

## Unit F - Area, Surface Area, Volume

### Overview

This unit explores the 3D world of surface area and volume. Students will discover the formulas for prisms, cylinders, cones, pyramids, and spheres. They will then use these concepts to determine the surface area and volume of composite figures. 2D cross-sections of 3D objects will be investigated with online applets. Finally, the effects of dilating dimensions on surface area and volume will be introduced.

**21<sup>st</sup> Century Capacities:** Synthesizing

### Stage 1 - Desired Results

#### ESTABLISHED GOALS/ STANDARDS

**MP 1** Make sense of problems and persevere in solving them

**MP4** Model with Mathematics

**MP7** Look for and make use of structure

CCSS.MATH.CONTENT.HSA.CED.A.1

Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

CCSS.MATH.CONTENT.HSA.REI.B.3

Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

CCSS.MATH.CONTENT.HSA.REI.B.4

Solve quadratic equations in one variable.

CCSS.MATH.CONTENT.HSA.REI.B.4.B

Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the

#### **Transfer:**

*Students will be able to independently use their learning in new situations to...*

1. Draw conclusions about graphs, shapes, equations, or objects.
2. Make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution. (synthesizing)
3. Apply familiar mathematical concepts to a new problem or apply a new concept to rework a familiar problem.

#### **Meaning:**

**UNDERSTANDINGS:** *Students will understand that:*

1. Mathematicians apply the mathematics they know to solve problems occurring in everyday life.
2. Mathematicians use geometric models, and spatial sense to interpret and make sense of the physical environment.

**ESSENTIAL QUESTIONS:** *Students will explore & address these recurring questions:*

- A. How can constructing and deconstructing help me know what to do?
- B. What have I seen in the past that might help me now?
- C. How can I simplify the problem?

#### **Acquisition:**

*Students will know...*

1. How a net creates a 3D figure
2. That surface area is just the area of each

*Students will be skilled at...*

1. Calculating surface area and volume of solids, whether a formula exists for the

## Geometry Level 3 Curriculum

<p>initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</p> <p>CCSS.MATH.CONTENT.HSG.GPE.B.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*</p> <p><b>Explain volume formulas and use them to solve problems</b></p> <p>CCSS.MATH.CONTENT.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, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i></p> <p>CCSS.MATH.CONTENT.HSG.GMD.A.2 (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.</p> <p>CCSS.MATH.CONTENT.HSG.GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*</p> <p><b>Visualize relationships between two-dimensional and three-dimensional objects</b></p> <p>CCSS.MATH.CONTENT.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.</p>	<p>surface of a solid, measured in square units</p> <ol style="list-style-type: none"> <li>That volume is the amount of space an object occupies, measured in cubic units</li> <li>Volume of prisms can be found by multiplying the area of the base by the height</li> <li>Any solid that comes to a point (cone or pyramid) is <math>\frac{1}{3}</math> the volume of the corresponding prism with the same height and base.</li> <li>The ratio of surface areas for similar solids is the square of the ratio of their dimensions</li> <li>The ratio of volumes for similar solids is the cube of the ratio of their dimensions</li> <li>Vocabulary: Surface Area, Volume, net, cross-section, prism, cone, cylinder, cube, sphere, hemisphere, pyramid, similar solids</li> </ol>	<p>shape or not</p> <ol style="list-style-type: none"> <li>Applying surface area and volume calculations to real world problems</li> <li>Visualizing and sketching nets of 3D figures</li> <li>Visualizing and sketching 2D cross-sections</li> <li>Determining surface area and volume ratios for similar solids</li> <li>Using pythagorean theorem to find missing measurements of solids</li> </ol>
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