



InspireData™ Standards Match

GEORGIA



Performance Standards for Mathematics

Meeting curriculum standards is a major focus in education today. This document highlights the correlation of **InspireData™** with the **Georgia Performance Standards for Mathematics**.

The Inspired Standards Match is designed to demonstrate the many ways InspireData supports the standards and to give educators ideas for using this tool to meet learning goals.

How to read the InspireData Standards Match:

- ▶ **Yellow** highlight indicates a standard or objective that can be supported by the use of InspireData databases, database templates, user generated databases, lesson plans or program features.
- ▶ **Green** notes list details about how InspireData can be used to meet the standards, including examples of specific databases, lesson plans or features that support them.

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3-5 Mathematics Georgia Performance Standards **Grade 4**

By the end of grade four, students will add and subtract decimal fractions and common fractions with common denominators. They will also understand how and when it is appropriate to use rounding. Students will use common measurement units to determine weight. Students will develop their understanding of measuring angles with appropriate units and tools. Students will understand the characteristics of geometric plane and solid figures. They will also use tables, graphs, and charts to record and analyze data.

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

Concepts/Skills to Maintain

Addition and subtraction of decimals
Multiplication and Division of whole numbers
Area
Perimeter
Place Value
Weight and Length

NUMBER AND OPERATIONS

Students will further develop their understanding of whole numbers and master the four basic operations with whole numbers by solving problems. They will also understand rounding and when to appropriately use it. Students will add and subtract decimal fractions and common fractions with common denominators.

M4N1. Students will further develop their understanding of how whole numbers are represented in the base-ten numeration system.

- a. Identify place value names and places from hundredths through one million.
- b. Equate a number's word name, its standard form, and its expanded form.

M4N2. Students will understand and apply the concept of rounding numbers.

- a. Round numbers to the nearest ten, hundred, or thousand.
- b. Describe situations in which rounding numbers would be appropriate and determine whether to round to the nearest ten, hundred, or thousand.

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- c. Understand the meaning of rounding a decimal fraction to the nearest whole number.
- d. Represent the results of computation as a rounded number when appropriate and estimate a sum or difference by rounding numbers.

M4N3. Students will solve problems involving multiplication of 2-3 digit numbers by 1-2 digit numbers.

M4N4. Students will further develop their understanding of division of whole numbers and divide in problem solving situations without calculators.

- a. Know the division facts with understanding and fluency.
- b. Solve problems involving division by a 2-digit number (including those that generate a remainder).
- c. Understand the relationship between dividend, divisor, quotient, and remainder.
- d. Understand and explain the effect on the quotient of multiplying or dividing both the divisor and dividend by the same number. ($2050 \div 50$ yields the same answer as $205 \div 5$).

M4N5. Students will further develop their understanding of the meaning of decimal fractions and use them in computations.

- a. Understand decimal fractions are a part of the base-ten system.
- b. Understand the relative size of numbers and order two digit decimal fractions.
- c. Add and subtract both one and two digit decimal fractions.
- d. Model multiplication and division of decimal fractions by whole numbers.
- e. Multiply and divide both one and two digit decimal fractions by whole numbers.

M4N6. Students will further develop their understanding of the meaning of common fractions and use them in computations.

- a. Understand representations of simple equivalent fractions.
- b. Add and subtract fractions and mixed numbers with common denominators. (Denominators should not exceed twelve.)
- c. Convert and use mixed numbers and improper fractions interchangeably.

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M4N7. Students will explain and use properties of the four arithmetic operations to solve and check problems.

- a. Describe situations in which the four operations may be used and the relationships among them.
- b. Compute using the order of operations, including parentheses.
- c. Compute using the commutative, associative, and distributive properties.
- d. Use mental math and estimation strategies to compute.

MEASUREMENT

Students will measure weight in appropriate metric and standard units. They will also measure angles.

M4M1. Students will understand the concept of weight and how to measure it.

- a. Use standard and metric units to measure the weight of objects.
- b. Know units used to measure weight (gram, kilogram, ounces, pounds and tons).
- c. Compare one unit to another within a single system of measurement.

M4M2. Students will understand the concept of angles and how to measure it.

- a. Use tools, such as a protractor or angle ruler, and other methods such as paper folding, drawing a diagonal in a square, to measure angles.
- b. Understand the meaning and measure of a half rotation (180°) and a full rotation (360°).

GEOMETRY

Students will understand and construct plane and solid geometric figures. They will also graph points on the coordinate plane.

M4G1. Students will define and identify the characteristics of geometric figures through examination and construction.

- a. Examine and compare angles in order to classify and identify triangles by their angles.
- b. Describe parallel and perpendicular lines in plane geometric figures.
- c. Examine and classify quadrilaterals (including parallelograms, squares, rectangles, trapezoids, and rhombi).
- d. Compare and contrast the relationships among quadrilaterals.

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M4G2. Students will understand fundamental solid figures.

- Compare and contrast a cube and a rectangular prism in terms of the number and shape of their faces, edges, and vertices.
- Describe parallel and perpendicular lines and planes in connection with the rectangular prism.
- Construct/collect models for solid geometric figures (cube, prisms, cylinder, etc.).

M4G3. Students will use the coordinate system.

- Understand and apply ordered pairs in the first quadrant of the coordinate system.
- Locate a point in the first quadrant in the coordinate plane and name the ordered pair.
- Graph ordered pairs in the first quadrant.

ALGEBRA

Students will investigate and represent mathematical relationships between quantities using mathematical expressions in problem-solving situations.

M4A1. Students will represent and interpret mathematical relationships in quantitative expressions.

- Understand and apply patterns and rules to describe relationships and solve problems.
- Represent unknowns using symbols, such as \square and Δ .
- Write and evaluate mathematical expressions using symbols and different values.

DATA ANALYSIS

Students will gather, organize, and display data. They will also compare features of graphs.

M4D1. Students will gather, organize, and display data according to the situation and compare related features.

- Represent data in bar, line and pictographs.
- Investigate the features and tendencies of graphs.

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- c. Compare different graphical representations for a given set of data.
- d. Identify missing information and duplications in data.

Process Skills

Each topic studied in this course should be developed with careful thought toward helping every student achieve the following process standards.

M4P1. 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.

M4P2. 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.

M4P3. 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.

M4P4. 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.

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M4P5. 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.

Terms / Symbols:

sum, difference, product, quotient, mixed fraction, proper fraction, improper fraction, point, ray, line, line segment, parallel, perpendicular, diagonal line, plane, weight, ounce, pound, ton, gram, kilogram, protractor, degree, rotation, parallelogram, trapezoid, rhombus, quadrilateral, congruent, cube, rectangular prism, coordinate system, ordered pair, ratio, proportion, variable, line graph, pictograph

3-5 Mathematics Georgia Performance Standards **Grade 5**

By the end of grade five, students will further develop their understanding of multiplication and division of whole numbers and decimal fractions. They will also understand and investigate algebraic mathematical expressions. Students will also expand their understanding of computing area and volume of simple geometric figures. Students will understand the meaning of congruent geometric shapes and the relationship of the circumference of a circle to its diameter. They will also use percentages and circle graphs to interpret statistical data.

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

Concepts/Skills to Maintain

Add and subtract decimal fractions
Whole numbers and decimal fraction
computation
Angle measurement
Length, area, and weight
Number sense
Add and subtract common fractions with
like denominators
Data usage and representation
Characteristics of 2D and 3D shapes
Order of Operations

NUMBER AND OPERATIONS

Students will further develop their understanding of the concept of whole numbers. They will also understand the meanings of multiplication and division of decimal fractions and use decimal fractions and common fractions in computation, as well as in problem solving situations.

M5N1. Students will further develop their understanding of whole numbers.

- a. Classify the set of counting numbers into subsets with distinguishing characteristics (odd/even, prime/composite).
- b. Find multiples and factors.
- c. Analyze and use divisibility rules.

3-5 Mathematics Georgia Performance Standards

Grade 5

M5N2. Students will further develop their understanding of decimal fractions as part of the base-ten number system.

- a. Understand place value.
- b. Analyze the effect on the product when a number is multiplied by 10, 100, 1000, 0.1, and 0.01.

M5N3. Students will further develop their understanding of the meaning of multiplication and division with decimal fractions and use them.

- a. Model multiplication and division of decimal fractions by another decimal fraction.
- b. Explain the process of multiplication and division, including situations in which the multiplier and divisor are both whole numbers and decimal fractions.
- c. Multiply and divide with decimal fractions including decimal fractions less than one and greater than one.
- d. Understand the relationships and rules for multiplication and division of whole numbers also apply to decimal fractions.

M5N4. Students will continue to develop their understanding of the meaning of common fractions and compute with them.

- a. Understand division of whole numbers can be represented as a fraction ($a/b = a \div b$).
- b. Understand the value of a fraction is not changed when both its numerator and denominator are multiplied or divided by the same number because it is the same as multiplying or dividing by one.
- c. Find equivalent fractions and simplify fractions.
- d. Model the multiplication and division of common fractions.
- e. Explore finding common denominators using concrete, pictorial, and computational models.
- f. Use $<$, $>$, or $=$ to compare fractions and justify the comparison.
- g. Add and subtract common fractions and mixed numbers with unlike denominators.
- h. Use fractions (proper and improper) and decimal fractions interchangeably.
- i. Estimate products and quotients.

 **M5N5. Students will understand the meaning of percentage.**

- a. Model percent on 10 by 10 grids.
- b. Apply percentage to circle graphs.

3-5 Mathematics Georgia Performance Standards

Grade 5

MEASUREMENT

Students will compute the area of geometric plane figures. They will also understand the concept of volume and compute the volume of simple geometric solids and measure capacity. Students will convert from one unit to another within one system of measurement.

M5M1. Students will extend their understanding of area of fundamental geometric plane figures.

- a. Estimate the area of fundamental geometric plane figures.
- b. Derive the formula for the area of a parallelogram (e.g., cut the parallelogram apart and rearrange it into a rectangle of the same area).
- c. Derive the formula for the area of a triangle (e.g. demonstrate and explain its relationship to the area of a rectangle with the same base and height).
- d. Find the areas of triangles and parallelograms using formulae.
- e. Estimate the area of a circle through partitioning and tiling and then with formula (let $\pi = 3.14$). (Discuss square units as they apply to circles.)
- f. Find the area of a polygon (regular and irregular) by dividing it into squares, rectangles, and/or triangles and find the sum of the areas of those shapes.

M5M3. Students will measure capacity with appropriately chosen units and tools.

- a. Use milliliters, liters, fluid ounces, cups, pints, quarts, and gallons to measure capacity.
- b. Compare one unit to another within a single system of measurement (e.g., 1 quart = 2 pints).

M5M4. Students will understand and compute the volume of a simple geometric solid.

- a. Understand a cubic unit (u^3) is represented by a cube in which each edge has the length of 1 unit.
- b. Identify the units used in computing volume as cubic centimeters (cm^3), cubic meters (m^3), cubic inches (in^3), cubic feet (ft^3), and cubic yards (yd^3).
- c. Derive the formula for finding the volume of a cube and a rectangular prism using manipulatives.
- d. Compute the volume of a cube and a rectangular prism using formulae.
- e. Estimate the volume of a simple geometric solid.
- f. Understand the similarities and differences between volume and capacity.

3-5 Mathematics Georgia Performance Standards

Grade 5

GEOMETRY

Students will further develop their understanding of geometric figures.

M5G1. Students will understand congruence of geometric figures and the correspondence of their vertices, sides, and angles.

M5G2. Students will understand the relationship of the circumference of a circle to its diameter is pi ($\pi \approx 3.14$).

ALGEBRA

Students will represent and investigate mathematical expressions algebraically by using variables.

M5A1. Students will represent and interpret the relationships between quantities algebraically.

- a. Use variables, such as n or x , for unknown quantities in algebraic expressions.
- b. Investigate simple algebraic expressions by substituting numbers for the unknown.
- c. Determine that a formula will be reliable regardless of the type of number (whole numbers or decimal fractions) substituted for the variable.

DATA ANALYSIS

Students will gather, organize, and display data and interpret graphs.



M5D1. Students will analyze graphs.

- a. Analyze data presented in a graph.
- b. Compare and contrast multiple graphic representations (circle graphs, line graphs, bar graphs, etc.) for a single set of data and discuss the advantages/disadvantages of each.

M5D2. Students will collect, organize, and display data using the most appropriate graph.

3-5 Mathematics Georgia Performance Standards

Grade 5

Process Skills

Each topic studied in this course should be developed with careful thought toward helping every student achieve the following process standards.

M5P1. 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.

M5P2. 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.

M5P3. 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.

M5P4. 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.

M5P5. Students will represent mathematics in multiple ways.

- a. Create and use representations to organize, record, and communicate mathematical ideas.

3-5 Mathematics Georgia Performance Standards
Grade 5

- b. Select, apply, and translate among mathematical representations to solve problems.
- c. Use representations to model and interpret physical, social, and mathematical phenomena.

Terms / Symbols:

simplify, common denominator, greatest common factor, least common multiple, congruence, %, percent, improper fraction, divisibility, multiple, factor, estimate, volume, tiling, irregular polygon, polygon, capacity, circumference, diameter, pi, circle graph, cup, pint, quart, gallon

6-8 Mathematics 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 Georgia's Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

Georgia Mathematics Performance Standards Grade 6

By the end of grade six, students will understand the four arithmetic operations as they relate to positive rational numbers; convert between and compute with different forms of rational numbers; understand the concept of ratio and solve problems using proportional reasoning; understand and use line and rotational symmetry; determine the surface area and volume of solid figures; use variables to represent unknown quantities in formulae, algebraic expressions and equations; utilize data to make predictions; and determine the probability of a given event.

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

6-8 Mathematics Georgia Performance Standards Grade 6


Concepts/Skills to Maintain

Operations with decimal fractions
Addition and subtraction of common fractions and mixed numbers with unlike denominators such as 2, 3, 4, 5, 6, 8, 10 and 12.
Modeling multiplication of common fractions
Modeling percent
Graphing data
Multiples and factors
Perimeter, capacity and area of geometric figures
Evaluating algebraic expressions

NUMBER AND OPERATIONS

Students will understand the meaning of the four arithmetic operations as related to positive rational numbers and will apply these concepts and associated skills in real world situations.

M6N1. Students will understand the meaning of the four arithmetic operations as related to positive rational numbers and will use these concepts to solve problems.

- a. Apply factors and multiples.
- b. Decompose numbers into their prime factorization (Fundamental Theorem of Arithmetic).
- c. Determine the greatest common factor (GCF) and the least common multiple (LCM) for a set of numbers.
- d. Add and subtract fractions and mixed numbers with unlike denominators.
- e. Multiply and divide fractions and mixed numbers.
-  f. Use fractions, decimals, and percents interchangeably.
- g. Solve problems involving fractions, decimals, and percents.

MEASUREMENT

Students will understand how to determine the volume and surface area of solid figures. They will understand and use the customary and metric systems of measurement to measure quantities efficiently and to represent volume and surface area appropriately.

M6M1. Students will convert from one unit to another within one system of measurement (customary or metric) by using proportional relationships.

6-8 Mathematics Georgia Performance Standards

Grade 6

- M6M2. Students will use appropriate units of measure for finding length, perimeter, area and volume and will express each quantity using the appropriate unit.**
- Measure length to the nearest half, fourth, eighth and sixteenth of an inch.
 - Select and use units of appropriate size and type to measure length, perimeter, area and volume.
 - Compare and contrast units of measure for perimeter, area, and volume.

- M6M3. Students will determine the volume of fundamental solid figures (right rectangular prisms, cylinders, pyramids and cones).**
- Determine the formula for finding the volume of fundamental solid figures.
 - Compute the volumes of fundamental solid figures, using appropriate units of measure.
 - Estimate the volumes of simple geometric solids.
 - Solve application problems involving the volume of fundamental solid figures.

- M6M4. Students will determine the surface area of solid figures (right rectangular prisms and cylinders).**
- Find the surface area of right rectangular prisms and cylinders using manipulatives and constructing nets.
 - Compute the surface area of right rectangular prisms and cylinders using formulae.
 - Estimate the surface areas of simple geometric solids.
 - Solve application problems involving surface area of right rectangular prisms and cylinders.

GEOMETRY

Students will further develop their understanding of plane and solid geometric figures, incorporating the use of appropriate technology and using this knowledge to solve authentic problems.

- M6G1. Students will further develop their understanding of plane figures.**
- Determine and use lines of symmetry.
 - Investigate rotational symmetry, including degree of rotation.
 - Use the concepts of ratio, proportion and scale factor to demonstrate the relationships between similar plane figures.
 - Interpret and sketch simple scale drawings.
 - Solve problems involving scale drawings.

6-8 Mathematics Georgia Performance Standards Grade 6

M6G2. Students will further develop their understanding of solid figures.

- a. Compare and contrast right prisms and pyramids.
- b. Compare and contrast cylinders and cones.
- c. Interpret and sketch front, back, top, bottom and side views of solid figures.
- d. Construct nets for prisms, cylinders, pyramids, and cones.

ALGEBRA

Students will investigate relationships between two quantities. They will write and solve proportions and simple one-step equations that result from problem situations.

M6A1. Students will understand the concept of ratio and use it to represent quantitative relationships.

M6A2. Students will consider relationships between varying quantities.

- a. Analyze and describe patterns arising from mathematical rules, tables, and graphs.
- b. Use manipulatives or draw pictures to solve problems involving proportional relationships.
- c. Use proportions ($a/b=c/d$) to describe relationships and solve problems, including percent problems.
- d. Describe proportional relationships mathematically using $y = kx$, where k is the constant of proportionality.
- e. Graph proportional relationships in the form $y = kx$ and describe characteristics of the graphs.
- f. In a proportional relationship expressed as $y = kx$, solve for one quantity given values of the other two. Given quantities may be whole numbers, decimals, or fractions. Solve problems using the relationship $y = kx$.
- g. Use proportional reasoning ($a/b=c/d$ and $y = kx$) to solve problems.

M6A3. Students will evaluate algebraic expressions, including those with exponents, and solve simple one-step equations using each of the four basic operations.

6-8 Mathematics Georgia Performance Standards Grade 6

DATA ANALYSIS AND PROBABILITY

Students will demonstrate understanding of data analysis by posing questions to be answered by collecting data. They will represent, investigate, and use data to answer those questions. Students will understand experimental and theoretical probability.

M6D1. Students will pose questions, collect data, represent and analyze the data, and interpret results.

- a. Formulate questions that can be answered by data. Students should collect data by using samples from a larger population (surveys), or by conducting experiments.
- b. Using data, construct frequency distributions, frequency tables, and graphs.
- c. Choose appropriate graphs to be consistent with the nature of the data (categorical or numerical). Graphs should include pictographs, histograms, bar graphs, line graphs, circle graphs, and line plots.
- d. Use tables and graphs to examine variation that occurs within a group and variation that occurs between groups.
- e. Relate the data analysis to the context of the questions posed.

M6D2. Students will use experimental and simple theoretical probability and understand the nature of sampling. They will also make predictions from investigations.

- a. Predict the probability of a given event through trials/simulations (experimental probability), and represent the probability as a ratio.
- b. Determine, and use a ratio to represent, the theoretical probability of a given event.
- c. Discover that experimental probability approaches theoretical probability when the number of trials is large.

Terms/Symbols:

positive rational numbers, factors, multiples, decompose, prime numbers, prime factorization, Fundamental Theorem of Arithmetic, GCF, LCM, evaluate, surface area, metric system of measurement, customary system of measurement, proportional relationships, right rectangular prism, cylinder, pyramid, cone, geometric solid, net, geometric figures, line symmetry, rotational symmetry, similar plane figures, scale factor, scale drawings, relations, varying quantities, ratio, direct proportion, proportions, proportional reasoning, frequency distributions, pictographs, histograms, bar graphs, line graphs, circle graphs, line plot, frequency table, experimental probability, theoretical probability, sampling, event, random sample, population, non-routine word problems.

6-8 Mathematics Georgia Performance Standards

Grade 6

Process Standards

Each topic studied in this course should be developed with careful thought toward helping every student achieve the following process standards.

M6P1. 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.

M6P2. 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.

M6P3. 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.

M6P4. 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.

M6P5. 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.

6-8 Mathematics Georgia Performance Standards Grade 6

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.

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- 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.

6-8 Mathematics Georgia Performance Standards Grade 7

By the end of grade seven, students will understand and use rational numbers, including signed numbers; solve linear equations in one variable; sketch and construct plane figures; demonstrate understanding of transformations; use and apply properties of similarity; examine properties of geometric shapes in space; describe and sketch solid figures, including their cross-sections; represent and describe relationships between variables in tables, graphs, and formulas; analyze the characteristics of linear relationships; and represent and analyze data using graphical displays, measures of central tendency, and measures of variation.

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.

Concepts/Skills to Maintain

Operations with positive rational numbers, including mixed numbers

Line and rotational symmetry

Surface area and volume

Ratio as a representation of quantitative relationships

NUMBER AND OPERATIONS

Students will further develop their understanding of the concept of rational numbers and apply them to real world situations.

M7N1. Students will understand the meaning of positive and negative rational numbers and use them in computation.

- a. Find the absolute value of a number and understand it as the distance from zero on a number line.
- b. Compare and order rational numbers, including repeating decimals.
- c. Add, subtract, multiply, and divide positive and negative rational numbers.
- d. Solve problems using rational numbers.

GEOMETRY

Students will further develop and apply their understanding of plane and solid geometric figures through the use of constructions and transformations. Students will explore the properties of similarity and further develop their understanding of 3-dimensional figures.

6-8 Mathematics Georgia Performance Standards

Grade 7

M7G1. Students will construct plane figures that meet given conditions.

- a. Perform basic constructions using both compass and straight edge, and appropriate technology. Constructions should include copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
- b. Recognize that many constructions are based on the creation of congruent triangles.

M7G2. Students will demonstrate understanding of transformations.

- a. Demonstrate understanding of translations, dilations, rotations, reflections, and relate symmetry to appropriate transformations.
- b. Given a figure in the coordinate plane, determine the coordinates resulting from a translation, dilation, rotation, or reflection.

M7G3. Students will use the properties of similarity and apply these concepts to geometric figures.

- a. Understand the meaning of similarity, visually compare geometric figures for similarity, and describe similarities by listing corresponding parts.
- b. Understand the relationships among scale factors, length ratios, and area ratios between similar figures. Use scale factors, length ratios, and area ratios to determine side lengths and areas of similar geometric figures.
- c. Understand congruence of geometric figures as a special case of similarity: The figures have the same size and shape.

M7G4. Students will further develop their understanding of three-dimensional figures.

- a. Describe three-dimensional figures formed by translations and rotations of plane figures through space.
- b. Sketch, model, and describe cross-sections of cones, cylinders, pyramids, and prisms.

ALGEBRA

Students will demonstrate an understanding of linear relations and fundamental algebraic concepts.

6-8 Mathematics Georgia Performance Standards Grade 7

M7A1. Students will represent and evaluate quantities using algebraic expressions.

- Translate verbal phrases to algebraic expressions.
- Simplify and evaluate algebraic expressions, using commutative, associative, and distributive properties as appropriate.
- Add and subtract linear expressions.

M7A2. Students will understand and apply linear equations in one variable.

- Given a problem, define a variable, write an equation, solve the equation, and interpret the solution.
- Use the addition and multiplication properties of equality to solve one- and two-step linear equations.



M7A3. Students will understand relationships between two variables.

- Plot points on a coordinate plane.
- Represent, describe, and analyze relations from tables, graphs, and formulas.
- Describe how change in one variable affects the other variable.
- Describe patterns in the graphs of proportional relationships, both direct ($y = kx$) and inverse ($y = k/x$).

DATA ANALYSIS AND PROBABILITY

Students will demonstrate understanding of data analysis by posing questions, collecting data, analyzing the data using measures of central tendency and variation, and using the data to answer the questions posed. Students will understand the role of probability in sampling.

M7D1. Students will pose questions, collect data, represent and analyze the data, and interpret results.

-  Formulate questions and collect data from a census of at least 30 objects and from samples of varying sizes.
- Construct frequency distributions.
-  Analyze data using measures of central tendency (mean, median, and mode), including recognition of outliers.
- Analyze data with respect to measures of variation (range, quartiles, interquartile range).

6-8 Mathematics Georgia Performance Standards Grade 7

- e. Compare measures of central tendency and variation from samples to those from a census. Observe that sample statistics are more likely to approximate the population parameters as sample size increases.
- f. Analyze data using appropriate graphs, including pictographs, histograms, bar graphs, line graphs, circle graphs, and line plots introduced earlier, and using box and- whisker plots and scatter plots.
- g. Analyze and draw conclusions about data, including describing the relationship between two variables.



Terms/Symbols:

natural number, whole number, sign, integer, opposite, negative, positive, absolute value, term, variable, commutative property, associative property, distributive property, algebraic expression, linear equation, direct and indirect proportions, constant of proportionality ($y = kx$), variation, polyhedron, translation, rotation, reflection, dilation, symmetry, bisector, parallel lines, perpendicular lines, cross-section, similar, congruent, point, line, plane, line segment, endpoints, intersection, ray, parallel lines, perpendicular lines, similar, similarity, rate, scale drawings, corresponding sides, corresponding angles, congruent, diagonal, algebraic expression, commutative property, associative property, distributive property, direct variation, inverse variation, inversely proportional, mean, median, mode, range, quartile, interquartile range, outlier, histogram, scatter plot, line plot, box-and-whisker plot, \cong , \sim , \approx , \parallel , \perp , \angle .

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.

M7P1. 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.

6-8 Mathematics Georgia Performance Standards Grade 7

M7P2. 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.

M7P3. 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.

M7P4. 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.

M7P5. 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.

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*.

6-8 Mathematics Georgia Performance Standards

Grade 7

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 subjects.
 - 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.

6-8 Mathematics Georgia Performance Standards Grade 8

By the end of grade eight, students will understand various numerical representations, including square roots, exponents and scientific notation; use and apply geometric properties of plane figures, including congruence and the Pythagorean theorem; use symbolic algebra to represent situations and solve problems, especially those that involve linear relationships; solve linear equations, systems of linear equations and inequalities; use equations, tables and graphs to analyze and interpret linear functions; use and understand set theory and simple counting techniques; determine the theoretical probability of simple events; and make inferences from statistical data, particularly data that can be modeled by linear functions.

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.

Concepts/Skills to Maintain
Operations with rational numbers
Properties of equalities
Direct & inverse proportions
Solving multi-step equations
Properties of real numbers
Statistics

NUMBER AND OPERATIONS

Students will understand the numeric and geometric meaning of square root, apply properties of integer exponents and use scientific notation.

M8N1. Students will understand different representations of numbers including square roots, exponents, and scientific notation.

- a. Find square roots of perfect squares.
- b. Recognize the (positive) square root of a number as a length of a side of a square with a given area.
- c. Recognize square roots as points and as lengths on a number line.
- d. Understand that the square root of 0 is 0 and that every positive number has two square roots that are opposite in sign.
- e. Recognize and use the radical symbol to denote the positive square root of a positive number.

6-8 Mathematics Georgia Performance Standards **Grade 8**

- f. Estimate square roots of positive numbers.
- g. Simplify, add, subtract, multiply, and divide expressions containing square roots.
- h. Distinguish between rational and irrational numbers.
- i. Simplify expressions containing integer exponents.
- j. Express and use numbers in scientific notation.
- k. Use appropriate technologies to solve problems involving square roots, exponents, and scientific notation.

GEOMETRY

Students will use and apply geometric properties of plane figures, including congruence and the Pythagorean theorem.

M8G1. Students will understand and apply the properties of parallel and perpendicular lines and understand the meaning of congruence.

- a. Investigate characteristics of parallel and perpendicular lines both algebraically and geometrically.
- b. Apply properties of angle pairs formed by parallel lines cut by a transversal.
- c. Understand the properties of the ratio of segments of parallel lines cut by one or more transversals.
- d. Understand the meaning of congruence: that all corresponding angles are congruent and all corresponding sides are congruent.

M8G2. Students will understand and use the Pythagorean theorem.

- a. Apply properties of right triangles, including the Pythagorean theorem.
- b. Recognize and interpret the Pythagorean theorem as a statement about areas of squares on the sides of a right triangle.

ALGEBRA

Students will use linear algebra to represent, analyze and solve problems. They will use equations, tables, and graphs to investigate linear relations and functions, paying particular attention to slope as a rate of change.

M8A1. Students will use algebra to represent, analyze, and solve problems.

- a. Represent a given situation using algebraic expressions or equations in one variable.
- b. Simplify and evaluate algebraic expressions.

6-8 Mathematics Georgia Performance Standards Grade 8

- c. Solve algebraic equations in one variable, including equations involving absolute values.
- d. Solve equations involving several variables for one variable in terms of the others.
- e. Interpret solutions in problem contexts.

M8A2. Students will understand and graph inequalities in one variable.

- a. Represent a given situation using an inequality in one variable.
- b. Use the properties of inequality to solve inequalities.
- c. Graph the solution of an inequality on a number line.
- d. Interpret solutions in problem contexts.

M8A3. Students will understand relations and linear functions.

- a. Recognize a relation as a correspondence between varying quantities.
- b. Recognize a function as a correspondence between inputs and outputs where the output for each input must be unique.
- c. Distinguish between relations that are functions and those that are not functions.
- d. Recognize functions in a variety of representations and a variety of contexts.
- e. Use tables to describe sequences recursively and with a formula in closed form.
- f. Understand and recognize arithmetic sequences as linear functions with whole number input values.
- g. Interpret the constant difference in an arithmetic sequence as the slope of the associated linear function.
- h. Identify relations and functions as linear or nonlinear.
- i. Translate among verbal, tabular, graphic, and algebraic representations of functions.

M8A4. Students will graph and analyze graphs of linear equations and inequalities.

- a. Interpret slope as a rate of change.
- b. Determine the meaning of the slope and y-intercept in a given situation.
- c. Graph equations of the form $y = mx + b$.
- d. Graph equations of the form $ax + by = c$.
- e. Graph the solution set of a linear inequality, identifying whether the solution set is an open or a closed half-plane.
- f. Determine the equation of a line given a graph, numerical information that defines the line or a context involving a linear relationship.
- g. Solve problems involving linear relationships.

6-8 Mathematics Georgia Performance Standards Grade 8

M8A5. Students will understand systems of linear equations and inequalities and use them to solve problems.

- a. Given a problem context, write an appropriate system of linear equations or inequalities.
- b. Solve systems of equations graphically and algebraically, using technology as appropriate.
- c. Graph the solution set of a system of linear inequalities in two variables.
- d. Interpret solutions in problem contexts.

DATA ANALYSIS AND PROBABILITY

Students will use and understand set theory and simple counting techniques; determine the theoretical probability of simple events; and make inferences from data, particularly data that can be modeled by linear functions.

M8D1. Students will apply basic concepts of set theory.

- a. Demonstrate relationships among sets through use of Venn diagrams.
- b. Determine subsets, complements, intersection, and union of sets.
- c. Use set notation to denote elements of a set.

M8D2. Students will determine the number of outcomes related to a given event.

- a. Use tree diagrams to find the number of outcomes.
- b. Apply the addition and multiplication principles of counting.



M8D3. Students will use the basic laws of probability.

- a. Find the probability of simple independent events.
- b. Find the probability of compound independent events.



M8D4. Students will organize, interpret, and make inferences from statistical data

- a. Gather data that can be modeled with a linear function.
- b. Estimate and determine a line of best fit from a scatter plot.

6-8 Mathematics Georgia Performance Standards Grade 8

Terms/Symbols:

square root, radical, $\sqrt{\quad}$, rational, irrational, exponent, additive inverse, multiplicative inverse, scientific notation, significant digits, inequality, sequence, arithmetic sequence, recursive, linear function, function, relation, rate of change, slope, intercept, linear equation, linear inequality, like terms, system of linear equations, transversal, vertical angles, complementary angles, supplementary angles, alternate interior angles, alternate exterior angles, corresponding angles, Pythagorean theorem, legs, hypotenuse, set, $\{ \}$, element, \in , subset, \subset , complement of a set, intersection, \cap , union, \cup , Venn diagram, tree diagram, multiplication principle, addition principle, line of best fit

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.

M8P1. 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.

M8P2. 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.

M8P3. 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.

6-8 Mathematics Georgia Performance Standards Grade 8

M8P4. 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.

M8P5. 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.

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*.

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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.

6-8 Mathematics Georgia Performance Standards **Grade 8**

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.

Mathematics 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 Georgia's Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

Georgia Performance Standards Mathematics 1

This is the first in a sequence of mathematics courses designed to prepare students to enter college at the calculus level. It includes radical, polynomial and rational expressions, basic functions and their graphs, simple equations, fundamentals of proof, properties of polygons, coordinate geometry, sample statistics, and curve fitting.

(Prerequisite: Successful completion of 8th Grade Mathematics.)

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.

Georgia Performance Standards Mathematics 1

ALGEBRA

Students will explore functions and solve simple equations. Students will simplify and operate with radical, polynomial, and rational expressions.

MM1A1. Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques.

- a. Represent functions using function notation.
- b. Graph the basic functions $f(x) = x^n$, where $n = 1$ to 3 , $f(x) = \sqrt{x}$, $f(x) = |x|$, and $f(x) = \frac{1}{x}$.
- c. Graph transformations of basic functions including vertical shifts, stretches, and shrinks, as well as reflections across the x - and y -axes.
- d. Investigate and explain the characteristics of a function: domain, range, zeros, intercepts, intervals of increase and decrease, maximum and minimum values, and end behavior.
- e. Relate to a given context the characteristics of a function, and use graphs and tables to investigate its behavior.
- f. Recognize sequences as functions with domains that are whole numbers.
- g. Explore rates of change, comparing constant rates of change (i.e., slope) versus variable rates of change. Compare rates of change of linear, quadratic, square root, and other function families.
- h. Determine graphically and algebraically whether a function has symmetry and whether it is even, odd, or neither.
- i. Understand that any equation in x can be interpreted as the equation $f(x) = g(x)$, and interpret the solutions of the equation as the x -value(s) of the intersection point(s) of the graphs of $y = f(x)$ and $y = g(x)$.

MM1A2. Students will simplify and operate with radical expressions, polynomials, and rational expressions.

- a. Simplify algebraic and numeric expressions involving square root.
- b. Perform operations with square roots.
- c. Add, subtract, multiply, and divide polynomials.
- d. Expand binomials using the Binomial Theorem.
- e. Add, subtract, multiply, and divide rational expressions.
- f. Factor expressions by greatest common factor, grouping, trial and error, and special products limited to the formulas below.

Georgia Performance Standards Mathematics 1

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$(x + y)(x - y) = x^2 - y^2$$

$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

$$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$$

$$(x - y)^3 = x^3 - 3x^2y + 3xy^2 - y^3$$

g. Use area and volume models for polynomial arithmetic.

MM1A3. Students will solve simple equations.

- Solve quadratic equations in the form $ax^2 + bx + c = 0$, where $a = 1$, by using factorization and finding square roots where applicable.
- Solve equations involving radicals such as $\sqrt{x} + b = c$, using algebraic techniques.
- Use a variety of techniques, including technology, tables, and graphs to solve equations resulting from the investigation of $x^2 + bx + c = 0$.
- Solve simple rational equations that result in linear equations or quadratic equations with leading coefficient of 1.

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.

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

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

Georgia Performance Standards Mathematics 1

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.

DATA ANALYSIS AND PROBABILITY

Students will use counting techniques and determine 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.

MM1D1. Students will determine the number of outcomes related to a given event.

- a. Apply the addition and multiplication principles of counting.
- b. Calculate and use simple permutations and combinations.

MM1D2. Students will use the basic laws of probability.

- a. Find the probabilities of mutually exclusive events.
- b. Find the probabilities of dependent events.
- c. Calculate conditional probabilities.
- d. Use expected value to predict outcomes.

Georgia Performance Standards Mathematics 1

MM1D3. Students will relate samples to a population.

- Compare summary statistics (mean, median, quartiles, and interquartile range) from one sample data distribution to another sample data distribution in describing center and variability of the data distributions.
- Compare the averages of the summary statistics from a large number of samples to the corresponding population parameters.
- Understand that a random sample is used to improve the chance of selecting a representative sample.

MM1D4. Students will explore variability of data by determining the mean absolute deviation (the average of the absolute values of the deviations).

Terms/Symbols:

function, domain, range, zero of function, quadratic function, even function, odd function, radical expression, rational expression, area model for polynomial arithmetic, volume model for polynomial arithmetic, monomial, binomial, trinomial, radical conjugates, conjecture, inductive reasoning, deductive reasoning, definition, axiom, theorem, counterexample, indirect proof, converse, inverse, contrapositive, kite, incenter, orthocenter, circumcenter, centroid, points of concurrence, angle bisectors, medians of triangle, altitudes of triangle, permutations (${}_nP_r$), combinations (${}_nC_r$), mutually exclusive events, dependent events, conditional probability, expected value, quartile, interquartile range, deviation, mean absolute deviation

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- Build new mathematical knowledge through problem solving.
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- Monitor and reflect on the process of mathematical problem solving.

*Georgia Performance Standards
Mathematics 1*

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- d. Select and use various types of reasoning and methods of proof.

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- d. Use the language of mathematics to express mathematical ideas precisely.

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Georgia Performance Standards Mathematics 1

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 - 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.

*Georgia Performance Standards
Mathematics 1*

- 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.

Mathematics 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 Georgia's Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

Georgia Performance Standards Mathematics 2

This is the second in a sequence of mathematics courses designed to prepare students to enter college at the calculus level. It includes complex numbers; quadratic, piecewise, and exponential functions; right triangles, and right triangular trigonometry; properties of circles; and statistical inference. (*Prerequisite: Successful completion of Mathematics 1 or Core Mathematics 2.*)

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.

Georgia Performance Standards Mathematics 2

NUMBER AND OPERATIONS

Students will use the complex number system.


MM2N1. Students will represent and operate with complex numbers.

- a. Write square roots of negative numbers in imaginary form.
- b. Write complex numbers in the form $a + bi$.
- c. Add, subtract, multiply, and divide complex numbers.
- d. Simplify expressions involving complex numbers.


ALGEBRA

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

MM2A1. Students will investigate step and piecewise functions, including greatest integer and absolute value functions.

- a. Write absolute value functions as piecewise functions.
-  b. Investigate and explain characteristics of a variety of piecewise functions including domain, range, vertex, axis of symmetry, zeros, intercepts, extrema, points of discontinuity, intervals over which the function is constant, intervals of increase and decrease, and rates of change.
- c. Solve absolute value equations and inequalities analytically, graphically, and by using appropriate technology.


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.

Georgia Performance Standards Mathematics 2

- 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.

MM2A3. Students will analyze quadratic functions in the forms $f(x) = ax^2 + bx + c$ and $f(x) = a(x - h)^2 + k$.

- a. Convert between standard and vertex form.
- b. Graph quadratic functions as transformations of the function $f(x) = x^2$.
-  c. Investigate and explain characteristics of quadratic functions, including domain, range, vertex, axis of symmetry, zeros, intercepts, extrema, intervals of increase and decrease, and rates of change.
- d. Explore arithmetic series and various ways of computing their sums.
- e. Explore sequences of partial sums of arithmetic series as examples of quadratic functions.

MM2A4. Students will solve quadratic equations and inequalities in one variable.

- a. Solve equations graphically using appropriate technology.
- b. Find real and complex solutions of equations by factoring, taking square roots, and applying the quadratic formula.
- c. Analyze the nature of roots using technology and using the discriminant.
- d. Solve quadratic inequalities both graphically and algebraically, and describe the solutions using linear inequalities.

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

GEOMETRY

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.

Georgia Performance Standards Mathematics 2

MM2G1. Students will identify and use special right triangles.

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

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

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

MM2G3. Students will understand the properties of circles.

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

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

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

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. They will use regression to analyze data and to make inferences.



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

- Pose a question and collect sample data from at least two different populations.
- Understand and calculate the means and standard deviations of sets of data.
- Use means and standard deviations to compare data sets.

Georgia Performance Standards Mathematics 2

- 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.

MM2D2. Students will determine an algebraic model to quantify the association between two quantitative variables.

- a. Gather and plot data that can be modeled with linear and quadratic functions.
- b. Examine the issues of curve fitting by finding good linear fits to data using simple methods such as the median-median line and “eyeballing.”
- c. Understand and apply the processes of linear and quadratic regression for curve fitting using appropriate technology.
- d. Investigate issues that arise when using data to explore the relationship between two variables, including confusion between correlation and causation.

Terms/Symbols:

piecewise function, exponential function, step function, extrema, point of discontinuity, asymptote, geometric sequence, standard form, vertex form, quadratic formula, discriminant, root, inverse of a function, one-to-one function, composition of functions, f^{-1} , sine, cosine, tangent, trigonometric ratio, complementary angles, trigonometry, chord, tangent, secant, central angle, inscribed angle, arc, sector, inference, population mean, standard deviation, curve fitting, linear regression, median-median line, algebraic model, quadratic regression

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.

*Georgia Performance Standards
Mathematics 2*

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.

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*.

Georgia Performance Standards Mathematics 2

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.

Mathematics 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 Georgia's Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

Georgia Performance Standards Mathematics 3

This is the third in a sequence of mathematics courses designed to prepare students to enter college at the calculus level. It includes exponential and logarithmic functions, matrices, polynomial functions of higher degree, conic sections, and normal distributions. (*Prerequisite: Successful completion of Mathematics 2 or Core Mathematics 4.*)

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.

Georgia Performance Standards Mathematics 3

ALGEBRA

Students will investigate exponential, logarithmic and polynomial functions of degree higher than 2. Students will understand matrices and use them to solve problems.

MM3A1. Students will analyze graphs of polynomial functions of higher degree.

- a. Graph simple polynomial functions as translations of the function $f(x) = ax^n$.
- b. Understand the effects of the following on the graph of a polynomial function: degree, lead coefficient, and multiplicity of real zeros.
- c. Determine whether a polynomial function has symmetry and whether it is even, odd, or neither.
- d. Investigate and explain characteristics of polynomial functions, including domain and range, intercepts, zeros, relative and absolute extrema, intervals of increase and decrease, and end behavior.

MM3A2. Students will explore logarithmic functions as inverses of exponential functions.

- a. Define and understand the properties of n^{th} roots.
- b. Extend properties of exponents to include rational exponents.
- c. Define logarithmic functions as inverses of exponential functions.
- d. Understand and use properties of logarithms by extending laws of exponents.
- e. Investigate and explain characteristics of exponential and logarithmic functions including domain and range, asymptotes, zeros, intercepts, intervals of increase and decrease, and rate of change.
- f. Graph functions as transformations of $f(x) = a^x$, $f(x) = \log_a x$, $f(x) = e^x$, $f(x) = \ln x$.
- g. Explore real phenomena related to exponential and logarithmic functions including half-life and doubling time.

MM3A3. Students will solve a variety of equations and inequalities.

- a. Find real and complex roots of higher degree polynomial equations using the factor theorem, remainder theorem, rational root theorem, and fundamental theorem of algebra, incorporating complex and radical conjugates.
- b. Solve polynomial, exponential, and logarithmic equations analytically, graphically, and using appropriate technology.
- c. Solve polynomial, exponential, and logarithmic inequalities analytically, graphically, and using appropriate technology. Represent solution sets of inequalities using interval notation.
- d. Solve a variety of types of equations by appropriate means choosing among mental calculation, pencil and paper, or appropriate technology.

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*Georgia Performance Standards
Mathematics 3*

MM3A4. Students will perform basic operations with matrices.

- a. Add, subtract, multiply, and invert matrices, when possible, choosing appropriate methods, including technology.
- b. Find the inverses of two-by-two matrices using pencil and paper, and find inverses of larger matrices using technology.
- c. Examine the properties of matrices, contrasting them with properties of real numbers.

MM3A5. Students will use matrices to formulate and solve problems.

- a. Represent a system of linear equations as a matrix equation.
- b. Solve matrix equations using inverse matrices.
- c. Represent and solve realistic problems using systems of linear equations.

MM3A6. Students will solve linear programming problems in two variables.

- a. Solve systems of inequalities in two variables, showing the solutions graphically.
- b. Represent and solve realistic problems using linear programming.

MM3A7. Students will understand and apply matrix representations of vertex-edge graphs.

- a. Use graphs to represent realistic situations.
- b. Use matrices to represent graphs, and solve problems that can be represented by graphs.

GEOMETRY

Students will understand and use the analytic geometry of conic sections and of planes and spheres in space.

MM3G1. Students will investigate the relationships between lines and circles.

- a. Find equations of circles.
- b. Graph a circle given an equation in general form.
- c. Find the equation of a tangent line to a circle at a given point.
- d. Solve a system of equations involving a circle and a line.
- e. Solve a system of equations involving two circles.

*Georgia Performance Standards
Mathematics 3*

MM3G2. Students will recognize, analyze, and graph the equations of the conic sections (parabolas, circles, ellipses, and hyperbolas).


- Convert equations of conics by completing the square.
- Graph conic sections, identifying fundamental characteristics.
- Write equations of conic sections given appropriate information.

MM3G3. Students will investigate planes and spheres.

- Plot the point (x, y, z) and understand it as a vertex of a rectangular prism.
- Apply the distance formula in 3-space.
- Recognize and understand equations of planes and spheres.


DATA ANALYSIS AND PROBABILITY

Students will use a normal distribution to calculate probabilities. They will organize, represent, investigate, interpret, and make inferences using data from both observational studies and experiments.

 **MM3D1. Students will create probability histograms of discrete random variables, using both experimental and theoretical probabilities.**

MM3D2. Students will solve problems involving probabilities by interpreting a normal distribution as a probability histogram for a continuous random variable (z-scores are used for a general normal distribution).

- Determine intervals about the mean that include a given percent of data.
- Determine the probability that a given value falls within a specified interval.
- Estimate how many items in a population fall within a specified interval.

 **MM3D3. Students will understand the differences between experimental and observational studies by posing questions and collecting, analyzing, and interpreting data.**

Terms/Symbols: logarithmic function, matrix, degree of a polynomial, multiplicity of roots, n^{th} root, n , asymptote, half-life, radical conjugate, inverse matrix, vertex-edge graph, conic sections, parabola, ellipse, hyperbola, 3-space, discrete random variable, normal distribution, discrete random variable, continuous random variable, z-score

Georgia Performance Standards Mathematics 3

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.

MM3P1. 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.

MM3P2. 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.

MM3P3. 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.

MM3P4. 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.

MM3P5. 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.

Georgia Performance Standards Mathematics 3

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.

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*Georgia Performance Standards
Mathematics 3*

- 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.

Mathematics 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 Georgia's Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

Georgia Performance Standards Mathematics 4

This is a course in precalculus and statistics, designed to prepare students to enter college at the calculus level. It includes rational, trigonometric, and inverse trigonometric functions; basic trigonometric identities and the laws of sines and cosines; sequences and series; vectors; the central limit theorem and confidence intervals. (*Prerequisite: Successful completion of Mathematics 3 or Accelerated Mathematics 2.*)

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.

Georgia Performance Standards Mathematics 4

ALGEBRA

Students will analyze rational and trigonometric functions. Students will investigate and apply sequences and series and will understand and use vectors.

MM4A1. Students will explore rational functions.

- a. Investigate and explain characteristics of rational functions, including domain, range, zeros, points of discontinuity, intervals of increase and decrease, rates of change, local and absolute extrema, symmetry, asymptotes, and end behavior.
- b. Find inverses of rational functions, discussing domain and range, symmetry, and function composition.
- c. Solve rational equations and inequalities analytically, graphically, and by using appropriate technology.

MM4A2. Students will use the circle to define the trigonometric functions.

- a. Define and understand angles measured in degrees and radians, including but not limited to 0° , 30° , 45° , 60° , 90° , their multiples, and equivalences.
- b. Understand and apply the six trigonometric functions as functions of general angles in standard position.
- c. Find values of trigonometric functions using points on the terminal sides of angles in the standard position.
- d. Understand and apply the six trigonometric functions as functions of arc length on the unit circle.
- e. Find values of trigonometric functions using the unit circle.

MM4A3. Students will investigate and use the graphs of the six trigonometric functions.

- a. Understand and apply the six basic trigonometric functions as functions of real numbers.
- b. Determine the characteristics of the graphs of the six basic trigonometric functions.
- c. Graph transformations of trigonometric functions including changing period, amplitude, phase shift, and vertical shift.
- d. Apply graphs of trigonometric functions in realistic contexts involving periodic phenomena.

*Georgia Performance Standards
Mathematics 4*

MM4A4. Students will investigate functions.

- Compare and contrast properties of functions within and across the following types: linear, quadratic, polynomial, power, rational, exponential, logarithmic, trigonometric, and piecewise.
- Investigate transformations of functions.
- Investigate characteristics of functions built through sum, difference, product, quotient, and composition.

MM4A5. Students will establish the identities below and use them to simplify trigonometric expressions and verify equivalence statements.

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cot \theta = \frac{\cos \theta}{\sin \theta}$$

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$$

$$\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\sin(2\theta) = 2 \sin \theta \cos \theta$$

$$\cos(2\theta) = \cos^2 \theta - \sin^2 \theta$$

MM4A6. Students will solve trigonometric equations both graphically and algebraically.

- Solve trigonometric equations over a variety of domains, using technology as appropriate.
- Use the coordinates of a point on the terminal side of an angle to express x as $r \cos \theta$ and y as $r \sin \theta$.
- Apply the law of sines and the law of cosines.

*Georgia Performance Standards
Mathematics 4*

MM4A7. Students will verify and apply $A = \frac{1}{2}ab \sin C$ to find the area of a triangle.

MM4A8. Students will investigate and use inverse sine, inverse cosine, and inverse tangent functions.

- a. Find values of the above functions using technology as appropriate.
- b. Determine characteristics of the above functions and their graphs.

MM4A9. Students will use sequences and series.

- a. Use and find recursive and explicit formulas for the terms of sequences.
- b. Recognize and use simple arithmetic and geometric sequences.
- c. Find and apply the sums of finite and, where appropriate, infinite arithmetic and geometric series.
- d. Use summation notation to explore finite series.

MM4A10. Students will understand and use vectors.

- a. Represent vectors algebraically and geometrically.
- b. Convert between vectors expressed using rectangular coordinates and vectors expressed using magnitude and direction.
- c. Add, subtract, and compute scalar multiples of vectors.
- d. Use vectors to solve realistic problems.

DATA ANALYSIS AND PROBABILITY

Students will organize, represent, investigate, interpret, and make inferences from data, using the central limit theorem and the standard normal distribution. Students will apply the Central Limit Theorem to calculate confidence intervals for a population mean using data from large samples. Students will use sample data and confidence intervals to draw conclusions about populations.

MM4D1. Using simulation, students will develop the idea of the central limit theorem.

MM4D2. Using student-generated data from random samples of at least 30 members, students will determine the margin of error and confidence interval for a specified level of confidence.

Georgia Performance Standards Mathematics 4

MM4D3. Students will use confidence intervals and margins of error to make inferences from data about a population. Technology is used to evaluate confidence intervals, but students will be aware of the ideas involved.

Terms/Symbols:

rational function, trigonometric function, period, amplitude, phase shift, cotangent, secant, cosecant, series, recursive formula, vector, confidence interval, level of confidence, central limit theorem, margin of error, standard deviation, correlation

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.

MM4P1. 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.

MM4P2. 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.

MM4P3. 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.

*Georgia Performance Standards
Mathematics 4*

MM4P4. 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.

MM4P5. 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.

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.

Georgia Performance Standards Mathematics 4

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.