

Read About Volume of Cylinders, Cones & Spheres

HOW DO YOU FIND THE VOLUME OF CYLINDERS, CONES & SPHERES?

Volume is the space inside a 3D solid. Volume is measured in cubic units. Formulas are rules that are written using mathematical symbols that relate quantities. You have already used volume formulas to find the volume of rectangular prisms and cubes. You can also use volume formulas to find the volumes of cones, cylinders, and spheres.

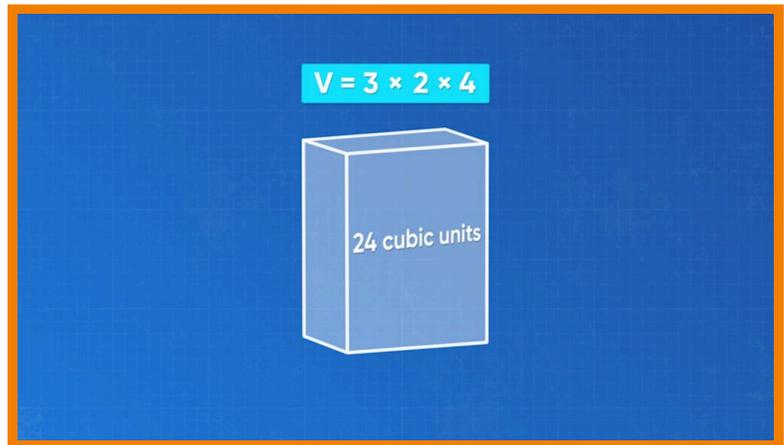
To better understand how to find the volume of cylinders, cones, and sphere...

LET'S BREAK IT DOWN!

Review Volume

You can find the volume of a rectangular prism by seeing how many cubic units fit inside it. The number of unit cubes that fit inside tells you the volume. You can also use a formula. The volume of a rectangular prism is length times width times height. If the length is 3 units, the width is 2 units, and the

height is 4 units, the volume is $3 \times 2 \times 4 = 24$ cubic units. Try this one yourself: A rectangular prism has length 5 units, width 6 units, and height 2 units. What is the volume of the rectangular prism?



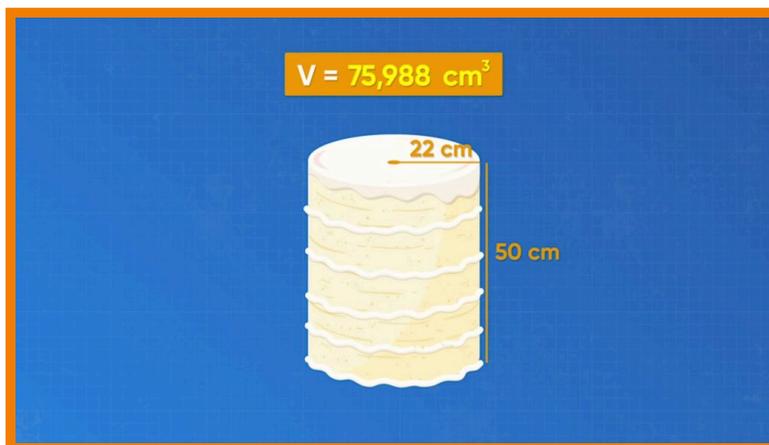
Volume of a Cylinder

How can you find the volume of a cake in the shape of a cylinder?

Think about this shape by comparing it to a rectangular prism.

The formula for the volume of a rectangular prism is length times width times height. The length times the width is the area of the base. So, another way to think of this formula

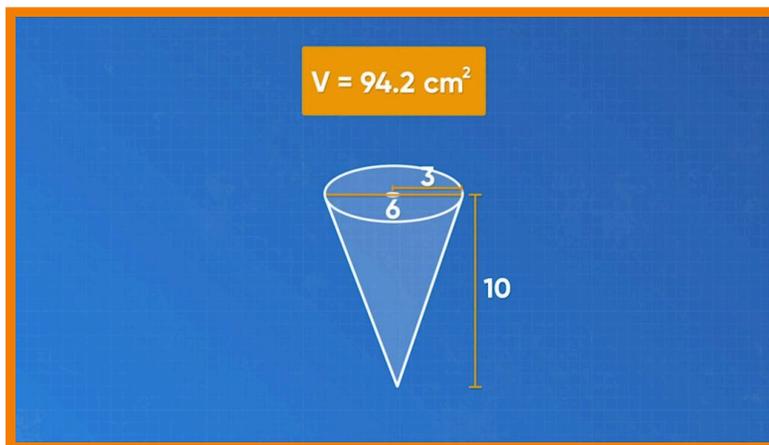
is the area of the base times the height. You can think of the volume of a cylinder in the same way: the area of the base times the height. The base is a circle. A circle has area πr^2 . So, the formula for the volume of a cylinder is $\pi r^2 h$. Amari's cake is a cylinder with diameter 44 cm and height 50 cm. What is the volume of the cake? The radius is half the diameter, so the radius is 22 cm. Use the formula. $3.14 \times 22^2 \times 50 = 75,988$ cubic centimeters. Remember that when you use 3.14 to approximate pi, your answer is an approximation. Try this one yourself: A cylinder has height 20 cm and diameter 16 cm. What is the volume of the cylinder?



Volume of a Cone

How can you find the volume of a plastic cup in the shape of a cone?

Compare the cone to a cylinder with the same diameter and same height. If you fill the cone with water and pour it into the cylinder, it takes exactly 3 cones full of water to fill the cylinder. The volume of the cone is one third the volume of the cylinder.

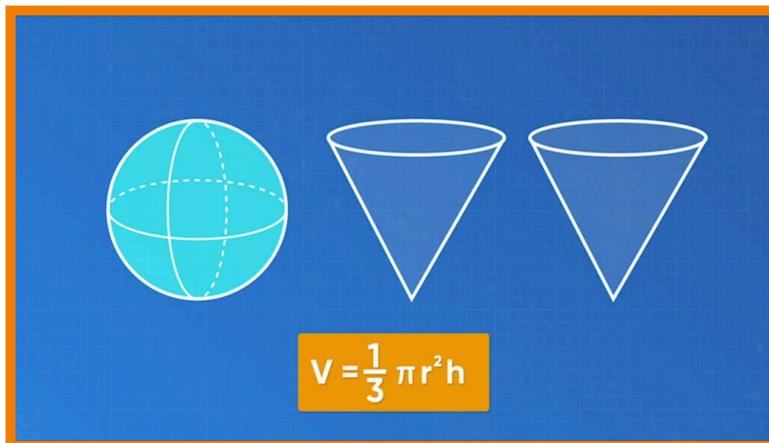


Remember, the formula for the volume of a cylinder is $\pi r^2 h$. So, the formula for the volume of a cone is $\frac{1}{3} \pi r^2 h$. Emily has a cone cup. The height is 10 cm and the diameter is 6 cm. What is the volume of the cup? The radius is half the diameter, or 3 cm. Substitute the numbers into the

volume formula. The volume of the cone cup is approximately 94.2 cubic centimeters. Try this one yourself: A cone has height 14 cm and diameter 12 cm. What is the volume of the cone?

Volume of a Sphere

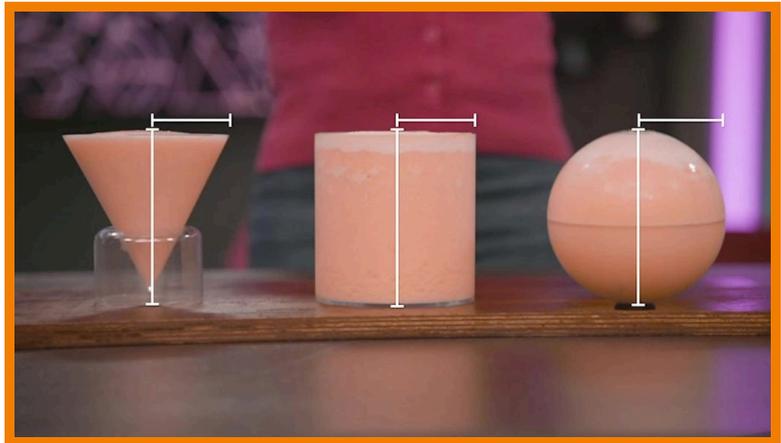
How can you find the volume of a sphere? Compare the sphere to a cone with the same radius and the same height. If you fill the cone with water and pour it into the sphere, it takes exactly 2 cones full of water to fill the sphere. The volume of the sphere is twice the volume of the cone. Remember, the formula for the



volume of a cone was $\frac{1}{3} \pi r^2 h$. So, $\frac{1}{3} \pi r^2 h + \frac{1}{3} \pi r^2 h$ is the volume of a sphere. You can make this formula simpler. The height of the sphere, h , is equal to the diameter, or $2r$. Now you have $\frac{1}{3} \pi r^2(2r) + \frac{1}{3} \pi r^2(2r)$. You can simplify this expression. Since you can multiply in any order, move the 2s to the front. Remember, $r2$ times r is $r3$. Now you have $\frac{2}{3} \pi r^3 + \frac{2}{3} \pi r^3$. Add these parts together: $\frac{4}{3} \pi r^3$. So, the formula for the volume of a sphere in its simplest form is $\frac{4}{3} \pi r^3$. You could use another version of the formula, but this version is simplest. Use this formula to solve a problem. A fishbowl in the shape of a sphere has diameter 20 cm. What is the volume of the fishbowl? The radius of the fishbowl is half the diameter, so it is 10 cm. Substitute that number into the formula. The volume of the fishbowl is approximately 4,187 cm^3 Try this one yourself: A sphere has diameter 18 cm. What is the volume of the sphere?

Relationship Between Cones, Cylinders, and Spheres

A restaurant serves smoothies in containers in three different shapes: cones, cylinders, and spheres. All three containers have the same radius and height. All of them are the same price. Which shape container should you order if you want to get the greatest amount of smoothie? Remember, 1 cylinder has the same



volume as 3 cones. 1 sphere has the same volume as 2 cones. The cylinder container gives you the greatest amount of smoothie. Try this one yourself: A cylinder and a cone have the same radius. They hold the same amount of water. How many times as tall as the cylinder is the cone?

VOLUME OF CYLINDERS, CONES & SPHERES VOCABULARY

Volume

The amount of space inside a 3D object.

Cone

A 3D shape with one circular base.

Cylinder

A 3D shape with two circular bases.

Sphere

A 3D shape in the shape of a ball.

Pi (π)

The ratio of the circumference of a circle to its diameter. This is always the same number: approximately 3.14. The actual number is an irrational number (a decimal that never ends or repeats).

Radius

The measurement from the center of a circle or sphere to its edge. The radius is half the diameter.

VOLUME OF CYLINDERS, CONES & SPHERES DISCUSSION QUESTIONS

What is the formula for the volume of a cylinder? What does each part of the formula mean?

$V = \pi r^2 h$. r is the radius of the circular base of the cylinder and h is the height of the cylinder (the distance between the two circular ends).

What is the formula for the volume of a cone? What does each part of the formula mean?

$V = \frac{1}{3} \pi r^2 h$. r is the radius of the circle at the base and h is the distance between the center point of the circular base and the point at the top of the cone.

What is the formula for the volume of a sphere? What does each part of the formula mean?

$V = \frac{4}{3} \pi r^3$. If I cut the sphere exactly in half I could see a circle on the face. r is the radius of the circle at the very center of the sphere.

[Draw a cylinder with radius 6 cm and height 10 cm.] What is the volume of this shape?

$360\pi \text{ cm}^3$ or about $1,130.4 \text{ cm}^3$.

Suppose you have a cone and a cylinder that have the same height and the same radius. Which has a greater volume?

The cylinder.
