Unit 11: Areas and Volumes of Solids

Content Area: **Mathematics**
Course(s): **English I, Geometry, Honors Geometry**
Time Period: **April**
Length: **2 weeks**
Status: **Published**

Unit Overview

- Find the area and the volume or a sphere.
- Find the lateral areas, surface areas (total areas), and volumes of right prisms, regular pyramids, right cylinders, and right cones.
- Identify common solids in the real world and find their lateral areas, surface areas, and volumes.
- Identify the parts of prisms, pyramids, cylinders and cones.
- State and apply the properties of similar solids.
- Volume measures the amount of space occupied by a solid.

Enduring Understandings

- Algebra is used with geometric formulas and properties to find unknown values.
- Geometric figures can be described and compared through measurement.
- Geometric relationships can be used to describe and measure a variety of phenomena in non-mathematical fields.

Essential Questions

- Identify objects in the real world that are measured using geometric formulas, how is the formula used?
- What is a non-mathematical area where geometry is utilized?
- How are solids measured and compared?
- How can an unknown length or angle measurement be found?
- Where do equations occur in geometry?
- Where is geometric terminology used in real world situations?

Lesson Titles/Objectives

- To find the area and the volume of a sphere
- To find the lateral areas, total areas, and volumes of right cylinders and right cones
- To find the lateral areas, total areas, and volumes of right prisms and regular pyramids
- To identify the parts of prisms, pyramids, cylinders, and cones
- To state and apply the properties of similar solids

Standards

MA.G-GMD.A	Explain volume formulas and use them to solve problems
MA.G-GMD.B	Visualize relationships between two-dimensional and three-dimensional objects
MA.G-MG.A	Apply geometric concepts in modeling situations
	Connections to Equations.
	Geometry

Indicators

	Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
	Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.
MA.G-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.
MA.G-GMD.A.2	Give an informal argument using Cavalieri’s principle for the formulas for the volume of a sphere and other solid figures.
MA.G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
MA.G-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.
MA.G-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).
MA.G-MG.A.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).

The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and problem solving. Just as the number line associates numbers with locations in one dimension, a pair of perpendicular axes associates pairs of numbers with locations in two dimensions. This correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

21st Century Skills and Career Ready Practices

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

Inter-Disciplinary Connections

LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
LA.L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

AGRI.9-12.9.4.12.A.(7).2	Assess and describe inventory management using industry-specific concepts and inventory control practices to ensure adequate inventory for business demand.

Instructional Strategies. Learning Activities. and Levels of Blooms/DOK:

- Intro. altitude
- Intro. applying area and volume of a sphere to solve problems
- Intro. applying volume of prisms, pyramids, cylinders, and cones
- Intro. area of a sphere
- Intro. area of similar solids
- Intro. bases and faces of prisms
- Intro. cones and their parts
- Intro. cylinders and their parts
- Intro. finding lateral area of cylinder and cones
- Intro. finding volume of cylinders and cones
- Intro. how to find lateral area and total area of a right prism
- Intro. how to find lateral area and total area of a right pyramid
- Intro. how to find volume of a right prism
- Intro. how to find volume of a right pyramid
- Intro. how to tell if two solids are similiar
- Intro. lateral faces, lateral edges and altitude of a pyramid
- Intro. Prism
- Intro. Pyramids
- Intro. regular pyramids
- Intro. right and oblique prisms
- Intro. slant height
- Intro. Volume
- Intro. volume of a sphere
- Intro. volume of similar solids
- Review anticipatory Set
- Review Homework
- Review HSPA warmup
- Review Quiz
- review spheres
- Students will take a quiz on 12.1-12.3
- students will take a quiz on 12.4-12.5
- students will take a test on chapter 12

Modifications:

ELLs Modifications

- 1:1 testing
- Offer alternate/or modify assessments
- Use manipulatives where possible
- Use real objects when possible
- Utilize explicit learning strategies that are well planned in advance (intentional planning)

IEP & 504 Modifications

- teaching the main ideas/concepts (limiting not needed details)to be taught and repeating them in several different ways over several different days (goal is 7 different ways same concept for students with learning disabilities)
- math tests could have formula's available on the test and/or sample problems
- providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides

G&T Modifications

- CTE - Additional reinforcement activities soliciting a deeper understanding of curriculum.
- Employ differentiated curriculum to keep interest high.
- Modeling

Formative Assessment

- closure find surface area of polyhedrons
- closure find volume of polyhedrons
- journal write
- pass out of class
- think-pair-share
- warm up identify pyramids and cones
- warm up identify rectangular solids and cylinders

Summative Assessment

- Test surface area and volume of prisms, cylinders, pyramids and cones.
- Test surface area and volume of spheres and irregular figures

Resources & Technology

Resources and Materials

- Geometry Text Book- McDougal – Littell
- Manipulatives
- Protractors
- Ruler
- Study Guide and Practice Sheet – Glencoe/McGraw Hill
- Teacher Created worksheets
- Teacher Generated worksheets

Technology

- Geometer sketchpad
- Mathxl
- Smart Board
- Ti-84 calculator
- Videos

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.