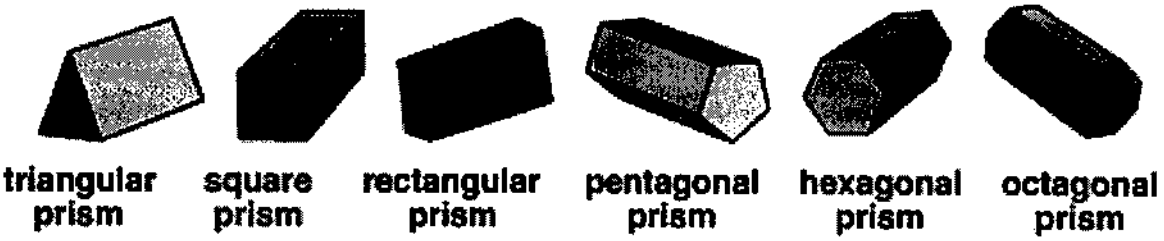
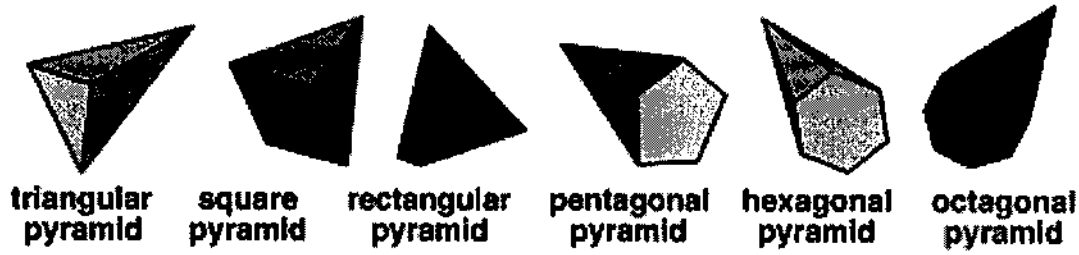
Unit 8b

3D Geometry

Volume, Surface Area, Cross Sections





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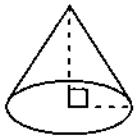
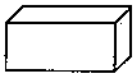
Vocabulary

Cone
A three-dimensional figure with a circular base and one vertex

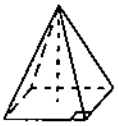


Great Circle
The intersection of a sphere and a plane such that the plane contains the center of the sphere; divides the sphere into two equal hemispheres

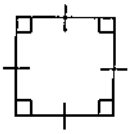
Prism
A figure in space that has two parallel and congruent bases in the shape of polygons



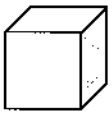
Pyramid
A figure in space with three or more triangular faces and a base in the shape of a polygon



Regular polygon
A polygon that is equilateral (equal sides) and equiangular (equal angles)

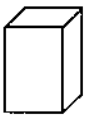


Regular polyhedron
A polyhedron in which all faces are congruent regular polygons, and the same number of faces meet at each vertex in exactly the same way

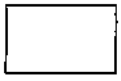


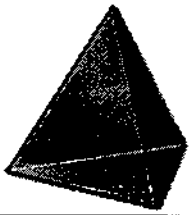
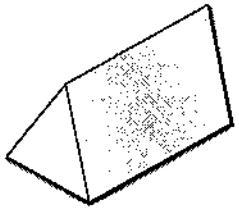
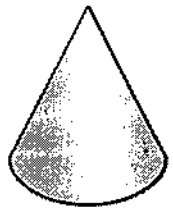
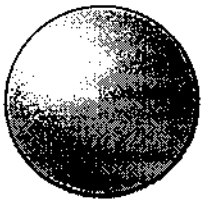
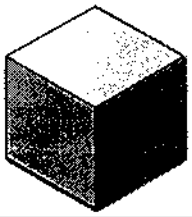
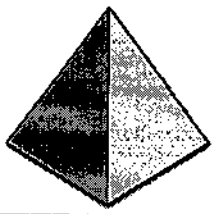
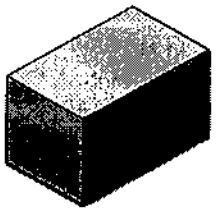
Sphere
A three-dimensional figure made up of all points that are equally distant from a point called the center

Three-dimensional objects
Objects existing in three dimensions; having length, width, and height



Two-dimensional objects
Objects existing in two dimensions; having length and width



	Names	Faces	Edges	Vertices
				
				
				
				
				
				
				
				

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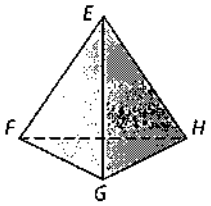
Lesson 4 Reteach

Three-Dimensional Figures

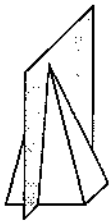
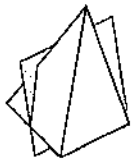
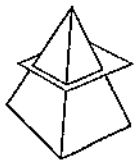
A **prism** is a polyhedron with two parallel, congruent **bases**. A **pyramid** is a polyhedron with one base. Prisms and pyramids are named by the shape of their bases, such as triangular or rectangular.

Example **Identify the figure. Name the bases, faces, edges, and vertices.**



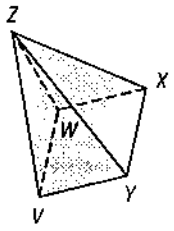
This figure has one triangular base, $\triangle FGH$, so it is a triangular pyramid.
faces: EFG, EGH, EFH, FGH
edges: $\overline{EF}$, $\overline{EG}$, $\overline{EH}$, $\overline{FG}$, $\overline{FH}$, $\overline{GH}$
vertices: E, F, G, H

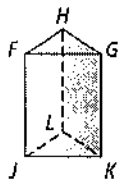
When a plane intersects, or slices, a figure, the resulting figure is called a **cross section**. Figures can be sliced vertically, horizontally, or at an angle.

Vertical Slice	Angled Slice	Horizontal Slice
		
This cross section is a triangle.	This cross section is a trapezoid.	This cross section is a square.

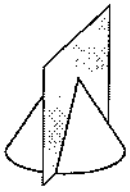
Exercises

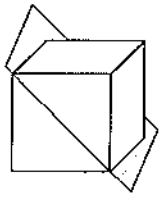
Identify each figure. Name the bases, faces, edges, and vertices.

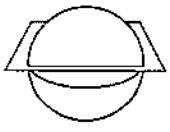
1. 

2. 

Describe the shape resulting from each cross section.

3. 

4. 

5. 

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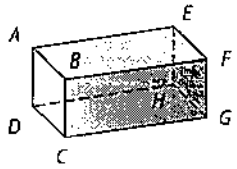
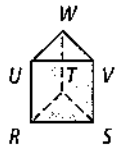
Lesson 4 Homework Practice

Three-Dimensional Figures

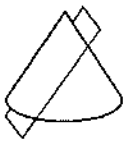
Identify each figure. Name the bases, faces, edges, and vertices.

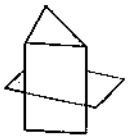
1. 

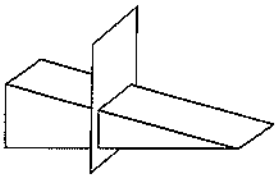
2. 

3. 

Draw and describe the shape resulting from each cross section.

4. 

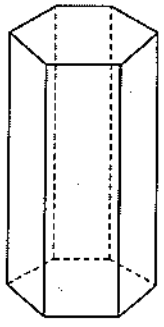
5. 

6. 

7. Miguel has a globe on his shelf. Draw and describe the shape resulting from vertical, angled, and horizontal cross sections of the globe.

vertical **angled** **horizontal**

8. Janie collects rocks and minerals. She bought the beryl crystal shown at the right. Draw the top view and side view. Then draw and describe the shape resulting from an angled cross section of the figure.



top view **side view** **angled cross section**

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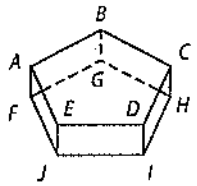
Lesson 4 Problem-Solving Practice

Three-Dimensional Figures

1. The Pentagon in Washington, D.C., is shaped like a pentagonal prism. Use the figure below to identify its bases and faces.

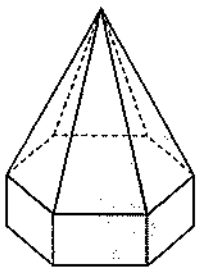


2. Selena saw a model of a teepee at the Natural History Museum.

Name the geometric solid that the teepee resembles. Then draw the top and side views of the teepee.

top view **side view**

3. Deck lights, like the one below, were used to send natural light into the lower decks of sailing ships.



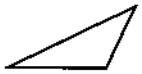
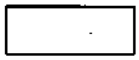
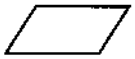
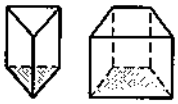
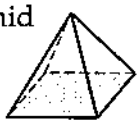
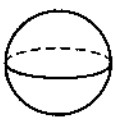
Identify the solid figure that forms the base of the light.

4. Frozen juice concentrate comes in a particular solid. Identify the solid and name four other food products that come in a similarly shaped solid.

5. Dice come in many different shapes. The most common die has six sides. There are also dice with four, eight, twelve, and twenty sides. How many edges do the four-, six-, and eight-sided dice have?

6. Refer to the information in Exercise 5. How many vertices do the four-, six-, and eight-sided dice have?

Formula Reference Sheet

Shape	Formulas for Area (A) and Circumference (C)
Triangle 	$A = \frac{1}{2}bh = \frac{1}{2} \times$ base $\times$ height
Rectangle 	$A = lw =$ length $\times$ width
Trapezoid 	$A = \frac{1}{2}(b_1 + b_2)h = \frac{1}{2} \times$ sum of bases $\times$ height
Parallelogram 	$A = bh =$ base $\times$ height
Circle 	$A = \pi r^2 = \pi \times$ square of radius $C = 2\pi r = 2 \times \pi \times$ radius $C = \pi d = \pi \times$ diameter
Figure	**Formulas for Volume (V) and Surface Area (SA)**
Rectangular Prism 	$V = lwh =$ length $\times$ width $\times$ height $SA = 2lw + 2hw + 2lh$ $=$ 2(length $\times$ width) + 2(height $\times$ width) + 2(length $\times$ height)
General Prisms 	$V = Bh =$ area of base $\times$ height $SA =$ sum of the areas of the faces
Right Circular Cylinder 	$V = Bh =$ area of base $\times$ height $SA = 2B + Ch =$ (2 $\times$ area of base) + (circumference $\times$ height)
Square Pyramid 	$V = \frac{1}{3}Bh = \frac{1}{3} \times$ area of base $\times$ height $SA = B + \frac{1}{2}P\ell$ $=$ area of base + ($\frac{1}{2} \times$ perimeter of base $\times$ slant height)
Right Circular Cone 	$V = \frac{1}{3}Bh = \frac{1}{3} \times$ area of base $\times$ height $SA = B + \frac{1}{2}C\ell =$ area of base + ($\frac{1}{2} \times$ circumference $\times$ slant height)
Sphere 	$V = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \pi \times$ cube of radius $SA = 4\pi r^2 = 4 \times \pi \times$ square of radius

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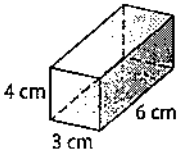
Lesson 5 Reteach

Volume of Prisms

To find the volume V of a prism, use the formula $V = Bh$, where B is the area of the base, and h is the height of the solid.

Example **Find the volume of each figure.**

a.

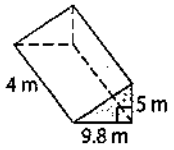


$V = Bh$

$V = (3 \cdot 6)4$

$V = 72$

b.



$V = Bh$

$V = \left(\frac{1}{2} \cdot 9.8 \cdot 5\right) 4$

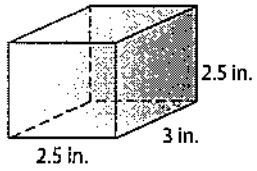
$V = 98$

Figures that are made up of more than one type of figure are called composite figures. You can find the volume of a composite figure by breaking it into smaller components. Then, find the volume of each component and finally add the volumes of the components to find the total volume.

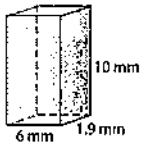
Exercises

Find the volume of each figure.

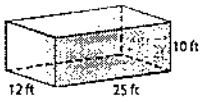
1.



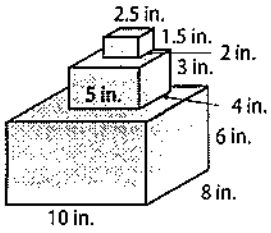
2.



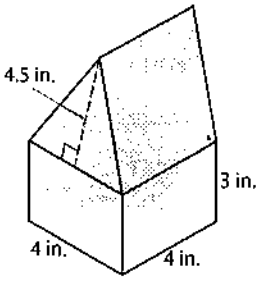
3.



4. Jamie made the tower of gifts shown below. Find the volume of the gifts.



5. Find the volume of the figure below.



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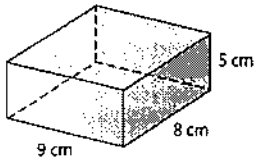
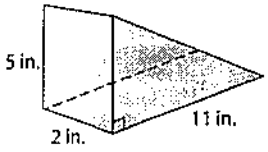
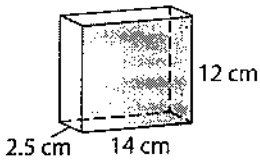
Lesson 5 Homework Practice

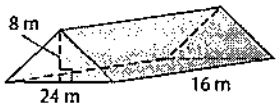
Volume of Prisms

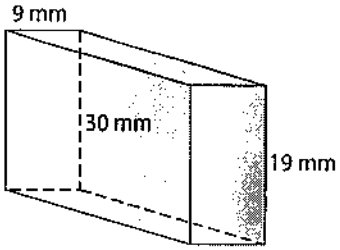
Find the volume of each figure.

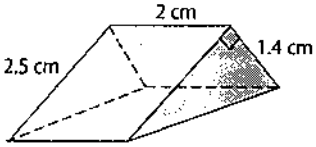
1. 

2. 

3. 

4. 

5. 

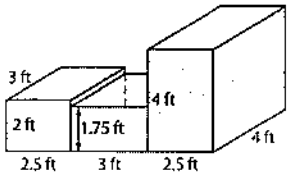
6. 

7. rectangular prism: length 22.5 feet, width 12.5 feet, height 1.2 feet

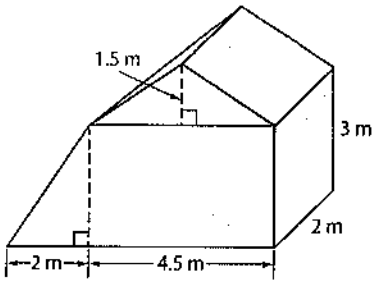
8. triangular prism: base of triangle 17 centimeters, height of triangle 3 centimeters, height of prism 10.2 centimeters

9. Find the height of a rectangular prism with a length of 11 meters, a width of 0.5 meter, and a volume of 23.1 cubic meters

10. Gina and her sister built a fort out of boxes. What is the volume of the fort?



11. Mr. Wilkins is building a shed. The sketch shows the dimensions of the shed. What is the volume of the shed?



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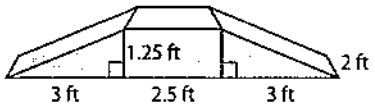
Lesson 5 Problem-Solving Practice

Volume of Prisms

1. Johnson Construction Company is going to build a house on a concrete slab. The slab is to have dimensions 30 feet by 20 feet by 2 feet. How many cubic feet of concrete should the construction company order?

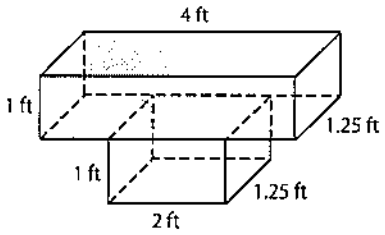
2. Paulo and his mother are building a rectangular compost bin for their garden. They want the bin to have a volume of 64 cubic feet. The width of the bin is 3.2 feet and the length is 5 feet. What should the height of the bin be?

3. The skateboard ramp shown below came in one piece in a crate with a length of 9 feet, a width of 2.5 feet, and a height of 1.5 feet.



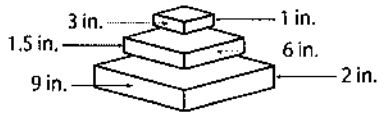
If packaging material was used to fill the remaining space inside the craft, how many cubic feet of packing material was used?

4. Sue is going to build a planter as sketched below. How many cubic feet of dirt will be needed to fill the planter?



5. The town of Old Creek, Oklahoma, has a water reservoir that is shaped like a triangular prism. The area of the triangular surface of the reservoir is 1500 square yards, and the depth is 20 yards. When the reservoir is completely full, how many gallons of water does it hold? (*Hint:* 1 yd^3 holds approximately 202 gallons.)

6. Ricky built a model of a square step pyramid. Find the volume of the pyramid.



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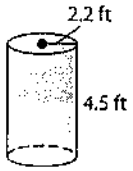
Lesson 6 Reteach

Volume of Cylinders

Just as with prisms, the volume of a cylinder is based on finding the product of the area of the base and the height. The volume V of a cylinder with radius r is the area of the base, πr^2, times the height h, or $V = \pi r^2 h$.

Example 1 **Find the volume of the cylinder.**

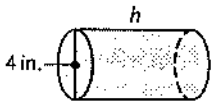
$V = Bh$	Volume of a cylinder.
$V = \pi r^2 h$	Replace B with πr^2.
$= \pi \cdot 2.2^2 \cdot 4.5$	Replace r with 2.2 and h with 4.5.
≈ 68.4	Use a calculator.



The volume is about 68.4 cubic feet.

Example 2 **The volume of a cylinder is 150 cubic inches. Find the height of the cylinder. Round to the nearest whole number.**

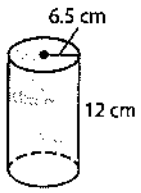
$V = \pi r^2 h$	Volume of a cylinder
$150 = \pi \cdot 2^2 \cdot h$	Replace V with 150 and r with 2.
$12 \approx h$	Use a calculator.

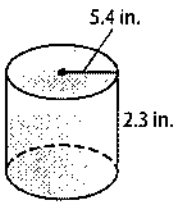


The height is about 12 inches.

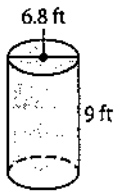
Exercises

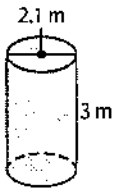
Find the volume of each cylinder. Round to the nearest tenth.

1. 

2. 

3. radius: 1.3 m
height: 3 m

4. 

5. 

6. diameter: 11 cm
height: 6 cm

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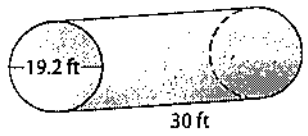
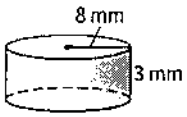
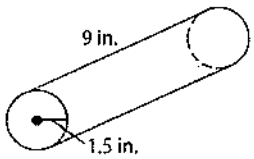
Lesson 6 Homework Practice

Volume of Cylinders

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

1. 

2. 

3. 

4. radius: 2.6 m
height: 8.4 m

5. diameter: 21 ft
height: 13 ft

6. diameter: 4.5 yd
height: 55 yd

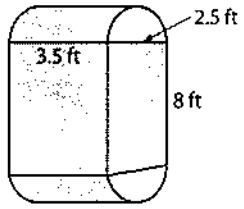
Find the height of each cylinder. Round to the nearest tenth.

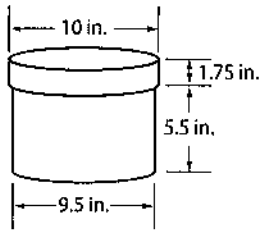
7. radius: 15 ft
volume: 60,052.5 ft^3

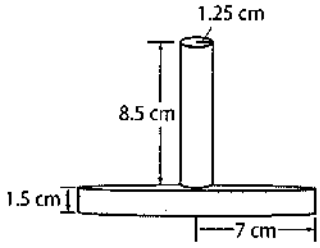
8. diameter: 2.9 cm
volume: 35.6 cm^3

9. diameter: 16 in.
volume: 5425.9 in^3

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

10. 

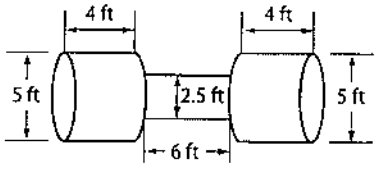
11. 

12. 

13. A pipe has a diameter of 2.5 inches and a length of 15 inches. To the nearest tenth, what is the volume of the pipe?

14. A cube is 8 inches on each side. What is the height of a cylinder having the same volume, if its radius is 4 inches? Round to the nearest tenth.

15. Gary's Gym has a giant dumbbell on the roof of its building. Find the volume of the dumbbell. Round to the nearest tenth.



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Lesson 6 Problem-Solving Practice

Volume of Cylinders

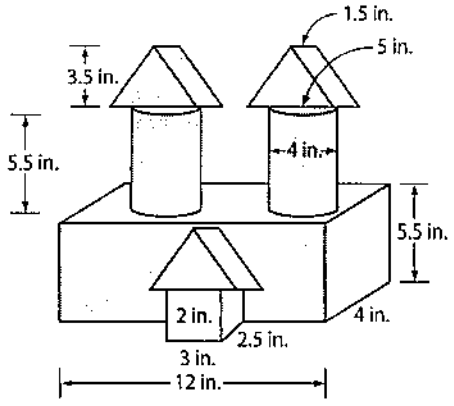
1. Mrs. Washington has a rain barrel with a radius of 1.25 feet and a volume of 15.9 cubic feet. Find the height of the rain barrel to the nearest tenth.

2. The Fresh Chili Company is changing the size of their cans of chili. The new can needs to hold 500 cubic centimeters of chili. The height of the can is to be 11 centimeters. What must the radius of the new can be? Round your answer to the nearest tenth.

3. At Peter's job, he needs to empty wastebaskets. The cylindrically shaped wastebaskets have a height of 3 feet and a diameter of $1\frac{1}{2}$ feet. Peter empties the wastebaskets into a dumpster that is shaped like a rectangular prism. If the dumpster is 8 feet wide, 6 feet deep, and 5 feet tall, how many wastebaskets full of trash will fit in the dumpster?

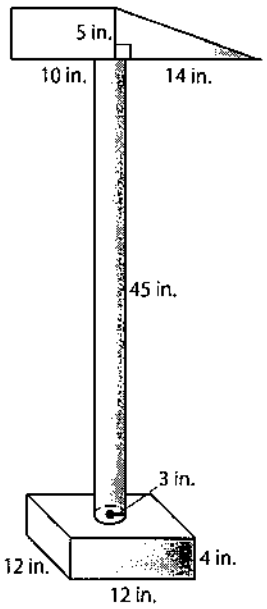
4. Mama Rosa's soup is shipped in boxes with 12 cans to a box. Each can has a diameter of 3.5 inches and a height of 5 inches. Find the volume of 12 cans of Mama Rosa's soup. Round to the nearest tenth.

5. Penny glued together wooden blocks to build the castle shown below. Each triangular prism has the same measurements and each cylinder has the same measurements.



She wants to send the castle to her cousin. She has a box which measures 15 inches long, 8 inches wide, and 15 inches tall. She plans to use popcorn to protect the castle during shipping. What volume of popcorn does Penny need?

6. A school principal ordered a podium for the debate club. Find the volume of the podium.



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Lesson 7 Reteach

Volume of Pyramids, Cones, and Spheres

A pyramid has $\frac{1}{3}$ the volume of a prism with the same base and height. To find the volume V of a pyramid, use the formula $V = \frac{1}{3}Bh$, where B is the area of the base and h is the height of the pyramid.

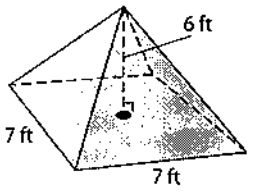
Example 1 **Find the volume of the pyramid.**

$V = \frac{1}{3}Bh$ Volume of a pyramid

$V = \frac{1}{3}(7 \cdot 7 \cdot 6)$ The base is a square, so $B = 7 \cdot 7$. The height of the pyramid is 6 ft.

$V = 98$ Simplify.

The volume is 98 ft^3.



A cone has $\frac{1}{3}$ the volume of a cylinder with the same base and height. To find the volume V of a cone, use the formula $V = \frac{1}{3}\pi r^2 h$, where r is the radius and h is the height of the cone.

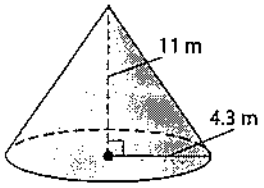
Example 2 **Find the volume of the cone. Round to the nearest tenth.**

$V = \frac{1}{3}\pi r^2 h$ Volume of a cone

$V = \frac{1}{3}\pi(4.3^2) \cdot 11$ Replace r with 4.3 and h with 11.

$V \approx 213.0\ m^3$ Simplify. Round to the nearest tenth.

The volume is about 213.0 m^3.



To find the volume V of a sphere, use the formula $V = \frac{4}{3}\pi r^3$, where r is the radius.

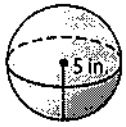
Example 3 **Find the volume of the sphere. Round to the nearest tenth.**

$V = \frac{4}{3}\pi r^3$ Volume of a sphere

$V = \frac{4}{3}\pi(5^3)$ Replace r with 5.

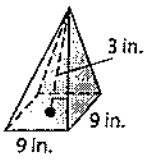
$V \approx 523.6\ in^3$ Simplify.

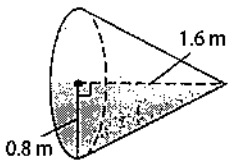
The volume is about 523.6 in^3.

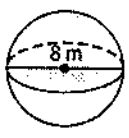


Exercises

Find the volume of each figure. Round to the nearest tenth, if necessary.

1. 

2. 

3. 

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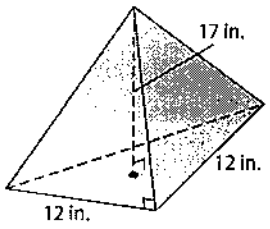
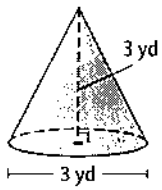
Lesson 7 Homework Practice

Volume of Pyramids, Cones, and Spheres

Find the volume of each figure. Round to the nearest tenth, if necessary.

1. 

2. 

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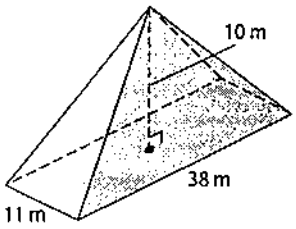
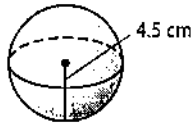
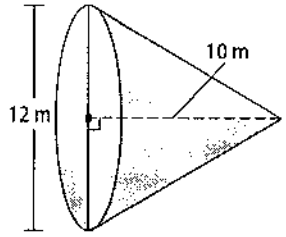
4. 

5. 

6. 

7. Find the volume of a rectangular pyramid with a length of 14 feet, a width of 12 feet, and a height of 9 feet.

8. Find the radius of a sphere with a volume of 972π cm^3.

9. Find the height of a cone with a radius of 12 in. and a volume of 408π in^3.

10. A cone with a diameter of 3 inches has a height of 4 inches. A 2-inch square pyramid is being designed to hold nearly the same amount of ice cream. What will be the height of the square pyramid? Round to the nearest tenth.

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Lesson 7 Problem-Solving Practice

Volume of Pyramids, Cones, and Spheres

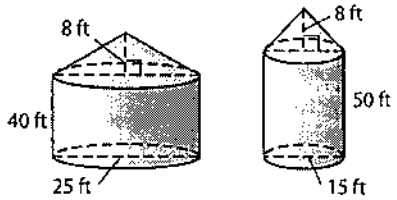
1. Although the Eiffel Tower in Paris is not a solid pyramid, its shape approximates that of a pyramid with a square base measuring 120 feet on a side and a height of 980 feet. If it were a solid pyramid, what would be the Eiffel Tower's volume, in cubic feet?

2. After a snow storm, you and a friend decide to build a snowman. You use three spheres of snow to build the snowman. The bottom sphere has a diameter of 4 feet, the middle has a diameter of 2 feet, and the head has a diameter of 18 inches. What is the volume of the snowman? Round to the nearest whole number.

3. A spherical scoop of ice cream is placed on a waffle cone. The diameter of the ice cream scoop is 6.4 centimeters. The waffle cone has a diameter of 5 centimeters and a height of 9 centimeters. If all the ice cream melts before you eat any, how much of the melted ice cream will overflow the waffle cone? Round to the nearest tenth.

4. The Great Pyramid of Khufu in Egypt has a square base measuring 756 feet on a side and a height of 481 feet. The stones used to build the Great Pyramid were limestone blocks with an average volume of 40 cubic feet. How many of these blocks were needed to construct the Great Pyramid? Round to the nearest whole number.

5. Mr. Mills has just finished his corn harvest. He filled 12 trucks with corn and needs to move the corn to one of the two silos on his farm. Each truck bed is shaped like a rectangular prism having dimensions 10 feet wide, 20 feet long, and 6 feet tall. Mr. Mills needs to fit all the corn in the same silo.



Which silo should Mr. Mills put all of his corn in? How many more full truckloads of corn could he store in the larger silo?

6. A giant soccer ball has a diameter of 40 inches. Find the volume of the soccer ball. Round to the nearest tenth. Then find how long it will take the ball to deflate if it leaks at a rate of 100 cubic inches per hour.

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Lesson 8 Reteach

Surface Area of Prisms

Every prism has two parallel bases. Faces that are *not* bases are called **lateral faces.**

The **lateral area** is the sum of the areas of the lateral faces. The **surface area** is the total area of all the faces, or the sum of the lateral area plus the area of the bases.

To find the lateral area L of a prism with a height h and base with a perimeter P, use the formula $L = Ph$.

To find the surface area S of a prism with a lateral area L and a base area B, use the formula $S = L + 2B$. This can also be written as $S = Ph + 2B$.

Example 1 Find the lateral and surface area of the rectangular prism.

Find the lateral area.

$L = Ph$

$= (2\ell + 2w)h$

$= (2 \cdot 2.1 + 2 \cdot 5.8)2.8$

$= 44.24 \text{ ft}^2$

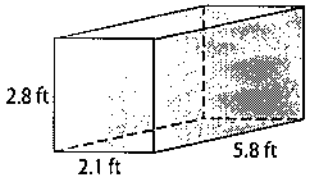
Find the surface area.

$S = L + 2B$

$= L + 2\ell w$

$= 44.24 + 2 \cdot 2.1 \cdot 5.8$

$= 68.6 \text{ ft}^2$



Example 2 Find the lateral and surface area of the triangular prism.

Find the lateral area.

$L = Ph$

$= (5 + 5 + 6)7$

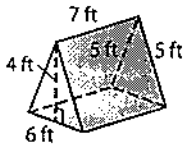
$= 112 \text{ ft}^2$

Find the surface area.

$S = L + 2B$

$= 112 + 2 \cdot \frac{1}{2} \cdot 6 \cdot 4$

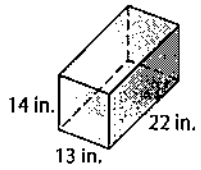
$= 136 \text{ ft}^2$



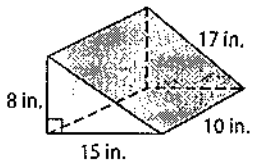
Exercises

Find the lateral and surface area of each prism.

1.



2.



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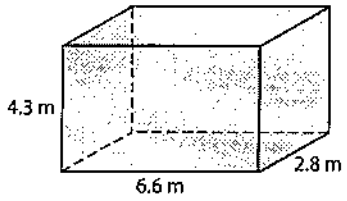

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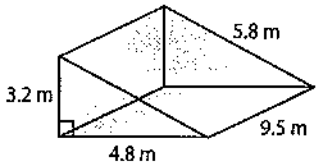

5. cube: side length 8.3 centimeters

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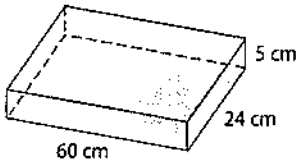
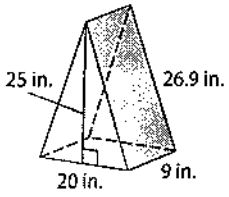
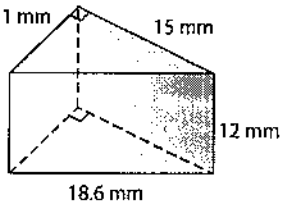
Lesson 8 Homework Practice

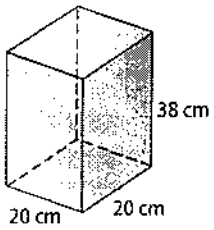
Surface Area of Prisms

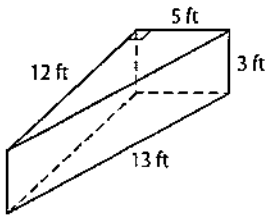
Find the lateral and surface area of each prism.

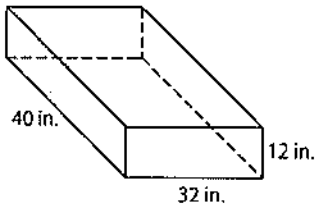
1. 

2. 

3. 

4. 

5. 

6. 

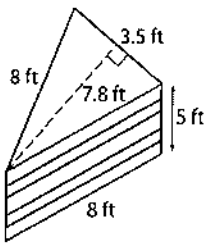
7. rectangular prism: length 10.2 meters, width 8.5 meters, height 9.1 meters

8. rectangular prism: length 15.4 centimeters, width 14.9 centimeters, height 0.8 centimeter

9. rectangular prism: length 28 millimeters, width 25 millimeters, height 32 millimeters

10. A door that is 30 inches wide, 84 inches high, and 1.5 inches thick is to be decoratively wrapped in gift paper. How many square inches of gift paper are needed?

11. The giant slice of cake on the roof of Jolene's Bake Shop needs to be repainted. Before the color can be painted, the entire cake must be painted with primer. Calculate the surface area of the cake. Then determine how many quarts of primer Jolene needs to buy if 1 quart covers about 90 square feet.



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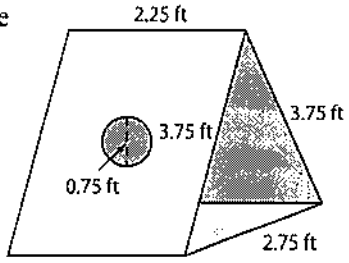
Lesson 8 Problem-Solving Practice

Surface Area of Prisms

1. Ms. Frank is going to wallpaper a living room with dimensions 24 feet long, 18 feet wide, and 8 feet high. What surface area does Ms. Frank plan to wallpaper?

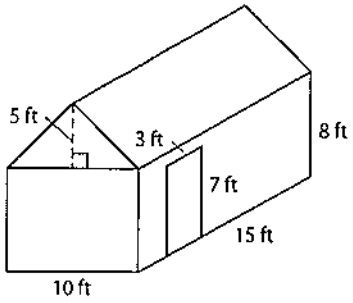
2. A museum curator needs to order a display case for a small artifact. The case needs to be a rectangular prism and made entirely of clear plastic. The bases must each measure $1\frac{1}{2}$ feet by $1\frac{3}{4}$ feet and the sides each 3 feet high. Find the cost of the case if the clear plastic costs \$10 per square foot.

3. The sixth grade is holding a carnival. One class built the beanbag toss game as shown.

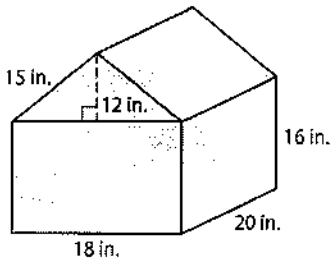


The game is a triangular prism with open sides. The class wants to paint the game with glow-in-the-dark paint. Each bottle of paint covers about 10 square feet and costs \$1.99. To the nearest tenth, what is the area that needs to be painted? How much will it cost to paint?

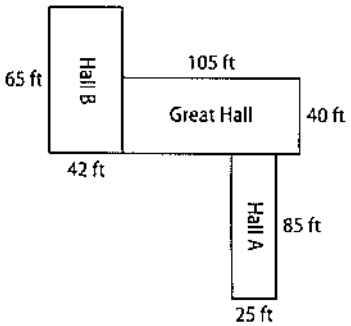
4. The Ramirez family is going to put vinyl siding on a shed. They will cover all four walls completely, except for the door. The siding costs \$3 per square foot. How much will the siding cost for their shed?



5. Lena built a house out of cardboard. The roof is a triangular prism and the main part of the house is a rectangular prism. She wants to paint both parts before gluing them together. Find the amount of paint Lena needs if 1 ounce of paint covers about 400 square inches.



6. The diagram below shows the floor plan of a museum.



The museum wants to repaint each of the three halls shown. The walls in each hall are 15 feet high. Each wall will receive a coat of primer and 2 coats of paint. One gallon covers about 400 square feet. About how many total gallons of primer and paint will need to be purchased?

NAME _____ DATE _____ PERIOD _____

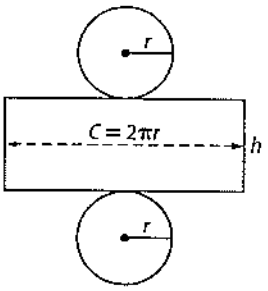
Lesson 9 Reteach

Surface Area of Cylinders

As with a prism, the surface area of a cylinder is the sum of the lateral area and the area of the two bases. If you unroll a cylinder, its net is a rectangle (lateral area) and two circles (bases).

The lateral area L of a cylinder with radius r and height h is the product of the circumference of the base ($2\pi r$) and the height h. This can be expressed by the formula $L = 2\pi rh$.

The surface area S of a cylinder with a lateral area L and a base area B is the sum of the lateral area and the area of the two bases. This can be expressed by the formula $S = L + 2B$ or $S = 2\pi rh + 2\pi r^2$.



Example **Find the lateral and surface area of the cylinder.**

Find the lateral area.

$L = 2\pi rh$

$= 2 \cdot \pi \cdot 3.5 \cdot 5$

$= 35\pi \text{ in}^2$ exact answer

$\approx 110.0 \text{ in}^2$ approximate answer

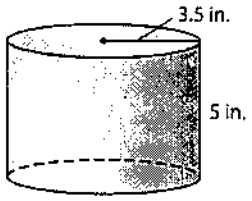
Find the surface area.

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

$= 35\pi + 2\pi(3.5)^2$

$= 59.5\pi \text{ in}^2$

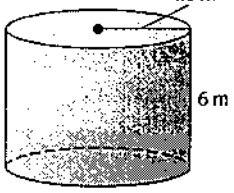
$\approx 186.9 \text{ in}^2$



Exercises

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

1.



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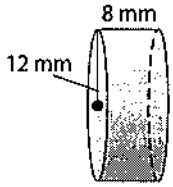

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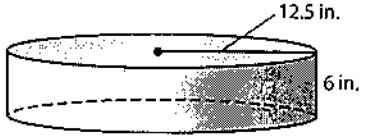

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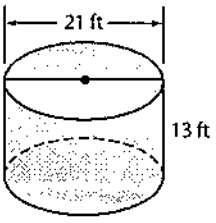

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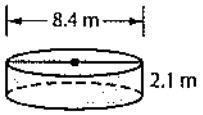
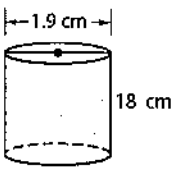


6.



7. diameter of 20 yards and a height of 22 yards

8. radius of 7.6 centimeters and a height of 10.2 centimeters

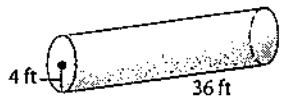
NAME _____ DATE _____ PERIOD _____

Lesson 9 Homework Practice

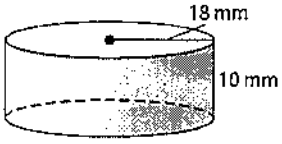
Surface Area of Cylinders

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

1.



2.



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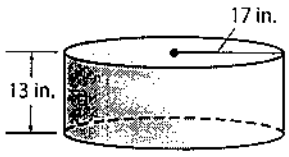

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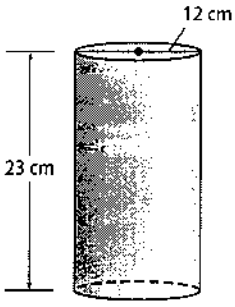

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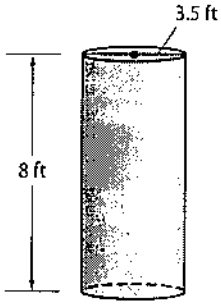
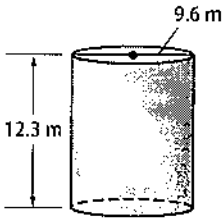


6.



7. radius of 28 millimeters and a height of 32 millimeters

8. diameter of 1.6 feet and a height of 4.2 feet

9. diameter of 25 inches and a height of 18 inches

For Exercises 10 and 11, use the following information. A cardboard shipping container is in the form of a cylinder, with a radius of 6 centimeters and a volume of 8595.4 cubic centimeters.

10. Find the height of the shipping container. Round to the nearest tenth.

11. Find the surface area of the shipping container. Round to the nearest tenth.

12. Mr. Jenkins has cylindrical columns and rectangular prism posts on his front porch. Both have a height of 3.5 feet. The columns have a radius of 0.5 foot. The prisms have a length and width of 1.25 feet. There are 4 columns and 2 posts. Mr. Jenkins wants to paint the lateral areas of all the columns and posts. How many square feet does Mr. Jenkins have to paint? If Mr. Jenkins can paint about 30 square feet an hour, approximately how long will it take him to complete the work?

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Lesson 9 Problem-Solving Practice

Surface Area of Cylinders

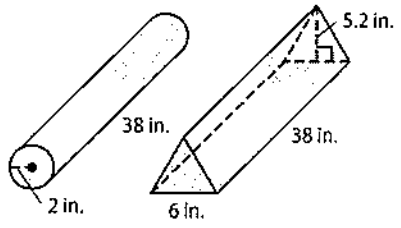
1. The Acme Canning Company produces cans for chicken soup. If each can has a diameter of 2 inches and a height of $3\frac{1}{4}$ inches, how much aluminum is needed to make one can? Round to the nearest hundredth.

2. A factory makes plastic barrels. The barrels have a diameter of 2.25 feet and a height of 3 feet. The plastic used to make them costs \$2.60 per square foot. What would be the cost of the plastic to make 10 barrels?

3. A farmer has a silo that has a volume of 2491.6 cubic feet. The silo is 24 feet tall. Find the surface area of the silo. Round to the nearest tenth.

4. Rachel has a can with a diameter of 3 inches and a height of 5.75 inches. She has another can with a diameter of 5 inches and a height of 3.25 inches. Which can has the greater surface area? Explain.

5. FPS, a shipping company, uses a container in the shape of a triangular prism to pack blueprints, posters, and other items that can be rolled up to fit inside the container. Packages-R-Us uses a container shaped like a cylinder for the same purposes. The cardboard used to make each container costs the same amount per square inch.



If each company buys 100 of these packages, which company will spend less money per package? Explain.

6. James is wrapping pipes in insulation. One pipe has a radius of 1.5 inches and a height of 30 inches. The other pipe has a radius of 3 inches and a height of 12.5 inches. Which pipe needs more insulation? Explain.

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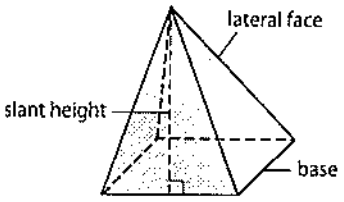
Lesson 10 Reteach

Surface Area of Pyramids and Cones

Regular pyramids have bases which are a regular polygon and lateral faces which are congruent isosceles triangles. The height of each lateral face is called the **slant height** of the pyramid.

The lateral area L of a regular pyramid is half the perimeter P of the base times the slant height ℓ or $L = \frac{1}{2}P\ell$. The total surface area S of a regular pyramid is the lateral area L plus the area of the base B or $S = L + B$, or $S = \frac{1}{2}P\ell + B$.



Example

Find the lateral and total surface area of the square pyramid.

Find the lateral area.

$L = \frac{1}{2}P\ell$ Write the formula.

$= \frac{1}{2}(3 \cdot 4)4.5$ Replace P with $3 \cdot 4$ and ℓ with 4.5.

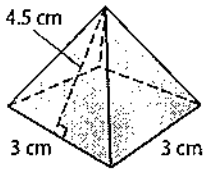
$= 27 \text{ cm}^2$ Simplify.

Find the surface area.

$S = L + B$ Write the formula.

$= 27 + (3 \cdot 3)$ Replace L with 27 and B with $3 \cdot 3$.

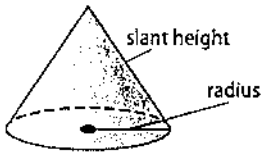
$= 36 \text{ cm}^2$ Simplify.



The lateral surface area is 27 cm^2, and the total surface area is 36 cm^2.

The lateral area L of a cone is the product of π, the radius r, and the slant height ℓ. This can be represented by the formula $L = \pi r\ell$.

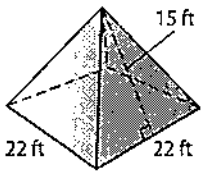
The surface area S of a cone is the lateral area L plus the area of the base or πr^2. This can be represented by the formula $S = L + \pi r^2$, or $S = \pi r\ell + \pi r^2$.



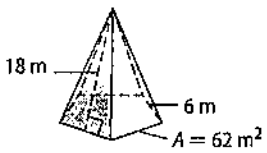
Exercises

Find the lateral and surface area of each figure. Round to the nearest tenth.

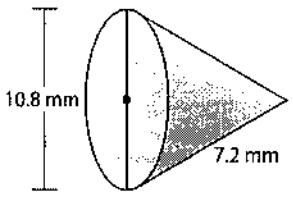
1.



2.



3.



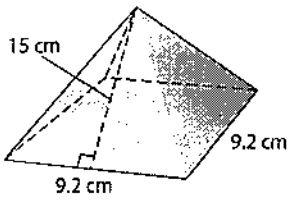
NAME _____ DATE _____ PERIOD _____

Lesson 10 Homework Practice

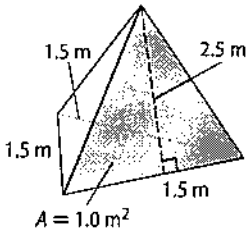
Surface Area of Pyramids and Cones

Find the lateral and surface area of each figure. Round to the nearest tenth.

1.



2.



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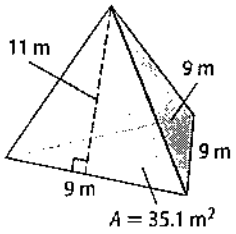

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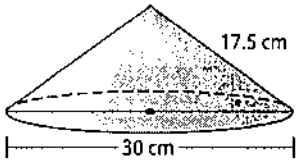

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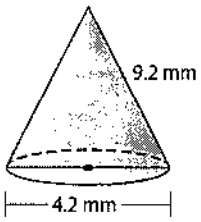

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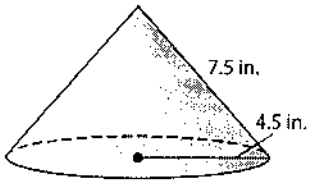
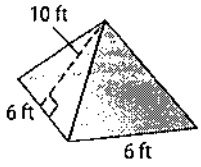
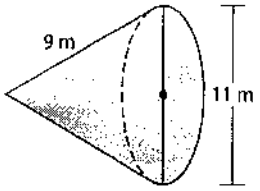


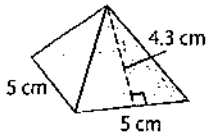
7.



8.



9.



10. square pyramid: base side length 8.4 inches, slant height 8.4 inches

11. cone: radius 9 feet, slant height 22 feet

12. cone: diameter 26 centimeters, slant height 15 centimeters

13. A wooden structure at a miniature golf course is a square pyramid whose base is 5 feet on each side. The slant height is 4.75 feet. Find the lateral area to be painted.

14. A cone-shaped icicle on a gingerbread house will be dipped in frosting. The icicle is 1 centimeter in diameter and the slant height is 7 centimeters. What is its total surface area?

15. The Great Pyramid in Egypt was built for the Pharaoh Khufu. The base of each side is 230 meters. The height from the base along the face to the top is 187 meters. Find the total surface area.

NAME_____ DATE _____ PERIOD _____

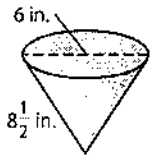
Lesson 10 Problem-Solving Practice

Surface Area of Pyramids and Cones

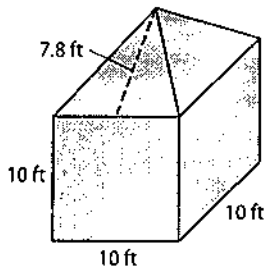
1. The Goodtime Company needs to make paper hats to use for special events. The paper hats are in the shape of a cone. The radius of the cone is 8 centimeters and the slant height is 20 centimeters. How many square centimeters of paper are needed to make each hat? Round to the nearest tenth.

2. Ryan is trying to build a teepee for a school project on Native Americans. Teepees are approximately the shape of a cone. Ryan has 290 square feet of canvas to make the teepee. If the diameter is to be 12 feet, what will the slant height be if he uses all the canvas? (*Hint*: There is no floor on the teepee.)

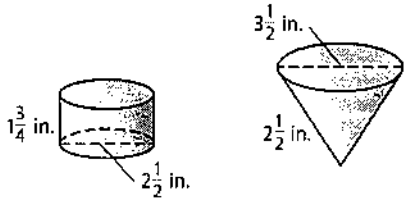
3. Audrey uses a metal scoop to measure the correct amount of food to give to her horse. The scoop is shaped like a cone, and its dimensions are shown below. How much metal was used to make the scoop? Round to the nearest tenth.



4. A water storage tank has a roof that is shaped like a square pyramid. What is the surface area of the water tank?



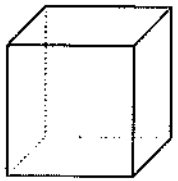
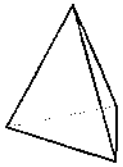
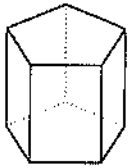
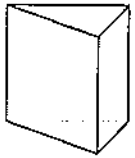
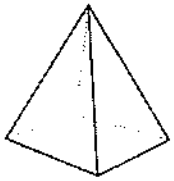
5. The SmileTime Ice Cream Co. is going to begin selling their ice cream in cardboard cones instead of cylindrically-shaped cups. (Note: There is no top on either container.)



What is the surface area of each container? Round your answer to the nearest tenth.

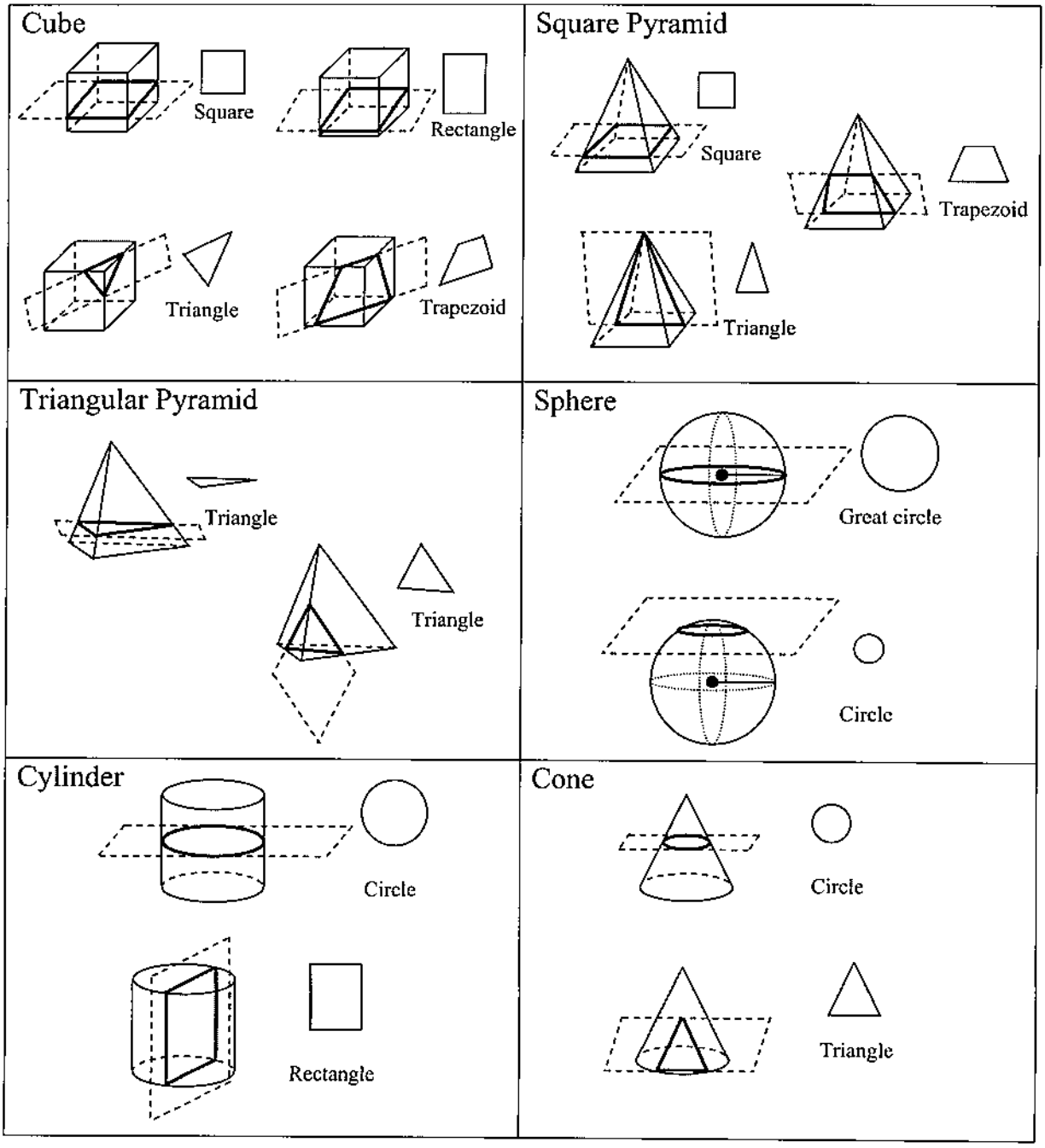
6. Refer to the diagrams in Exercise 5. If the paper costs 90¢ per square foot, how much does SmileTime Ice Cream Company save for every 100 cups they buy?

Name _____ **Directions: Answer the questions for each of the solid figures below.**

	What is the name of the solid?	Which figure is the base of the solid?	How many faces does it have?	Which figure results when you slice it parallel to the base?	Which figure results when you slice it perpendicular to the base?	Which figure results when you slice it diagonal to the base?
						
						
						
						
						
						

Don't Be Cross With Me

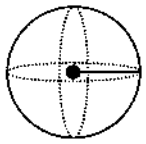
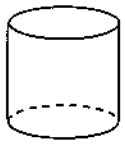
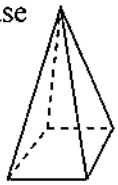
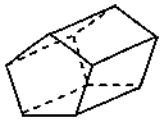
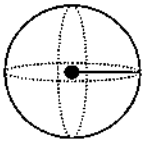
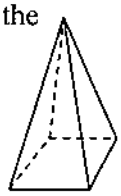
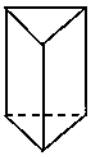
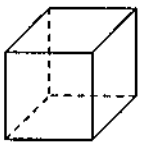
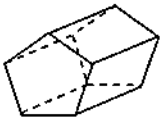
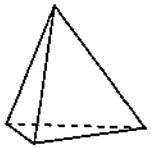
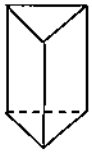
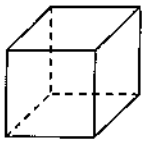
The cross section of a three-dimensional figure shows the intersection of the three-dimensional figure with a plane.



Name _____

Why Did the Plane Cross the Figure?

Directions: *Sketch and state the figure that is the cross section described for the given figure and the stated plane.*

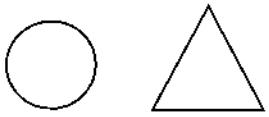
1. Passing through the center 	2. Parallel to the base 	3. Parallel to the base 
4. Parallel to the base 	5. Parallel to the base (the pentagon is the base) 	6. Passing through the top with a horizontal plane 
7. Perpendicular to the base passing through the vertex 	8. Perpendicular to the base 	9. Perpendicular to the base passing through the vertex 
10. Parallel to the base 	11. Parallel to the base 	12. Perpendicualr to the base (the pentagon is the base) 
13. Parallel to the base 	14. Perpendicular to the base 	15. At an angle with the base and passes through both the front and back sides of the figure 

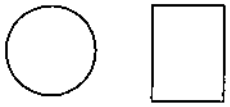
Name _____

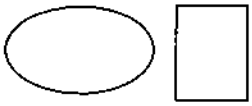
Cross Sectional

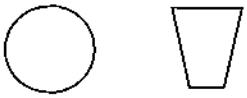
Directions: *Read each problem carefully. Solve each problem and show your work. Then choose the correct answer from the list of choices. If no answer choices are available, write your answer in the space provided.*

1. Which of the following could represent cross sections of a cylinder?

A. 

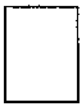
B. 

C. 

D. 

2. Which of the following shapes shows a cross section of a triangular prism that is perpendicular to the base?

A. 

B. 

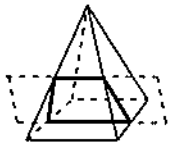
C. 

D. 

3. Which of the following figures does not have a triangular cross section?

   A. A square pyramid
   B. A cone
   C. A rectangular prism
   D. A cylinder

4. A plane intersects a square pyramid at an angle oblique to its base. What describes the shape of the cross section that is produced?



   A. square
   B. trapezoid
   C. triangle
   D. rectangle

5. Which of the following shows a cross section that is parallel to the base of a pentagonal prism?

   A. 

   B. 

   C. 

   D. 

6. Which of the following are possible cross sections of a cube?

   I. Square
   II. Rectangle
   III. Trapezoid

   A. I only
   B. I and II only
   C. II and III only
   D. I, II, and III

7. Which of the following is a cross section that is parallel to the base of a cone?

A. 

B. 

C. 

D. 

8. All the following correctly identify a correct cross section for a square pyramid except for which one?

A. Square if it is parallel to the base
B. Square if it is perpendicular to the base
C. Triangle if it is perpendicular to the base
D. Triangle if it intersects the base at an angle that is not perpendicular

9. Sketch a cross section that is perpendicular to the base of a cylinder and a cross section that is parallel to the base of a cylinder.

NOTES SECTION:

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