Unit 06-Three-Dimensional Geometry

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **3 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

The overarching goals of the Unit are to have students develop (1) understanding of surface area and volume for common three-dimensional shapes and of circumference and area of circles; (2) strategies for calculating those measures for prisms, circles, cylinders, spheres, and cones; and (3) skill in the application of area and volume concepts to solving measurement problems.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

Surface Areas and Volumes of Polygonal Prisms and Cylinders:

- Understand surface areas and volumes of prisms and cylinders and how they are related
- Describe prisms by using their vertices, faces, and edges
- Visualize three-dimensional shapes and the effects of slicing those shapes by planes
- Deepen understanding of volumes and surface areas of rectangular prisms
- Estimate and calculate surface areas and volumes of polygonal prisms by relating them to rectangular prisms
- Explore the relationships between the surface areas and volumes of prisms
- Relate surface areas and volumes for common figures, especially optimization of surface area for fixed volume
- Predict the effects of scaling dimensions on linear, surface area, and volume measures of prisms, cylinders, and other figures
- Investigate the relationship between volumes of prisms and volumes of cylinders as well as the relationship between surface areas of prisms and surface areas of cylinders
- Use volumes and surface areas of prisms to develop formulas for volumes and surface areas of cylinders
- Discover that volumes of prisms and cylinders can be calculated as the product of the area of the base and the height
- Solve problems involving surface areas and volumes of solid figures

Areas and Circumferences of Circles:

- Understand the areas and circumferences of circles and how they are related
- Relate area of a circle to covering a figure and circumference to surrounding a figure
- Estimate and calculate areas and circumferences of circles
- Explore the relationship between circle radius (or diameter) and area
- Investigate the connection of π to area calculation by estimating the number of radius squares needed to cover a circle
- Investigate the relationship between area and circumference of a circle
- Solve problems involving areas and circumferences of circles

Volumes of Spheres and Cones:

- Understand the relationships between the volumes of cylinders and the volumes of cones and spheres
- Relate volumes of cylinders to volumes of cones and spheres
- Estimate and calculate volumes of spheres and cones
- Solve problems involving surface areas and volumes of spheres and cones

Essential Questions:

- When would one want to find the area of a figure?
- When would one want to find the surface area of a figure?
- When would one want to find the volume of a figure?
- How would changing the radius or diameter of a circle affect its circumference?
- What is the relationship between the area of a circle and its radius?
- What is the relationship between the circumference and area of a circle?

Enduring Understanding:

• Prisms are named for their bases. The name of a prism indicates the number of vertices, edges, and faces the prism has.
• Slicing prisms vertically, horizontally, or on a slant can expose different shapes of cross-sections, depending on which of the original edges are intersected.
• Comparing, reasoning about, and extending what you know about area and volume leads to an understanding of the formulas for finding the surface area and volume of prisms, cones, and pyramids.
• Proportional changes to dimensions of the sides of a prism leads to predictable changes in the surface area and the volume.
• Approximations of the ratio of the circumference of a circle to the circle's diameter leads to exact formulas for the area and circumference of a circle.

CONTENT AREA STANDARDS

7.G

A. Draw, construct, and describe geometrical figures and describe the relationships between them

B. Solve real-life and mathematical problems involving angle measure, area, surface area, and volume

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.7.G.A.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
MA.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.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.

TECH.K-12.P.4	Demonstrate creativity and innovation.
TECH.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will:

- Know the formulas for area and circumference of a circle.

Procedural Knowledge

Students will be able to:

- Describe the two-dimensional figures that result from slicing three-dimensional figures.
- Give an informal derivation of the relationship between circumference and area of a circle.
- Solve real-world and mathematical problems involving the area of two-dimensional objects composed of triangles, quadrilaterals, and polygons.
- Solve real-world and mathematical problems involving the volume and surface area of three-dimensional objects composed of cubes and right prisms.
- Use formulas for area and circumference of a circle to solve problems.

EVIDENCE OF LEARNING

Benchmark Assessment

- BOY Diagnostic Snapshot Assessment
- MP1 Quarterly Assessment
- MP2 Quarterly Assessment
- MP3 Quarterly Assessment
- MP4 Quarterly Assessment
- EOY Diagnostic Snapshot Assessment

Alternate Assessment

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Formative Assessments

- MathXL Assignments
- Do Now Check ins
- Formative Assessments - exit tickets, student-friendly proficiency scales, skill checklists (Google Drive Folder)

Summative Assessments

- Summative Assessment Google Drive Folder
- OnCourse Assessments

RESOURCES (Instructional, Supplemental, Intervention Materials)

Instructional Materials:

- CMP3 - Filling & Wrapping (Online link - teacher and student resources)
- Resources for Unit 6 Google Drive Folder

Supplemental/Intervention Materials:

- Desmos - Volume Comparisons with Prisms, Pyramids, Cones, & Cylinders
- MathXL
- Khan Academy
- NCTM Illuminations
- Illustrative Math
- Illustrative Math Tasks

INTERDISCIPLINARY CONNECTIONS

- Computations

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.