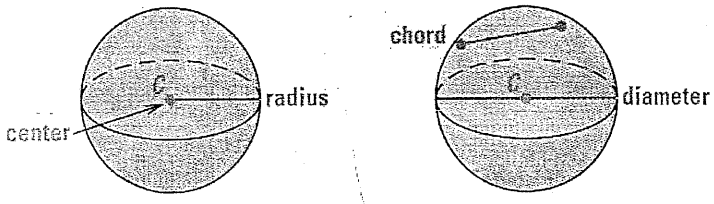
6.9 Surface Area and Volume of Spheres

GPS Geometry

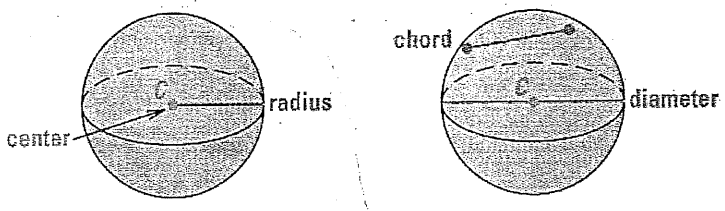
Finding the Surface Area of a Sphere

- In Lesson 6.1, a circle was described as the set of all points in a plane that are equidistant from a given point. (center).
- A sphere is the set of all points in space that are equidistant from a given point. (center)



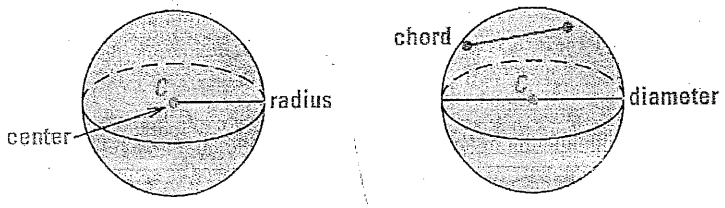
Finding the Surface Area of a Sphere

- 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.



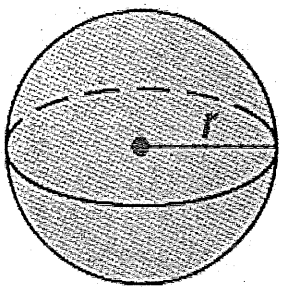
Finding the Surface Area of a Sphere

- A diameter is a chord that contains the center. As with all circles, the terms radius and diameter also represent distances, and the diameter is twice the radius.



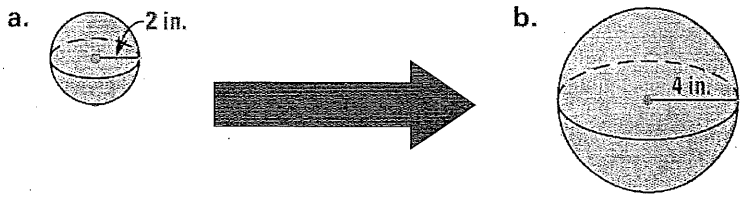
Theorem 6.22: Surface Area of a Sphere

- The surface area of a sphere with radius r is $S = 4\pi r^2$.

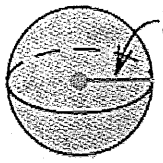


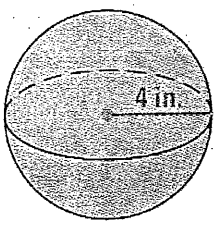
Ex. 1: Finding the Surface Area of a Sphere

- Find the surface area. When the radius doubles, does the surface area double?



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

a. 

b. 

a) $r = 2$ in.

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

$S = 16\pi$ in^2 (exact)

$S \approx 50.26$ in^2 (approx.)

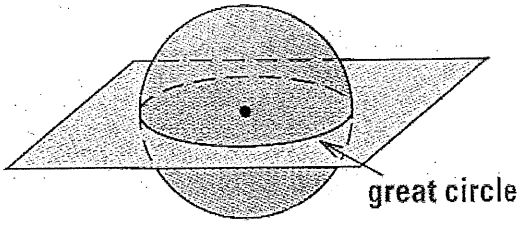
b) $r = 4$ in.

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

$S = 64\pi$ in^2 (exact)

$S \approx 201.06$ in^2 (approx.)

More . . .



- 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. Every great circle of a sphere separates a sphere into two congruent halves called hemispheres.

Ex. 2: Using a Great Circle

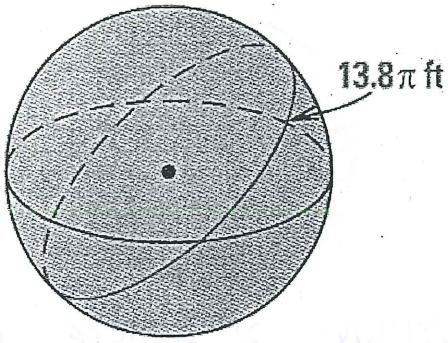
- The circumference of a great circle of a sphere is 13.8π feet. What is the surface area of the sphere?

$C = 13.8\pi$ ft.

a) find radius

b) find Surface Area

$C = 2\pi r$



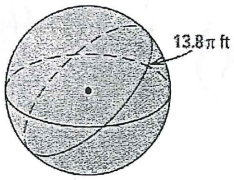
$\frac{13.8\pi}{2\pi} = \frac{2\pi r}{2\pi}$

$6.9 \text{ ft} = r$

$S = 4\pi r^2$

$S = 4\pi(6.9)^2$

Solution:



$S = 190.44\pi \text{ ft}^2$ (exact)

$S \approx 598.28 \text{ ft}^2$ (approx.)

So, the surface area of the sphere is

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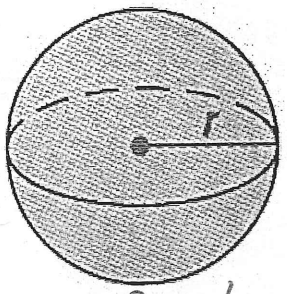
Theorem 6.23: Volume of a Sphere

- The volume of a sphere with radius r is V

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



a) Find volume of sphere if $r = 12$ in.

b) Find radius if $V = 36\ in^3$

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

$V = \frac{4\pi}{3}(12)^3$

(exact) $V = 2304\pi\ in^3$

(approx) $V \approx 7238.22\ in^3$

b) $V = 36\ in^3$

$\frac{36}{\frac{4\pi}{3}} = \frac{\frac{4\pi}{3} r^3}{\frac{4\pi}{3}}$

$\sqrt[3]{8.59} = \sqrt[3]{r^3}$

$2.04 = r$

$r = 2.04$ in.