Unit 11 Circumference, Area, Volume, and Surface Area

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 4**
Length: **2 weeks**
Status: **Published**

Brief Summary of Unit

Students will explain and use the formulas for the circumference and area of a circle. They will derive the fact that the length of the arc intercepted by an angle is proportional to the radius. Students will derive the formula for the area of a sector. Students will identify the shapes of cross sections of solids and solids generated by rotations of two-dimensional objects. They will explain and use volume formulas and surface area formulas for cylinders, pyramids, cones, and spheres.

Revision Date: July 2024

Standards

Students will analyze geometric designs which connects to various cultures. Embracing the diversity within society incorporates the following:

Amistad Commission

This unit also reflects the goals of the Department of Education and the Amistad Commission including the infusion of the history of Africans and African-Americans into the curriculum in order to provide an accurate, complete, and inclusive history regarding the importance of of African-Americans to the growth and development of American society in a global context.

Asian American and Pacific Islander History Law

This unit includes instructional materials that highlight the history and contributions of Asian Americans and Pacific Islanders in accordance with the New Jersey Student Learning Standards in Social Studies.

New Jersey Diversity and Inclusion Law

In accordance with New Jersey's Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including:

economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance.

ELA.K-12.1	Developing Responsibility for Learning: Cultivating independence, self-reflection, and responsibility for one's own learning.
ELA.K-12.3	Valuing Evidence in Argumentation: Constructing viable claims and evaluating, defending, challenging, and qualifying the arguments of others.
ELA.K-12.4	Building Knowledge: Building strong content knowledge and connecting ideas across disciplines using a variety of text resources and media.
MATH.9-12.G.C.B.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
MATH.9-12.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. Use dissection arguments, Cavalieri's principle, and informal limit arguments.
MATH.9-12.G.GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
MATH.9-12.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.
MATH.9-12.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).
MATH.9-12.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).
CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
TEC.K-12.8.1	All students will use computer applications to gather and organize information and to solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
WORK.K-12.9.2	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.

Essential Questions

- How can you determine the intersection of a solide and a plane?
- How do you find the area and circumference of polygons and circles?
- How do you find the surface area and volume of a solid?

Enduring Understandings

- The area of a regular polygon is related to the distance from the center to a side.
- The volume of a pyramid is related to the volume of a prism with the same base and height.
- To find the surface area of a three-dimensional figure, find the sum of the areas of all the surfaces of the figure.
- To find the surface area of a three-dimensional figure, find the sum of the areas of all the surfaces of the figure.
- You can find the area of a parallelogram or a triangle when you know the length of the base and its height.
- You can find the area of a trapezoid when you know its height and the lengths of its bases.
- You can find the surface area and the volume of a sphere when you know its radius.
- You can find the volume of a prism and the volume of a cylinder.

Students Will Know

- How to calculate population density and how to model with area.
- How to find and apply the properties of circumference and arc length.
- How to find the area of a trapezoid, rhombus, or kite.
- How to find the area of circles and areas of sectors of circles.
- How to find the area of parallelograms and triangles.
- How to find the surface area and volume of a sphere.
- How to find the surface area of a prism and a cylinder.
- How to find the surface area of a pyramid and a cone.
- How to find the volume of a prism and the volume of a cylinder.
- How to find the volume of a pyramid and of a cone.

Students Will Be Skilled At

- Describing and drawing cross sections.
- Describing attributes of solids.
- Finding areas of sectors of circles.
- Finding surface area and volumes of similar solids.
- Finding surface areas of cones and spheres.
- Finding the arc length and use arc lengths to find measures.
- Finding volumes of composite solids.
- Finding volumes of prisms and cylinders.
- Finding volumes of pyramids, cones, na d spheres.
- Solving for the area of any two-dimensional polygon.
- Solving for the surface area and volume of any three-dimensional figure, including spheres.

- Solving problems involving areas of sectors.
- Solving real world problems involving circumference.
- Using the formula for area of a circle to find measures.
- Using the formula for the circumference of a circle to find measures.
- Using volumes of pyramids to find measure.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

Unit 11: Chapter 11, Circumference and Area, Chapter 12, Surface Area and Volume (1-2 days per topic, 9 days instruction, 2 days practice/review, 2 days assessment for 13 days)

- Circumference and Arc Length 11.1
    - Finding Circumference given diameter or radius
    - Finding radius or diameter given Circumference
    - Finding Arc Length as a portion of the circumference of a circle

- Areas of Circles and Sectors 11.2
    - Area of Circle Formula
    - Given Area, find radius
    - Area of sector of a circle
- Modeling with Area 11.4
    - Understand the concept of population density
    - Find population density
    - Use area formulas to solve problems
- Cross Sections of Solids 12.1
    - Classify Solids
    - Describe two dimensional cross sections of three dimensional solids
- Volumes of Prisms and Cylinders 12.2
    - Apply formulas
- Volumes of Pyramids, Cones, and Spheres 12.3, 12.4, 12.5
    - Apply formulas for volume
    - Find volume of composite solids
    - Include examples involving density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
- Surface Area of Cones and Spheres 12.4, 12.5
    - Apply formula for Surface Area
    - Include examples in which students apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost).

Materials

Core instructional materials: Core Book List including Big Ideas Math Common Core Geometry

Supplemental materials: Khan Academy, Edia, DeltaMath

- District approved textbook and ancillary materials
- Online resources: Khan Academy, IXL, Delta Math, Edia Geogebra

- Teacher created activiites
- Teacher created notes

Suggested Strategies for Modifications

Possible accommodations/modification for Geometry CP.