# Standard #: MAFS.912.G-MG.1.2

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Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★

**Subject Area:** Mathematics

**Grade:** 912

**Domain-Subdomain:** Geometry: Modeling with Geometry

**Cluster:** Level 2: Basic Application of Skills & Concepts

**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 2: Basic Application of Skills & Concepts - 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: EE item(s)

N/A

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

**Calculator :**
Neutral

**Clarification :**
Students will apply concepts of density based on area in modeling situations.

Students will apply concepts of density based on volume in modeling situations.

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

**Response Attributes :**
Items may require the student to apply the basic modeling cycle.

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

## SAMPLE TEST ITEMS (1)

**Test Item #:** Sample Item 1

**Question:**

The population of Florida in 2010 was 18,801,310 and the land area was 53,625 square miles. The population increased by 5.8% by 2014.

A. To the nearest whole number, what is the population density, in people per square mile, for Florida in 2014?

B. To the nearest whole number, how much did the population density, in people per square mile, increase from 2010 to 2014?

**Difficulty:** N/A

**Type:** EE: Equation Editor

## Related Courses

| Course Number | Course Title |
|---|---|
| 1200400: | Intensive Mathematics (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |

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|---|---|
| 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)) |
| 2020910: | Astronomy Solar/Galactic Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2000320: | Biology 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2000330: | Biology 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current)) |
| 2003350: | Chemistry 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2003360: | Chemistry 2 (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2001320: | Earth/Space Science Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2000440: | Genetics (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2002410: | Integrated Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2002430: | Integrated Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2002450: | Integrated Science 3 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2002510: | Marine Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2002520: | Marine Science 2 (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2002530: | Marine Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2020710: | Nuclear Radiation Honors (formerly 202071A) (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2003320: | Physical Science Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2003380: | Physics 1 (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2003390: | Physics 1 Honors (Specifically in versions: 2014 - 2015, 2015 and beyond (current)) |
| 2003410: | Physics 2 (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)) |
| 2003385: | Physics 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated)) |
| 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.2a: | Recognize the relationship between density and area; density and volume using real-world models. |

## Related Resources

Problem-Solving Task

| Name | Description |
|---|---|
| Archimedes and the King's Crown: | This problem solving task uses the tale of Archimedes and the King of Syracuse's crown to determine the volume and mass of gold and silver. |
| Eratosthenes and the circumference of the earth: | This problem solving task gives an interesting context for implementing ideas from geometry and trigonometry. |
| 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. |

Teaching Idea

| Name | Description |
|---|---|
| Echolocation and Density-SeaWorld Classroom Activity: | Students will solve density problems. |

Perspectives Video: Teaching Idea

| Name | Description |
|---|---|
| Ecological Sampling Methods and Population Density: | Dr. David McNutt explains how a simple do-it-yourself quadrat and a transect can be used for ecological sampling to estimate population density in a given area. |

| | |
|---|---|
| Modeling Sound Waves Traveling through Different Mediums : | Let this teacher transfer some ideas about teaching wave and material properties to you. Then pass it on to someone else. |

Perspectives Video: Professional/Enthusiast

| Name | Description |
|---|---|
| Field Sampling with the Point-centered Quarter Method: | In this video, Jim Cox describes a sampling method for estimating the density of dead trees in a forest ecosystem. |
| KROS Pacific Ocean Kayak Journey: Calories, Distance, and Rowing Rates: | Food is fuel, especially important when your body is powering a boat across the ocean.<br>Related Resources:<br>KROS Pacific Ocean Kayak Journey: GPS Data Set[.XLSX]<br>KROS Pacific Ocean Kayak Journey: Path Visualization for Google Earth[.KML] |
| KROS Pacific Ocean Kayak Journey: Energy and Nutrition: | Calorie-dense foods can power the human body across the ocean? Feel the burn.<br>Related Resources:<br>KROS Pacific Ocean Kayak Journey: GPS Data Set[.XLSX]<br>KROS Pacific Ocean Kayak Journey: Path Visualization for Google Earth[.KML] |
| KROS Pacific Ocean Kayak Journey: Food Storage Mass and Volume: | What do you do if you don't have room for all your gear on a solo ocean trek? You're gonna need a bigger boat...or pack smarter with math.<br>Related Resources:<br>KROS Pacific Ocean Kayak Journey: GPS Data Set[.XLSX]<br>KROS Pacific Ocean Kayak Journey: Path Visualization for Google Earth[.KML] |

Formative Assessment

| Name | Description |
|---|---|
| How Many Trees?: | Students are asked to determine an estimate of the density of trees and the total number of trees in a forest. |
| Mudslide: | Students are asked to create a model to estimate volume and mass. |
| Population of Utah: | Students are asked to determine the population of the state of Utah given the state's population density and a diagram of the state's perimeter with boundary distances labeled in miles. |

Lesson Plan

| Name | Description |
|---|---|
| It's Not Waste—It's Matter!: | It's Not Waste—It's Matter is an MEA that gives students an opportunity to review matter, their physical properties, and mixtures. The MEA provides students to work in teams to resolve a real-life scenario creating a design method by which recyclable products are separated in order to further process. |
| Olympic Snowboard Design: | This MEA requires students to design a custom snowboard for five Olympic athletes, taking into consideration how their height and weight affect the design elements of a snowboard. There are several factors that go into the design of a snowboard, and the students must use reasoning skills to determine which factors are more important and why, as well as what factors to eliminate or add based on the athlete's style and preferences. After the students have designed a board for each athlete, they will report their procedure and reasons for their decisions. |
| Propensity for Density: | Students apply concepts of density to situations that involve area (2-D) and volume (3-D). |

Perspectives Video: Expert

| Name | Description |
|---|---|
| MicroGravity Sensors & Statistics: | Statistical analysis played an essential role in using microgravity sensors to determine location of caves in Wakulla County. |

Educational Game

| Name | Description |
|---|---|
| Population Density: | Play a game about density and population. Students may select **Teach Me** to learn about the density formula prior to beginning play. Hints and feedback are provided to players. |

Assessment

| Name | Description |
|---|---|
| Sample 2 - High School Geometry State Interim Assessment: | This is a State Interim Assessment for 9th-12th grade. |
| Sample 4 - High School Geometry State Interim Assessment: | This is a State Interim Assessment for 9th-12th grades. |

## Student Resources

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| Archimedes and the King's Crown: | This problem solving task uses the tale of Archimedes and the King of Syracuse's crown to determine the volume and mass of gold and silver. |
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| MicroGravity Sensors & Statistics: | Statistical analysis played an essential role in using microgravity sensors to determine location of caves in Wakulla County. |
| Population Density: | Play a game about density and population. Students may select **Teach Me** to learn about the density formula prior to beginning play. Hints and feedback are provided to players. |

### Parent Resources

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