

Unit 12: Areas and Volumes of Solids

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

Unit Overview

- Find the area and the volume of 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?

Student Learning 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.

Lesson Titles

- Area & Volume of Similar Figures
- Important Solids & Cross Sections
- Surface Area of Cylinders, Cones, Spheres
- Surface Area of Prisms & Pyramids
- Volumes of Cylinders, Cones, Spheres
- Volumes of Prisms & Pyramids

Career Readiness, Life Literacies & Key Skills

TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
TECH.9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
TECH.9.4.2.DC.1	Explain differences between ownership and sharing of information.
TECH.9.4.2.DC.2	Explain the importance of respecting digital content of others.
TECH.9.4.2.DC.3	Explain how to be safe online and follow safe practices when using the internet (e.g., 8.1.2.NI.3, 8.1.2.NI.4).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.3	Enter information into a spreadsheet and sort the information.

Inter-Disciplinary Connections

LA.RL.9-10.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
--------------	---

LA.RL.9-10.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).
LA.RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
LA.RI.9-10.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).
LA.WHST.9-10.1.E	Provide a concluding paragraph or section that supports the argument presented.

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 similar
- 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 Quiz
- review spheres
- Review standardized-test practice questions for warmup
- students will take a test on chapter 12 on Areas and Volumes of Solids

Modifications:

ELLs Modifications

- 1:1 testing
- Offer alternate/or modify assessments
- Tutoring during Delsea One
- 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)
- Cue Attention
- Extra time
- Family Communication
- Focus on domain specific vocabulary and keywords
- Frequent Check of Work/Reminders
- math tests could have formula's available on the test and/or sample problems
- Modify homework expectations
- Preferential Seating
- Provide Study Guides/Notes
- providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides
- Repeat/Reword/Clarify
- Small group testing
- State Expectations Clearly
- Tutoring during Delsea One

- Use of calculator

G&T Modifications

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

At Risk Modifications

- Additional help during tutoring/Delsea One/Academic Enrichment
- Retesting
- Speaking to students privately when redirecting behaviors
- Study Guides
- Tutoring during Delsea One

Formative Assessment

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

Alternate Assessments

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Benchmark Assessments

Skills-based assessment- math practice

Summative Assessment

- Alternate Assessment
- Marking Period 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

- deltamath.com
- desmos.com
- edpuzzle.com
- Geometer sketchpad
- gimkit.com
- ixl.com
- kahoot.com
- Mathxl
- Peardeck
- 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.