

14-1

Area of Parallelograms (pages 546–549)

A parallelogram is a quadrilateral with two pairs of parallel sides. The base is any one of the sides and the height is the shortest distance (the length of a perpendicular segment) from the base to the opposite side.

Finding the Area of a Parallelogram	The area A of a parallelogram equals the product of its base b and height h . $A = bh$	
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EXAMPLES

A Find the area of the parallelogram.

Multiply the length of the base of the parallelogram (4 in.) and the height drawn to that base (5 in.).

$A = bh$
 $A = 4(5) = 20 \text{ in}^2$

B The area of a parallelogram is 30 square inches. The base is 10 inches long. What is the height?

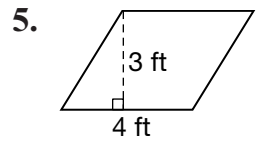
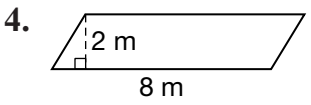
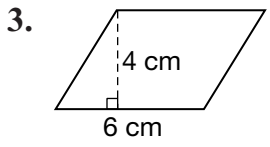
$A = bh$
 $30 = 10h$ *Substitute the values you know.*
 $h = 3$ $30 = 10 \cdot 3$
The height is 3 inches.

Try These Together

- Find the area (to the nearest tenth) of a parallelogram that is 3.6 centimeters wide and 5.2 centimeters high.
HINT: Use the formula and then round.
- Find the base of a parallelogram that has a height of 7 centimeters and an area of 56 square centimeters.
HINT: Write the formula, substitute values, and solve for b.

PRACTICE

Find the area of each parallelogram.



- What is the area of a parallelogram that is 5 centimeters wide and 8 centimeters high?
- Puzzles** Kai has a puzzle that is a parallelogram. It is 30 centimeters long and 22 centimeters high. What is the area of the puzzle?

8. Standardized Test Practice If a parallelogram has an area of 42 square centimeters and its height is 6 centimeters, how long is its base?

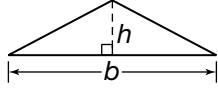
A 6 cm **B** 7 cm **C** 5 cm **D** 8 cm

Answers: 1. 18.7 in² 2. 8 cm 3. 24 cm² 4. 16 m² 5. 12 ft² 6. 40 cm² 7. 660 cm² 8. B

14-2

Area of Triangles (pages 551–554)

You can divide a parallelogram into two congruent triangles by drawing a diagonal. Since the formula for the area of a parallelogram is $A = bh$, then the formula for the area of a triangle is $A = \frac{1}{2}bh$.

Finding the Area of a Triangle	The area A of a triangle equals half of the product of the length of the base b and the height h . $A = \frac{1}{2}bh$	
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EXAMPLES

A What is the area of a triangle with a height of 25 cm and a base of 36 cm?

$A = \frac{1}{2}bh$ Write the formula.

$A = \frac{1}{2}(36)(25)$ Substitute the values you know.

$A = 450 \text{ cm}^2$ Multiply to find the area.

B The area of a triangle is 54 in^2 and the height is 12 in. Find the base.

$A = \frac{1}{2}bh$ Write the formula.

$54 = \frac{1}{2}(b)(12)$ Substitute the values you know.

$54 = 6b$ Multiply.

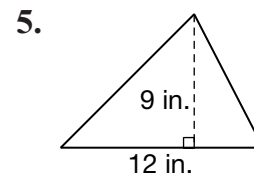
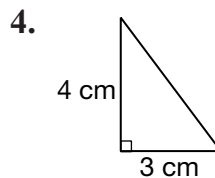
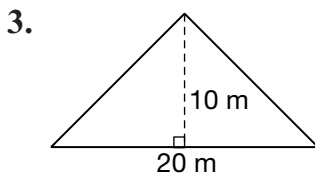
$9 \text{ in.} = b$ $54 = 6 \cdot 9$

Try These Together

- Find the area of a triangle that has a base of 1 yd and height of $\frac{1}{3}$ yd.
HINT: Use the formula and multiply.
- A triangle has a base of 8 cm and an area of 64 cm^2 . Find the height.
HINT: Substitute in the formula and solve for h .

PRACTICE

Find the area of each triangle.



6. **Flags** The flag of the country of Guyana has a red triangle on it. If the base of the triangle is 30 inches and the height is 26 inches, what is the area of the triangle?



7. **Standardized Test Practice** How long is the base of a triangle that has an area of 63 square centimeters and a height of 7 centimeters?

- A** 7 cm **B** 9 cm **C** 16 cm **D** 18 cm

Answers: 1. $\frac{6}{1} \text{ yd}^2$ 2. 16 cm 3. 100 m^2 4. 6 cm^2 5. 54 in^2 6. 390 in^2 7. D

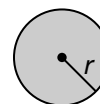
14-3

Area of Circles (pages 556–559)

If you cut a circle into a number of equal-sized pie-shaped pieces and arrange them carefully, you can form a rough parallelogram. The height of the parallelogram is about equal to the radius of the circle. The base is about equal to $\frac{1}{2}$ of the circumference of the circle. This would mean that the area is about $\frac{1}{2}Cr$. Substitute the circumference formula for C and you get the following equation.

Finding the Area of a Circle

The area A of a circle equals the product of π and the square of the radius r .
 $A = \pi r^2$



EXAMPLES

- A** Find the area of a circle with a radius of 7 cm. Use 3.14 for π .
 $A = \pi r^2$ Write the formula.
 $A \approx 3.14(7)^2$ Substitute the values you know.
 $A \approx 154 \text{ cm}^2$ Use a calculator and round.

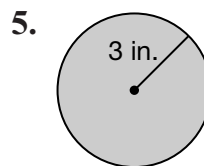
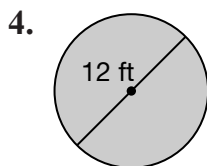
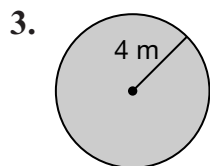
- B** Find the area of a circle that has a diameter of 5 inches. Use 3.14 for π .
 $A = \pi r^2$ Write the formula.
 $A \approx 3.14(2.5)^2$ $r = \frac{1}{2}d$ or 2.5 in.
 $A \approx 19.6 \text{ in}^2$ Use a calculator and round.

Try These Together

- A circle has a radius of 2 in. What is its area? Use 3.14 for π .
HINT: Write the formula and substitute.
- The diameter of a circle is 4.2 yd. Find its area. Use 3.14 for π .
HINT: First find the radius.

PRACTICE

Find the area of each circle to the nearest tenth. Use 3.14 for π .



6. diameter, 18 centimeters 7. radius, 5 meters 8. radius, 10 inches



9. **Standardized Test Practice** What is the area of a circle that has a diameter of 30 centimeters?

- A** 353.3 cm^2 **B** $2,826 \text{ cm}^2$ **C** 176.6 cm^2 **D** 706.5 cm^2

Answers: 1. about 12.6 in^2 2. about 13.8 yd^2 3. 50.2 m^2 4. 113.0 ft^2 5. 28.3 in^2 6. 254.3 cm^2 7. 78.5 m^2 8. 314.0 in^2 9. D

14-4

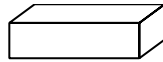
Three-Dimensional Figures (pages 564–566)

A **three-dimensional** figure encloses a part of space. The flat surfaces are called **faces**. The segments formed by the intersecting faces are the **edges**. The edges intersect at the **vertices**.

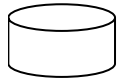
<p>Identifying Three-Dimensional Figures</p>	<ul style="list-style-type: none"> • prism: two parallel and congruent faces, called bases • pyramid: triangular faces; one base <p>Prisms and pyramids are named by the polygon(s) at their base(s).</p> <ul style="list-style-type: none"> • cone: curved surface; one circular base • cylinder: curved surface; two circular bases • sphere: all the points are the same distance from the center
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EXAMPLES

A Identify this figure.
The faces are rectangular, so the figure is a prism.
The bases are rectangles, so it is a rectangular prism.



B Identify this figure.
The surface is curved and there are two circular bases.
The figure is a cylinder.



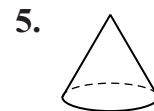
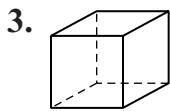
Try These Together

1. Is a square a two-dimensional or a three-dimensional figure?
HINT: Does a square have the three dimensions of length, width, and height?

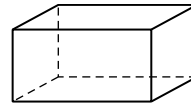
2. How many faces, edges, and vertices are there in the figure of Example A?
HINT: Think of a closed box shape.

PRACTICE

Identify each figure.



6. How many edges does this rectangular prism have?



7. **Gift Wrapping** Juanita bought her mother a candle in the shape of a square pyramid for her birthday. How many faces does the candle have for Juanita to cover with wrapping paper?



8. **Standardized Test Practice** How many faces does a triangular pyramid have?

A 4

B 3

C 5

D 2

Answers: 1. two-dimensional 2. 6; 12; 8 3. cube (or square prism) 4. sphere 5. cone 6. 12 7. 5 8. A
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14-5

Volume of Rectangular Prisms (pages 570–573)

The amount of space inside a three-dimensional figure is called its **volume**.
Volume is expressed in cubic units.

Finding the Volume of a Rectangular Prism

The volume V of a rectangular prism equals the product of its length ℓ , its width w , and its height h .
 $V = \ell wh$, or $V = Bh$, where B is the area of the base.



EXAMPLES

A Find the volume of a rectangular prism that is 8 by 9 by 7 inches.

$V = \ell wh$ Write the formula.
 $V = 8(9)(7)$ Substitute the values you know.
 $V = 504 \text{ in}^3$ Multiply to find the volume.

B A cereal box is 29 cm tall and its top measures 7 cm by 20 cm. Find the volume.

$V = Bh$ Write the formula.
 $V = 20(7)(29)$ Substitute the values you know.
 $V = 4,060 \text{ cm}^3$ Multiply to find the volume.

Try These Together

1. What is the volume of a storage shed 7 feet high with a floor that is 10 feet by 9 feet?

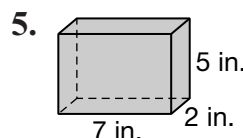
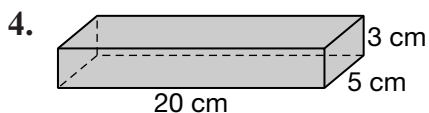
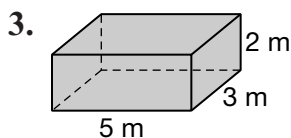
HINT: Do you know the length, width, and height?

2. A rectangular prism has a height of 2 yards, a width of 0.6 yards, and a length of 1.4 yards. Find the volume.

HINT: Write the formula and substitute.

PRACTICE

Find the volume of each rectangular prism.



6. What is the volume of a rectangular prism that is 12 mm high, 10 mm wide, and 18 mm long?

7. **Hobbies** Mr. Maki is building a new flower bed. The bed is 3 feet wide, 10 feet long, and 1.5 feet deep. How many cubic feet of dirt will he need for his new flower bed?

8. **Standardized Test Practice** Find the volume of a rectangular prism that is 5 feet wide, 8 feet tall, and 11 feet long.

A 55 ft^3

B 880 ft^3

C 440 ft^3

D 40 ft^3

Answers: 1. 630 ft^3 2. 1.68 yd^3 3. 30 m^3 4. 300 cm^3 5. 70 in^3 6. $2,160 \text{ mm}^3$ 7. 45 ft^3 8. C

14-6

Surface Area of Rectangular Prisms

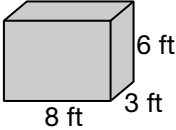
(pages 575–578)

The **surface area** of a three-dimensional object is the total area of its faces and curved surfaces.

<p>Finding the Surface Area of a Rectangular Prism</p>	<ul style="list-style-type: none"> • Find the area of the top and bottom bases. • Find the area of the front and back faces. • Find the area of the right and left sides. <p>Add all these areas to find the total surface area of the prism.</p>
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EXAMPLES

A Find the surface area of a box that is 8 ft by 6 ft by 3 ft.



Area of the top is 8×3 .
 Area of the front is 6×8 .
 Area of the side is 3×6 .
 There are 2 of each face.
 Total area = $2(24) + 2(48) + 2(18)$ or 180 ft^2

B What is the surface area of a rectangular prism with length = 3 in., width = 7 in., and height = 2 in.?

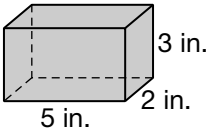
Area = $2(3 \times 7) + 2(3 \times 2) + 2(7 \times 2)$
 Area = $2(21 + 6 + 14)$
 Area = $2(41)$
 Area = 82 in^2

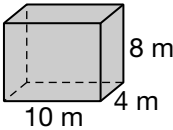
Try These Together

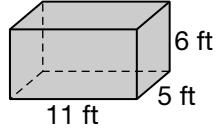
- Find the surface area of a cube that has an edge of 3 yards.
HINT: A cube is a rectangular prism with 6 congruent faces.
- Find the surface area of a rectangular prism that is 1.3 cm by 2.4 cm by 5.7 cm.
HINT: Begin by making a sketch and labeling it.

PRACTICE

Find the surface area of each rectangular prism.

3. 

4. 

5. 

6. length = 12 ft
width = 3 ft
height = 8 ft

7. length = 3 cm
width = 9 cm
height = 1 cm

8. length = 5 m
width = 7 m
height = 8 m

9. **Decorating** Josie is putting wallpaper in her room. If her room is 10 feet wide, 12 feet long and 8 feet high, how much wallpaper will she need? Remember, she will not wallpaper the ceiling or the floor.



10. **Standardized Test Practice** What is the surface area of a 20-cm cube?
A $1,200 \text{ cm}^2$ **B** $2,400 \text{ cm}^2$ **C** 400 cm^2 **D** $4,400 \text{ cm}^2$

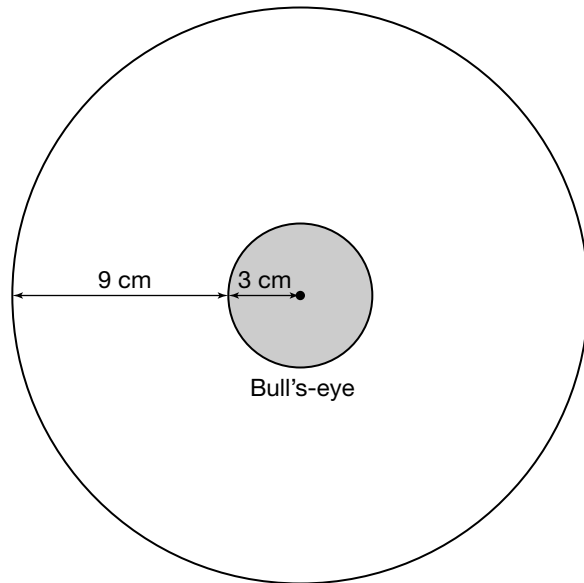
Answers: 1. 54 yd^2 2. 48.42 cm^2 3. 62 in^2 4. 304 m^2 5. 302 ft^2 6. 312 ft^2 7. 78 cm^2 8. 262 m^2 9. 352 ft^2 10. B

14

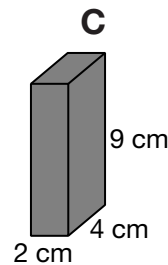
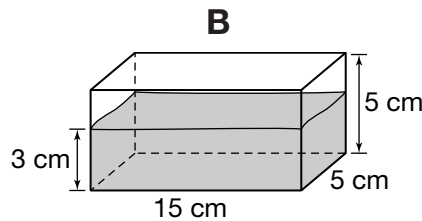
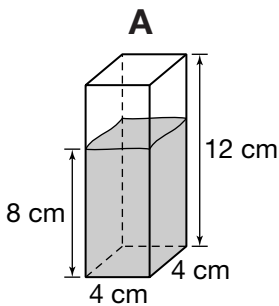
Chapter 14 Review

Geometry Carnival

1. You want to make a target like the ones you saw at a carnival. You want the bull's-eye at the center to have less than $\frac{1}{10}$ of the area of the whole target. Does a target with the measurements shown at the right meet this requirement?



2. At the same carnival, you came across a very interesting game. Two tanks are partially filled with water as shown below. You must place solid prism C into one of the containers without spilling a drop of water to win a prize. Containers A and B are open on the top.



Into which container can you drop prism C without spilling water? Explain.

Answers are located on p. 108.