Name _____ Date _____

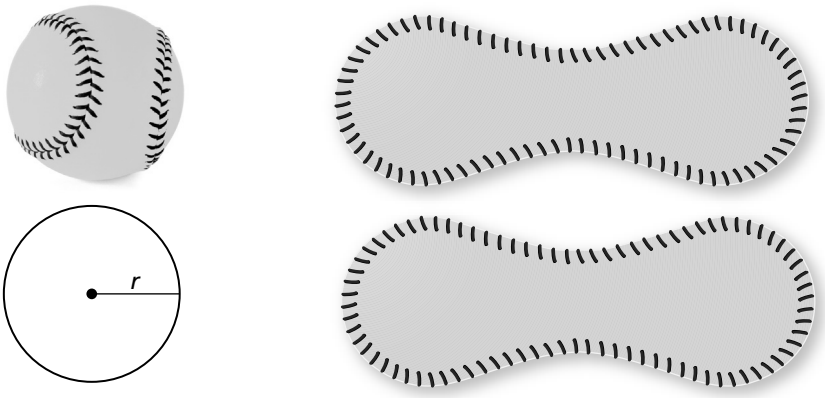
8.7 Surface Areas and Volumes of Spheres

For use with Exploration 8.7

Essential Question How can you find the surface area and the volume of a sphere?

1 EXPLORATION: Finding the Surface Area of a Sphere

Work with a partner. Remove the covering from a baseball or softball.



You will end up with two "figure 8" pieces of material, as shown above. From the amount of material it takes to cover the ball, what would you estimate the surface area S of the ball to be? Express your answer in terms of the radius r of the ball.

$S =$ _____ Surface area of a sphere

Use the Internet or some other resource to confirm that the formula you wrote for the surface area of a sphere is correct.

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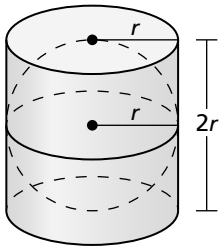
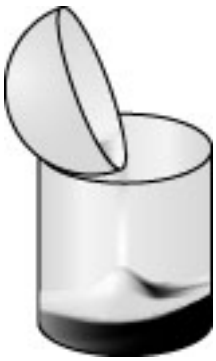
8.7 Surface Areas and Volumes of Spheres (continued)

2 EXPLORATION: Finding the Volume of a Sphere

Work with a partner. A cylinder is circumscribed about a sphere, as shown. Write a formula for the volume V of the cylinder in terms of the radius r.



$V =$ _____ Volume of cylinder



When half of the sphere (a *hemisphere*) is filled with sand and poured into the cylinder, it takes three hemispheres to fill the cylinder. Use this information to write a formula for the volume V of a sphere in terms of the radius r

$V =$ _____ Volume of a sphere

Communicate Your Answer

3. How can you find the surface area and the volume of a sphere?

4. Use the results of Explorations 1 and 2 to find the surface area and the volume of a sphere with a radius of (a) 3 inches and (b) 2 centimeters.

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8.7 Practice
For use after Lesson 8.7

Core Concepts

Surface Area of a Sphere

The surface area S of a sphere is

$$S = 4\pi r^2$$

where r is the radius of the sphere.

$S = 4\pi r^2$

Notes:

Volume of a Sphere

The volume V of a sphere is

$$V = \frac{4}{3}\pi r^3$$

where r is the radius of the sphere.

$V = \frac{4}{3}\pi r^3$

Notes:

Worked-Out Examples

Example #1

Find the indicated measure.

Find the radius of a sphere with a surface area of 4π square feet.

$S = 4\pi r^2$

$4\pi = 4\pi r^2$

$r^2 = 1$

$r = 1$

The radius of the sphere is 1 foot.

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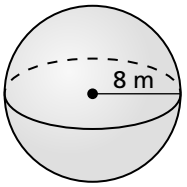
8.7 Practice (continued)

Example #2

Find the volume of the sphere.



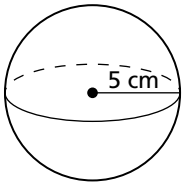
$$V = \frac{4}{3}\pi r^3$$
$$= \frac{4}{3}\pi(8)^3$$
$$= \frac{2048}{3}\pi \approx 2144.66$$

The volume of the sphere is about 2144.66 cubic meters.

Practice A

In Exercises 1–4, find the surface area of the solid.

1.



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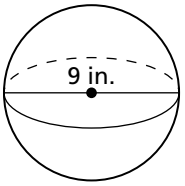

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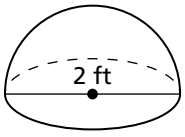
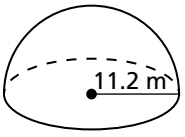


4.



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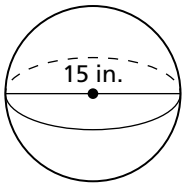
8.7 Practice (continued)

In Exercises 5–8, find the volume of the sphere.

5.



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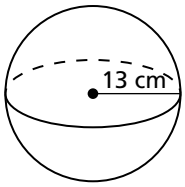

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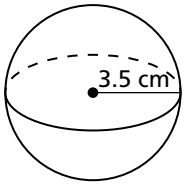

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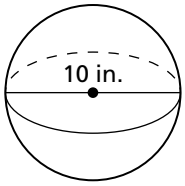

In Exercises 9–11, find the indicated measure.

9. Find the diameter of a sphere with a surface area of 144π square centimeters.

10. Find the volume of a sphere with a surface area of 256π square inches.

11. Find the volume of a sphere with a surface area of 400π square feet.

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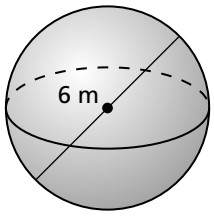
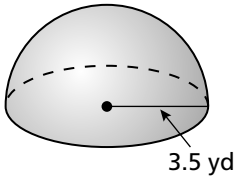
Practice B

In Exercises 1–3, find the surface area of the sphere or hemisphere.

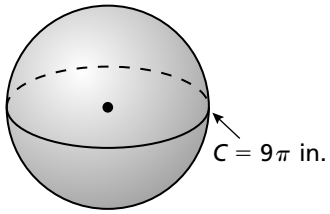
1.



2.



3.



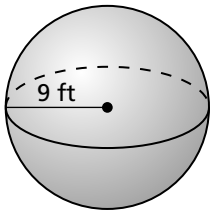
In Exercises 4 and 5, find the indicated measure.

4. Find the radius of a sphere with a surface area of 100π square.

5. Find the diameter of a sphere with a surface area of 6.25π square inches.

In Exercises 6–8, find the volume of the sphere or hemisphere.

6.



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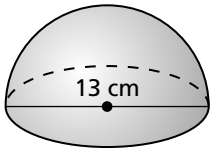

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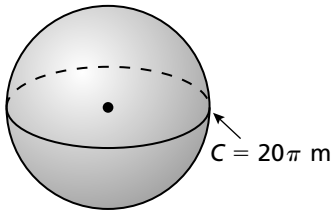


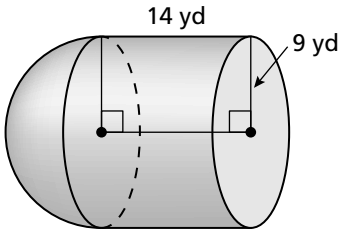
In Exercises 9 and 10, find the volume of the sphere with the given surface area.

9. Surface Area $= 144\pi$ ft^2

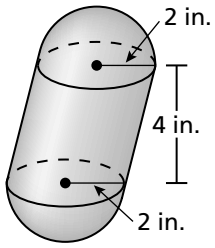
10. Surface Area $= \pi$ mi^2

In Exercises 11 and 12, find the volume of the composite solid.

11.



12.



13. The diameter of a spherical balloon shrinks to one-half of its original size. Describe how the surface area and volume of the balloon change.

14. A museum has two spherical cannonballs on display. Each cannonball is made of a type of iron that weighs about 463 pounds per cubic foot.

a. The diameter of the smaller cannonball is 1 inch less than the diameter of the larger cannonball. Can you determine how much less the smaller cannonball weighs than the larger cannonball? Explain your reasoning.

b. The smaller cannonball displaces 33.5 cubic inches of water when dropped in a bucket full of water. To the nearest pound, how much less does the smaller cannonball weigh than the larger cannonball?