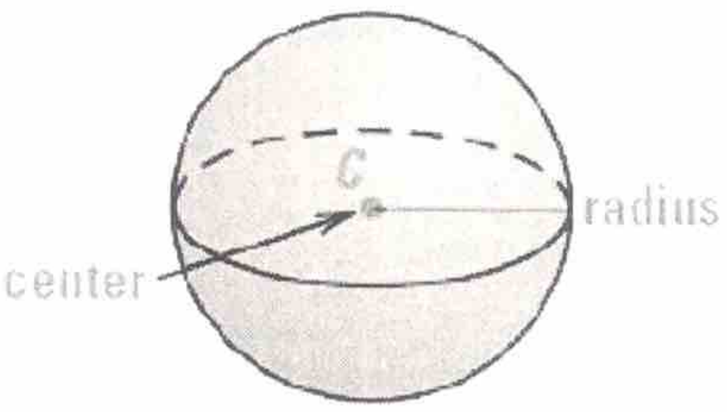
12.6 Surface Area & Volume of Spheres

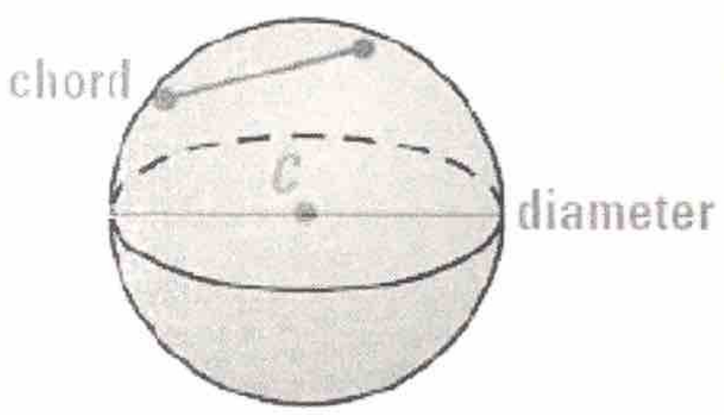
sphere – the set of all points in space equidistant from a given point, called the **center**

radius of a sphere – segment from the center to any point on the sphere

chord of a sphere – segment whose endpoints are on the sphere

diameter of a sphere – a chord that contains the center, twice the radius





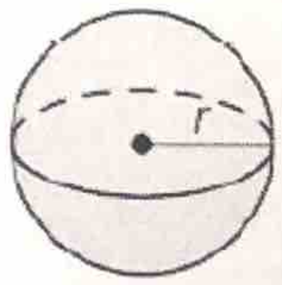
THEOREM *For Your Notebook*

THEOREM 12.11 Surface Area of a Sphere

The surface area S of a sphere is

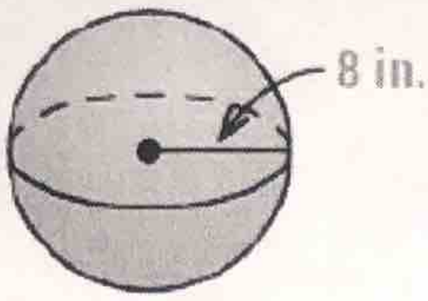
$$S = 4\pi r^2,$$

where r is the radius of the sphere.



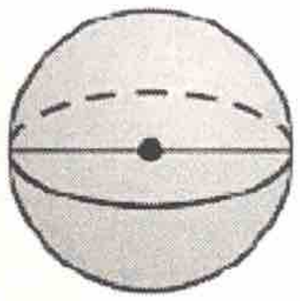
$S = 4\pi r^2$

Ex 1: Find the surface area of the sphere.



$$SA = 4\pi r^2$$
$$= 4\pi (8)^2$$
$$= 256\pi$$
$$\approx \boxed{804.25 \text{ in}^2}$$

Ex 2: The surface area of the sphere is 20.25π square centimeters. What is the diameter of the sphere?

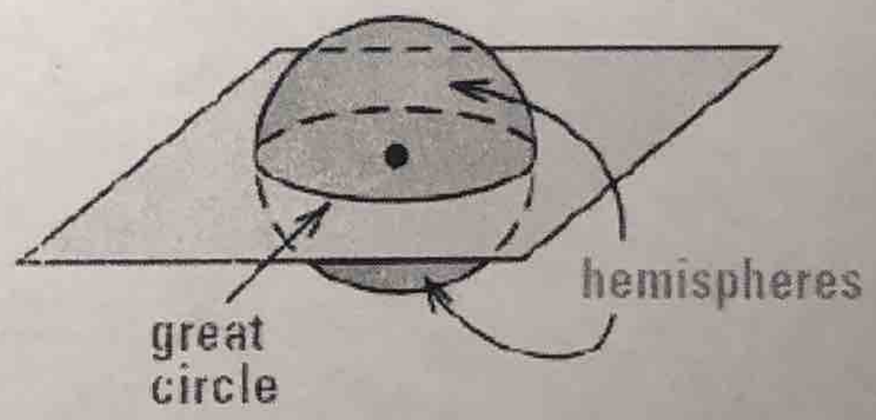


$S = 20.25\pi \text{ cm}^2$

$$SA = 4\pi r^2$$
$$20.25\pi = 4\pi r^2$$
$$r^2 = 5.0625$$
$$r = 2.25$$
$$\text{diameter} = 2r$$
$$= 2(2.25)$$
$$= \boxed{4.5 \text{ cm}}$$

If a plane intersects a sphere, the intersection is either a single point or a circle.

great circle - when a plane intersects the center of a sphere



Ex 3: In a sport called *sphereing*, a person rolls down a hill inside an inflatable ball surrounded by another ball. The circumference of the inner ball is 6π feet. Find the surface area of the inner ball. Round your answer to 2 decimal places.

$C = 2\pi r$

$6\pi = 2\pi r$

$r = 3$

$SA = 4\pi r^2$

$= 4\pi(3)^2$

$= 36\pi$

$= \boxed{113.10 \text{ ft}^2}$

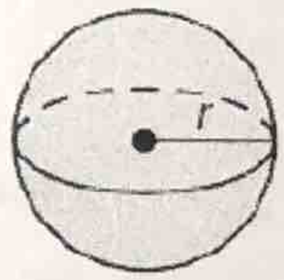
THEOREM *For Your Notebook*

THEOREM 12.12 Volume of a Sphere

The volume V of a sphere is

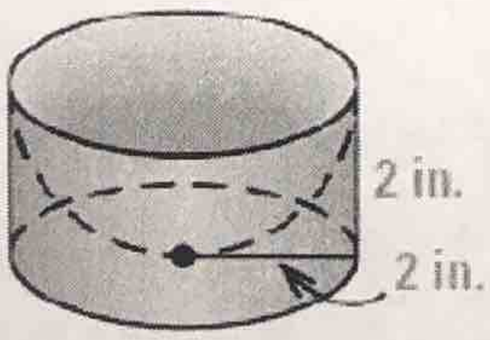
$$V = \frac{4}{3}\pi r^3,$$

where r is the radius of the sphere.



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

Ex 4: Find the volume of the composite solid.



Volume of solid = volume cylinder - volume hemisphere

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

$= \pi(2)^2(2) - \frac{2}{3}\pi(2)^3$

$= 8\pi - \frac{2}{3}(8\pi)$

$= \frac{24}{3}\pi - \frac{16}{3}\pi$

$= \frac{8}{3}\pi$

$\approx \boxed{8.38 \text{ in}^3}$