Grade 8 Target I

Domain, Target, Standards, DOK, Vertical Alignments, Achievement Levels, Evidence Required, Vocabulary, Response Types, Materials, Attributes, Question Types, and Question Banks (Examples)

Content Domain:Geometry
Target I [s]: 8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
Standards included in Target A: 8.G.C,8.G.
Vertical Alignment
Achievement Level Descriptors
Evidence Required
Vocabulary
Response Types
Materials
Attributes
Claim 1: Concepts and Procedures (DOK 1, 2) Question Banks
Claim 2 Problem Solving Question Banks
Claim 4 Modeling and Data Analysis Question Banks

Content Domain:Geometry

Target I [s]: 8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

Standards included in Target A: 8.G.C,8.G.

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

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

Vertical Alignment

Related Grade 7 standards

7.G.B Solve real-world and mathematical problems involving angle measure, area, surface area, and volume.

7 .G.B.6 Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Related Grade HS Standards

G-GMD.A Explain volume formulas and use them to solve problems.

G-GMD.A.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.A.2 (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

G-GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

G-GMD.B Visualize relationships between two-dimensional and three-dimensional objects.

G-GMD.B.4 Identify the shape of two-dimensional cross-sections of three-dimensional objects, and identifies three-dimensional objects generated by rotations of two-dimensional objects.

G-MG.A Apply geometric concepts in modeling situations.

G-MG.A.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). G-MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

G-MG.A.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).

Achievement Level Descriptors

Level 1 Students should be able to identify the key dimensions (i.e., radii, heights, circumferences, and diameters) of cones, cylinders, and spheres.

Level 2 Students should be able to identify the appropriate formula for the volumes of a cone, a cylinder, and a sphere and should be able to connect the key dimensions to the appropriate locations in the formula.

Level 3 Students should be able to calculate the volumes of cones, cylinders, and spheres in direct and familiar mathematical and real world problems.

Level 4 Students should be able to solve unfamiliar or multi-step problems involving volumes of cones, cylinders, and spheres.

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Evidence Required

1. The student solves real-world problems by applying the formulas for the volumes of cylinders, cones, and spheres.

2. The student solves mathematical problems by applying the formulas for the volumes of cylinders, cones, and spheres.

Vocabulary
Volume, cylinder, cone, sphere, radius, diameter, area, base, pi

Response Types
Equation/Numeric; Multiple Choice, single correct response

Materials
Three-dimensional representations of cylinders, cones, and spheres

Attributes
It is expected that students will know and use the formulas for the volumes of cylinders, cones, and spheres.

Claim 1: Concepts and Procedures (DOK 1, 2) Question Banks
Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Claim 1 8.G.C.9 DOK Level 2

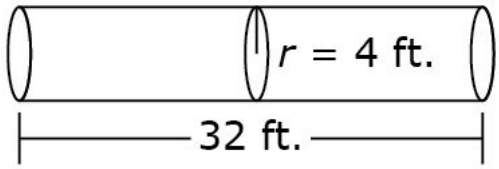
Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Evidence Required

The student solves real-world problems by applying the formulas for the volumes of cylinders, cones, and spheres.

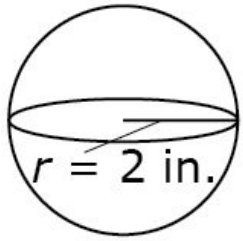
Question Type 1: The student is presented with a situation that includes sufficient measurements of a cylinder, cone, or sphere.

1. This figure shows the dimensions of a tanker truck. The tank forms a cylinder with a length of 32 feet and radius of 4 feet.



What is the volume, in cubic feet, of the tank? Round your answer to the nearest hundredth.

2. A spherical baseball has a radius of 2 inches, as shown in the diagram.

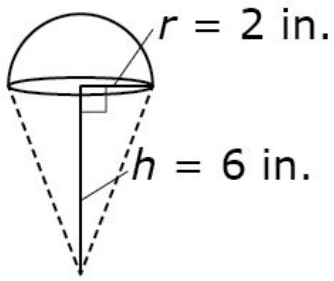


What is the volume, in cubic inches, of the baseball? Round your answer to the nearest hundredth.

Rubric: (1 point) The student gives the correct volume within a range to accommodate different acceptable values of pi (e.g., 1608.50; 33.51).

Response Type: Equation/Numeric

Example Stem 3: An ice cream cone has a height of 6 inches and a radius of 2 inches as shown. The ice cream completely fills the cone, as well as the half-sphere above the cone.



Which is closest to the total volume, in cubic inches, of the ice cream?

A. $\frac{16}{3}\pi$

B. 8π

C. $\frac{40}{3}\pi$

D. 20π

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Answer Choice: The answer choices include the pi symbol as part of the solution. Incorrect answer choices show errors based on miscalculations such as multiplying instead of applying the exponent rule, including the height as a part of the formula for sphere.

Rubric: (1 point) The student gives the correct solution (e.g., C).

Response Type: Multiple Choice, single correct response

Claim 1 8.G.C.9 DOK Level 2

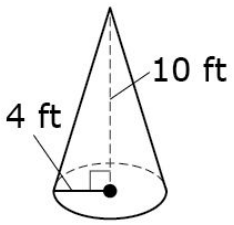
Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real world and mathematical problems.

Evidence Required

The student solves mathematical problems by applying the formulas for the volumes of cylinders, cones, and spheres.

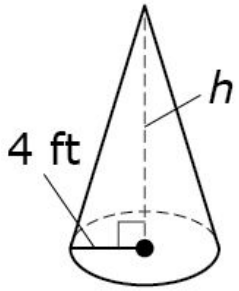
Question Type 1: Student is presented with a 3-dimensional object with measurements.

1. A cone with radius 4 feet and height 10 feet is shown.



Enter the volume of the cone, in cubic feet. Round your answer to the nearest hundredth.

2. A cone with radius 4 feet is shown. Its approximate volume is 165 cubic feet.



Enter the height of the cone, in feet. Round your answer to the nearest hundredth.

Rubric: (1 point) The student gives the correct value within a range to accommodate different acceptable values of pi (e.g., 167.47; 9.85).

Response Type: Equation/Numeric

Claim 2 Problem Solving Question Banks

Claim Descriptors and Targets

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.

Example 1

A sphere and the base of a cone have a radius of 3 inches. The volume of the sphere equals the volume of the cone. What is the height of the cone, in inches?

Enter the height, in inches.

Rubric: (1 point) The student enters the correct radius in the response box (e.g., 12).

Response Type: Equation/Numeric

Example 2

A right cylindrical tank has a height of 10 feet and a radius of 4 feet. Jane fills this tank with water at a rate of 8 cubic feet per minute.

Using this rate, determine the number of minutes it will take Jane to completely fill the tank.

Enter your answer, rounded to the nearest minute, in the response box.

Rubric: (1 point) The student enters the correct number of minutes in the response box (e.g., 63).

Response Type: Equation/Numeric

Claim 4 Modeling and Data Analysis Question Banks

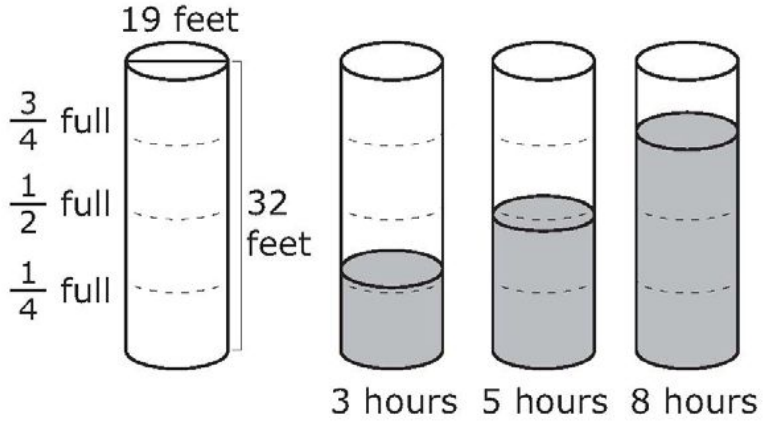
Claim Descriptors and Targets

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Example 1

An empty tank in the shape of a cylinder is being filled with water. The tank is filled at a constant rate for a total of 10 hours. The figure shows the height of water in the tank at the given number of hours after filling started.



Enter the percent of the tank that is filled with water at 10 hours.

Rubric: (2 points) The student enters the correct numerical value for the percent (93.75–94).
(1 point) The student gives the height of water in the tank after 10 hours (30-30.1) OR the volume of water in the tank 10 hours (8500–8532), but forgets to find the percentage.

Response Type: Equation/Numeric (label the response box with %)
Commentary: The task can be done knowing only the information from the third picture (the height is 24 feet after 8 hours), so students who ignore extraneous information are rewarded. Notice that it is not necessary to compute the volume to find the percent, since it can be found by computing the ratio of the heights. Although it is not expected that many students will notice this, the task thus also rewards students with good modeling sense and geometric insight.