

# Unit 06-Three-Dimensional Geometry

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

## General Overview, Course Description or Course Philosophy

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The overarching goals of the Unit are to have students develop (1) understanding of surface area and volume for common three-dimensional shapes and of circumference and area of circles; (2) strategies for calculating those measures for prisms, circles, cylinders, spheres, and cones; and (3) skill in the application of area and volume concepts to solving measurement problems.

## OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

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### Objectives:

#### 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
- Visualize three-dimensional shapes and the effects of slicing those shapes by planes
- 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

#### 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  $\pi$  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

### 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:**

- 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 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?

### **Enduring Understanding:**

- Prisms are named for their bases. The name of a prism indicates the number of vertices, edges, and faces the prism has.
- Slicing prisms vertically, horizontally, or on a slant can expose different shapes of cross-sections, depending on which of the original edges are intersected.
- 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.

## 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**

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|------------|--|
| MA.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.                          |
| 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.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.   |

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

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9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.

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| TECH.K-12.P.4 | Demonstrate creativity and innovation.   |
| TECH.K-12.P.8 | Use technology to enhance productivity increase collaboration and communicate effectively. |

### **STUDENT LEARNING TARGETS**

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#### **Declarative Knowledge**

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Students will:

- Know the formulas for area and circumference of a circle.

## **Procedural Knowledge**

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Students will be able to:

- Describe the two-dimensional figures that result from slicing three-dimensional figures.
- Give an informal derivation of the relationship between circumference and area of a circle.
- Solve real-world and mathematical problems involving the area of two-dimensional objects composed of triangles, quadrilaterals, and polygons.
- Solve real-world and mathematical problems involving the volume and surface area of three-dimensional objects composed of cubes and right prisms.
- Use formulas for area and circumference of a circle to solve problems.

## **EVIDENCE OF LEARNING**

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### **Benchmark Assessment**

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

### **Alternate Assessment**

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- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

## **Formative Assessments**

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- MathXL Assignments
- Do Now Check ins
- Formative Assessments - exit tickets, student-friendly proficiency scales, skill checklists ([Google Drive Folder](#))

## **Summative Assessments**

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- Summative Assessment [Google Drive Folder](#)
- OnCourse Assessments

## **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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### **Instructional Materials:**

- CMP3 - Filling & Wrapping ([Online link](#) - teacher and student resources)
- Resources for Unit 6 [Google Drive Folder](#)

### **Supplemental/Intervention Materials:**

- Desmos - [Volume Comparisons with Prisms, Pyramids, Cones, & Cylinders](#)
- [MathXL](#)
- [Khan Academy](#)
- [NCTM Illuminations](#)
- [Illustrative Math](#)
- [Illustrative Math Tasks](#)

## **INTERDISCIPLINARY CONNECTIONS**

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- Computations

## **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.