

Geometry: Surface Area and Volume

Stage 1 Desired Results		
ESTABLISHED GOALS: Competencies: - Students will demonstrate the ability to decontextualize (represent symbols) and contextualize (understand the meaning of quantities) by converting real-world situations into mathematical symbols for manipulation, and interpreting symbolic results back into practical contexts. - Students will demonstrate application skills by using mathematical concepts and symbols to represent, analyze, and solve problems arising in everyday life, society, and the workplace. - Students will demonstrate accuracy and clarity using correct mathematical terminology, specifying units of measure, and calculating with the degree of precision appropriate for the problem context. - Students will demonstrate the ability to notice repetitive calculations or patterns, evaluate the reasonableness of results, and formulate general methods, formulas, or shortcuts while maintaining oversight of the process. - Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials. - Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences. - Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style. Content Standards: - 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). - 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). - 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). - 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.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. - 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. - MP2 Reason abstractly and quantitatively. - MP3 Construct viable arguments and critique the reasoning of others. - MP7 Look for and make use of structure. - MP8 Look for and express regularity in repeated reasoning.	Transfer	
	Students will be able to independently use their learning to <i>apply their understanding of two- and three-dimensional space to create models that most efficiently utilize resources.</i>	
	Meaning	
	ENDURING UNDERSTANDINGS <i>Students will understand that...</i> three dimensional figures are created from two dimensional figures; therefore the formulas for finding the surface area of three dimensional figures are based on the formulas of finding the area of two dimensional figures.	ESSENTIAL QUESTIONS What are the relationships between finding area, surface area, and volume of two- and three-dimensional figures?
	Acquisition	
	<i>Students will know...</i> - that mapping three dimensions onto two (or two onto three) may introduce distortions. - the following formulas and principles: - Euler's Formula - Cavalieri's Principle - lateral and surface area formulas of a prism, cylinder, pyramid, and cone - volume formulas of a prism, cylinder, pyramid, and cone. - surface area and volume formulas of a sphere. vocabulary: face, polyhedron, cross section, lateral area, surface area, prism, right prism, oblique prism, bases, lateral faces, altitude, height, cylinder, right cylinder, oblique cylinder, pyramid, lateral faces, vertex, regular pyramid, slant height, cone, right cone, volume, similar solids, sphere, great circle, hemispheres, composite space figures, density	<i>Students will be skilled at...</i> - examining and describing cross sections. - using dissection arguments, Cavalieri's principle, and limit arguments to create the following formulas informally: - circumference of a circle - area of a circle - volume of a cylinder, pyramid, and cone - calculating lateral area of prisms, pyramids, cylinders, and cones. - calculating surface area of prisms, pyramids, cylinders, cones, and spheres. - calculating volume of prisms, pyramids, cylinders, cones, and spheres. - using Cavalieri's Principle to compare volumes. - using ratios of similar solids to compare area and volumes of similar solids. - applying concepts of density based on area and volume in modeling situations.
Content Area Literacy Standards		21st Century Skills

• RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. • RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	• <i>reason effectively</i> • <i>use systems thinking</i> • <i>communicate clearly</i> • <i>make judgments and decisions</i>
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Stage 2 - Evidence	
<i>Evaluative Criteria</i>	<i>Assessment Evidence</i>
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan	
Summary of Key Learning Events and Instruction	
<i>Language Arts Integration</i>	<i>Mathematics Integration</i>
• 1.OA.1 Use	• 1.OA.1 Use
<i>Technology Integration</i>	<i>District Materials</i>
• 1.OA.1 Use	

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