GEOMETRY UNIT 11

12-4: AREA AND VOLUME OF SPHERES

WARM-UP

- Each group will be given an example of the object that we will be working with today…

A Sphere

- Make some observations about these spheres and discuss them with your group.
- Focus your discussion on these questions:
  - What do you notice about the sphere?
  - How is it similar to the other shapes we have looked at in this chapter? How is it different?

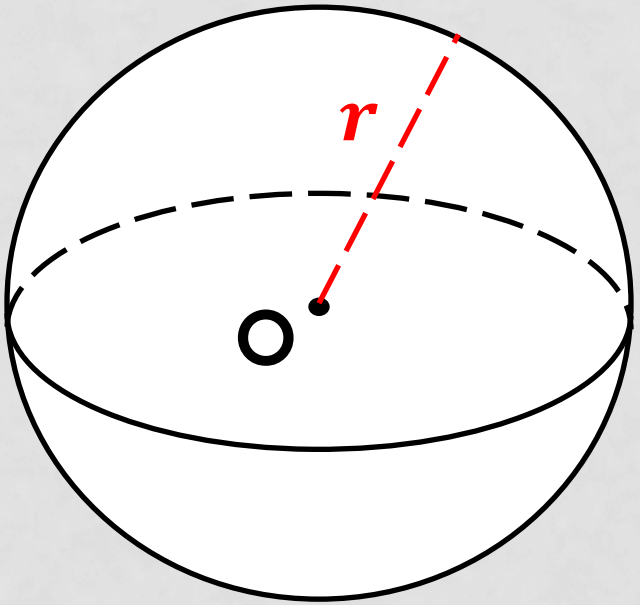
AREA AND VOLUME OF SPHERES

- **Content Objective**: Students will be able to identify the similarities between spheres and circles.

- **Language Objective**: Students will be able to use equations to solve for the area and volume of spheres.

SPHERES

- A sphere with **center** O and **radius** r is the set of all points in a space at a distance r from point O.
- Many of the terms used with spheres are the same as those used with circles.



SPHERES

$\overline{OA}$, $\overline{OB}$, and $\overline{OD}$ are **Radii**

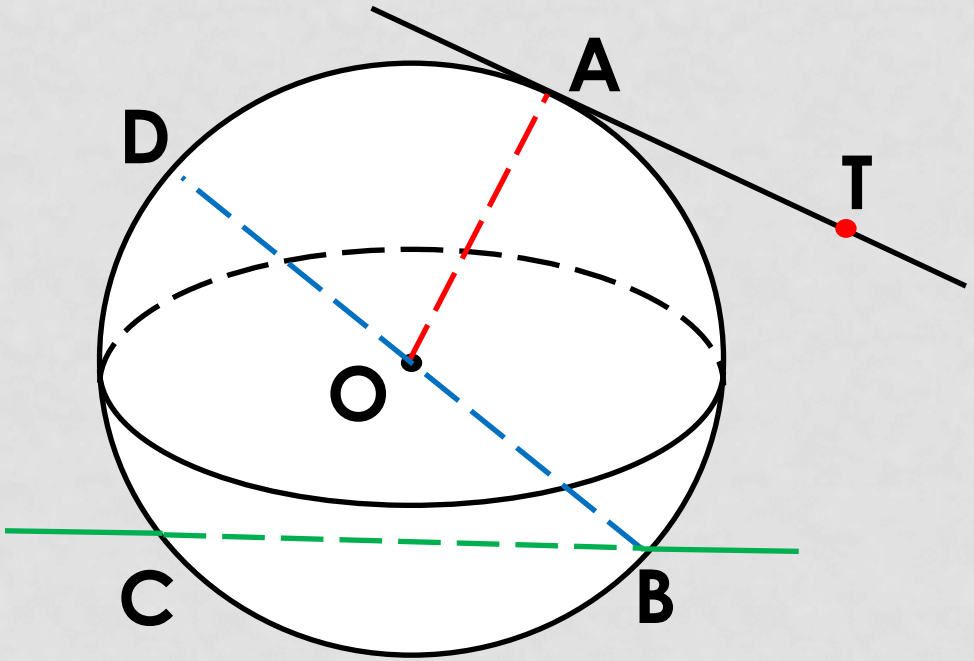
$\overline{BD}$ is a **Diameter**

$\overline{BC}$ is a **Chord**

$\overleftrightarrow{BC}$ is a **Secant**

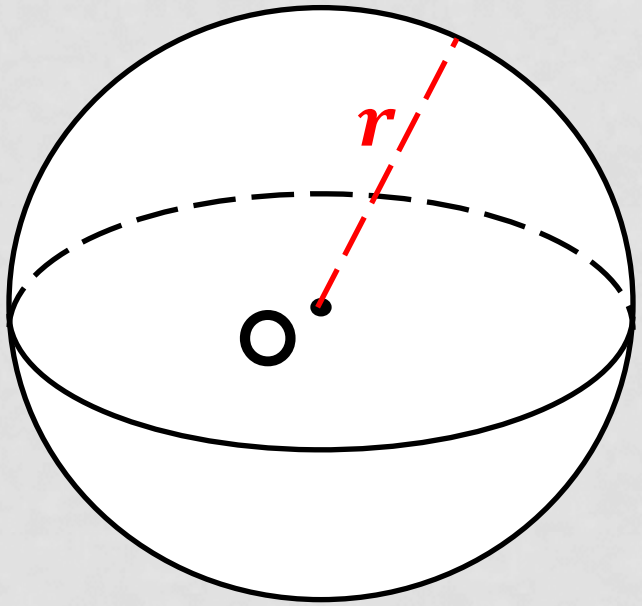
$\overleftrightarrow{AT}$ is a **Tangent**

$\overline{AT}$ is a **Tangent Segment**



SPHERES

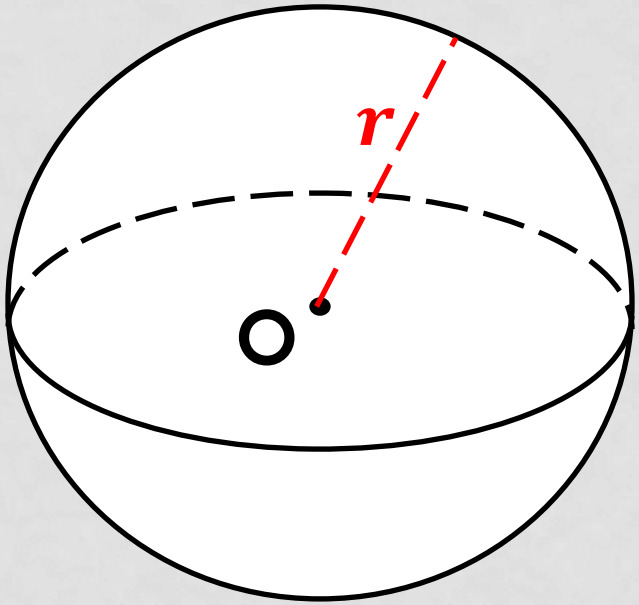
- Spheres have no lateral faces. **Why?**
- Thus we do not have a lateral area to calculate.
- For Spheres, we only calculate the Total Area, or just Area, and the Volume.



SPHERES - AREA

- **Theorem 12-9:** The area of a sphere equals 4π times the square of the radius.

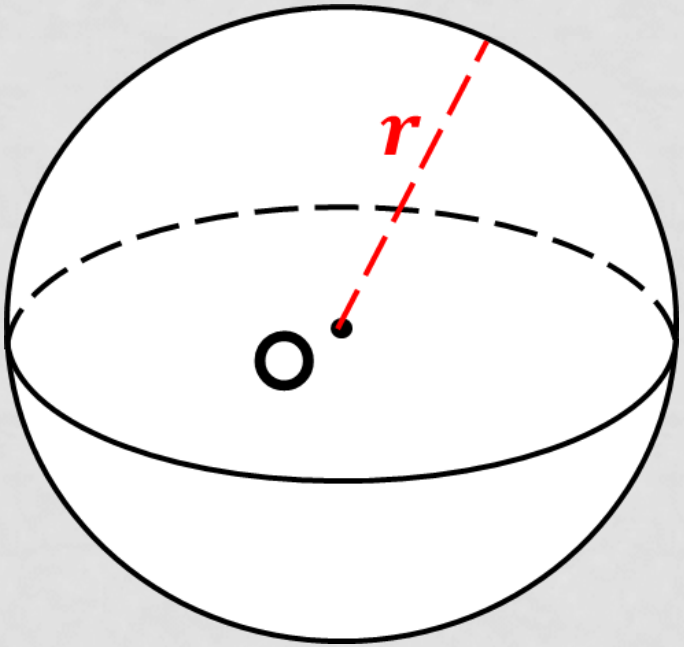
Equations: $A = 4\pi r^2$



SPHERES - VOLUME

- **Theorem 12-10:** The volume of a sphere equals $\frac{4}{3}\pi$ times the cube of the radius.

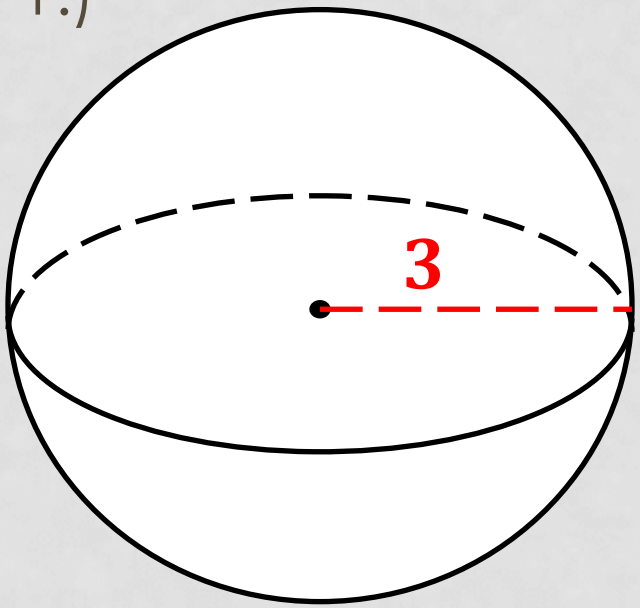
Equations: $A = \frac{4}{3}\pi r^3$



PRACTICE

- Find the Area and Volume of the following Spheres.

1.)



Area:

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

$$A = 4\pi(3^2)$$

$$\boldsymbol{A = 36\pi}$$

Volume:

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

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

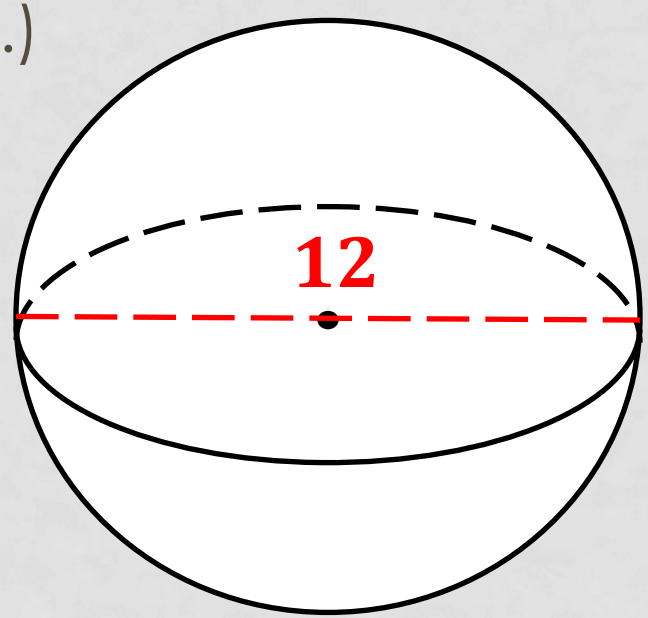
$$V = \frac{4}{3}\pi \times 27$$

$$\boldsymbol{V = 36\pi}$$

PRACTICE

- Find the Area and Volume of the following Spheres.

2.)



Area:

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

$$A = 4\pi(6^2)$$

$$\boldsymbol{A = 144\pi}$$

Volume:

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

$$V = \frac{4}{3}\pi(6^3)$$

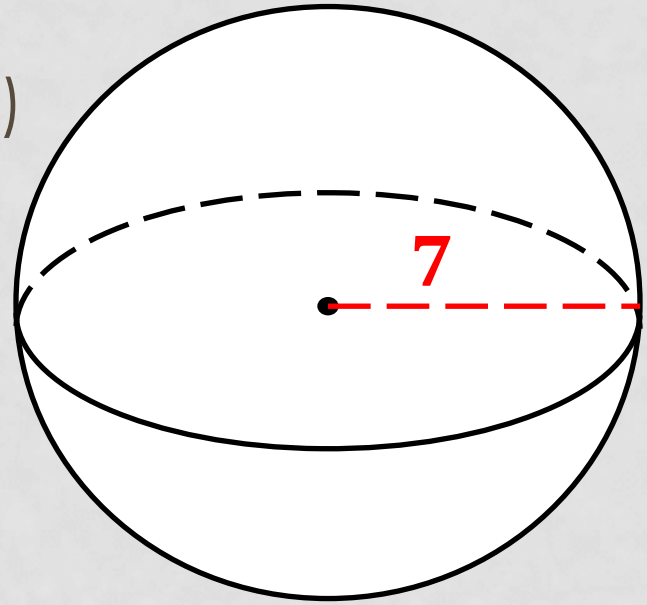
$$V = \frac{4}{3}\pi \times 216$$

$$\boldsymbol{V = 288\pi}$$

GROUP PRACTICE

- Find the Area and Volume of the following Spheres in your groups.

1.)



Area:

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

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

$$\boldsymbol{A = 196\pi}$$

Volume:

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

$$V = \frac{4}{3}\pi(7^3)$$

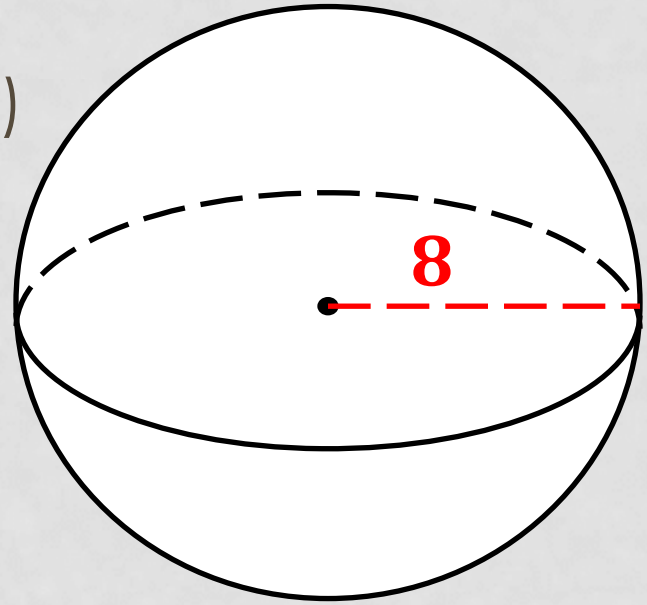
$$V = \frac{4}{3}\pi \times 343$$

$$\boldsymbol{V = \frac{1372}{3}\pi}$$

GROUP PRACTICE

- Find the Area and Volume of the following Spheres in your groups.

2.)



Area:

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

$$A = 4\pi(8^2)$$

$$\boldsymbol{A = 256\pi}$$

Volume:

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

$$V = \frac{4}{3}\pi(8^3)$$

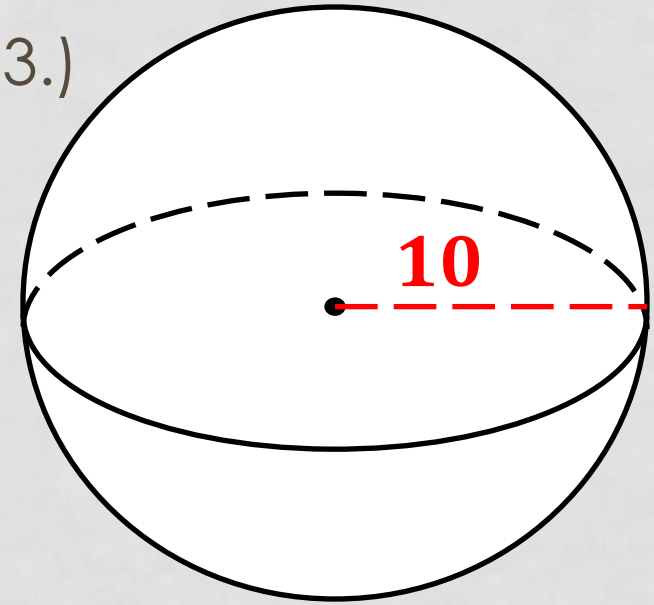
$$V = \frac{4}{3}\pi \times 512$$

$$\boldsymbol{V = \frac{2048}{3}\pi}$$

GROUP PRACTICE

- Find the Area and Volume of the following Spheres in your groups.

3.)



Area:

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

$$A = 4\pi(10^2)$$

$$\boldsymbol{A = 400\pi}$$

Volume:

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

$$V = \frac{4}{3}\pi(10^3)$$

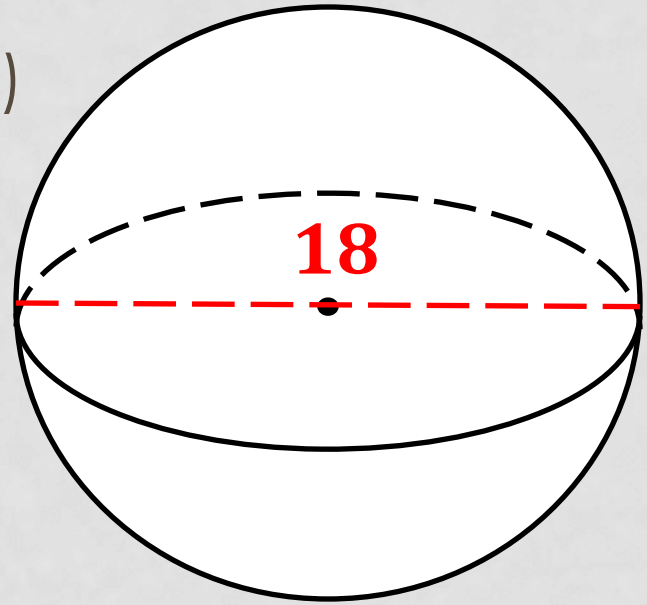
$$V = \frac{4}{3}\pi \times 1000$$

$$\boldsymbol{V = \frac{4000}{3}\pi}$$

GROUP PRACTICE

- Find the Area and Volume of the following Spheres in your groups.

4.)



Area:

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

$$A = 4\pi(9^2)$$

$$\boldsymbol{A = 324\pi}$$

Volume:

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

$$V = \frac{4}{3}\pi(9^3)$$

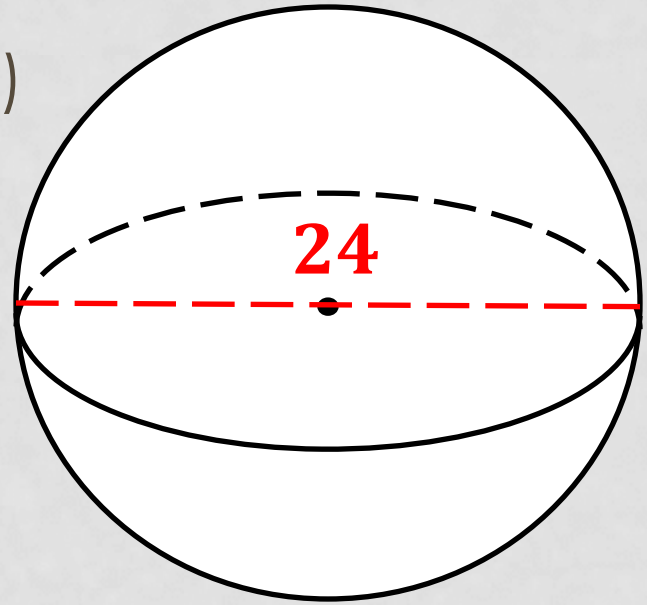
$$V = \frac{4}{3}\pi \times 729$$

$$\boldsymbol{V = 972\pi}$$

GROUP PRACTICE

- Find the Area and Volume of the following Spheres in your groups.

5.)



Area:

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

$$A = 4\pi(12^2)$$

$$\boldsymbol{A = 576\pi}$$

Volume:

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

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

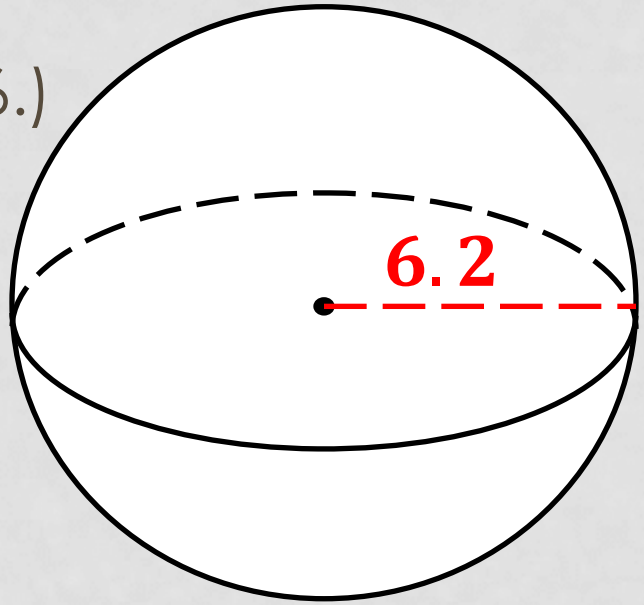
$$V = \frac{4}{3}\pi \times 1728$$

$$\boldsymbol{V = 2304\pi}$$

GROUP PRACTICE

- Find the Area and Volume of the following Spheres in your groups.

6.)



Area:

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

$$A = 4\pi(6.2^2)$$

$$\boldsymbol{A = 153.76\pi}$$

Volume:

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

$$V = \frac{4}{3}\pi(6.2^3)$$

$$V = \frac{4}{3}\pi \times 238.328$$

$$\boldsymbol{V = 317.77\pi}$$

GROUP PRACTICE

7.) A sphere with diameter of 15.6. Find the area and volume.

$r = 7.8$

Area:

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

$$A = 4\pi(7.8^2)$$

$$\boldsymbol{A = 243.36\pi}$$

Volume:

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

$$V = \frac{4}{3}\pi(7.8^3)$$

$$V = \frac{4}{3}\pi \times 474.552$$

$$\boldsymbol{V = 632.736\pi}$$

GROUP PRACTICE

8.) A sphere has a volume of $\frac{1372\pi}{3}$. Find the radius and the area.

Radius:

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

$$\frac{1372\pi}{3} = \frac{4}{3}\pi r^3$$

$$1372 = 4r^3$$

$$343 = r^3$$

$$\boldsymbol{r = 7}$$

Area:

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

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

$$\boldsymbol{A = 196\pi}$$

GROUP PRACTICE

9.) A sphere has an area of 144π. Find the radius and volume.

Radius:

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

$$144\pi = 4\pi r^2$$

$$36 = r^2$$

$$\boldsymbol{r = 6}$$

Volume:

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

$$V = \frac{4}{3}\pi(6^3)$$

$$V = \frac{4}{3}\pi \times 216$$

$$\boldsymbol{V = 288\pi}$$