

K-12 Mathematics Introduction

The Georgia Mathematics Curriculum focuses on actively engaging the students in the development of mathematical understanding by using manipulatives and a variety of representations, working independently and cooperatively to solve problems, estimating and computing efficiently, and conducting investigations and recording findings. There is a shift towards applying mathematical concepts and skills in the context of authentic problems and for the student to understand concepts rather than merely follow a sequence of procedures. In mathematics classrooms, students will learn to think critically in a mathematical way with an understanding that there are many different ways to a solution and sometimes more than one right answer in applied mathematics. Mathematics is the economy of information. The central idea of all mathematics is to discover how knowing some things well, via reasoning, permit students to know much else—without having to commit the information to memory as a separate fact. It is the connections, the reasoned, logical connections that make mathematics manageable. As a result, implementation of Georgia’s Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

Georgia Performance Standards

GPS Geometry

This is the second course in a sequence of courses designed to provide students with a rigorous program of study in mathematics. It includes fundamentals of proof, properties of polygons, coordinate geometry, right triangles, and right triangular trigonometry; properties of circles; statistical inference and exponential functions. (*Prerequisite: Successful completion of GPS Algebra.*)

Instruction and assessment should include the appropriate use of manipulatives and technology. Topics should be represented in multiple ways, such as concrete/pictorial, verbal/written, numeric/data-based, graphical, and symbolic. Concepts should be introduced and used, where appropriate, in the context of realistic phenomena.

GEOMETRY

Students will explore, understand, and use the formal language of reasoning and justification. Students will apply properties of polygons and determine distances and points of concurrence. Students will explore right triangles and right-triangle trigonometry. They will understand and apply properties of circles and spheres, and use them in determining related measures.

MM1G1. Students will investigate properties of geometric figures in the coordinate plane.

- a. Determine the distance between two points.
- b. Determine the distance between a point and a line.
- c. Determine the midpoint of a segment.
- d. Understand the distance formula as an application of the Pythagorean theorem.
- e. Use the coordinate plane to investigate properties of and verify conjectures

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related to triangles and quadrilaterals.

MM1G2. Students will understand and use the language of mathematical argument and justification.

- a. Use conjecture, inductive reasoning, deductive reasoning, counterexamples, and indirect proof as appropriate.
- b. Understand and use the relationships among a statement and its converse, inverse, and contrapositive.

MM1G3. Students will discover, prove, and apply properties of triangles, quadrilaterals, and other polygons.

- a. Determine the sum of interior and exterior angles in a polygon.
- b. Understand and use the triangle inequality, the side-angle inequality, and the exterior-angle inequality.
- c. Understand and use congruence postulates and theorems for triangles (SSS, SAS, ASA, AAS, HL).
- d. Understand, use, and prove properties of and relationships among special quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid, and kite.
- e. Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid.

MM2G1. Students will identify and use special right triangles.

- a. Determine the lengths of sides of 30° - 60° - 90° triangles.
- b. Determine the lengths of sides of 45° - 45° - 90° triangles.

MM2G2. Students will define and apply sine, cosine, and tangent ratios to right triangles.

- a. Discover the relationship of the trigonometric ratios for similar triangles.
- b. Explain the relationship between the trigonometric ratios of complementary angles.
- c. Solve application problems using the trigonometric ratios.

MM2G3. Students will understand the properties of circles.

- a. Understand and use properties of chords, tangents, and secants as an application of triangle similarity.
- b. Understand and use properties of central, inscribed, and related angles.
- c. Use the properties of circles to solve problems involving the length of an arc and the area of a sector.
- d. Justify measurements and relationships in circles using geometric and algebraic properties.

MM2G4. Students will find and compare the measures of spheres.

- a. Use and apply surface area and volume of a sphere.
- b. Determine the effect on surface area and volume of changing the radius or diameter of a sphere.

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DATA ANALYSIS AND PROBABILITY

Students will demonstrate understanding of data analysis by posing questions to be answered by collecting data. Students will organize, represent, investigate, interpret, and make inferences from data.

MM2D1. Using sample data, students will make informal inferences about population means and standard deviations.

- a. Pose a question and collect sample data from at least two different populations.
- b. Understand and calculate the means and standard deviations of sets of data.
- c. Use means and standard deviations to compare data sets.
- d. Compare the means and standard deviations of random samples with the corresponding population parameters, including those population parameters for normal distributions. Observe that the different sample means vary from one sample to the next. Observe that the distribution of the sample means has less variability than the population distribution.

ALGEBRA

Students will investigate exponential functions using numerical, analytical, and graphical approaches, focusing on the use of these functions in problem-solving situations. Students will explore inverses of functions.

MM2A2. Students will explore exponential functions.

- a. Extend properties of exponents to include all integer exponents.
- b. Investigate and explain characteristics of exponential functions, including domain and range, asymptotes, zeros, intercepts, intervals of increase and decrease, rates of change, and end behavior.
- c. Graph functions as transformations of $f(x) = a^x$.
- d. Solve simple exponential equations and inequalities analytically, graphically, and by using appropriate technology.
- e. Understand and use basic exponential functions as models of real phenomena.
- f. Understand and recognize geometric sequences as exponential functions with domains that are whole numbers.
- g. Interpret the constant ratio in a geometric sequence as the base of the associated exponential function.

MM2A5. Students will explore inverses of functions.

- a. Discuss the characteristics of functions and their inverses, including one-to-oneness, domain, and range.
- b. Determine inverses of linear, quadratic, and power functions and functions of the form $f(x) = \frac{a}{x}$, including the use of restricted domains.

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- c. Explore the graphs of functions and their inverses.
- d. Use composition to verify that functions are inverses of each other.

Process Standards

The following process standards are essential to mastering each of the mathematics content standards. They emphasize critical dimensions of the mathematical proficiency that all students need.

MM2P1. Students will solve problems (using appropriate technology).

- a. Build new mathematical knowledge through problem solving.
- b. Solve problems that arise in mathematics and in other contexts.
- c. Apply and adapt a variety of appropriate strategies to solve problems.
- d. Monitor and reflect on the process of mathematical problem solving.

MM2P2. Students will reason and evaluate mathematical arguments.

- a. Recognize reasoning and proof as fundamental aspects of mathematics.
- b. Make and investigate mathematical conjectures.
- c. Develop and evaluate mathematical arguments and proofs.
- d. Select and use various types of reasoning and methods of proof.

MM2P3. Students will communicate mathematically.

- a. Organize and consolidate their mathematical thinking through communication.
- b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
- c. Analyze and evaluate the mathematical thinking and strategies of others.
- d. Use the language of mathematics to express mathematical ideas precisely.

MM2P4. Students will make connections among mathematical ideas and to other disciplines.

- a. Recognize and use connections among mathematical ideas.
- b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- c. Recognize and apply mathematics in contexts outside of mathematics.

MM2P5. Students will represent mathematics in multiple ways.

- a. Create and use representations to organize, record, and communicate mathematical ideas.
- b. Select, apply, and translate among mathematical representations to solve problems.
- c. Use representations to model and interpret physical, social, and mathematical phenomena.

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Reading Standard Comment

After the elementary years, students are seriously engaged in reading for learning. This process sweeps across all disciplinary domains, extending even to the area of personal learning. Students encounter a variety of informational as well as fictional texts, and they experience text in all genres and modes of discourse. In the study of various disciplines of learning (language arts, mathematics, science, social studies), students must learn through reading the communities of discourse of each of those disciplines. Each subject has its own specific vocabulary, and for students to excel in all subjects, they must learn the specific vocabulary of those subject areas *in context*.

Beginning with the middle grades years, students begin to self-select reading materials based on personal interests established through classroom learning. Students become curious about science, mathematics, history, and literature as they form contexts for those subjects related to their personal and classroom experiences. As students explore academic areas through reading, they develop favorite subjects and become confident in their verbal discourse about those subjects.

Reading across curriculum content develops both academic and personal interests in students. As students read, they develop both content and contextual vocabulary. They also build good habits for reading, researching, and learning. The Reading Across the Curriculum standard focuses on the academic and personal skills students acquire as they read in all areas of learning.

MRC. Students will enhance reading in all curriculum areas by:

- a. Reading in all curriculum areas
 - Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas
 - Read both informational and fictional texts in a variety of genres and modes of discourse
 - Read technical texts related to various subject areas
- b. Discussing books
 - Discuss messages and themes from books in all subject areas.
 - Respond to a variety of texts in multiple modes of discourse.
 - Relate messages and themes from one subject area to messages and themes in another area.
 - Evaluate the merit of texts in every subject discipline.
 - Examine author's purpose in writing.
 - Recognize the features of disciplinary texts.
- c. Building vocabulary knowledge
 - Demonstrate an understanding of contextual vocabulary in various subjects.
 - Use content vocabulary in writing and speaking.
 - Explore understanding of new words found in subject area texts.
- d. Establishing context
 - Explore life experiences related to subject area content.
 - Discuss in both writing and speaking how certain words are subject area related.
 - Determine strategies for finding content and contextual meaning for unknown words.

Georgia Performance Standards Framework
High School Mathematics
GPS Geometry

Georgia Performance Standards: Curriculum Map					
1 st Semester			2 nd Semester		
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Geometry Gallery	Coordinate Geometry	Statistics	Right Triangle Trigonometry	Circles and Spheres	Exponential, and Inverses
7 weeks	4 weeks	5 Weeks	4 Weeks	6 Weeks	6 Weeks
MM1G3a,b,c,d,e MM1G2a,b	MM1G1a,b,c,d,e	MM2D1a,b,c,d	MM2G1a,b MM2G2a,b,c	MM2G3a,b,c,d MM2G4a,b	MM2A2a,b,c,d,e,f, g MM2A5a,b,c,d
<p><i>These units were written to build upon concepts from prior units, so later units contain tasks that depend upon the concepts addressed in earlier units. Standards listed in bold are key standards. All units will include the Process Standards and indicate skills to maintain.</i></p>					
<p>Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.</p>					