Geometry 1-2 Volume	**UNIT 10**	Name:______________________ Teacher: ____________ Per:___

My academic goal for this unit is...

Check for Understanding Key:

- ● Understanding at start of the unit
- | Understanding after practice
- ▲ Understanding before unit test

LEARNING TARGETS		How is my understanding?	Test Score	Retake?
10a	I can classify 3D figures and identify their parts.	1 2 3 4		
10b	I can calculate volume of prisms and cylinders.	1 2 3 4		
10c	I can calculate volume of pyramids and cones.	1 2 3 4		
10d	I can calculate the surface area and volume of a sphere.	1 2 3 4		
10e	I can use volume and displacement to calculate density.	1 2 3 4		
10f	I can calculate new <u>surface area</u> and <u>volume</u> given a similarity ratio (scale factor).	1 2 3 4		

Why do boats float?

What is you favorite 3D shape? Can you sketch it?.

DP/1 **Developing Proficiency** Not yet, Insufficient	CP/2 **Close to Proficient** Yes, but..., Minimal	PR/3 **Proficient** Yes, Satisfactory	HP/4 **Highly Proficient** WOW, Excellent
I can't do it and am not able to explain process or key points	I can sort of do it and am able to show process, but not able to identify/explain key math points	I can do it and able to both explain process and identify/explain math points	I'm great at doing it and am able to explain key math points accurately in a variety of problems

Unit 10 Conjectures

Title	***Conjecture***	***Diagram***
Conjecture A	If B is the area of the base of a right rectangular prism and h is the height of the solid, then the formula for the volume is V = ________.	
Conjecture B	If B is the area of the base of a right prism (or cylinder) prism and h is the height of the solid, then the formula for the volume is V = _________.	
Conjecture C	The volume of an oblique prism (or cylinder) is the same as the volume of a right prism (or cylinder) that has the same ______________ and the same _________________.	
Prism-Cylinder Volume Conjecture	The volume of a prism or a cylinder is the ____________________ multiplied by the ____________________.	
Pyramid-Cone Volume Conjecture	If B is the area of the base of a pyramid or a cone and h is the height of the solid, then the formula for the volume is ____________.	
Sphere Volume Conjecture	The volume of a sphere with radius r is given by the formula __________________.	
Sphere Surface Area Conjecture	The surface area of a sphere with radius r is given by the formula ___________________.	

Additional Notes:

Notes

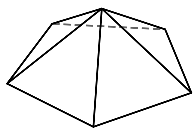
Notes

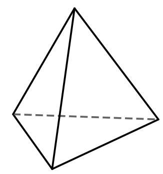
Name: ________________________________

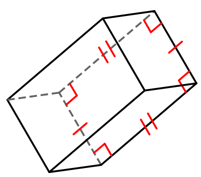
Practice: Naming Solid Figures

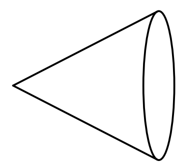
Date: ____________________ Period: ______

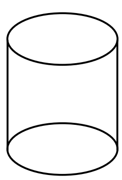
Name each figure.

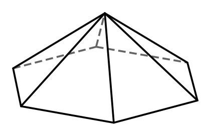
1) 

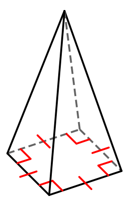
2) 

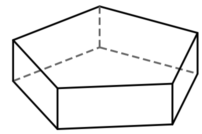
3) 

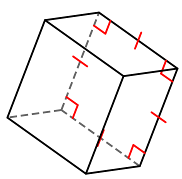
4) 

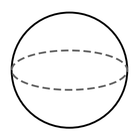
5) 

6) 

7) 

8) 

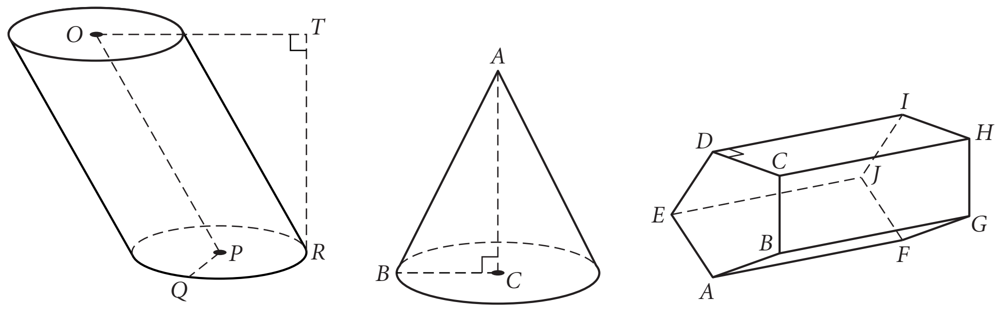
9) 

10) 

Lesson 10.1 • The Geometry of Solids

Name ________________________ **Period** __________ **Date** ______________

For Exercises 1–14, refer to the figures below.



1. The cylinder is (oblique, right).

2. $\overline{OP}$ is ________________ of the cylinder.

3. $\overline{TR}$ is ________________ of the cylinder.

4. Circles O and P are ________________ of the cylinder.

5. $\overline{PQ}$ is ________________ of the cylinder.

6. The cone is (oblique, right).

7. Name the base of the cone.

8. Name the vertex of the cone.

9. Name the altitude of the cone.

10. Name a radius of the cone.

11. Name the type of prism.

12. Name the bases of the prism.

13. Name all lateral edges of the prism.

14. Name an altitude of the prism.

In Exercises 15–17, tell whether each statement is true or false. If the statement is false, give a counterexample or explain why it is false.

15. The axis of a cylinder is perpendicular to the base.

16. A rectangular prism has four faces.

17. The bases of a trapezoidal prism are trapezoids.

For Exercises 18 and 19, draw and label each solid. Use dashed lines to show the hidden edges.

18. A right triangular prism with height equal to the hypotenuse

19. An oblique trapezoidal pyramid

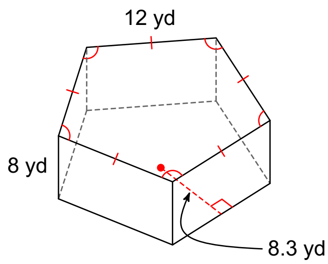
Geometry 1-2 Name: ______________________

Practice: Volume - Prisms & Cylinders

Date: ________________ Period: ______

Find the volume of each figure. Round your answers to the nearest hundredth, if necessary. Leave your answers in terms of π for answers that contain π.

1)



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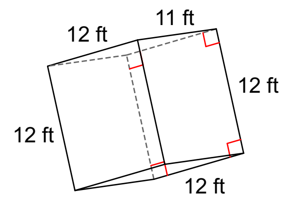

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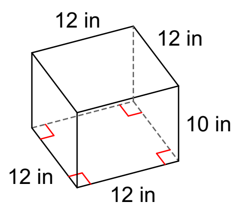

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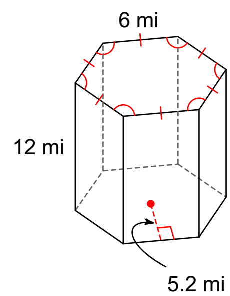

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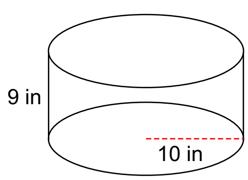

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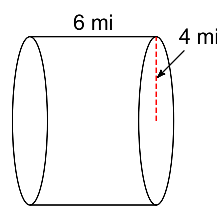

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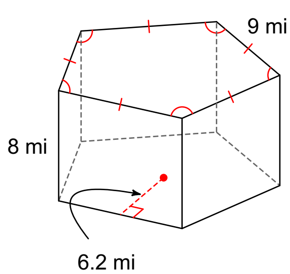

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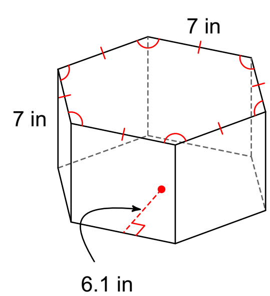

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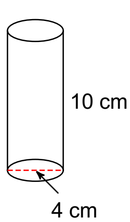

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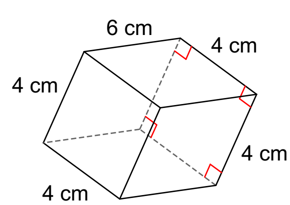
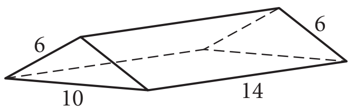


Lesson 10.2 • Volume of Prisms and Cylinders

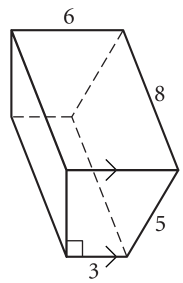
Name ________________________________ **Period** __________ **Date** ____________

In Exercises 1–3, find the volume of each prism or cylinder. All measurements are in centimeters. Round your answers to the nearest 0.01.

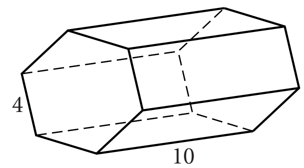
1. Right triangular prism



2. Right trapezoidal prism

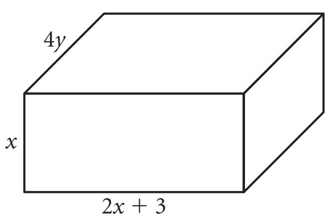


3. Regular hexagonal prism

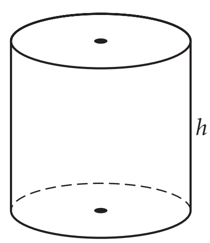


In Exercises 4–6, use algebra to express the volume of each solid.

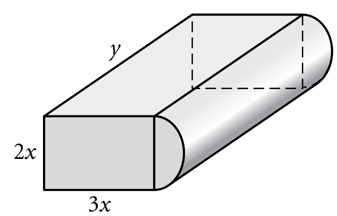
4. Right rectangular prism



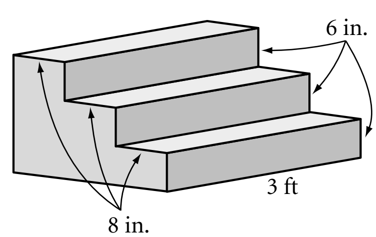
5. Right cylinder; base circumference $= p\pi$



6. Right rectangular prism and half of a cylinder



7. You need to build a set of solid cement steps for the entrance to your new house. How many cubic feet of cement do you need?



Geometry 1-2 Name: ____________________

Practice: Pyramids and Cones

Date: ________________ Period: ______

Find the volume of each figure. Round your answers to the nearest hundredth, if necessary.

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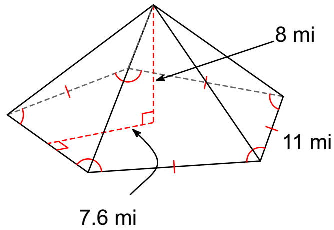

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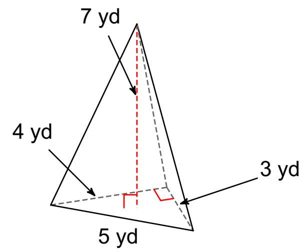

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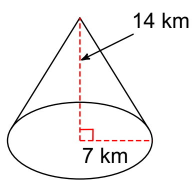

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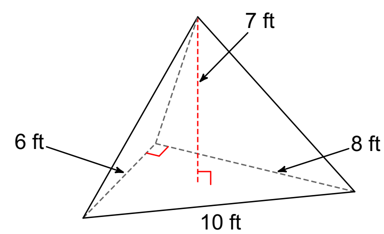

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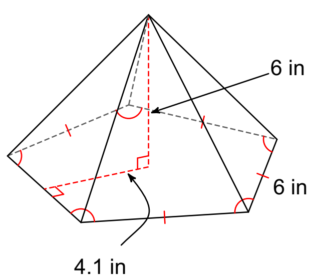

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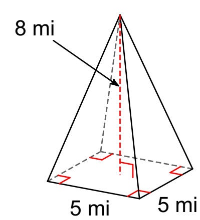

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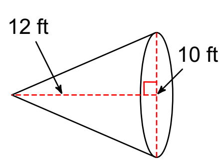

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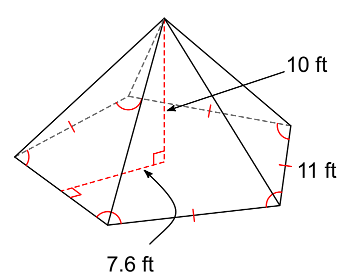

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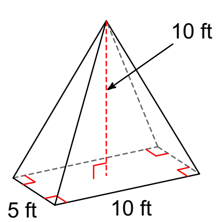

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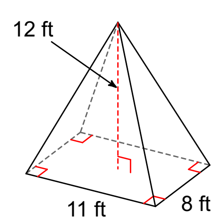
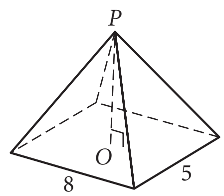


Lesson 10.3 • Volume of Pyramids and Cones

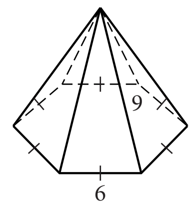
Name ______________________________ **Period** __________ **Date** ______________

In Exercises 1–3, find the volume of each solid. All measurements are in centimeters. Round your answers to two decimal places.

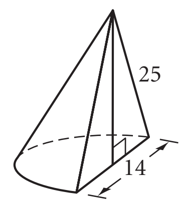
1. Rectangular pyramid; $OP = 6$



2. Right hexagonal pyramid

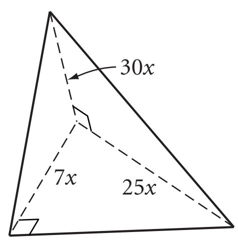


3. Half of a right cone



In Exercises 4–6, use algebra to express the volume of each solid.

4.



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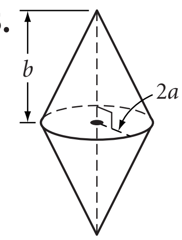
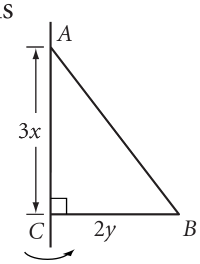
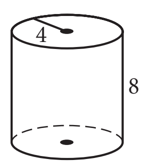


6. The solid generated by spinning $\triangle ABC$ about the axis

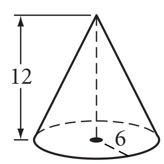


In Exercises 7–9, find the volume of each figure and tell which volume is larger.

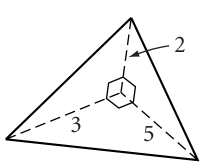
7. **A.**



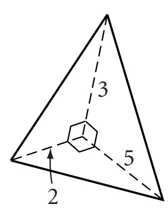
B.



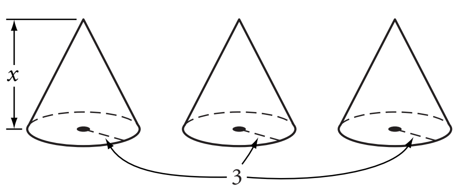
8. **A.**



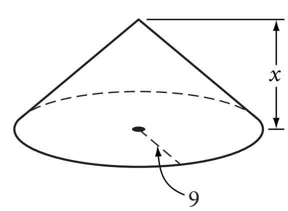
B.



9. **A.**



B.



Lesson 10.4 • Volume Problems

Name ______________________________ **Period** __________ **Date** ______________

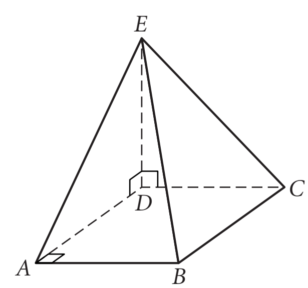
1. A cone has volume 320 cm^3 and height 16 cm. Find the radius of the base. Round your answer to the nearest 0.1 cm.

2. How many cubic inches are there in one cubic foot? Use your answer to help you with Exercises 3 and 4.

3. Jerry is packing cylindrical cans with diameter 6 in. and height 10 in. tightly into a box that measures 3 ft by 2 ft by 1 ft. All rows must contain the same number of cans. The cans can touch each other. He then fills all the empty space in the box with packing foam. How many cans can Jerry pack in one box? Find the volume of packing foam he uses. What percentage of the box's volume is filled by the foam?

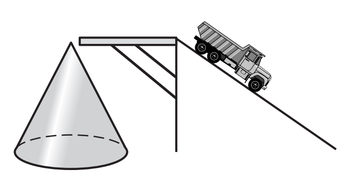
4. A king-size waterbed mattress measures 72 in. by 84 in. by 9 in. Water weighs 62.4 pounds per cubic foot. An empty mattress weighs 35 pounds. How much does a full mattress weigh?

5. Square pyramid *ABCDE*, shown at right, is cut out of a cube with base *ABCD* and shared edge $\overline{DE}$. $AB = 2$ cm. Find the volume and surface area of the pyramid.



6. In Dingwall the town engineers have contracted for a new water storage tank. The tank is cylindrical with a base 25 ft in diameter and a height of 30 ft. One cubic foot holds about 7.5 gallons of water. About how many gallons will the new storage tank hold?

7. The North County Sand and Gravel Company stockpiles sand to use on the icy roads in the northern rural counties of the state. Sand is brought in by tandem trailers that carry 12 m^3 each. The engineers know that when the pile of sand, which is in the shape of a cone, is 17 m across and 9 m high they will have enough for a normal winter. How many truckloads are needed to build the pile?

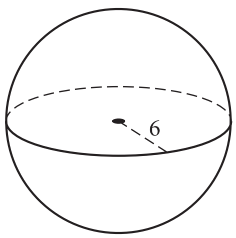


Lesson 10.6 • Volume of a Sphere

Name ______________________________ Period ________ Date ____________

In Exercises 1–6, find the volume of each solid. All measurements are in centimeters. Write your answers in exact form and rounded to the nearest 0.1 cm^3.

1.



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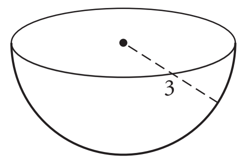

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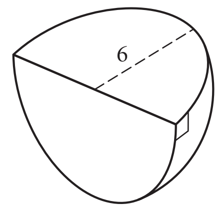

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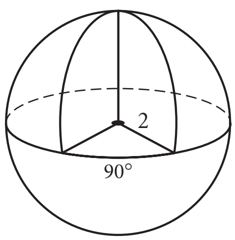

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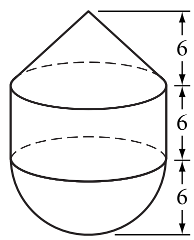
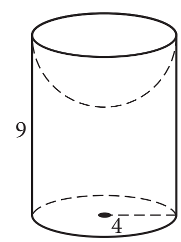


6. Cylinder with hemisphere taken out of the top



7. A sphere has volume $221\frac{5}{6}\pi$ cm^3. What is its diameter?

8. The area of the base of a hemisphere is 225π in^2. What is its volume?

9. Eight wooden spheres with radii 3 in. are packed snugly into a square box 12 in. on one side. The remaining space is filled with packing beads. What is the volume occupied by the packing beads? What percentage of the volume of the box is filled with beads?

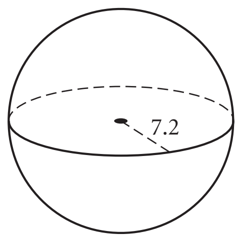
10. The radius of Earth is about 6378 km, and the radius of Mercury is about 2440 km. About how many times greater is the volume of Earth than that of Mercury?

Lesson 10.7 • Surface Area of a Sphere

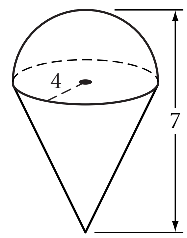
Name ______________________ **Period** ________ **Date** ____________

In Exercises 1–4, find the volume and total surface area of each solid. All measurements are in centimeters. Round your answers to the nearest 0.1 cm.

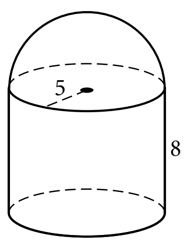
1.



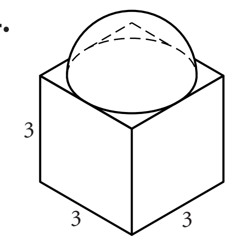
2.



3.



4.



5. If the surface area of a sphere is 48.3 cm^2, find its diameter.

6. If the volume of a sphere is 635 cm^3, find its surface area.

7. Lobster fishers in Maine often use spherical buoys to mark their lobster traps. Every year the buoys must be repainted. An average buoy has a 12 in. diameter, and an average fisher has about 500 buoys. A quart of marine paint covers 175 ft^2. How many quarts of paint does an average fisher need each year?

Lesson 10.5 • Displacement and Density

Name ______________________ **Period** __________ **Date** ____________

1. A stone is placed in a 5 cm-diameter graduated cylinder, causing the water level in the cylinder to rise 2.7 cm. What is the volume of the stone?

2. A 141 g steel marble is submerged in a rectangular prism with base 5 cm by 6 cm. The water rises 0.6 cm. What is the density of the steel?

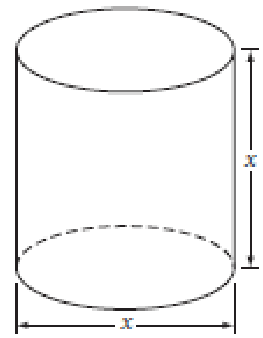
3. A solid wood toy boat with a mass of 325 g raises the water level of a 50 cm-by-40 cm aquarium 0.3 cm. What is the density of the wood?

4. For Awards Night at Baddeck High School, the math club is designing small solid silver pyramids. The base of the pyramids will be a 2 in.-by-2 in. square. The pyramids should not weigh more than $2\frac{1}{2}$ pounds. One cubic foot of silver weighs 655 pounds. What is the maximum height of the pyramids?

5. While he hikes in the Gold Country of northern California, Sid dreams about the adventurers that walked the same trails years ago. He suddenly kicks a small bright yellowish nugget. Could it be gold? Sid quickly makes a balance scale using his walking stick and finds that the nugget has the same mass as the uneaten half of his 330 g nutrition bar. He then drops the stone into his water bottle, which has a 2.5 cm radius, and notes that the water level goes up 0.9 cm. Has Sid struck gold? Explain your reasoning. (Refer to the density chart in Lesson 10.5 in your book.)

Unit 10 • Challenge Problems

1. (*Target 10b*)
   A can with equal diameter and height is called a "square" can because it looks like a square when viewed from the side.

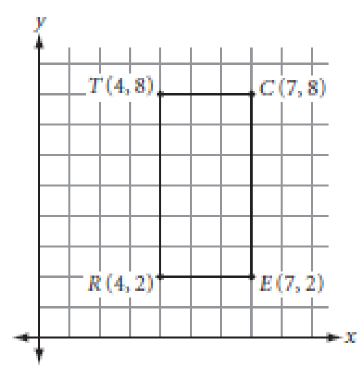
   a. Find the volume and surface area of a square can with height x.

   b. Sketch and label the dimensions of another can with the same volume that is not a square can.

   c. Find the surface area of your second can.

   d. Which of the two cans with equal volume has less surface area?

1. (*Target 10b*)
   Use rectangle RECT for this problem. Show all your work. Include sketches with each part.

   a. Sketch the solid generated by revolving RECT about the y-axis. Calculate the volume of the solid.

   b. Find the center of rectangle RECT.

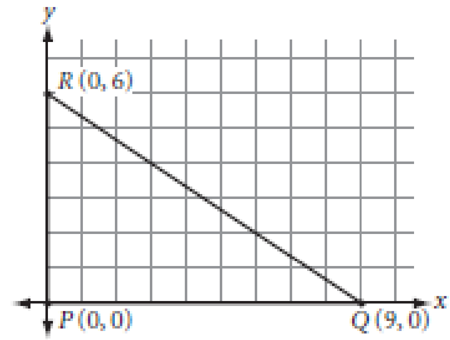
   c. Find the circumference of the circle generated by the center (from part b) as RECT revolves about the y-axis.

   d. Multiply the circumference (from part c) by the area of RECT. How does the result compare with the volume you found in part a?

Unit 10 • Challenge Problems

2. (*Target 10c*)
   Consider ΔPQR. Show all your work in each part.

   a. Sketch the solid generated by rotating ΔPQR about the y-axis. Find the volume of the solid.

   b. Find the coordinates of the centroid (center of mass) of ΔPQR. Explain the steps you followed to find the centroid.

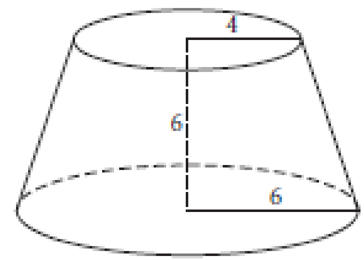
   c. Find the distance the centroid travels as ΔPQR rotates about the y-axis.

   d. Multiply the area of ΔPQR by the distance in part c. How does the result compare with the volume you found in part a?

3. (*Target 10c*)
   A solid block of steel sinks in water because its density (7.85 g/cm3) is greater than that of water (1 g/cm3). Ships can be made from steel because an object will float if the mass of the water it displaces is greater than the mass of the object. Design a V-shaped ship's hull (a triangular prism with one lateral face missing) made out of 50 kg of steel that will just barely float. Assume you can roll the steel into sheets as thin as you like. Explain your thinking.

Unit 10 • Challenge Problems

4. (*Targets 10c*)
   The frustum of a right cone has bases with radii 4 units and 6 units and height 6 units.
   a. Sketch and label the section formed by slicing the frustum through the centers of both bases.



   b. Carefully draw the section from part a on a coordinate plane. Place the center of the larger base at the origin and the center of the other base on the positive y-axis. Label the coordinates of the vertices.
   c. Extend one of the lateral sides of the section and find where it crosses the y-axis.
   d. Use the information from part c to find the volume of the frustum. Explain your method.

5. (*Target 10b & 10c*)
   The High Country Tent Company wants to produce a tent that provides adequate interior space for moving around and sleeping but uses a minimum amount of material. High Country has determined that the tent needs 60 ft^3 of space. They are considering three possible designs:
   a. A hemisphere tent
   b. A tent shaped like a triangular prism. The floor of the tent would be a rectangle witH dimensions 4 ft by 6 ft. The two triangular ends would be isosceles triangles with base length 4 ft.
   c. A square pyramid tent with height 5 ft.
      i. Find the total surface area of each tent to the nearest 0.1 ft^2. Also, find the height of the tallest person who can sleep stretched out in each tent. Show and explain your work.
      ii. Which tent do you think the company should produce? Why?

LESSON 10.1 • The Geometry of Solids

1. oblique **2.** the axis **3.** the altitude

4. bases **5.** a radius **6.** right

7. Circle *C* **8.** *A* **9.** $\overline{AC}$ or *AC*

10. $\overline{BC}$ or *BC* **11.** Right pentagonal prism

12. *ABCDE* and *FGHIJ*

13. $\overline{AF}$, $\overline{BG}$, $\overline{CH}$, $\overline{DI}$, $\overline{EJ}$

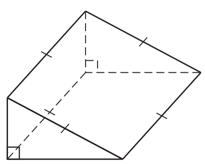
14. Any of $\overline{AF}$, $\overline{BG}$, $\overline{CH}$, $\overline{DI}$, $\overline{EJ}$ or their lengths

15. False. The axis is not perpendicular to the base in an oblique cylinder.

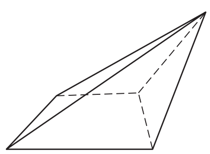
16. False. A rectangular prism has six faces. Four are called lateral faces and two are called bases.

17. True

18.



19.



LESSON 10.2 • Volume of Prisms and Cylinders

1. 232.16 cm^3 **2.** 144 cm^3

3. 415.69 cm^3

4. $V = 4xy(2x + 3)$, or $8x^2y + 12xy$

5. $V = \frac{1}{4}p^2h\pi$ **6.** $V = \left(6 + \frac{1}{2}\pi\right)x^2y$

7. 6 ft^3

LESSON 10.3 • Volume of Pyramids and Cones

1. 80 cm^3 **2.** 209.14 cm^3 **3.** 615.75 cm^3

4. $V = 840x^3$ **5.** $V = \frac{8}{3}\pi a^2b$ **6.** $V = 4\pi xy^2$

7. **A:** 128π cubic units, **B:** 144π cubic units. **B** is larger.

8. **A:** 5 cubic units, **B:** 5 cubic units. They have equal volumes.

9. **A:** $9\pi x$ cubic units, **B:** $27\pi x$ cubic units. **B** is larger.

LESSON 10.4 • Volume Problems

1. 4.4 cm **2.** 1728 in^3

3. 24 cans; 3582 in^3 = 2.07 ft^3; 34.6%

4. 2000.6 lb (about 1 ton)

5. Note that $\overline{AE} \perp \overline{AB}$ and $\overline{EC} \perp \overline{BC}$. $V = \frac{8}{3}$ cm^3; $SA = (8 + 4\sqrt{2})$ $cm^2 \approx 13.7$ cm^2

6. About 110,447 gallons

7. 57 truckloads

LESSON 10.5 • Displacement and Density

All answers are approximate.

1. 53.0 cm^3 **2.** 7.83 g/cm^3

3. 0.54 g/cm^3 **4.** 4.94 in.

5. No, it's not gold (or at least not pure gold). The mass of the nugget is 165 g, and the volume is 17.67 cm^3, so the density is 9.34 g/cm^3. Pure gold has density 19.3 g/cm^3.

LESSON 10.6 • Volume of a Sphere

1. 288π cm^3, or about 904.8 cm^3

2. 18π cm^3, or about 56.5 cm^3

3. 72π cm^3, or about 226.2 cm^3

4. $\frac{28}{3}\pi$ cm^3, or about 29.3 cm^3

5. 432π cm^3, or about 1357.2 cm^3

6. $\frac{304}{3}\pi$ cm^3, or about 318.3 cm^3

7. 11 cm

8. 2250π $in^3 \approx 7068.6$ in^3

9. 823.2 in^3; 47.6% **10.** 17.86

LESSON 10.7 • Surface Area of a Sphere

1. $V = 1563.5$ cm^3; $S = 651.4$ cm^2

2. $V = 184.3$ cm^3; $S = 163.4$ cm^2

3. $V = 890.1$ cm^3; $S = 486.9$ cm^2

4. $V = 34.1$ cm^3; $S = 61.1$ cm^2

5. About 3.9 cm

6. About 357.3 cm^2

7. 9 quarts

Answers to Practice: Naming Solid Figures

1) pentagonal pyramid
2) triangular pyramid
3) rectangular prism
4) cone
5) cylinder
6) hexagonal pyramid
7) square pyramid
8) pentagonal prism
9) square prism
10) sphere

Answers to Practice: Volume - Prisms & Cylinders

1) 1992 yd^3
2) 1584 ft^3
3) 1440 in^3
4) 1123.2 mi^3
5) 900π in^3
6) 96π mi^3
7) 1116 mi^3
8) 896.7 in^3
9) 40π cm^3
10) 96 cm^3

Answers to Practice: Pyramids and Cones

1) 557.33 mi^3
2) 14 yd^3
3) 718.38 km^3
4) 56 ft^3
5) 123 in^3
6) 66.67 mi^3
7) 314.16 ft^3
8) 696.67 ft^3
9) 166.67 ft^3
10) 352 ft^3