Unit 12: Volume and Surface Area

Content Area: **Mathematics**
Course(s): **Mathematics**
Time Period: **Week 32**
Length: **4 Weeks**
Status: **Published**

Unit Overview

In this unit, students will compare and contrast prisms, pyramids, cylinders, cones, and spheres. They will find the lateral area, total area (or surface area), and volume of these three-dimensional figures. They will apply their knowledge to solve real-world problems involving these figures. Finally, they will investigate the ratio of volumes for similar three-dimensional figures.

Standards

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.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
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).

Essential Questions

1) How can surface area and volume of three-dimensional figures be applied when solving real-world problems?

2) How can knowledge of two-dimensional figures assist in solving problems involving three-dimensional figures?

3) How can algebraic principles be used to solve problems or prove geometric statements?

Application of Knowledge and Skills...

Students will know that...

- 1) prisms and cylinders differ from pyramids and cones in that the former has two bases while the latter has one base.
- 2) lateral area is the total area of the lateral faces.
- 3) total area (or surface area) is the total area of all of the faces of a three-dimensional figure.
- 4) volume is the amount of space that a three-dimensional figure occupies.
- 5) the ratio of the volumes of similar figures is the cube of the ratio of scale factors.

Students will be skilled at...

Students will be able to:

- a) calculate the lateral area, total area, and volume of prisms and cylinders.
- b) calculate the lateral area, total area, and volume of pyramids and cones.
- c) calculate the surface area and volume of spheres.
- d) calculate missing dimensions of a figure when given either the lateral area, total area, or volume.
- e) calculate the ratio of lateral areas, total area, and volumes of similar three-dimensional figures.
- f) solve real-world problems involving three-dimensional figures.

Assessments

- Daily Formative Assessment Formative: Other written assessments Formative assessments, such as Do-Now assignments, homework assignments, Tickets-to-Leave, and SmartPal response board practice problems, will provide daily data for teachers.
- Pre-Assessment Diagnostic: Other written assessments Students will be assessed on their prior knowledge of calculating surface area and volume of three-dimensional figures.
- Unit Quiz Formative: Written Test Students will be assessed on their knowledge of calculating surface area and volume of prisms, pyramids, cylinders, and cones.
- Unit Test Summative: Written Test Students will be assessed on their knowledge of calculating surface area and volume of prisms, pyramids, cylinders, cones, spheres, and complex figures, and finding ratios of lateral areas, total area, and volumes of similar three-dimensional figures.

Activities

Communicator Practice

Students will complete differentiated practice problems on SmartPal response boards.

Cooperative Problem-Solving

Students will work cooperatively on challenge problems. This work may be presented by students, discussed as a class, or turned in for grading and comments.

Similar Solids Investigation

Students will investigate the ratios for surface area and volume of similar solids.

Activities to Differentiate Instruction

Interactive Smartboard Activities will be utilized.

Students will work in mixed-level groups.

Students will be assigned optional and mandatory challenge problems on homework assignments.

Enrichment worksheets will be available for classwork and/or homework.

Guided notes and study guides will be provided accordingly.

Appropriately leveled problems for students to complete. Proofs can range from having few steps to requiring multiple steps using multiple geometric figures.

Integrated/Cross-Disciplinary Instruction

Students will build connections between geometry and architecture by discovering how knowing the surface area and volume of complex three-dimensional figures is essential when constructing new objects.

Resources

McDougal Littell *Geometry for Enjoyment and Challenge* textbook and resources

Smartboard

Smart Exchange

McDougal Littell *Activity Generator* CD-ROM

Smart Exchange

21st Century Skills

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.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
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.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team

members. They plan and facilitate effective team meetings.