

09 - Area, Surface Area, and Volume (3-D Geometry)

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

General Overview, Course Description or Course Philosophy

Pre-Algebra 7A units were created and organized in line with the areas of focus as identified by the New Jersey Student Learning Standards. Each unit consists of standards that are considered major content along with standards that are supporting and/or additional content. The expectation is that students will have many opportunities to develop fluency with rational number arithmetic and solving multi-step problems (including those involving positive and negative rational numbers and word problems leading to one variable equations) throughout the school year. This course prepares students to take Algebra 1 in Grade 8 by addressing a combination of Grade 7 and Grade 8 standards in one school year.

In this unit, students will also develop an understanding of radius and diameter and finding the circumference and area of circles. They will also gain fluency in finding the area of composite figures, volume, and surface area. They will use this knowledge to gain fluency in finding the volume and surface area of composite three-dimensional solids. They will also apply their fluency to solve real-world problems.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

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

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
- 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

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:

- 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?
- 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 can we measure objects to solve problems?

Enduring Understanding:

- Prisms are named for their bases. The name of a prism indicates the number of vertices, edges, and faces the prism has.
- 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.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.
MA.8.G.C	Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
MA.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.

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

WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.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:

- Find the circumference of circles.
- Find the area of circles.
- Give an informal derivation of the relationship between circumference and area of a circle.
- Use formulas for area and circumference of a circle to solve problems.
- Find the area of composite figures.
- Solve real-world and mathematical problems involving the area of two-dimensional objects composed of triangles, quadrilaterals, and polygons.
- Find the volume of prisms and pyramids.
- Find the surface area of prisms and pyramids.
- Solve real-world and mathematical problems involving the volume and surface area of three-dimensional objects composed of cubes and right prisms.
- Find the volume of cylinders.
- Find the volume of cones.
- Find the volume of spheres and hemispheres.
- Find the volume of and surface area of composite solids.

EVIDENCE OF LEARNING

Benchmark Assessments

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

Formative Assessments

- Delta Math Assignments

- Three-Dimensional Geometry Proficiency Scale
- 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
- Teacher created assessments (both test generator and teacher generated questions)
- Delta Math - Teacher generated assessments

RESOURCES (Instructional, Supplemental, Intervention Materials)

Instructional Materials:

- Reveal Math Accelerated - Area, Surface Area, and Volume (Module 12) ([Online link](#) - teacher and student resources)
- Resources for Unit 9 [Google Drive Folder](#)

Supplemental/Intervention Materials:

- Desmos - [Volume Comparisons with Prisms, Pyramids, Cones, & Cylinders](#)
- [Delta Math](#)
- [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.