Georgia Department of Education

*Common Core Georgia Performance Standards*

*Advanced Mathematical Decision Making*

**Mathematics Common Core Georgia Performance Standards**

**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 Mathematics Common Core Georgia Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

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*Advanced Mathematical Decision Making*

This is a course designed to follow the completion of Mathematics III or Accelerated Mathematics II. The course will give students further experiences with statistical information and summaries, methods of designing and conducting statistical studies, an opportunity to analyze various voting processes, modeling of data, basic financial decisions, and use network models for making informed decisions. *(Prerequisite: Successful completion of Mathematics III or Accelerated Mathematics II)*

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.

**NUMBER AND OPERATIONS**

Students will extend their understanding and use of ratios, proportions to solve problems involving in decision making.

**MAMDMN1.** Students will extend the understanding of proportional reasoning, ratios, rates, and percents by applying them to various settings to include business, media, and consumerism.

a. Use proportional reasoning to solve problems involving ratios.
b. Understand and use averages, weighted averages, and indices.
c. Solve problems involving large quantities that are not easily measured.
d. Understand how identification numbers, such as UPCs, are created and verified.

**ALGEBRA**

Students will explore the applications of functions, their characteristics and their use in modeling. Vectors and matrices are employed for solving problems.

**MAMDMA1. Students will use vectors and matrices to organize and describe problem situations.**

a. Represent situations and solve problems using vectors in areas such as transportation, computer graphics, and the physics of force and motion.
b. Represent geometric transformations and solve problems using matrices in fields such as computer animations.

**MAMDMA2. Students will use a variety of network models to organize data in quantitative situations, make informed decisions, and solve problems.**

a. Solve problems represented by a vertex-edge graph, and find critical paths, Euler paths, and minimal spanning trees.
b. Construct, analyze, and interpret flow charts to develop an algorithm to describe processes such as quality control procedures.
c. Investigate the scheduling of projects using PERT.
d. Consider problems that can be resolved by coloring graphs.

**MAMDMA3. Students will create and analyze mathematical models to make decisions related to earning, investing, spending, and borrowing money.**

a. Use exponential functions to model change in a variety of financial situations.
b. Determine, represent, and analyze mathematical models for income, expenditures, and various types of loans and investments.

**MAMDMA4. Students will analyze and evaluate the mathematics behind various methods of voting and selection.**

a. Evaluate various voting and selection processes to determine an appropriate method for a given situation.
b. Apply various ranking algorithms to determine an appropriate method for a given situation.
GEOMETRY
Students apply tools to model geometric situations and solve problems. Students extend their knowledge of right triangle trigonometry.

MAMDMG1. Students will create and use two- and three-dimensional representations of authentic situations.

MAMDMG2. Students will solve geometric problems involving inaccessible distances using basic trigonometric principles, including the Law of Sines and the Law of Cosines.

DATA ANALYSIS AND PROBABILITY
Students will explore representations of data and models of data as tools in the decision making.

MAMDMD1. Students will determine probability and expected value to inform everyday decision making.
   a. Determine conditional probabilities and probabilities of compound events to make decisions in problem situations.
   b. Use probabilities to make and justify decisions about risks in everyday life.
   c. Calculate expected value to analyze mathematical fairness, payoff, and risk.

MAMDMD2. Students will build the skills and vocabulary necessary to analyze and critique reported statistical information, summaries, and graphical displays.

MAMDMD3. Students will apply statistical methods to design, conduct, and analyze statistical studies.

MAMDMD4. Students will use functions to model problem situations in both discrete and continuous relationships.
   a. Determine whether a problem situation involving two quantities is best modeled by a discrete (pattern identification, population growth, compound interest) or continuous (medication dosage, climate change, bone decay) relationship.
   b. Use linear, exponential, logistic, piecewise and sine functions to construct a model.

Terms/Symbols: Networks, weighted average, indices, vector, critical path, Euler path, minimal spanning trees, PERT, Law of Sines, Law of Cosines, payoff, risk, discrete, continuous, logistics, annuity, future value, present value, ranking, margin of error, cyclical, period, amplitude, phase shift, commission, salary, perpetuity, electoral college, periodic functions, statistical bias.
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**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.

**MM1P1. 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.

**MM1P2. Students will reason and evaluate mathematical arguments.**
   a. Recognize reasoning and proof as fundamental aspects of mathematics.
   b. Make and investigate mathematical conjecture.
   c. Develop and evaluate mathematical arguments and proofs.
   d. Select and use various types of reasoning and methods of proof.

**MM1P3. 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.

**MM1P4. 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.

**MM1P5. 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.