MATHEMATICS COMMON CORE CURRICULUM UNIT #3 Geometry*
North Smithfield School District

TITLE OF UNIT: Modeling Geometric Measurement and Dimensions **COURSE:** Geometry

DATE PRESENTED: ____3/27/13____**DATE DUE:** _____ **LENGTH OF TIME:** Several weeks, quarter, semester

OVERVIEW OF UNIT:

In this unit we will gain an understanding of three-dimensional figures. We will investigate and make connections between two-dimensional and three-dimensional figures. We will explain and calculate volume of various solids while applying our finding to real-life situations.

ESSENTIAL QUESTIONS

How do you identify cross sections of three-dimensional figures and how do you use rotations to generate three-dimensional figures?

How do you calculate the volume of a pyramid, cylinder, cone, or sphere?

How do you use geometry to solve design problems?

STANDARDS: Common Core Math Standards – Grade level Categories 9-12

Number and Quantity	Algebra	Functions	Modeling	Geometry	Statistics and Probability
☐ The Real Number System N-RN	☐ Seeing Structure in Expressions A-SSE	☐ Interpreting Function F-If	☐	☐ Congruence G-CO	☐ Interpreting Categorical and Quantitative Data S-ID
☐ Quantities N-Q	☐ Arithmetic with Polynomials and Rational Expressions A-APR	☐ Building Functions F-BF	☐	☐ Similarity, Right Triangles, and Trigonometry G-SRT	☐ Making Inferences and Justifying Conclusions S-IC
☐ The Complex Number System N-CN	☐ Creating Equations A-CED	☐ Linear, Quadratic, and Exponential Models F-LE		☐ Circles G-c	
☐ Vector and Matrix Quantities N-VM	☐ Reasoning with Equations and Inequalities A-REI	☐ Trigonometric Functions F-TF		☐ Expressing Geometric Properties with Equations G-GPE	
☐	☐	☐		☐ Geometric Measurement and Dimensions G-GMD	
☐	☐	☐		☐ Modeling with Geometry G-MG	

STANDARDS: Mathematical Practices grades K-12

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics ★
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

FOCUS MATHEMATICS STANDARDS:

- ☐ Explain volume formulas and use them to solve problems. G-GMD.1,2,3
- ☐ Visualize the relation between two-dimensional and three dimensional objects. G-GMD.4
- ☐ Apply geometric concepts in modeling situations. G-MG.1,2,3

Applied Learning Standards:

problem solving communication critical thinking research reflection/ evaluation

Expectations for Student Learning (High School only):

Problem Solving, Communication, Body of Knowledge, Proficiency in the Arts, Responsibility

ENDURING UNDERSTANDING:

At the end of this unit, students will be proficient in the following:

- Explain volume formulas and use them to solve problems.
- Visualize the relation between two-dimensional and three dimensional objects.
- Apply geometric concepts in modeling situations.

*Referenced templates from *Common Core Curriculum Maps, English Language Arts* and *The Understanding By Design Guide to Creating High Quality Units*

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PRIOR KNOWLEDGE:

- Algebra I
- Area of polygons
- Units 1 & 2

STUDENT OBJECTIVES, SKILLS and/or NEW KNOWLEDGE:

- Informal arguments can be used to explain the formulas for the circumference and area of a circle, volume of a cylinder, pyramid, and cone.
- Cavalieri's principle can be used to explain the formulas for the volume of a cylinder and other solid figures.
- What constitutes an informal argument?
- How is the formula for the circumference of a circle related to the formula for the area of a circle?
- What is Cavalieri's principle and how is it used in informal arguments?
- Volume formulas for cylinders, pyramids, cones and spheres can be used to solve real-world problems.
- What is a real-world situation in which you would need to calculate the volume of a cylinder? Pyramid? Cone? Sphere?
- Cross-sections of three-dimensional objects create two-dimensional shapes.
- Three-dimensional objects can be created by rotating two-dimensional objects.
- What two-dimensional shapes are created by taking cross-sections of a given three-dimensional object?
- What three-dimensional objects can be sliced to create a trapezoid, and how?
- How do you create a circle or parabola by slicing a three-dimensional figure?
- Give an example and explain how a three-dimensional object is created from a two-dimensional object.
- Geometric shapes and their properties can be used to model real-world objects.
- How can you model objects in your classroom as geometric shapes?
- Density is the measure of a quantity per area or volume.
- How is density related to area and volume?
- Design and structure problems can be solved with geometry.
- Give an example of a real-world problem that can be solved using geometry.

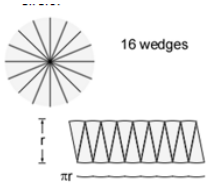
SUGGESTED PROBLEMS:

Teaching Example:

- Cavalieri's principle is if two solids have the same height and the same cross-sectional area at every level, then they have the same volume

Examples:

- Use the diagram below to give an informal argument for the formula for finding the area of a circle.



- Prove that the right cylinder and the oblique cylinder have the same volume.

Teaching Example:

- Missing measures can include but are not limited to slant height, altitude, height, diagonal of a prism, edge length, and radius.

Example:

- Determine the volume of the figure below.

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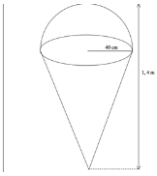
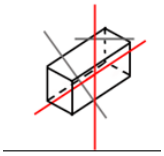


Teaching Examples

- Identify the shape of the vertical, horizontal, and other cross sections of a cylinder.
- Identify the shape of the vertical, horizontal, and other cross sections of a rectangular prism.



Teaching Examples

Example:

- A cylinder can model a tree trunk or a human torso.

How can you model objects in your classroom as geometric shapes?

Teaching Examples

- How is a typographic grid used in design?

Example:

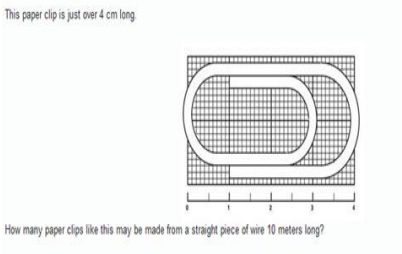
- Tucson has about one million people within approximately 195 square miles. What is Tucson's population density?

Teaching Examples

- Students may use simulation software and modeling software to explore which model best describes a set of data or situation.

Examples:

- Design an object or structure to satisfy physical constraints or minimize cost.
- Work with typographic grid systems based on ratios



From: illustrativemathematics.org

Assessment Problems:

- http://www.illustrativemathematics.org/illustrations/1141
- http://www.illustrativemathematics.org/illustrations/1127
- http://www.illustrativemathematics.org/illustrations/1128
- http://www.illustrativemathematics.org/illustrations/1125
- http://www.illustrativemathematics.org/illustrations/720
- http://schools.nyc.gov/NR/rdonlyres/C03D80B2-9213-43A9-AAA3-BB0032C62F4F/139657/NYCDOE_G10_ADayattheBeach_FINAL1.pdf

ACTIVITIES, PRODUCTS, PERFORMANCE, and ASSESSMENTS: see curriculum introduction

1. Application to real world problems
2. Creating charts/collecting data
3. Collaboration - interpersonal
4. Conferencing
5. Exhibits
6. Graphic organizers
7. Graphing
8. Interviews
9. Journals
10. KWL charts
11. Mathematical Practices
12. Modeling ★
13. Oral presentations
14. Problem/Performance based/common tasks
15. Real-life applications involving graphing
16. Represent numbers
17. Rubrics/checklists (mathematical practice, modeling)
18. Technology
19. Summarizing and note-taking
20. Tests and quizzes
21. Writing genres
    Arguments/ opinion
    Informative

*Referenced templates from *Common Core Curriculum Maps, English Language Arts* and *The Understanding By Design Guide to Creating High Quality Units*

- Tests and quizzes
- Warm ups
- Exit Slips
- Polls

HIGHER ORDER THINKING SKILLS: Web's Depth of Knowledge 2 – 4 or Bloom's Taxonomy

Web's Depth of Knowledge	Bloom's Taxonomy
• skill/conceptual understanding	• apply
• strategic reasoning	• analyze
• extended reasoning	• synthesize/create
	• evaluate

ADDITIONAL RESOURCES: see curriculum for specifics

Textbook

- McDougal Littell Geometry, Applying, Reasoning and Measuring 1.7, 12.1, 12.4-12.6(no surface area)
- H*oughton Mifflin Harcourt, On Core Mathematics Geometry* **Unit 10 (10.1 - 10.6)**

Technology

- Computers
- LCD projectors
- Interactive boards

Websites

- http://curriculum.northsmithfieldschools.com
- http://www.achieve.org/http://my.hrw.com
- http://www.illustrativemathematics.org/standards/practice
- http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEDefaultPage.aspx?page=1
- http://www.parcconline.org/sites/parcc/files/PARCC%20Math%20S
- http://www.tusd1.org/contents/distinfo/curriculum/index.asp
- www.commoncore.org/maps
- www.corestandards.org
- www.khanacademy.com
- www.ride.ri.gov
- http://physics.weber.edu/carroll/archimedes/method1.htm
- http://www.comap.com/

Materials

- Computer dynamic geometry software (Geometer's Sketchpad®, Cabri®, or Geogebra®).
- Concrete models of circles cut into sectors and cylinders, pyramids, cones and spheres cut into slices.
- Drinking Straws
- Dynamic geometry software (Geometer's Sketchpad®, Cabri®, or Geogebra®)
- Geoblocks or comparable models of solid shapes
- Geometry & its Applications (GeoMAP). An exciting National Science Foundation project to introduce new discoveries and real-world applications of geometry to high school students. Produced by COMAP
- Graph paper
- Instructional Resources/Tools
- Mathematics: Modeling our World, Course 1 and Course 2, by the Consortium for Mathematics and its Applications (COMAP), http://www.comap.com/
- Origami paper
- Protractor
- Pythagorean Puzzle - http://www.nsa.gov/academia/_files/collected_learning/high_school/geometry/pythagorean_puz Compass
- Reflection tool (e.g. Mira®).
- Rope or string
- Ruler
- Scientific and/or Graphing calculators and other handheld technology such as TI-Nspire™.

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- Sourcebook of Applications of School Mathematics, compiled by a Joint Committee of the Mathematical Association of America and the National Council of Teachers of Mathematics (1980).
- String
- Tracing paper (patty paper)
- Transparencies
- Video: The Story of Pi from Project MATHEMATICS!

VOCABULARY

- Area
- Cavaliere's Principle
- Circumference
- Cone
- Cross section
- Cylinder
- Density
- Informal argument
- Physical constraints
- Pyramid
- Rotations
- Spheres
- Three-dimensional
- Two-dimensional
- Typographic grid system
- Volume

LESSON PLAN for UNIT _____

LESSONS

- **Lesson # 1 Summary:**
- **Lesson #2 Summary:**
- **Lesson #3 Summary:**

OBJECTIVES for LESSON # _____

- **Materials/Resources:**
- **Procedures:**
  - **Lead –in**
  - **Step by step**
  - **Closure**
- **Instructional strategies:** see curriculum introduction
- **Assessments:** see curriculum introduction
  - **Formative**
  - **Summative**

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