Chapter Review

11

Connecting **BIG** ideas and Answering the Essential Questions
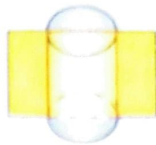
Visualization

You can determine the intersection of a solid and a plane by visualizing how the plane slices the solid to form a two-dimensional cross section.

Space Figures and Cross Sections (Lesson 11-1)

This vertical plane intersects the cylinder in a rectangular cross section.

Surface Areas and Volumes of Prisms, Cylinders, Pyramids, and Cones (Lessons 11-2 through 11-5)

	Surface Area (S.A.)	Volume (V)
Prism	$ph + 2B$	Bh
Cylinder	$2\pi rh + 2B$	Bh
Pyramid	$\frac{1}{2}p\ell + B$	$\frac{1}{3}Bh$
Cone	$\pi r\ell + B$	$\frac{1}{3}Bh$

Measurement

You can find the surface area or volume of a solid by first choosing a formula to use and then substituting the needed dimensions into the formula.

Surface Areas and Volumes of Spheres (Lesson 11-6)

$$S.A. = 4\pi r^2$$
$$V = \frac{4}{3}\pi r^3$$

Similarity

The surface areas of similar solids are proportional to the squares of their corresponding dimensions. The volumes are proportional to the cubes of their corresponding dimensions.

Areas and Volumes of Similar Solids (Lesson 11-7)

If the scale factor of two similar solids is $a : b$, then
- the ratio of their areas is $a^2 : b^2$
- the ratio of their volumes is $a^3 : b^3$

Chapter Vocabulary

- altitude (pp. 699, 701, 708, 711)
- center of a sphere (p. 733)
- cone (p. 711)
- cross section (p. 690)
- cylinder (p. 701)
- edge (p. 688)
- face (p. 688)
- great circle (p. 733)
- hemisphere (p. 733)
- lateral area (pp. 700, 702, 709, 711)
- lateral face (pp. 699, 708)
- polyhedron (p. 688)
- prism (p. 699)
- pyramid (p. 708)
- right cone (p. 711)
- right cylinder (p. 701)
- right prism (p. 699)
- slant height (pp. 708, 711)
- sphere (p. 733)
- surface area (pp. 700, 702, 709, 711)
- volume (p. 717)

Choose the correct term to complete each sentence.

1. A set of points in space equidistant from a given point is called a(n) __?__.

2. A(n) __?__ is a polyhedron in which one face can be any polygon and the lateral faces are triangles that meet at a common vertex.

3. If you slice a prism with a plane, the intersection of the prism and the plane is a(n) __?__ of the prism.
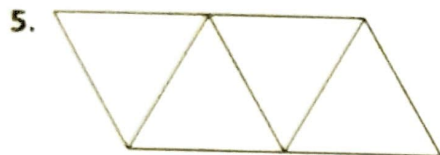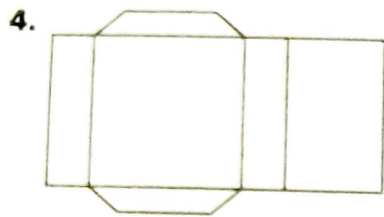
Answers

Chapter Review
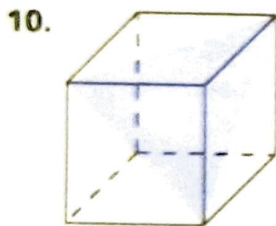
1. sphere
2. pyramid
3. cross section

Answers

Chapter Review (continued)

4–5. Answers may vary. Samples are given.

4.

5.

6. 8

7. 8

8. 5

9. a circle

10.

11. 36 cm²

12. 66π m²

13. 208 in.²

14. 36π cm²

15. 32.5π cm²

## 11-1 Space Figures and Cross Sections

Quick Review

A **polyhedron** is a three-dimensional figure whose surfaces are polygons. The polygons are **faces** of the polyhedron. An **edge** is a segment that is the intersection of two faces. A **vertex** is a point where three or more edges intersect. A **cross section** is the intersection of a solid and a plane.

Example

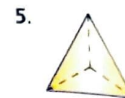**How many faces and edges does the polyhedron have?**

The polyhedron has 2 triangular bases and 3 rectangular faces for a total of 5 faces.

The 2 triangles have a total of 6 edges. The 3 rectangles have a total of 12 edges. The total number of edges in the polyhedron is one half the total of 18 edges, or 9.
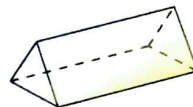
Exercises

Draw a net for each three-dimensional figure.

4.

5.

Use Euler's Formula to find the missing number.

6. $F = 5$, $V = 5$, $E = $ ▓

7. $F = 6$, $V = $, $E = 12$

8. How many vertices are there in a solid with 4 triangular faces and 1 square base?

9. Describe the cross section in the figure at the right.

10. Sketch a cube with an equilateral triangle cross section.

11-2 Surface Areas of Prisms and Cylinders

Quick Review

The **lateral area of a right prism** is the product of the perimeter of the base and the height. The **lateral area of a right cylinder** is the product of the circumference of the base and the height of the cylinder. The **surface area** of each solid is the sum of the lateral area and the areas of the bases.

Example

What is the surface area of a cylinder with radius 3 m and height 6 m? Leave your answer in terms of π.

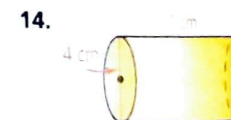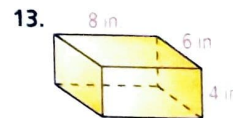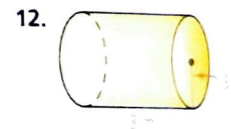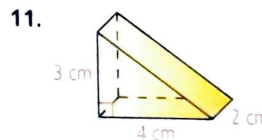|	
S.A. = L.A. + 2B	Use the formula for surface area of a cylinder.
$= 2\pi r h + 2(\pi r^2)$	Substitute formulas for lateral area and area of a circle.
$= 2\pi(3)(6) + 2\pi(3)^2$	Substitute 3 for r and 6 for h.
$= 36\pi + 18\pi$	Simplify.
$= 54\pi$	

The surface area of the cylinder is 54π m².

Exercises

Find the surface area of each figure. Leave your answers in terms of π where applicable.

11.

3 cm 4 cm 2 cm

12.

13.

8 in 6 in 4 in

14.

4 cm

15. A cylinder has radius 2.5 cm and lateral area 20π cm². What is the surface area of the cylinder in terms of π?

11-3 Surface Areas of Pyramids and Cones

Quick Review

The **lateral area of a regular pyramid** is half the product of the perimeter of the base and the slant height. The **lateral area of a right cone** is half the product of the circumference of the base and the slant height. The **surface area** of each solid is the sum of the lateral area and the area of the base.

Example

What is the surface area of a cone with radius 3 in. and slant height 10 in.? Leave your answer in terms of π.

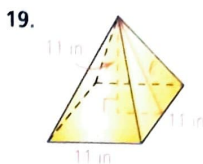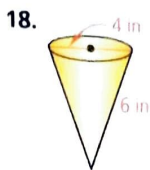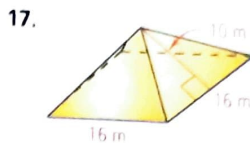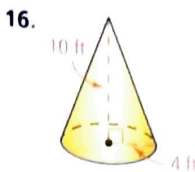|	
$S.A. = L.A. + B$	Use the formula for surface area of a cone.
$= \pi r \ell + \pi r^2$	Substitute formulas for lateral area and area of a circle.
$= \pi(3)(10) + \pi(3)^2$	Substitute 3 for r and 10 for ℓ.
$= 30\pi + 9\pi$	Simplify.
$= 39\pi$	

The surface area of the cone is 39π in.^{2}.

Exercises

Find the surface area of each figure. Round your answers to the nearest tenth.

16.

17.

18.

19.

20. Find the formula for the base area of a prism in terms of surface area and lateral area.

11-4 and 11-5 Volumes of Prisms, Cylinders, Pyramids, and Cones

Quick Review

The **volume** of a space figure is the space that the figure occupies. Volume is measured in cubic units. The **volume of a prism** and the **volume of a cylinder** are the product of the area of a base and the height of the solid. The **volume of a pyramid** and the **volume of a cone** are one third the product of the area of the base and the height of the solid.

Example

What is the volume of a rectangular prism with base 3 cm by 4 cm and height 8 cm?

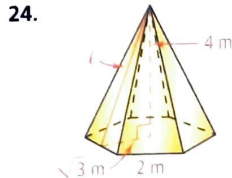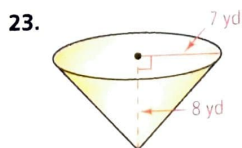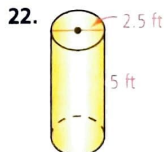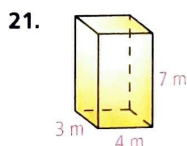|	
$V = Bh$	Use the formula for the volume of a prism.
$= (3 \cdot 4)(8)$	Substitute.
$= 96$	Simplify.

The volume of the prism is 96 cm^3.

Exercises

Find the volume of each figure. If necessary, round to the nearest tenth.

21.

22.

23.

24.

PowerGeometry.com

16. about 185.6 ft^2

17. 576 m^2

18. about 50.3 in.^{2}

19. about 391.6 in.^{2}

20. $B = \dfrac{S.A. - L.A.}{2}$

21. 84 m^3

22. 24.5 ft^3

23. 410.5 yd^3

24. 13.9 m^3

Answers

Chapter Review (continued)

25. S.A. = 314.2 in.^{2}; V = 523.6 in.^{3}

26. S.A. = 153.9 cm^2; V = 179.6 cm^3

27. S.A. = 50.3 ft^2; V = 33.5 ft^3

28. S.A. = 8.0 ft^2; V = 2.1 ft^3

29. 904.78 cm^3

30. 314 m^2

31. 8.6 in.^{3}

32. Answers may vary. Sample:
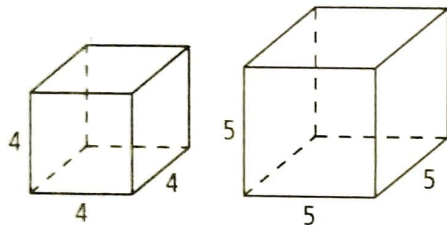
33. 27 : 64

34. 64 : 27

35. 324 pencils

11-6 Surface Areas and Volumes of Spheres

Quick Review

The **surface area of a sphere** is four times the product of π and the square of the radius of the sphere. The **volume of a sphere** is $\frac{4}{3}$ the product of π and the cube of the radius of the sphere.

Example

What is the surface area of a sphere with radius 7 ft? Round your answer to the nearest tenth.

S.A. = $4\pi r^2$ Use the formula for surface area of a sphere.

= $4\pi(7)^2$ Substitute.

≈ 615.8   Simplify.

The surface area of the sphere is about 615.8 ft^2.

Exercises

Find the surface area and volume of a sphere with the given radius or diameter. Round your answers to the nearest tenth.

25. $r = 5$ in.   **26.** $d = 7$ cm

27. $d = 4$ ft   **28.** $r = 0.8$ ft

29. What is the volume of a sphere with a surface area of 452.39 cm^2? Round your answer to the nearest hundredth.

30. What is the surface area of a sphere with a volume of 523.6 m^3? Round your answer to the nearest square meter.

31. Sports Equipment The circumference of a lacrosse ball is 8 in. Find its volume to the nearest tenth of a cubic inch.

11-7 Areas and Volumes of Similar Solids

Quick Review

Similar solids have the same shape and all their corresponding dimensions are proportional.

If the scale factor of two similar solids is $a : b$, then the ratio of their corresponding surface areas is $a^2 : b^2$, and the ratio of their volumes is $a^3 : b^3$.

Example

Is a cylinder with radius 4 in. and height 12 in. similar to a cylinder with radius 14 in. and height 35 in.? If so, give the scale factor.
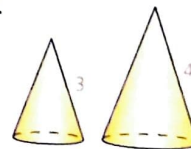
$\frac{4}{14} \neq \frac{12}{35}$

The cylinders are not similar because the ratios of corresponding linear dimensions are not equal.
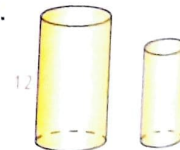
Exercises

32. Open-Ended Sketch two similar solids whose surface areas are in the ratio 16 : 25. Include dimensions.

For each pair of similar solids, find the ratio of the volume of the first figure to the volume of the second.

33.

34.

35. Packaging There are 12 pencils in a regular-sized box. If a jumbo box is made by tripling all the dimensions of the regular-sized box, how many pencils will the jumbo box hold?