Unit 6 Area and Volume
Advanced 2

Last Update: August 1, 2025

Archdiocesan Curriculum > Advanced 2> Math > Length of unit 12 to 15 days

Stage 1: Desired Results

General Information

In this unit, students will derive and apply formulas for the circumference and area of circles, as well as use these formulas to calculate areas of composite figures. They will identify and describe two-dimensional figures formed by horizontal and vertical cross-sections of solids. Students will calculate the surface area and volume of right prisms, develop and use formulas for the volume of cylinders, cones, and spheres, and apply these concepts to solve multi-step problems involving three-dimensional figures.

Mathematical Practices

- MP4 – Model with mathematics
- MP5 – Use appropriate tools strategically
- MP6 – Attend to precision
- MP7 – Look for and make use of structure

Essential Question(s)

- How can we derive and use formulas to find the circumference and area of a circle?
- In what ways can we calculate the area of composite figures by combining known shapes?
- What can the cross-sections of three-dimensional solids tell us about their shape and properties?
- How do we calculate the surface area and volume of right prisms, cylinders, cones, and spheres?
- How can formulas for surface area and volume be applied to solve real-world multi-step problems involving three-dimensional figures?

Enduring Understanding/Knowledge

Students will:

- Derive and apply formulas for circumference.
- Derive and apply formulas for the area of a circle.
- Use known formulas to calculate the areas of composite figures.

Review/Assess

- Identify and describe the two-dimensional figures resulting from horizontal and vertical cross-sections of solids.
- Calculate the surface area of a right prism using the surface area formula.
- Calculate the volume of a right prism using the volume formula.
- Develop and use the formula for the volume of a cylinder.
- Develop and use the formulas for the volume of a cone and the volume of a sphere.
- Solve multi-step problems involving three-dimensional figures using formulas for surface area and volume.

Review/Assess

Vocabulary

New	Review
• circumference • pi (π) • cross section • cylinder • right cone • sphere	• composite figure • pyramid • rectangular prism • surface area

Connections to Catholic Identity / Other Subjects

Religion/Catholic Identity:

- The cross, a central symbol of Catholic faith, is itself a geometric shape—two perpendicular lines that form a right angle.
  - Example: In a math lesson, students can explore the properties of perpendicular lines and how they are used in creating

Differentiation

Enrichment

- **Explore Pi (π) Origins and Approximations** — Have students investigate the history of π and explore various approximations, including using polygons to approximate circumference and area.
- **Create Composite Figure Challenges** —

both simple and complex structures, just as the cross is foundational to Catholic belief and symbolism. ● Catholic architecture, especially in cathedrals, often features symmetric designs, like the shape of a cross or a rose window. Symmetry, an important geometric concept, is not only beautiful but also a sign of balance and harmony. ● You shall have just balances, just weights, a just ephah, and a just hin; I am the LORD your God, who brought you out from the land of Egypt. (Lev 19:36) ● And he measured its wall, seventy-two yards, according to human measurements, which are also angelic measurements. (Rev 21:17) **Other Subject Here:** ● **Art:** Symmetry, Patterns, Shapes	Challenge students to design and calculate areas of their own composite figures combining circles and polygons. ● **Analyze Cross Sections of Complex Solids** — Extend cross-section exploration to include more complex solids such as cones and spheres, and identify resulting shapes. ● **Derive Volume Formulas Using Calculus Concepts** (for advanced learners) — Introduce the conceptual basis for volume formulas via slicing or integration. ● **Solve Real-World Multi-Step Problems** — Provide open-ended problems involving volumes and surface areas (e.g., designing packaging or containers) to apply formulas creatively. **Support** ● **Use Visual Models for Circumference and Area** — Provide hands-on activities with string and circular objects to measure circumference and area before formalizing formulas. ● **Guided Exploration of Cross Sections** — Use physical solids and cutting simulations (or virtual tools) to visualize and describe cross sections step-by-step. ● **Formula Reference Sheets** — Provide clear, scaffolded formula sheets with labeled diagrams for surface area and volume to reduce cognitive load. ● **Step-by-Step Problem Solving Templates** — Break down multi-step surface area and volume problems into manageable parts with prompts for each step. ● **Use Manipulatives for Volume Concepts** — Use unit cubes or water displacement demonstrations to build conceptual understanding of volume.

Standards & Benchmarks

Analyze Figures to Find Circumference and Area:

7.GM.2
Understand the formulas for area and circumference of a circle and use them to solve real-world and other mathematical problems; give an informal derivation of the relationship between circumference and area of a circle.

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.

7.EE.B.3
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example, If someone making $25 an hour gets a 10% raise, that is an additional 1/10 of their salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

7.G.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.

7.EE.3
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

7.G.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.

7.CE.1.a
Students will demonstrate the following Knowledge and Skills: Estimate, solve, and justify solutions to contextual problems involving addition, subtraction, multiplication, and division with rational numbers expressed as integers, fractions (proper or improper), mixed numbers, and decimals. Fractions may be positive or negative. Decimals may be positive or negative and are limited to the thousandths place.
7.GM.3.2
Demonstrate an understanding of the proportional relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is pi (π) and can be approximated by rational numbers such as 22/7 and 3.14.

Cross Sections, Surface Area, and Volume:

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.
8.G.C.9
Apply the formulas for the volume of cones, cylinders, and spheres to solve real-world and mathematical problems.
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.
7.EE.B.3
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example, If someone making $25 an hour gets a 10% raise, that is an additional 1/10 of their salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.
7.G.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.
7.EE.3
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
8.G.9
Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
7.G.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.

Teaching Ideas/Resources

Websites/Resources:

- **Mathigon (Amplify) Polypad** – Use this collection of digital manipulatives to allow students to experiment with geometric construction.
- Volume and Surface Area This is great for introduction and homework
- Geometry Challenges https://www.geogebra.org/m/wMtsHNWZ

Desmos Free Classroom units on angles, triangles, prisms, cylinder, cones, and spheres:

- Angles, triangles, anGeometry challd prisms
- Cylinders
- Cones
- Spheres