UbD: Geometry - Solid Geometry

<table>
<tr><td>Time Frame: 18 Lessons</td><td>Unit 5: Solid Geometry</td><td>Course Name: Geometry</td></tr>
<tr><td colspan="3">Stage 1: Desired Results</td></tr>
<tr><td>Established Goal(s)</td><td colspan="2">Transferable Skills</td></tr>
<tr><td rowspan="5">Standards Addressed:

HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
HSA-SSE.A.1.a Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients
HSA-SSE.A.1.b Interpret expressions that represent a quantity in terms of its context. b. Interpret complicated expressions by viewing one or more of their parts as a single entity.
HSF-IF.C.7.b Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
HSG-GMD.A.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder,</td><td colspan="2">Students will be able to independently use their learning to...

● explain volume formulas and use them to solve problems.
● visualize relationships between two-dimensional and three-dimensional objects.
● apply geometric concepts in modeling situations.
● apply mathematical knowledge, skill, and reasoning to solve real-world problems.
● develop clear and effective communication.
● increase self-direction.
● develop creative and practical problem-solving.
● develop informed and integrative thinking.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td><u>Understandings</u>
Students will understand that...
● they should be able to explain volume formulas and use them to solve problems.
● they should be able to visualize relationships between two-dimensional and three-dimensional objects.
● they can apply geometric concepts in modeling situations.
● math is a continuum, Algebra is needed for Geometry, and math concepts will build on themselves as we develop our mathematical understandings.</td><td><u>Essential Questions</u>
● How do we find the perimeter, area, and volume of two-dimensional and three-dimensional shapes?
● How can the perimeter, area, and volume of two-dimensional and three-dimensional shapes be useful in everyday life?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know...
● how to draw the two-dimensional shape that creates a particular three-dimensional solid when rotated using a given axis.
● how to identify the three-dimensional solid created by rotating a two-dimensional figure using a linear axis.
● how to identify the three-dimensional shape that generates a set of cross-sections.</td><td>Students will be able to...
● create and recognize solids of rotation.
● recognize two-dimensional slices of three-dimensional objects.
● create cross sections by dilating.
● scaling and unscaling in two and three dimensions.
● square roots and cubed roots to find scale factors.</td></tr>
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pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments **HSG-GMD.A.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. **HSG-GMD.B.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. **HSG-MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.. **HSG-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). **HSG-MG.A.3** Apply geometric methods to solve design problems **HSG-SRT.C.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. **HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	• how to visualize and draw multiple cross-sections of a three-dimensional figure. • that a pyramid's cross sections are dilations of its base with scale factors ranging from 0 to 1. • that when figures are dilated by a scale factor of k. their areas are multiplied by k^2. • how to use square root graphs and do calculations to interpret the relationships between scale factors and areas. • that when a solid is dilated by a scale factor of k its surface area is multiplied by k^2 and its volume is multiplied by k^3. • how to create and describe graphs that show relationships between volumes and scale factors. • how to work backward from a volume or surface area scaling to find a scale factor. • how to calculate scale factors for lengths, surface areas, and volumes if I'm given any 1 of the 3 factors. • how to calculate volumes of solids that are composed of cylinders. • how to explain that finding the volume of a prism relates to finding the volume of a cylinder. • that if two solids have equal-area cross sections at all heights, they have the same volumes. • how to calculate volumes of right and oblique prisms and cylinders and figures composed of prisms and cylinders. • how to explain the relationships between pyramids, cones, prisms, and cylinders. • how to explain why the volume formula for pyramids and cones is V= $(1/3)$Bh. • how to calculate volumes of pyramids and cones. • how to work backward from a given volume to find possible dimensions of a pyramid or cone. • how to use the Pythagorean Theorem and trigonometry to help calculate volumes of prisms, cylinders, cones, and pyramids, including solids of rotation. • how to use surface area and volume relationships to solve problems.	• find cylinder volumes. • find cross-sections and volumes of a variety of solids. • build a volume formula for a pyramid. • find volumes and surface areas of prisms. • find volumes and surface areas of pyramids. • solve real-life problems involving pyramids. • solve real-life problems of complex solids that can be represented by a composite of basic solids. • solve real-life problems involving surface area and volume. • solve real-life problems involving volume and density. • define and use geometry-specific vocabulary words that were introduced in this unit. Mathematical Practices: • make sense of problems and persevere in solving them. • reason abstractly and quantitatively. • construct viable arguments and critique the reasoning of others. • model with mathematics. • use appropriate tools strategically. • attend to precision. • look for and make use of structure. • look for and express regularity in repeated reasoning.

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	● how to solve problems involving density and volume. ● that the density of an object is the ratio between its mass and its volume. ● how to use cube root and square root graphs to solve geometric problems. ● the difference between *axis of rotation* and *solid of rotation* ● how to define and correctly use the glossary terms:: cone, cross-section, cylinder, face, prism, pyramid, sphere, oblique (solid), right (solid), apex, and density. ● and apply Cavalieri's Principle.	