

12.6

Surface Area and Volume of Spheres

Goal • Find surface areas and volumes of spheres.

Your Notes

VOCABULARY

Sphere A sphere is the set of all points in space equidistant from a given point.

Center of a sphere The center of a sphere is the given point from which all points on the sphere are equidistant.

Radius of a sphere A radius of a sphere is a segment from the center to a point on the sphere.

Chord of a sphere A chord of a sphere is a segment whose endpoints are on the sphere.

Diameter of a sphere A diameter of a sphere is a chord that contains the center of the sphere.

Great circle A great circle is the intersection of a sphere and a plane that contains the center of the sphere.

Hemisphere A hemisphere is one of the congruent halves of a sphere.

THEOREM 12.11: SURFACE AREA OF A SPHERE

The surface area S of a sphere is

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

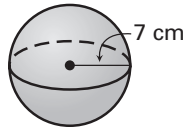
where r is the radius of the sphere.



Your Notes

Example 1 Find the surface area of a sphere

Find the surface area of the sphere.



Solution

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

Formula for surface area of a sphere

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

Substitute 7 for r .

$$= 196\pi$$

Simplify.

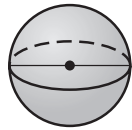
$$\approx 615.75$$

Use a calculator.

The surface area of the sphere is about 615.75 cm^2 .

Example 2 Find the diameter of a sphere

The surface area of a sphere is 110.25π square feet.
Find the diameter of the sphere.



Solution

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

Formula for surface area of a sphere

$$110.25\pi = 4\pi r^2$$

Substitute 110.25π for S .

$$27.5625 = r^2$$

Divide each side by 4π .

$$5.25 = r$$

Find the positive square root.

The diameter of the sphere is

$$2r = 2 \cdot 5.25 = 10.5 \text{ feet.}$$

Be sure to multiply the value of r by 2 to find the diameter.

Your Notes

THEOREM 12.12: VOLUME OF A SPHERE

The volume V of a sphere is

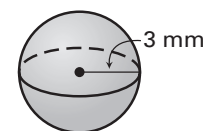
$$V = \frac{4}{3}\pi r^3,$$

where r is the radius of the sphere.



Example 3 Find the volume of a sphere

Find the volume of the sphere.



Solution

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

$$= \frac{4}{3}\pi(\underline{3})^3$$

$$\approx \underline{113.1}$$

Formula for
volume of a
sphere

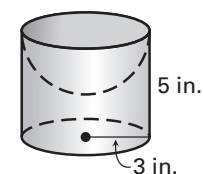
Substitute 3
for r .

Use a calculator.

The volume of the sphere is about 113.1 cubic millimeters.

Example 4 Find the volume of a composite solid

Find the volume of the composite solid.



Solution

$$\text{Volume of solid} = \text{Volume of } \underline{\text{cylinder}} - \text{Volume of } \underline{\text{hemisphere}}$$

$$= \pi r^2 h - \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$$

$$= \pi(\underline{3})^2(\underline{5}) - \frac{1}{2}\left(\frac{4}{3}\pi(\underline{3})^3\right)$$

$$= \underline{45}\pi - \underline{18}\pi$$

$$\approx \underline{84.82}$$

Volume formulas

Substitute.

Simplify.

Use a calculator.

The volume of the solid is about 84.82 cubic inches.

Your Notes

✓ Checkpoint Complete the following exercises.

1. The diameter of a sphere is $\frac{1}{\sqrt{\pi}}$ meter. Find the surface area of the sphere.

1 m²

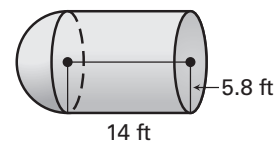
2. The surface area of a sphere is 169π square inches. Find the radius of the sphere.

6.5 in.

3. The radius of a sphere is 2.4 cm. Find the volume of the sphere. Round your answer to two decimal places.

57.89 cm³

4. Find the volume of the composite solid. Round your answer to two decimal places.



1888.20 ft³

Homework