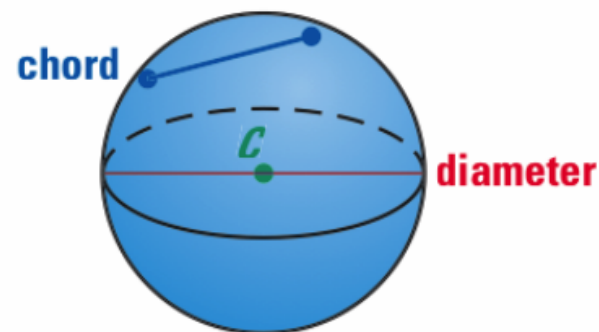
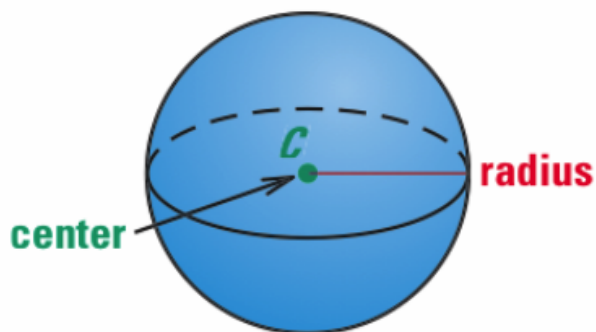


12.6 Surface Area and Volume of Spheres

A **sphere** is the set of all points in space equidistant from a given point. This point is called the **center** of the sphere. A **radius** of a sphere is a segment from the center to a point on the sphere. A **chord** of a sphere is a segment whose endpoints are on the sphere. A **diameter** of a sphere is a chord that contains the center.



As with circles, the terms radius and diameter also represent distances, and the diameter is twice the radius.

THEOREM*For Your Notebook***THEOREM 12.11 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.



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

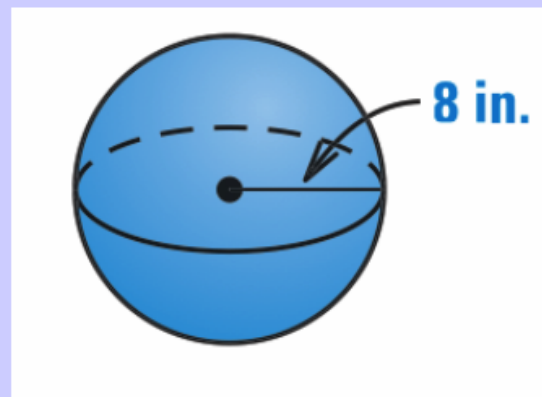
SURFACE AREA FORMULA To understand how the formula for the surface area of a sphere is derived, think of a baseball. The surface area of a baseball is sewn from two congruent shapes, each of which resembles two joined circles, as shown.

So, the entire covering of the baseball consists of four circles, each with radius r . The area A of a circle with radius r is $A = \pi r^2$. So, the area of the covering can be approximated by $4\pi r^2$. This is the formula for the surface area of a sphere.



EXAMPLE 1 Find the surface area of a sphere

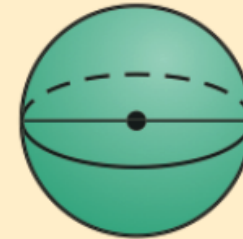
Find the surface area of the sphere.



EXAMPLE 2 **Standardized Test Practice**

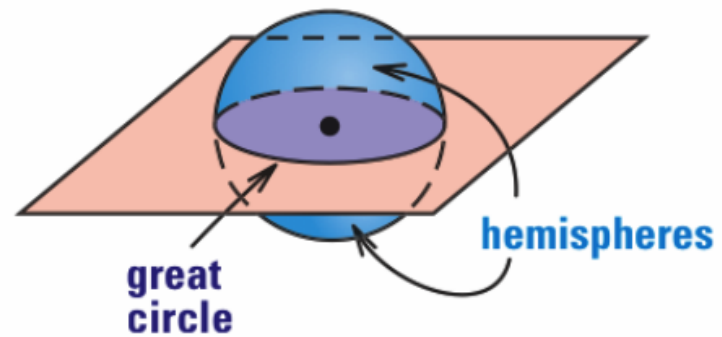
The surface area of the sphere is 20.25π square centimeters. What is the diameter of the sphere?

- (A) 2.25 cm (B) 4.5 cm
(C) 5.5 cm (D) 20.25 cm



$$S = 20.25\pi \text{ cm}^2$$

GREAT CIRCLES If a plane intersects a sphere, the intersection is either a single point or a circle. If the plane contains the center of the sphere, then the intersection is a **great circle** of the sphere. The circumference of a great circle is the circumference of the sphere. Every great circle of a sphere separates the sphere into two congruent halves called **hemispheres**.



EXAMPLE 3 Use the circumference of a sphere

EXTREME SPORTS In a sport called *sphereing*, a person rolls down a hill inside an inflatable ball surrounded by another ball. The diameter of the outer ball is 12 feet. Find the surface area of the outer ball.



VOLUME FORMULA Imagine that the interior of a sphere with radius r is approximated by n pyramids, each with a base area of B and a height of r . The volume of each pyramid is $\frac{1}{3}Br$ and the sum of the base areas is nB . The surface area of the sphere is approximately equal to nB , or $4\pi r^2$. So, you can approximate the volume V of the sphere as follows.

$$V \approx n\left(\frac{1}{3}Br\right)$$

Each pyramid has a volume of $\frac{1}{3}Br$.

$$\approx \frac{1}{3}(nB)r$$

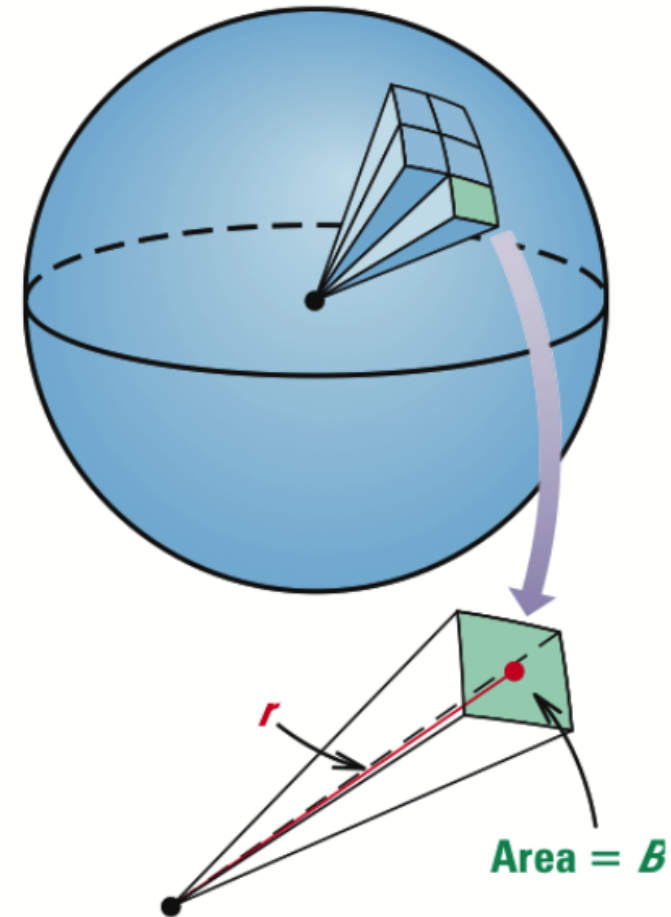
Regroup factors.

$$= \frac{1}{3}(4\pi r^2)r$$

Substitute $4\pi r^2$ for nB .

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

Simplify.



THEOREM*For Your Notebook***THEOREM 12.12** 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.



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

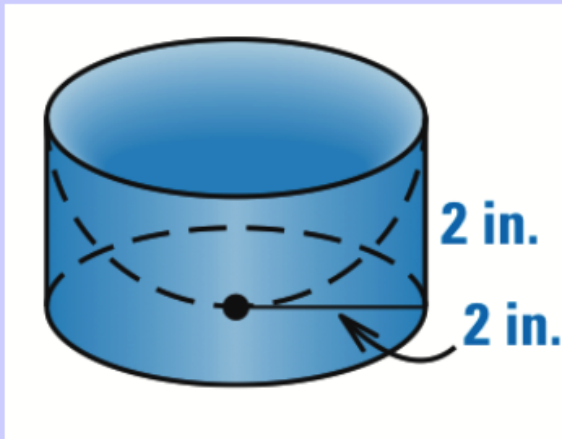
EXAMPLE 4 Find the volume of a sphere

The soccer ball has a diameter of 9 inches.
Find its volume.



EXAMPLE 5 Find the volume of a composite solid

Find the volume of the composite solid.

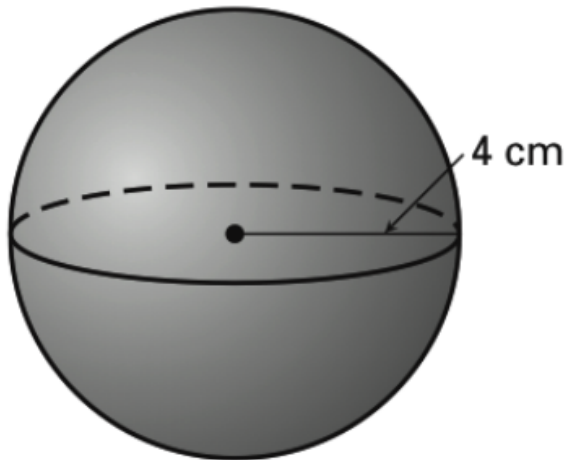


Assignment:
12.6 ws

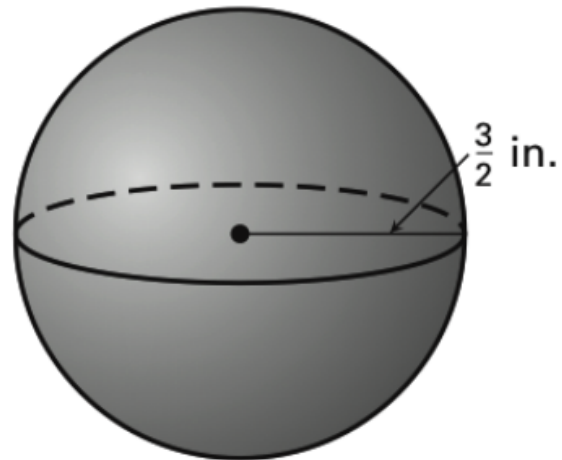
LESSON
12.6**Practice***For use with pages 838–845*

Find the surface area of the sphere. Round your answer to two decimal places.

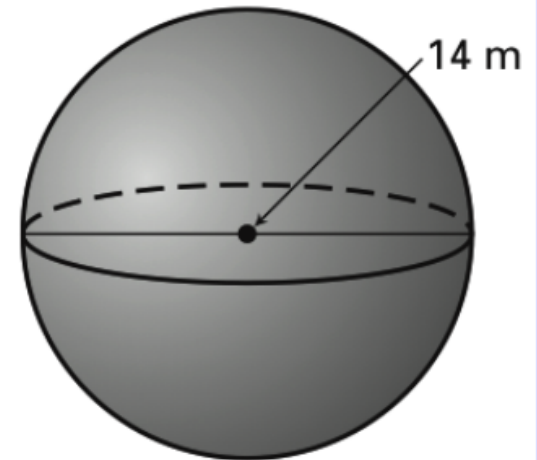
1.



2.



3.



4. Multiple Choice What is the approximate radius of a sphere with a surface area of 40π square feet?

A. 2 ft

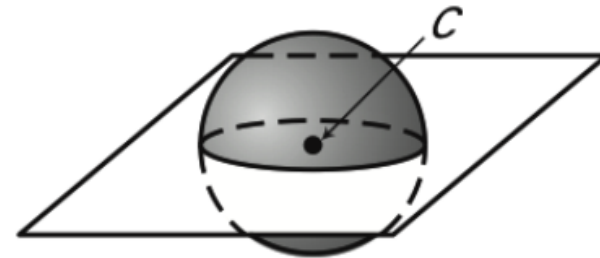
B. 3.16 ft

C. 6.32 ft

D. 10 ft

In Exercises 5–7, use the sphere below. The center of the sphere is C and its circumference is 7π centimeters.

5. Find the radius of the sphere.



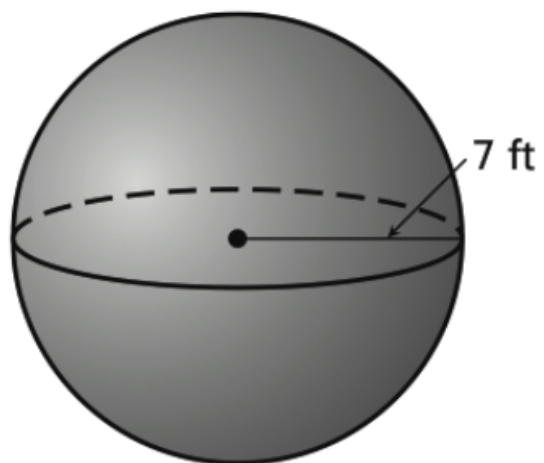
6. Find the diameter of the sphere.

7. Find the surface area of one hemisphere.
Round your answer to two decimal places.

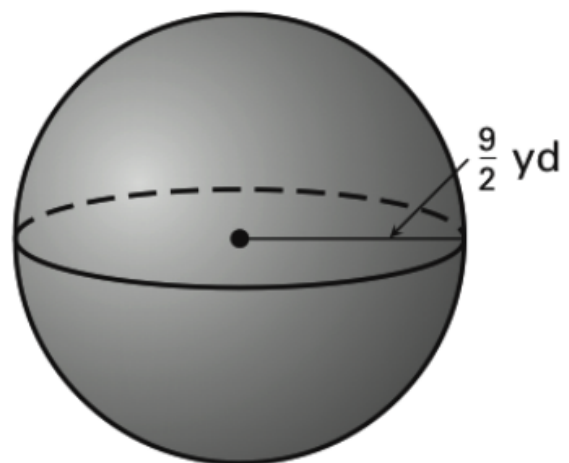
8. Great Circle The circumference of a great circle of a sphere is 24.6π meters. What is the surface area of the sphere? Round your answer to two decimal places.

Find the volume of the sphere. Round your answer to two decimal places.

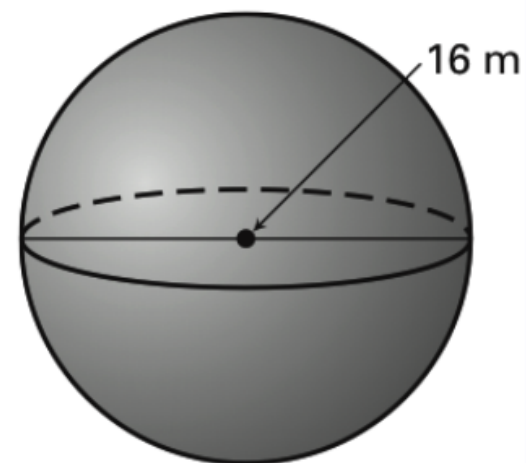
9.



10.



11.



Find the radius of the sphere with the given volume V . Round your answer to two decimal places.

12. $V = 64 \text{ in.}^3$

13. $V = 150\pi \text{ cm}^3$

14. $V = 152 \text{ m}^3$

15. Multiple Choice What is the approximate radius of a sphere with a volume of 128π cubic centimeters?

A. 2.5 cm

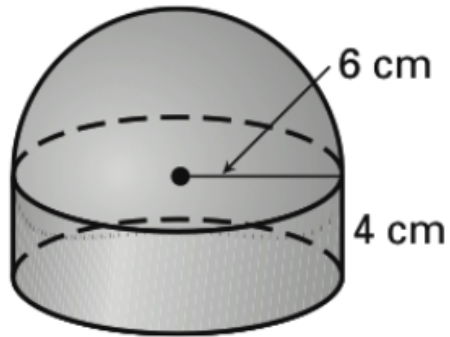
B. 4.58 cm

C. 6.62 cm

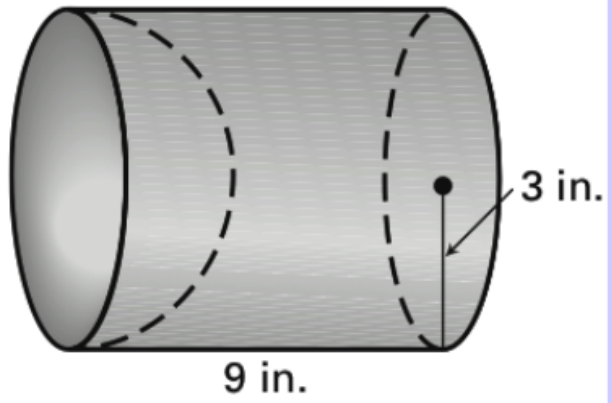
D. 8 cm

Find the surface area and the volume of the solid. The cylinders and cones are right. Round your answer to two decimal places.

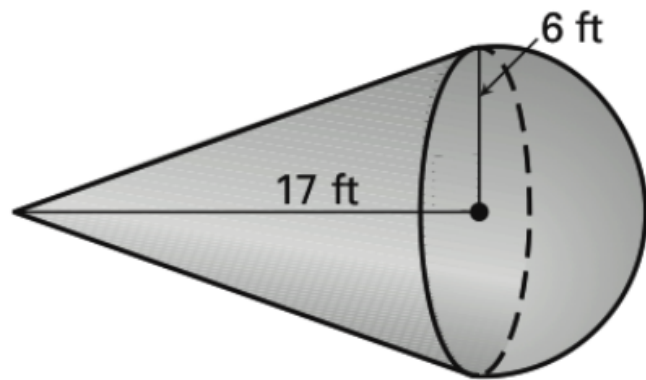
16.



17.



18.



Complete the table below. Leave your answers in terms of π .

	Radius of sphere	Circumference of great circle	Surface area of sphere	Volume of sphere
19.	12 mm			
20.		8π in.		
21.			49π ft ²	
22.				288π m ³

23. Finding a Diameter The volume of a sphere is 972π cubic centimeters. What is the diameter of the sphere?

