Volume

Cones

Cylinders

Spheres

Common Core Standard 8.G.9

Teacher Notes

Common Core Standard - Geometry 8.G

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Mathematical Practices

- Make sense of problems and persevere in solving them.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and express regularity in repeated reasoning.

Introduction –

The teacher will briefly review volumes of polyhedrons that students learned in 7th grade – prisms and pyramids. (7.G.6)

Students have been taught area and circumference of circles in 7th grade. (7.G.4) Review these formulas and lead into a discussion of volumes of cylinders, cones and spheres. Discuss what these three geometric solids have in common and how they are different.

Using large models of clear geometric solids, demonstrate that the volume of a cone with the same base and height as a cylinder will hold 1/3 as much water as the cylinder.

Fill the cone with water and pour the water into the cylinder. You must do this three times to fill the cylinder.
OR
Fill the cylinder with water and pour into the cone. The water from the cylinder will fill the cone three times.

The volume of the cylinder is three times the volume of the cone. The volume of the cone is 1/3 the volume of the cylinder.

The volume of a cylinder is found in a similar way of finding the volume of a prism. Multiply the area of the base times the height. The base of a cylinder is a circle. Think of the volume of a cylinder as stacking circles on top of each other. The number of circles stacked is the height of the cylinder. Stress the unit used to measure volume – cubic units.

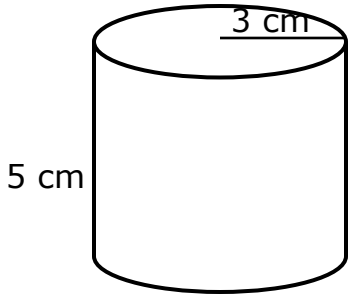
Volume of a Cylinder = Area of Base X height = $\boldsymbol{\pi r^2 h}$

Volume of a Cone = $\frac{1}{3}\pi r^2 h$

Volume of a Sphere = $\frac{4}{3}\pi r^3$

Volume – Cylinders, Cones, Spheres **Name_____**

1. What is the volume of the cylinder below? Show your work.



Formula for volume of a cylinder _____

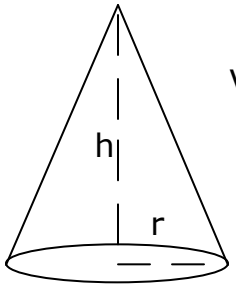
r = _____ h = _____

Volume = _____

2. Michael has a barrel in the pasture to keep water for his horse. The barrel is four feet tall with a diameter of 2 feet.

   What is the volume of the barrel? Show your work.

   How many gallons of water will the barrel hold? $1\ \text{ft}^3 \approx 7.5\ \text{gal}$

3. 

Volume = $\frac{1}{3}\pi r^2 h$

The radius of the cone is 6 meters and the height is 11 meters. What is the volume of the cone? Show your work.

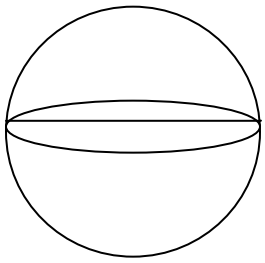
If the radius of the cone is doubled, how would the volume change?

A. The volume would double.
B. The volume would be multiplied by 4.
C. The volume would be multiplied by 6.
D. The volume would be multiplied by 12.

Explain your reasoning.

4. Volume of a sphere = $\frac{4}{3}\pi r^3$ What is the volume of the sphere below? Show your work.

diameter = 10 feet

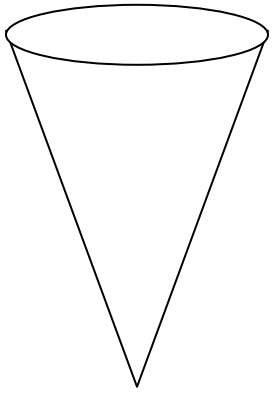


5. The radius of the sun is approximately 700,000 kilometers.

   What is the volume of the sun?

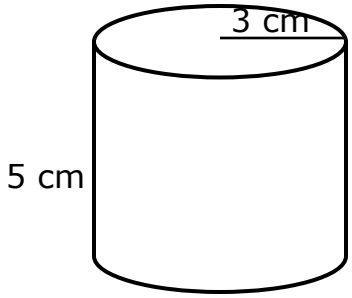
6. An ice cream cone has a diameter of 3 inches. The distance from the top of the cone to the point at the bottom (height) is 5 inches.

   How many cubic inches of ice cream will the cone hold?



Volume – Cylinders, Cones, Spheres **Name__ANSWER KEY_**

1. What is the volume of the cylinder below? Show your work.



Formula for volume of a cylinder _____V = $\pi r^2 h$_____

r = _**3 cm**___ h = __**5 cm**___

Volume = __**3.14 (3 cm)^2 (5 cm)**_____ **= 141.3 cm^3**

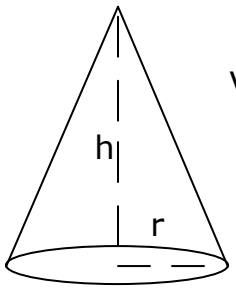
2. Michael has a barrel in the pasture to keep water for his horse. The barrel is four feet tall with a diameter of 2 feet. **Radius = 1 foot**

   What is the volume of the barrel? Show your work.
   The barrel is a cylinder.
   V = 3.14 (1 ft)^2 (4 ft) = 12.56 ft^3

   How many gallons of water will the barrel hold? $1\ \text{ft}^3 \approx 7.5\ \text{gal}$

12.56 ft^3 $\bullet \frac{7.5 gal}{1 ft^3}$ **= 94.2 gallons**

The barrel will hold about 94.2 gallons.

3. 

Volume = $\frac{1}{3}\pi r^2 h$

The radius of the cone is 6 meters and the height is 11 meters. What is the volume of the cone? Show your work.

V = $\frac{1}{3}(3.14)(6m)^2(11m)$ **= 414.48 m³**

If the radius of the cone is doubled, how would the volume change?

E. The volume would double.
F. The volume would be multiplied by 4.
G. The volume would be multiplied by 6.
H. The volume would be multiplied by 12.

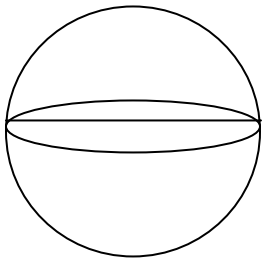
Explain your reasoning.

The new radius would be 12 meters. The new volume would be $\frac{1}{3}(3.14)(12m)^2(11m)$ **= 1657.92 m³**

1657.92 m³ ÷ 414.48 m³ = 4 The new volume is 4 times greater than the original volume.

4. Volume of a sphere = $\frac{4}{3}\pi r^3$ What is the volume of the sphere below? Show your work.

diameter = 10 feet



Radius = 5 ft

V = $\frac{4}{3}(3.14)(5\,ft)^3 \approx$ **523.33** ft^3

5. The radius of the sun is approximately 700,000 kilometers.

   What is the volume of the sun?

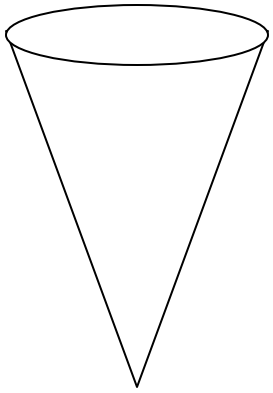
V = $\frac{4}{3}\pi r^3$ **V =** $\frac{4}{3}(3.14)(700000km)^3$ **V = 1.436 X 10^{18} km^3**

The volume of the sun is approximately 1.436 X 10^{18} km^3.

6. An ice cream cone has a diameter of 3 inches. The distance from the top of the cone to the point at the bottom (height) is 5 inches.

   How many cubic inches of ice cream will the cone hold?

   Radius = 1.5 inches



V = $\frac{1}{3}\pi r^2 h$ **V =** $\frac{1}{3}(3.14)(1.5in)^2(5in)$ **V ≈ 11.8 in^3**

The cone will hold approximately 11.8 in^3.