Standard #: MAFS.912.G-MG.1.1

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

Grade: 912

Cluster: Apply geometric concepts in modeling situations. (Geometry - Major Cluster) -
Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Date Adopted or Revised: 02/14

Content Complexity Rating: Level 1: Recall - More Information

Date of Last Rating: 02/14

Status: State Board Approved

Assessed: Yes

TEST ITEM SPECIFICATIONS

Item Type(s): This benchmark may be assessed using: MI item(s)

N/A

Assessment Limits :
Items may require the student to use knowledge of other Geometry standards.

Items may include composite figures.

Items must not also assess G-GMD.1.3 or G-MG.1.3.

Calculator :
Neutral

Clarification :
Students will use geometric shapes to describe objects found in the real world.

Students will use measures of geometric shapes to find the area, volume, surface area, perimeter, or circumference of a shape found in the real world.

Students will apply properties of geometric shapes to solve real-world problems.

Stimulus Attributes :
Items must be set in a real-world context.

Response Attributes :
Items may require the student to use or choose the correct unit of measure.

Items may require the student to apply the basic modeling cycle.

SAMPLE TEST ITEMS (1)

Test Item #: Sample Item 1

Question:
Match each building with the geometric shapes that can be used to model it.

Difficulty: N/A

Type: MI: Matching Item

Related Courses

Course Number	Course Title
1200400:	Intensive Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206300:	Informal Geometry (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206310:	Geometry (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1206320:	Geometry Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912060:	Access Informal Geometry (Specifically in versions: 2014 - 2015 (course terminated))
7912070:	Access Liberal Arts Mathematics (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2019, 2019 and beyond (current))
1206315:	Geometry for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
1207300:	Liberal Arts Mathematics 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current))
7912065:	Access Geometry (Specifically in versions: 2015 and beyond (current))

Related Access Points

Access Point

Access Points Number	Access Points Title
MAFS.912.G-MG.1.AP.1a:	Describe the relationship between the attributes of a figure and the changes in the area or volume when one attribute is changed.

Related Resources

Perspectives Video: Professional/Enthusiast

Name	Description
3D Modeling with 3D Shapes:	Complex 3D shapes are often created using simple 3D primitives! Tune in and shape up as you learn about this application of geometry!
Bacteriophage Geometry and Structure:	Viruses aren't alive but they still need to stay in shape! Learn more about the geometric forms of bacteriophages!
The Relationship between Wing Shape and Flight Performance:	Ken Blackburn, an aerospace engineer for the United States Air Force, describes the relationship between wing shape and flight performance.

Lesson Plan

Name	Description
A Pi-ece of Florida History:	A **Pi**-ece of Florida History discovers significant dates in Florida History in the first 8 digits after the decimal of the number Pi. Historical people associated with those dates are identified and described. Students then use body measurements to approximate volume.
Building Blocks of Geometry:	Students will be introduced to the undefinable concepts of points, lines, and planes that are the building blocks of geometry and recognize that these three terms become the basis for many other geometric definitions. Students will participate in a Building Block Scavenger Hunt, using cameras to photograph examples of specified terms that they find outside of the math classroom. The students will compose a power point to display their photographs of the required terms. This lesson is adapted from a presentation that included an activity by Dianne Olix, 1995.
Cape Florida Lighthouse: Lore and Calculations:	The historic Cape Florida Lighthouse, often described as a conical tower, teems with mathematical applications. This lesson focuses on the change in volume and lateral surface area throughout its storied existence.
Interchangeable Wristwatch Band:	Students use measures and properties of rectangular prisms and cylinders to model and rank 3D printable designs of interchangeable wristwatch bands that satisfy physical constraints.
Modeling: Rolling Cups:	This lesson unit is intended to help you assess how well students are able to choose appropriate mathematics to solve a non-routine problem, generate useful data by systematically controlling variables and develop experimental and analytical models of a physical situation.
NASA Space Shuttle Mission Patches:	Students apply geometric measures and methods, art knowledge, contextual information, and utilize clear and coherent writing to analyze NASA space shuttle mission patches from both a mathematical design and visual arts perspective.
Quadrilaterals using Unit Origami - Sonobe Cube:	This lesson can be used as an introduction - unit attention grabber- or as a final review on quadrilaterals. As the class forms a Sonobe cube, the different quadrilaterals are formed with each new fold. Included is a Power Point introduction, a video I made demonstrating how to fold the unit origami design, a video of my lesson I use as a middle or high school introduction to quadrilaterals and 2 worksheets which accompany the lesson. I enjoy doing this activity each year and am amazed all the prior knowledge the students have retained as the lesson proceeds.
Turning Tires Model Eliciting Activity:	The Turning Tires MEA provides students with an engineering problem in which they must work as a team to design a procedure to select the best tire material for certain situations. The main focus of the MEA is applying geometric concepts through modeling.

Formative Assessment

Name	Description
Camping Calculations:	Students are asked to find the measure of an angle formed by the support poles of a tent using the properties of geometric shapes.
Estimating Area:	Students are asked to select appropriate geometric shapes to model a lake and then use the model to estimate the surface area of the lake.
Estimating Volume:	Students are asked to model a tree trunk with geometric solids and to use the model to estimate the volume of the tree trunk.
Size It Up:	Students are asked to name geometric solids that could be used to model several objects.

Problem-Solving Task

Name	Description
Coins in a circular pattern:	Using a chart of diameters of different denominations of coins, students are asked to figure out how many coins fit around a central coin.
Global Positioning System II:	Reflective of the modernness of the technology involved, this is a challenging geometric modeling task in which students discover from scratch the geometric principles underlying the software used by GPS systems.
Hexagonal pattern of beehives:	The goal of this task is to use geometry to study the structure of beehives.
How many cells are in the human body?:	This problem solving task challenges students to apply the concepts of mass, volume, and density in the real-world context to find how many cells are in the human body.
How many leaves on a tree?:	This is a mathematical modeling task aimed at making a reasonable estimate for something which is too large to count accurately, the number of leaves on a tree.
How many leaves on a tree? (Version 2):	This is a mathematical modeling task aimed at making a reasonable estimate for something which is too large to count accurately, the number of leaves on a tree.
How thick is a soda can? (Variation I):	This problem solving task challenges students to find the surface area of a soda can, calculate how many cubic centimeters of aluminum it contains, and estimate how thick it is.
How thick is a soda can? (Variation II):	This problem solving task asks students to explain which measurements are needed to estimate the thickness of a soda can.
Regular Tessellations of the Plane:	This task examines the ways in which the plane can be covered by regular polygons in a very strict arrangement called a regular tessellation. These tessellations are studied here using algebra, which enters the picture via the formula for the measure of the interior angles of a regular polygon (which should therefore be introduced or reviewed before beginning the task). The goal of the task is to use algebra in order to understand which tessellations of the plane with regular polygons are possible.
Running around a track I:	In this problem, geometry is applied to a 400 meter track to find the perimeter of the track.
Running around a track II:	The goal of this task is to model a familiar object, an Olympic track, using geometric shapes. Calculations of perimeters of these shapes explain the staggered start of runners in a 400 meter race.
Seven Circles III:	This provides an opportunity to model a concrete situation with mathematics. Once a representative picture of the situation described in the problem is drawn (the teacher may provide guidance here as necessary), the solution of the task requires an understanding of the definition of the sine function.
Solar Eclipse:	This problem solving task encourages students to explore why solar eclipses are rare by examining the radius of the sun and the furthest distance between the moon and the earth.
Tennis Balls in a Can:	This task is inspired by the derivation of the volume formula for the sphere. If a sphere of radius 1 is enclosed in a cylinder of radius 1 and height 2, then the volume not occupied by the sphere is equal to the volume of a "double-naped cone" with vertex at the center of the sphere and bases equal to the bases of the cylinder
The Lighthouse Problem:	This problem asks students to model phenomena on the surface of the earth by examining the visibility of the lamp in a lighthouse from a boat.
Toilet Roll:	The purpose of this task is to engage students in geometric modeling, and in particular to deduce algebraic relationships between variables stemming from geometric constraints.
Use Cavalieri's Principle to Compare Aquarium Volumes:	This task presents a context that leads students toward discovery of the formula for calculating the volume of a sphere.

Text Resource

Name	Description
Geometry and Art: Symmetry, Balance, Scale:	This informational text resource is intended to support reading in the content area. There are many parallels between geometry and art, including lthe use of line, shape, form, pattern, symmetry, scale, and proportion. When looking at works of art, students are encouraged to ask themselves questions that help them to reflect on the connections between visual arts and mathematics. The selection is based on the first 3 pages of the PDF.
Math for Hungry Birds:	This informational text resource is intended to support reading in the content area. A new study indicates that the flying patterns of hunting albatrosses may resemble mathematical designs called fractals. This article describes the basics of fractals and why scientists think the albatross may hunt in such patterns. As it turns out, many animals may use math to find food!

Perspectives Video: Expert

Name	Description
Implications of the Spherical Earth:	To understand atmospheric and oceanic currents, one needs a well-rounded understanding of geometry and the shape of the Earth.
Mathematical Patterns and Folds in the Brain:	A bio-mathematician discusses the folds and the structure of the brain and how they relate to math.

Assessment

Name	Description
Sample 1 - High School Geometry State Interim Assessment:	This is a State Interim Assessment for 9th-12th grade.
Sample 3 - High School Geometry State Interim Assessment:	This is a State Interim Assessment for 9th-12th grade.

Student Resources

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Parent Resources

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