches (in^3). The volume of the figure at the right can be shown using cubes.



The bottom layer, or base, has $4 \cdot 3$ or 12 cubes.



There are two layers.

It takes $12 \cdot 2$ or 24 cubes to fill the box. So, the volume of the box is 24 cubic meters.

A **rectangular prism** is a solid figure that has two parallel and congruent sides, or bases, that are rectangles. To find the volume of a rectangular prism, multiply the area of the base and the height, or find the product of the length ℓ , the width w , and the height h .

$$V = Bh \text{ or } V = \ell wh$$

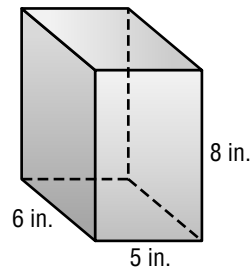
EXAMPLE 1 Find the volume of the rectangular prism.

$$V = \ell wh \quad \text{Volume of a rectangular prism}$$

$$V = 5 \cdot 6 \cdot 8 \quad \text{Replace } \ell \text{ with 5, } w \text{ with 6, and } h \text{ with 8.}$$

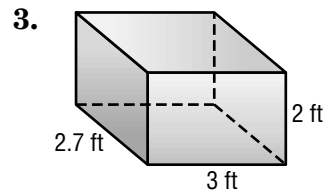
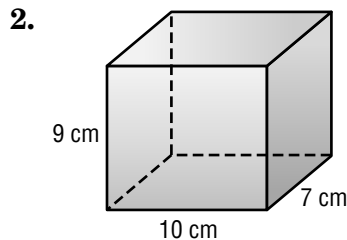
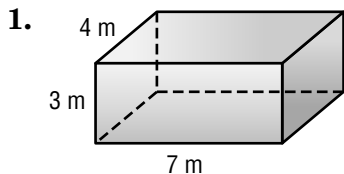
$$V = 240 \quad \text{Multiply.}$$

The volume is 240 cubic inches.



EXERCISES

Find the volume of each rectangular prism. Round to the nearest tenth if necessary.



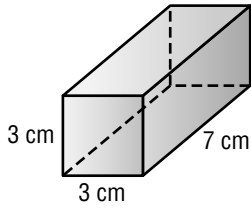
12-2

Practice: Skills

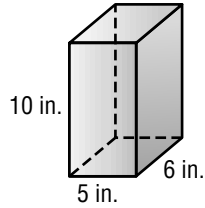
Volume of Rectangular Prisms

Find the volume of each rectangular prism. Round to the nearest tenth if necessary.

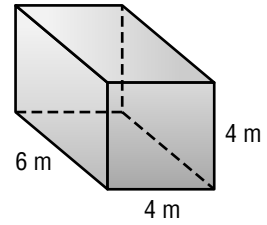
1.



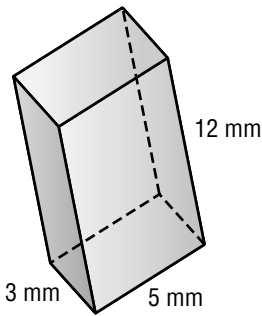
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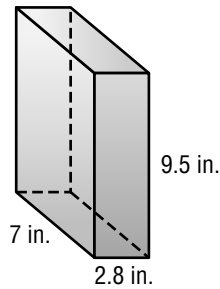
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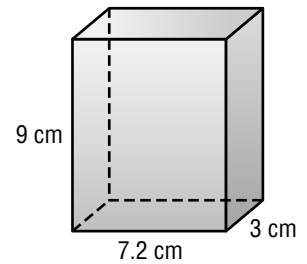
4.



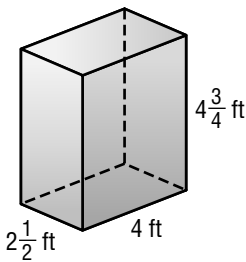
5.



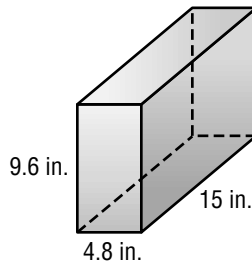
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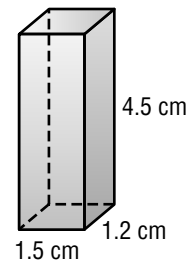
7.



8.



9.



12-2**Practice: Word Problems*****Volume of Rectangular Prisms***

1. PACKAGING A cereal box has a length of 8 inches, a width of $1\frac{3}{4}$ inches, and a height of $12\frac{1}{8}$ inches. What is the volume of the cereal box?

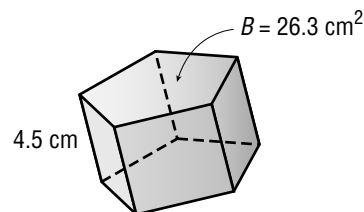
2. FOOD STORAGE Nara wants to determine how much ice it will take to fill her cooler. If the cooler has a length of 22 inches, a width of 12 inches, and a height of $10\frac{1}{2}$ inches, how much ice will her cooler hold?

3. TRANSPORTATION The cargo-carrying part of Billy's truck has a length of 8.3 meters, a width of 3 meters, and a height of 4.2 meters. What is the maximum volume of sand that Billy's truck can carry?

4. PLUMBING Alexia's bathroom has a tub in the shape of a rectangular prism with a length of 1.5 meters, a width of 0.5 meter, and a height of 0.4 meter. How many cubic feet of water can it hold?

5. PACKAGING A box of tissues has a length of 11.2 centimeters, a width of 11.2 centimeters, and a height of 13 centimeters. What is the volume of the tissue box?

6. GEOMETRY A *pentagonal prism* is a prism that has bases that are pentagons. Use $V = Bh$ where B is the area of the base, to find the volume of the pentagonal prism below.



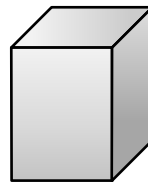
12-2**Reading to Learn Mathematics*****Volume of Rectangular Prisms***

Pre-Activity *Complete the Mini Lab at the top of page 520 in your textbook. Write your answers below.*

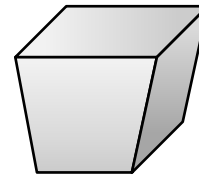
1. What is the area of the base, or bottom, of the box? What is the height of the box?
2. How many centimeter cubes fit in the box?
3. What do you notice about the product of the base area and the height of the box?

Reading the Lesson

4. Which of the figures at the right is a rectangular prism? Why is the other figure not a rectangular prism?



A



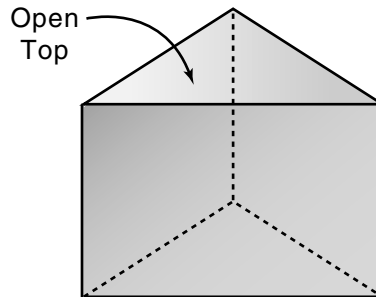
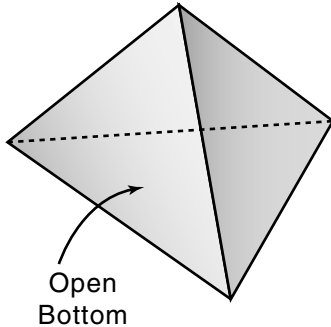
B

Helping You Remember

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

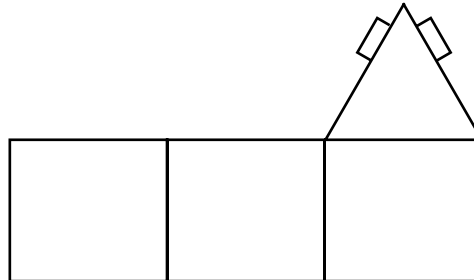
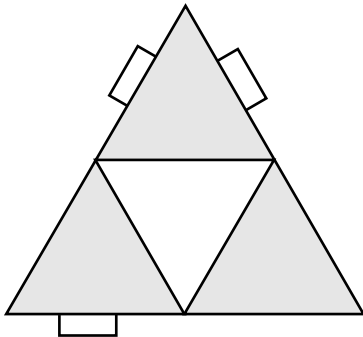
12-2**Enrichment****Volumes of Pyramids**

A pyramid and a prism with the same base and height are shown below.

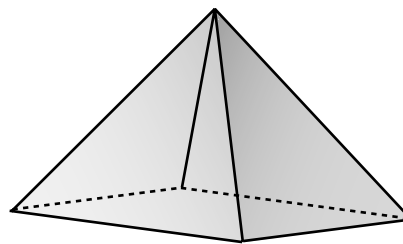


The exercises on this page will help you discover how their volumes are related.

Enlarge and make copies of the two patterns below to make the open pyramid and the open prism shown above. (Each equilateral triangle should measure 8 centimeters on a side.)



1. Describe the bases of the two solids.
2. How do the heights of the solids compare?
3. Fill the open pyramid with sand or sugar. Pour the contents into the open prism. How many times must you do this to fill the open prism?
4. Describe how you would find the volume of the pyramid shown at the right.

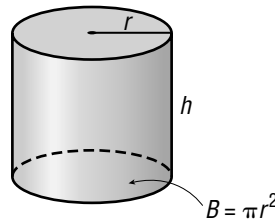


5. Generalize: State a formula for the volume of a pyramid.

12-3**Study Guide and Intervention****Volume of Cylinders**

A **cylinder** is a solid figure that has two congruent, parallel circles as its bases. The volume V of a cylinder with radius r is the area of the base B times the height h .

$$V = Bh \text{ or } V = \pi r^2 h, \text{ where } B = \pi r^2$$



EXAMPLE 1 Find the volume of the cylinder. Round to the nearest tenth.

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

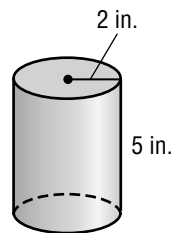
Volume of a cylinder

$$V = \pi(2)^2(5)$$

Replace r with 2 and h with 5.

$$V \approx 62.8$$

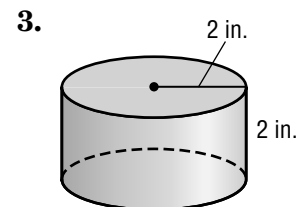
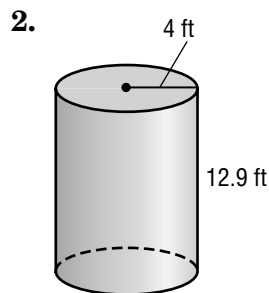
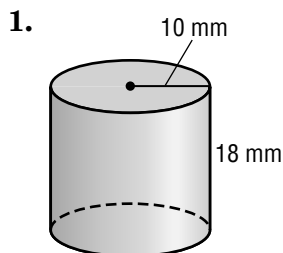
Simplify.



The volume is approximately 62.8 cubic inches. Check by using estimation.

EXERCISES

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



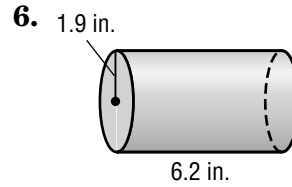
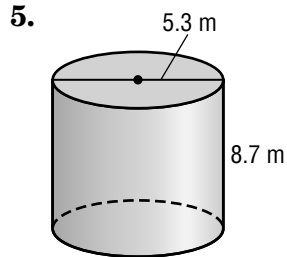
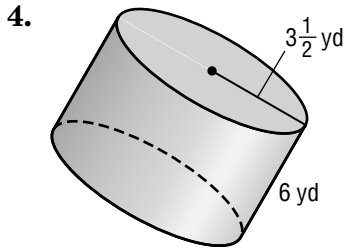
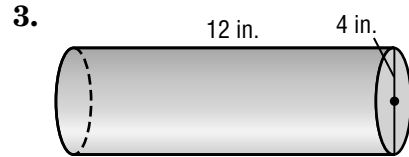
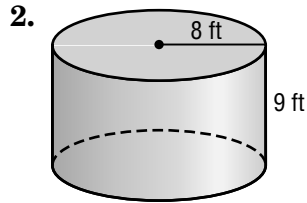
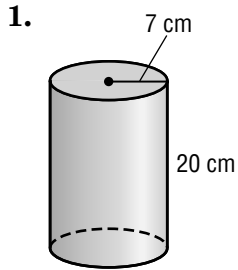
4. radius = 9.5 yd
height = 2.2 yd

5. diameter = 6 cm
height = 11 cm

6. diameter = $3\frac{2}{5}$ m
height = $1\frac{1}{4}$ m

12-3**Practice: Skills*****Volume of Cylinders***

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



7. radius = 8.8 cm
height = 4.7 cm

8. radius = 4 ft
height = $2\frac{1}{2}$ ft

9. diameter = 10 mm
height = 4 mm

10. diameter = 7.1 in.
height = 1 in.

12-3**Practice: Word Problems*****Volume of Cylinders***

1. WATER STORAGE A cylindrical water tank has a diameter of 5.3 meters and a height of 9 meters. What is the maximum volume that the water tank can hold? Round to the nearest tenth.

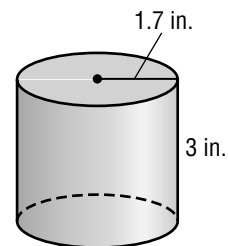
2. PACKAGING A can of corn has a diameter of 6.6 centimeters and a height of 9.9 centimeters. How much corn can the can hold? Round to the nearest tenth.

3. CONTAINERS Tionna wants to determine the maximum capacity of a cylindrical bucket that has a radius of 6 inches and a height of 12 inches. What is the capacity of Tionna's bucket? Round to the nearest tenth.

4. DESIGN Rodolfo is designing a new, cylindrical drinking glass. If the glass has a diameter of 8 centimeters and a height of 12.8 centimeters, what is its volume? Round to the nearest tenth.

5. PAINT A can of paint is 15 centimeters high and has a diameter of 13.6 cm. What is the volume of the can? Round to the nearest tenth.

6. SPICES A spice manufacturer uses a cylindrical dispenser like the one shown. Find the volume of the dispenser to the nearest tenth.



12-3**Reading to Learn Mathematics*****Volume of Cylinders***

Pre-Activity *Complete the Mini Lab at the top of page 524 in your textbook. Write your answers below.*

1. Estimate the number of centimeter cubes that would fit at the bottom of the can. Include parts of cubes.
2. How many layers would it take to fill the cylinder?
3. **Make a conjecture** about how you could find the volume of the soup can.

Reading the Lesson

4. Write *C* if the phrase is true of a cylinder, *P* if the phrase is true of a prism, or *CP* if the phrase is true of both.

_____ has bases that are parallel and congruent

_____ has sides and bases that are polygons

_____ has bases that are circular

_____ is a solid

_____ has volume

_____ is three-dimensional

5. What shape is the base of a cylinder?
6. What is the formula for the area of the base of a cylinder?

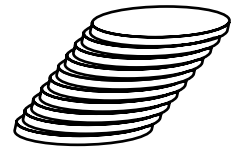
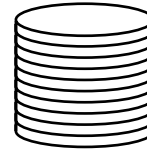
Helping You Remember

7. Work with a partner. Bring an object that is a cylinder to school. Take the measurements and determine the volume of your cylindrical object. Exchange objects with your partner, but do not share the calculations. Determine the volume of your partner's object. Then compare your results with those of your partner.

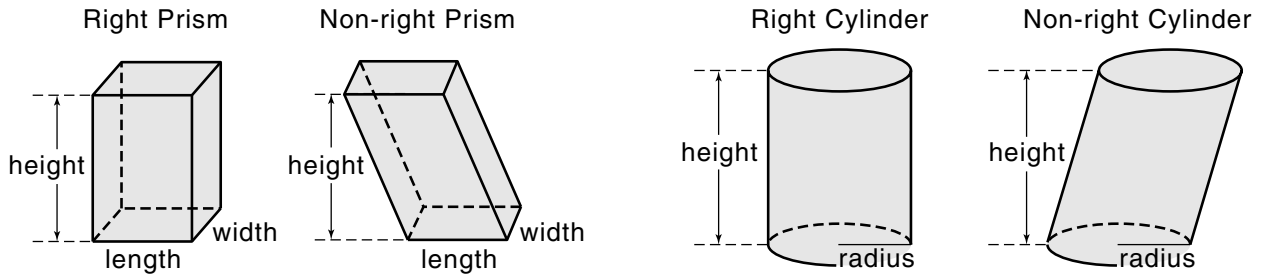
12-3 Enrichment

Volumes of Non-Right Solids

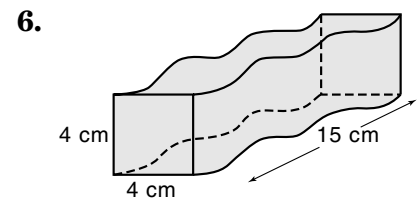
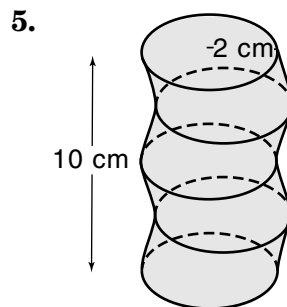
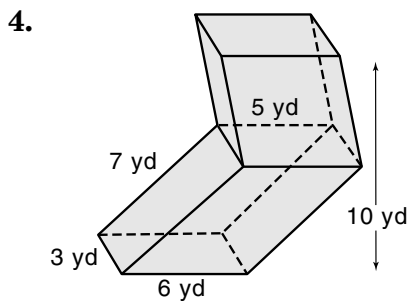
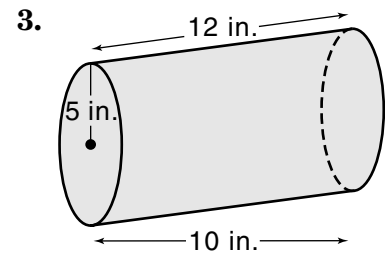
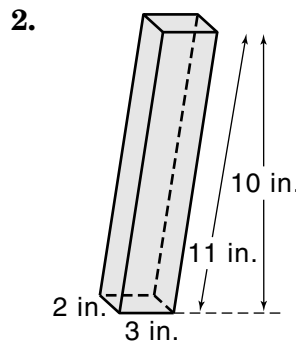
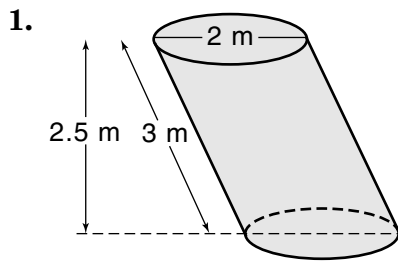
Imagine a stack of ten pennies. By pushing against the stack, you can change its shape as shown at the right. But, the volume of the stack does not change.



The diagrams below show prisms and cylinders that have the same volume but do not have the same shape.



Find the volume of each solid figure. Round to the nearest tenth.



12-4

Study Guide and Intervention

Surface Area of Rectangular Prisms

The sum of the areas of all the surfaces, or faces, of a three-dimensional figure is the **surface area**. The surface area S of a rectangular prism with length ℓ , width w , and height h is found using the following formula.

$$S = 2\ell w + 2\ell h + 2wh$$

EXAMPLE 1 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

top and bottom $(4 \cdot 3) + (4 \cdot 3) = 24$

front and back $(4 \cdot 2) + (4 \cdot 2) = 16$

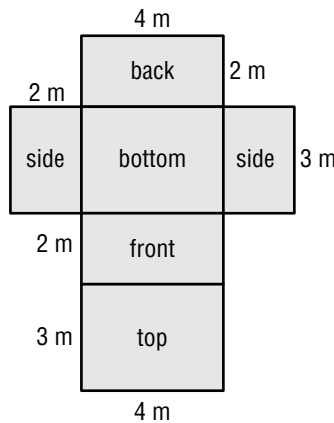
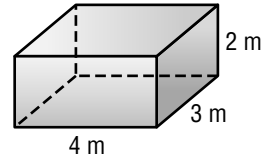
two sides $(2 \cdot 3) + (2 \cdot 3) = 12$

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

Alternatively, replace ℓ with 4, w with 3, and h with 2 in the formula for surface area.

$$\begin{aligned} S &= 2\ell w + 2\ell h + 2wh \\ &= 2 \cdot 4 \cdot 3 + 2 \cdot 4 \cdot 2 + 2 \cdot 3 \cdot 2 && \text{Follow order of operations.} \\ &= 24 + 16 + 12 \\ &= 52 \end{aligned}$$

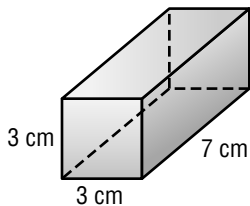
So, the surface area of the rectangular prism is 52 square meters.



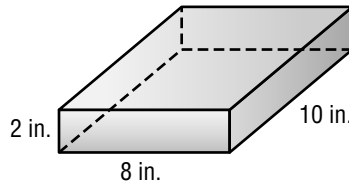
EXERCISES

Find the surface area of each rectangular prism.

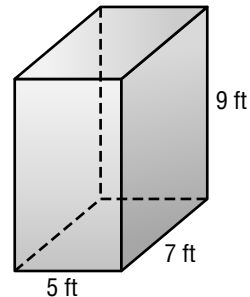
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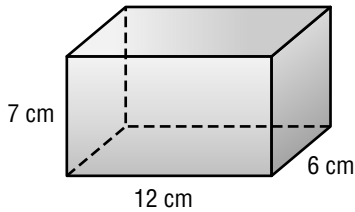
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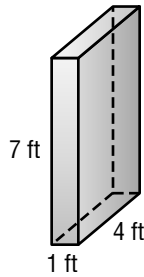
12-4**Practice: Skills****Surface Area of Rectangular Prisms**

Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.

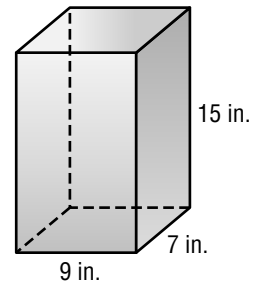
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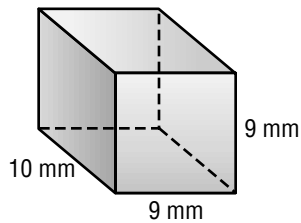
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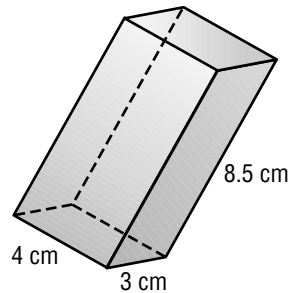
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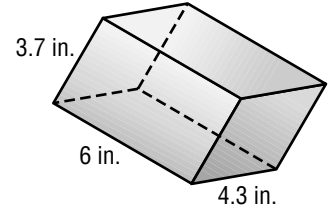
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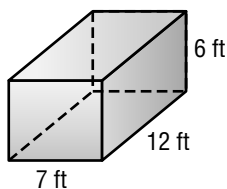
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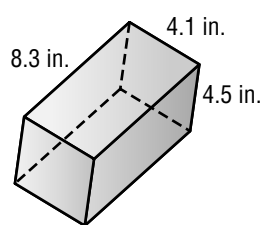
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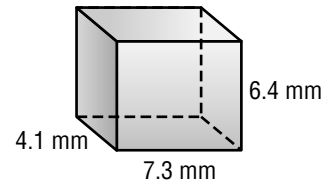
7.



8.



9.



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

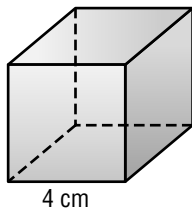
11. Find the surface area of a rectangular prism that has a length of 8 inches, a width of 3 inches, and a height of 6 inches.

12-4**Practice: Word Problems****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 $7\frac{1}{2}$ feet high. How much insulation should Jane buy if all inside surfaces except the floor are to be insulated?

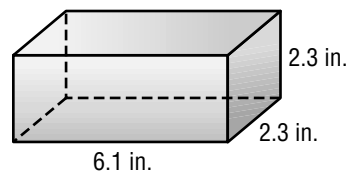
- 3. ICE** Suppose the length of each edge of a cube of ice is 4 centimeters. Find the surface area of the cube.



- 4. 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?



12-4**Reading to Learn Mathematics****Surface Area of Rectangular Prisms**

Pre-Activity Complete the Mini Lab at the top of page 532 in your textbook. Write your answers below.

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

Dimensions	Volume	Surface Area

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

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

Reading the Lesson

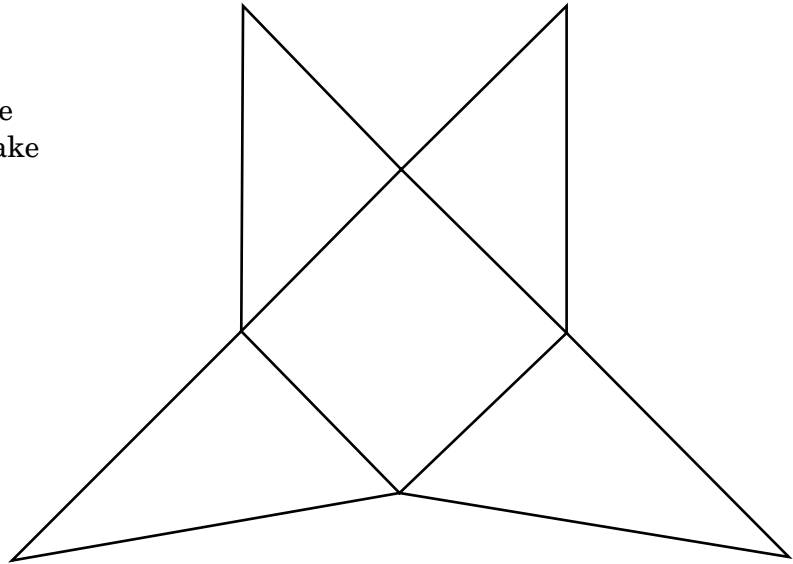
4. How many pairs of congruent faces are there in a rectangular prism? Name them.
5. Tell how to find the surface area of a rectangular prism in words.

Helping You Remember

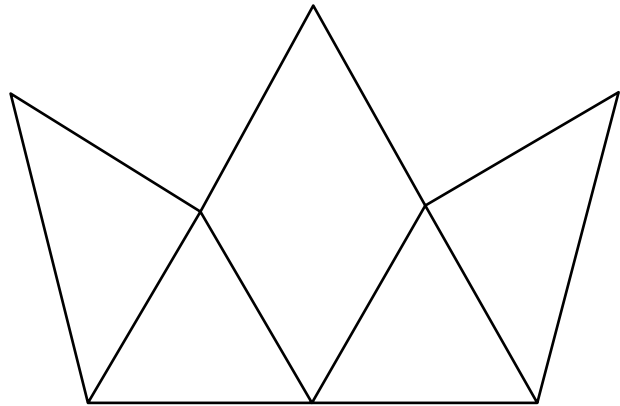
6. Work with a partner. Bring a box that is a rectangular prism to class (any size, such as a crayon box) that you can cut apart to form a net. Label the surfaces front, back, top, bottom, side, side. Measure the faces and find the surface area. Use adhesive tape to form the net into a three-dimensional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

12-4**Enrichment****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.

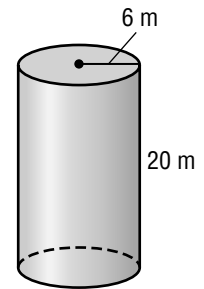
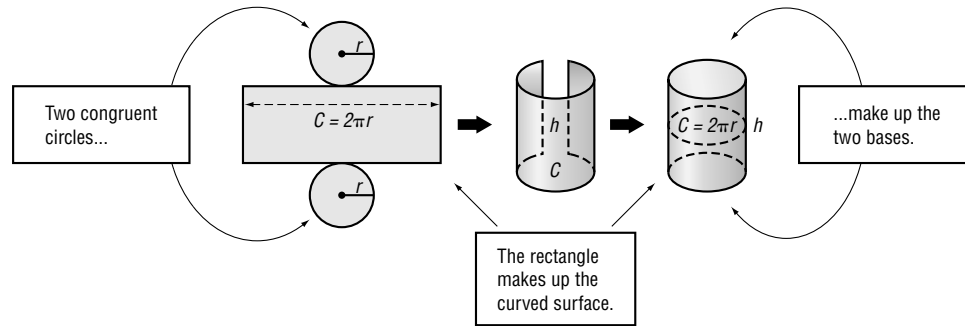
12-5

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 of a cylinder equals the area of two bases plus the area of the 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 1 Find the surface area of the cylinder. Round to the nearest tenth.

$$S = 2\pi r^2 + 2\pi rh$$

Surface area of a cylinder.

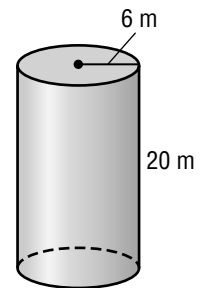
$$S = 2\pi(6)^2 + 2\pi(6)(20)$$

Replace r with 6 and h with 20.

$$\approx 980.2$$

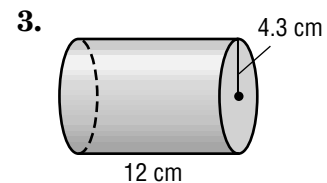
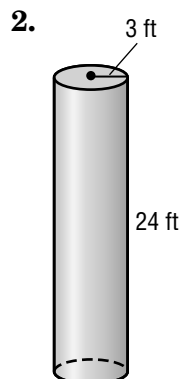
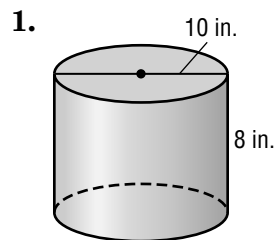
Simplify.

The surface area is about 980.2 meters.



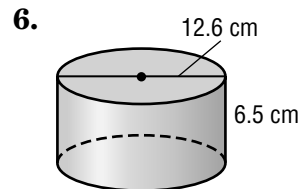
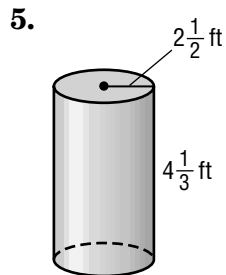
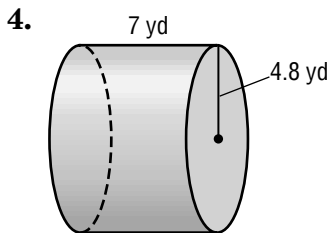
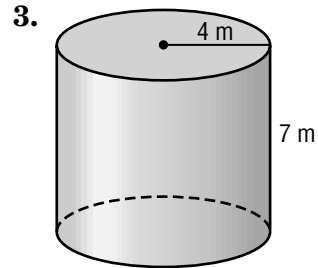
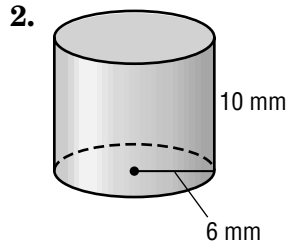
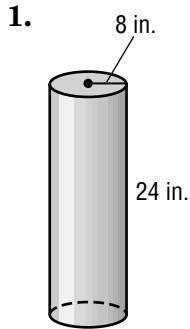
EXERCISES

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



12-5**Practice: Skills****Surface Area of Cylinders**

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



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.

12-5**Practice: Word Problems****Surface Area of Cylinders**

<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>
<p>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. (<i>Hint:</i> Do not include the top.)</p>	<p>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.</p>

12-5**Reading to Learn Mathematics****Surface Area of Cylinders**

Pre-Activity Complete the Mini Lab at the top of page 538 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.

Reading 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.

Helping You Remember

9. Complete the table.

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

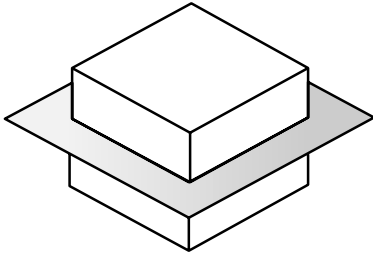
12-5 Enrichment

Cross Sections

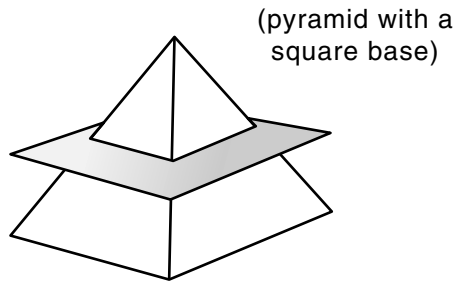
In each diagram on this page, a plane cuts through a solid figure. The intersection of the plane with the solid figure is called a *cross section*.

Sketch the cross section formed in each diagram.

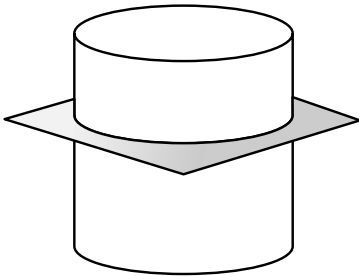
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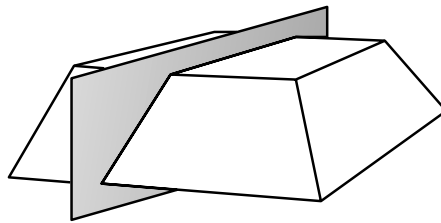
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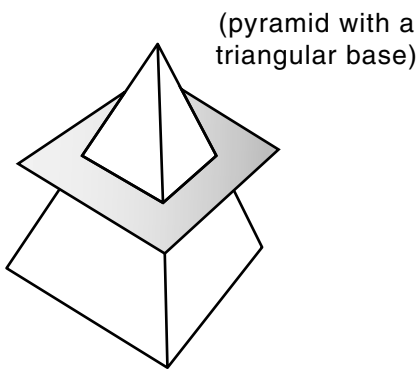
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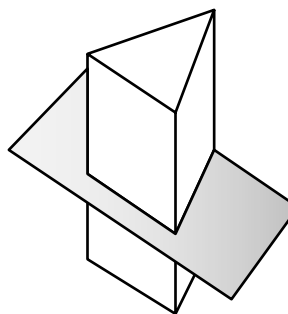
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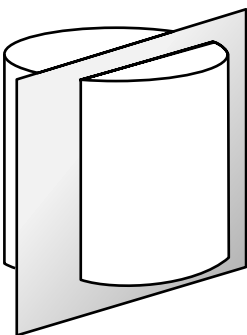
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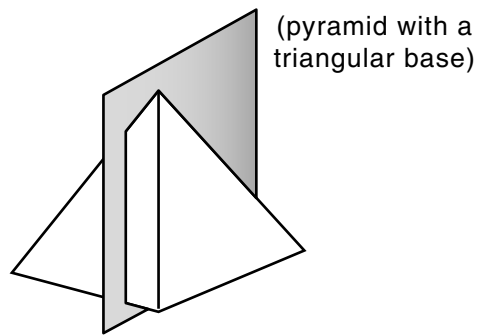
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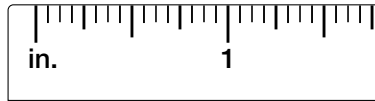
12-6

Study Guide and Intervention

Precision and Measurement

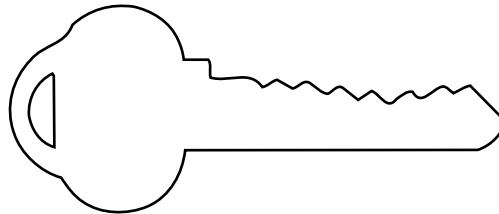
The **precision** or *exactness* of a measurement depends on the unit of measure. The **precision unit** is the smallest unit on a measuring tool. **Significant digits** include all of the digits of a measurement that you know for sure, plus one estimated digit.

EXAMPLE 1 Identify the precision unit of the measuring tool.

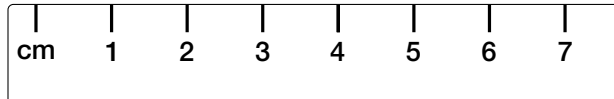


The smallest unit is a sixteenth of an inch. So, the precision unit is $\frac{1}{16}$ inch.

EXAMPLE 2 State the measurement of the key using significant digits.

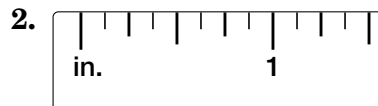
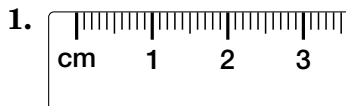


The precision unit is 1 centimeter. You know for certain that the length is between 6 and 7 centimeters. One estimate is 6.6 centimeters.

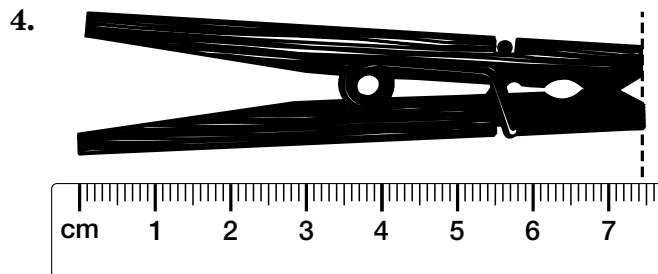
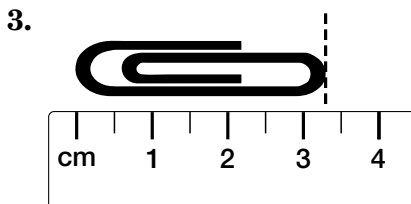


EXERCISES

Identify the precision unit of each measuring tool.



State the measure using significant digits.

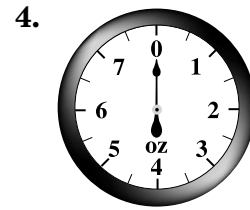
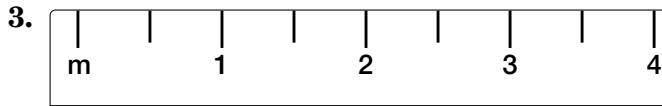
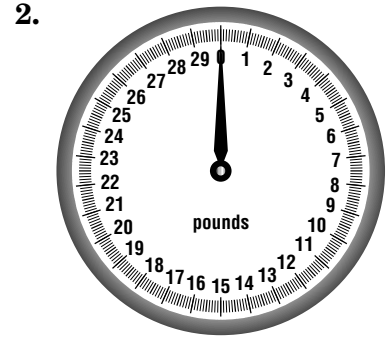
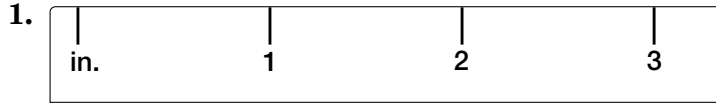


12-6

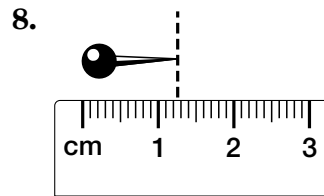
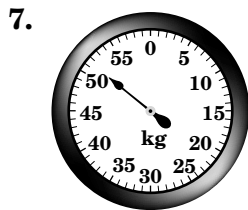
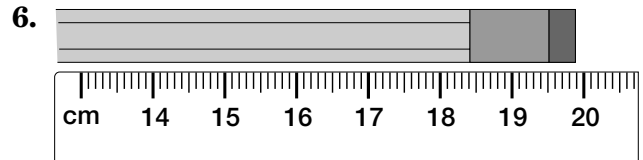
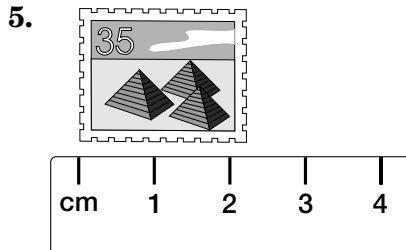
Practice: Skills

Precision and Measurement

Identify the precision unit of each measuring tool.



State the measure using significant digits.



12-6**Practice: Word Problems*****Precision and Measurement***

FOOTBALL For Exercises 1–3, use the information about **Quentin Griffin**.

University of Oklahoma running back Quentin Griffin ran 248 yards on the ground against No. 2 Texas to earn the USATODAY.com Player of the Week honors. The senior added two touchdowns in the fourth quarter to lift the third-ranked Oklahoma Sooners past the Texas Longhorns 35-24.

<p>1. How many significant digits are in the measurement of the distance that Quentin Griffin ran?</p>	<p>2. What is the precision unit on a football field? Would the distance measurement be more precise if the field was measured in meters? Explain.</p>
<p>3. How many significant digits are in the score of the game?</p>	<p>4. LAND SPEED On October 15, 1997, Andy Green set the land speed record of 763.035 miles per hour. How many significant digits are in the measurement of the land speed record?</p>
<p>5. TRACK The record for the men's high jump is held by Javier Sotomayor (Cuba), who became world champion with a distance of 2.45 meters on July 27, 1993, in Salamanca, Spain. How many significant digits are in the measurement of the high jump record?</p>	<p>6. OCEANOGRAPHY On March 24, 1995, the Japanese probe <i>Kaiko</i> recorded the depth of the Marianas Trench, the deepest point in the ocean, at 10,911 meters or 35,797 feet. Which expression of the measurement is more precise? Explain.</p>

12-6**Reading to Learn Mathematics*****Precision and Measurement***

Pre-Activity *Read the introduction at the top of page 542 in your textbook. Write your answers below.*

1. What is the smallest unit of measure?
2. Explain whether a ruler whose smallest increment is 0.5 centimeter could have been used to measure the bubble.

Reading the Lesson

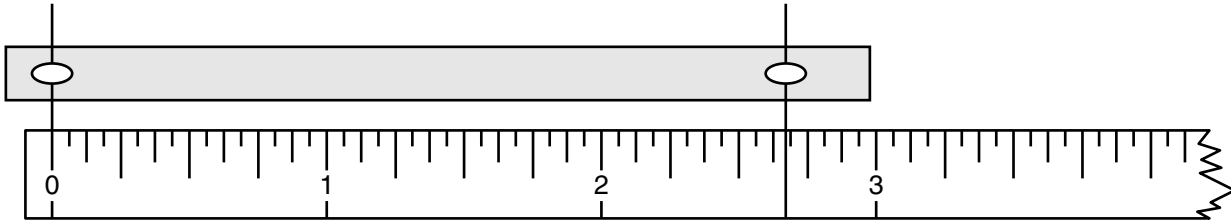
3. When might it be necessary to use significant digits?
4. When you use significant digits, how many digits are estimated?
5. If a beaker in the chemistry lab has markings on the side that measure the number of whole milliliters of fluid in the beaker, what is the precision unit of the beaker?
6. Which is more precise, a ruler that has markings for centimeters or a ruler that has markings for millimeters? Explain.

Helping You Remember

7. Look in your home for everyday measuring tools. Identify the precision unit for each tool you can find. Compare lists with other students in your class.

12-6**Enrichment****Absolute Error**

The **absolute error** of a measurement is defined to be one-half the smallest unit used in making the measurement. For example, this drawing shows the distance between the centers of the two holes in a piece of metal.



If the distance were measured to the nearest quarter of an inch, the absolute error would be one-eighth of an inch. The symbol \pm means “plus or minus.” This symbol is often used to report measurements.

This way of reporting measurements helps to show how accurate the measurement is. The actual measurement will lie somewhere in this interval.

$$2\frac{3}{4} \text{ in.} - \frac{1}{8} \text{ in.} < m < 2\frac{3}{4} \text{ in.} + \frac{1}{8} \text{ in.}$$

$$2\frac{5}{8} \text{ in.} < m < 2\frac{7}{8} \text{ in.}$$

Write each reported measurement using an interval. Use m to represent the actual measurement.

1. $25,000 \pm 500$ voters
2. 15 ± 0.5 kg
3. 750 ± 25 customers
4. 75 ± 5 mi
5. $14 \pm \frac{1}{2}$ gal
6. $7\frac{1}{4} \pm \frac{1}{4}$ in.

Name the unit of measure used to make each measurement.

7. $32 \pm \frac{1}{2}$ ft
8. 23 ± 0.5 m
9. $5\frac{1}{4} \pm \frac{1}{8}$ mi
10. 14 ± 0.5 cm
11. $2\frac{3}{8} \pm \frac{1}{16}$ in.
12. $8 \pm \frac{1}{2}$ yd