Common Core Standards - Resource Page

The resources below have been created to assist teachers' understanding and to aid instruction of this standard.

Domain	**Standard:** 8.G.9 - Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
Geometry **Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.**	Questions to Focus Learning What is the relationship between area and volume? What is the relationship between volume and surface area? Student Friendly Objectives *Knowledge Targets* Students must know the difference between surface area and volume. Students must apply the formulas to determine the volumes of cones, cylinders, and spheres. Students must identify solids in the environment similar to cones, cylinders, and spheres. Vocabulary altitude base area center chord circular base cone height lateral surface area radius slant height sphere surface area volume

Teacher Tips

Begin by recalling the formula, and its meaning, for the volume of a right rectangular prism:
$V = l \times w \times h$. Then ask students to consider how this might be used to make a conjecture about the volume formula for a cylinder

Most students can be readily led to the understanding that the volume of a right rectangular prism can be thought of as the area of a "base" times the height, and so because the area of the base of a cylinder is πr^2 the volume of a cylinder is $V = \pi r^2 h$.

To manipulate the formula for the volume of a cone, use cylinders and cones with the same base and height. Fill the cone with rice or water and pour into the cylinder. Students will discover/experience that 3 cones full are needed to fill the cylinder. This non-mathematical derivation of the formula for the volume of a cone, $V = 1/3\ \pi r^2 h$, will help most students remember the formula.

In a drawing of a cone inside a cylinder, students might see that that the triangular cross-section of a cone is 1/2 the rectangular cross-section of the cylinder. Ask them to reason why the volume (three dimensions) turns out to be *less* than 1/2 the volume of the cylinder. It turns out to be 1/3.

Core Principles Newsletter Math 8.EE.1

Vertical Progression

G.GMD.1 - Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.
G.GMD.2 - Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
G.GMD.3 - Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *(Modeling Standard)
G.GMD.4 - Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
G.MG.1 - Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). *(Modeling Standard)
G.MG.2 - Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). *(Modeling Standard)
G.MG.3 - Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). *(Modeling Standard)

The above information and more can be accessed for free on the Wiki-Teacher website.
Direct link for this standard: 8.G.9