Understanding Georgia’s K-12 Mathematics Standards

Georgia Department of Education
Mathematics Team

January 2023
GaDOE Mathematics Team Members

YOUR GADOE MATHEMATICS TEAM IS
HERE TO SERVE YOU!

Follow us: @GaDOEMath

Important Websites

Georgia Mathematics Program Updates:
www.gadoe.org/mathematics

Professional Learning Communities:
https://community.gadoe.org

Curriculum Resources:
www.georgiastandards.org

Professional Learning Conferences:
www.gadoe.org/mathcon

• Lya Snell, Ph.D.
  Mathematics & Computer
  Science Program Manager
  lsnell@doe.k12.ga.us

• Karla Cwetna, Ph.D.
  Secondary Mathematics
  Program Specialist
  kcwetna@doe.k12.ga.us

• Kenneth Golden
  Secondary Mathematics
  Program Specialist
  Kenneth.golden@doe.k12.ga.us

• Michael Wiernicki
  Elementary Mathematics
  Program Specialist
  mwiernicki@doe.k12.ga.us

• Jenise Sexton
  Mathematics Content
  Integration Specialist
  jsexton@doe.k12.ga.us
Learning Outcomes

- Overview of Georgia’s K-12 Mathematics Standards
- Implementation Plan for 2023-2024
Important Details

As you engage with the new standards:

- Use the progressions, age appropriateness guardrails, decomposition of the standards through learning objectives or expectations, and evidence of student learning in all grade levels.

- Explore the embedded ways to help students master the fundamentals in numeracy development in K-5.

- Build relevant pathways through the big ideas to engage students based on a foundation of part-whole reasoning and flexible thinking.
Important Details

As you engage with students:

- Communicate flexibility in strategy selection or approach to solving mathematical problems.

- Promote the use of mathematical reasoning and sense-making through research-based, effective mathematics teaching practices in all grade levels and courses.

- Make mathematics learning fun and engaging while helping learners see the connection between mathematics and real-life phenomena.
## Georgia’s K-12 Mathematics Standards
### Mathematics Big Ideas and Learning Progressions, K-12

<table>
<thead>
<tr>
<th>K</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical Modeling (MM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematical Practices (MP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data &amp; Statistical Reasoning (DSR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numerical Reasoning (NR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patterning &amp; Algebraic Reasoning (PAR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geometric &amp; Spatial Reasoning (GSR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement &amp; Data Reasoning (MDR)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Functional & Graphical Reasoning (FGR)**

**Probability Reasoning (PR)**

**Probabilistic Reasoning (PR)**

*The Big Ideas extend to High School 4th course options beyond Advanced Algebra: Concepts and Connections. These Big Ideas can be found within each course standards document.*
Georgia’s K-12 Mathematics Standards

COURSE STANDARDS

A.MP: Display perseverance and patience in problem solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals.

MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

A.FGR.2: Construct and interpret arithmetic sequences as functions, algebraically and graphically, to model and explain real-life phenomena. Use formal notation to represent linear functions and the key characteristics of graphs of linear functions, and informally compare linear and non-linear functions using parent graphs.

A.GSR.3: Solve problems involving distance, midpoint, slope, area, and perimeter to model and explain real-life phenomena.

A.PAR.4: Create, analyze, and solve linear inequalities in two variables and systems of linear inequalities to model real-life phenomena.

A.NR.5: Investigate rational and irrational numbers and rewrite expressions involving square roots and cube roots.

A.PAR.6: Build quadratic expressions and equations to represent and model real-life phenomena; solve quadratic equations in mathematically applicable situations.

A.FGR.7: Construct and interpret quadratic functions from data points to model and explain real-life phenomena; describe key characteristics of the graph of a quadratic function to explain a mathematically applicable situation for which the graph serves as a model.

A.PAR.8: Create and analyze exponential expressions and equations to represent and model real-life phenomena; solve exponential equations in mathematically applicable situations.

A.FGR.9: Construct and analyze the graph of an exponential function to explain a mathematically applicable situation for which the graph serves as a model; compare exponential with linear and quadratic functions.

A.DSR.10: Collect, analyze, and interpret univariate quantitative data to answer statistical investigative questions that compare groups to solve real-life problems; Represent bivariate data on a scatter plot and fit a function to the data to answer statistical questions and solve real-life problems.
8.FGR.7: Justify and use various strategies to solve systems of linear equations to model and explain realistic phenomena.
Understanding the Standards Coding

2nd Grade

2.PAR.4: Identify, describe, extend, and create repeating patterns, growing patterns, and shrinking patterns.

5th Grade

5.NR.4: Read, write, and compare decimal numbers to the thousandths place, and round and perform operations with decimal numbers to the hundredths place to solve relevant, mathematical problems.

8th Grade

8.PAR.4: Show and explain the connections between proportional and non-proportional relationships, lines, and linear equations; create and interpret graphical mathematical models and use the graphical, mathematical model to explain real phenomena represented in the graph.

High School Algebra: Concepts & Connections

A.NR.5: Investigate rational and irrational numbers and rewrite expressions involving square roots and cube roots.
# PROBABILITY REASONING – likelihood, theoretical and experimental probability

## 7.PR.6: Using mathematical reasoning, investigate chance processes and develop, evaluate, and communicate simple models to find probabilities of simple events presented in graphic form.

### Evidence of Student Learning

<table>
<thead>
<tr>
<th>Expectations</th>
<th>Strategies and Methods</th>
<th>Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.PR.6.1</td>
<td>Students should be able to represent the probability as a fraction, decimal numbers, or percentage.</td>
<td>Descriptions may include impossible, unlikely, equally likely, likely, and certain.</td>
</tr>
<tr>
<td>7.PR.6.2</td>
<td>Students should be able to predict the approximate, relative frequency given the theoretical probability.</td>
<td>Example: When rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.</td>
</tr>
<tr>
<td>7.PR.6.3</td>
<td>Students should have multiple opportunities to collect data using physical objects, graphing calculators, or web-based simulations.</td>
<td>Example: Kim calculates the probability of landing on heads when tossing a coin to be 50%. She uses this to predict that when Tiffany tosses a coin 20 times, the coin will land on heads 10 times. When Tiffany performed the experiment, the coin landed on heads 7 times. Explain possible reasons why Kim’s prediction and Tiffany’s results do not match.</td>
</tr>
<tr>
<td>7.PR.6.4</td>
<td>Students should use side by side bar graphs or segmented bar graphs to compare categorical data distributions.</td>
<td>Example: Compare the heights of the basketball teams.</td>
</tr>
<tr>
<td>7.PR.6.5</td>
<td>Students should be able to represent the probability as a fraction, decimal numbers, or percentage.</td>
<td>Descriptions may include impossible, unlikely, equally likely, likely, and certain.</td>
</tr>
<tr>
<td>7.PR.6.6</td>
<td>Students should use side by side bar graphs or segmented bar graphs to compare categorical data distributions.</td>
<td>Example: Compare the heights of the basketball teams.</td>
</tr>
</tbody>
</table>
Competency-Based/Clustering Instructional Approach

- For instructional purposes, the learning objectives are not intended to be taught as an isolated checklist, but rather as a cluster within the standard.

- Ultimately, students must show mastery of the overall standard/key competency for the grade level.
Instructional Resources and Supports for Georgia’s K-12 Mathematics Standards
ESSENTIAL INSTRUCTIONAL GUIDANCE

- Mathematical Practices
- Mathematical Modeling
- Framework for Statistical Reasoning
- Computational Strategies for Whole Numbers
Instructional Resources

KEY HIGHLIGHTS

- Mathematical Modeling Continuum
- Statistical Reasoning, Mathematical Practices, and Mathematical Modeling embedded throughout
- Interdisciplinary Connections and Support for all grade levels
- Capstone Units included for all grade levels and courses
- New enhanced courses added for middle and high school

(providing open access to pathways that allow for AP Statistics, AP Calculus, and advanced college Calculus options for any interest student aligned to assessment and accountability requirements)
Georgia’s K-12 Mathematics Standards: Learning Progressions

This document provides a visual progression of mathematics expectations within Georgia’s K-12 Mathematics Standards across all grade levels for students, parents, and educators to make connections among key concepts as students move from grade level to grade level.
GEORGIA’S K-12 MATHEMATICS STANDARDS

MATHMATICAL PRACTICES

The Mathematical Practices describe the reasoning behaviors students should develop as they build an understanding of mathematics — the “habits of mind” that help students become mathematical thinkers. There are eight standards, which apply to all grade levels and conceptual categories.

These mathematical practices describe how students should engage with the mathematics content for their grade level. Developing these habits of mind builds students’ capacity to become mathematical thinkers. These practices can be applied individually or together in mathematics lessons, and no particular order is required. In well-designed lessons, there are often two or more Mathematical Practices present.

MATHMATICAL PRACTICES

<table>
<thead>
<tr>
<th>Code</th>
<th>Expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP.1</td>
<td>Make sense of problems and persevere in solving them.</td>
</tr>
<tr>
<td>MP.2</td>
<td>Reason abstractly and quantitatively.</td>
</tr>
<tr>
<td>MP.3</td>
<td>Construct viable arguments and critique the reasoning of others.</td>
</tr>
<tr>
<td>MP.4</td>
<td>Model with mathematics.</td>
</tr>
<tr>
<td>MP.5</td>
<td>Use appropriate tools strategically.</td>
</tr>
<tr>
<td>MP.6</td>
<td>Attend to precision.</td>
</tr>
<tr>
<td>MP.7</td>
<td>Look for and make use of structure.</td>
</tr>
<tr>
<td>MP.8</td>
<td>Look for and express regularity in repeated reasoning.</td>
</tr>
</tbody>
</table>

8 Mathematical Practices
(K-12 Habits of Mind for Mathematics)
Specific mathematics strategies for teaching and learning are not mandated by the Georgia Department of Education or assessed on state or federally mandated tests. Students may solve problems in different ways and have the flexibility to choose a mathematical strategy that allows them to make sense of and strategically solve problems using efficient methods that are most comfortable for and makes sense to them. It is critical that teachers and parents remain partners to help each child grow to become a mathematically literate citizen.
Mathematical Modeling Framework (K-12)

Teaching students to model with mathematics is engaging, builds confidence and competence, and gives students the opportunity to collaborate and make sense of the world around them. The main reason for doing mathematics is to give students the tools they need to make sense of the world around them. Students who engage in mathematical modeling will not only be prepared for their chosen career but will also learn to make informed daily life decisions based on data and the models they create.

A Mathematical Modeling Framework

- Explore & describe real-life, mathematical situations or problems.
- Evaluate the model and interpret solutions generated from other models. Draw and validate conclusions.
- Critical thinking Communication Collaboration Creative Problem Solving
- Gather information, make assumptions, and define variables related to the problem.
- Analyze and revise models, as necessary.
- Create a model and arrive at a solution to explain the problem presented.
Framework for Statistical Reasoning (K-12)

Statistical reasoning is important for learners to engage as citizens and professionals in a world that continues to change and evolve. Humans are naturally curious beings and statistics is a language that can be used to better answer questions about personal choices and/or make sense of naturally occurring phenomena. Statistics is a way to ask questions, explore, and make sense of the world around us.

The Framework for Statistical Reasoning should be used in all grade levels and courses to guide learners through the sense-making process, ultimately leading to the goal of statistical literacy in all grade levels and courses. Reasoning with statistics provides a context that necessitates the learning and application of a variety of mathematical concepts.

**Figure 1: Georgia Framework for Statistical Reasoning**

The following four-step statistical problem-solving process can be used throughout each grade level and course to help learners develop a solid foundation in statistical reasoning and literacy:

I. **Formulate Statistical Investigative Questions**  
   Ask questions that anticipate variability.

II. **Collect & Consider the Data**  
    Ensure that data collection designs acknowledge variability.

III. **Analyze the Data**  
    Make sense of data and communicate what the data mean using pictures (graphs) and words. Give an accounting of variability, as appropriate.

IV. **Interpret the Results**  
    Answer statistical investigative questions based on the collected data.
Statistical Problem-Solving Process

Critical Thinking
Communication
Collaboration
Creative Problem-Solving

EXPLORE & DESCRIBE REAL-LIFE, MATHEMATICAL SITUATIONS OR PROBLEMS.

ANALYZE

Interpret the Results

Evaluate the model and interpret solutions generated from other models. Draw and validate conclusions.

Gather information, make assumptions, and define variables related to the problem.

CREATE MODEL

Analyze and revise models, as necessary.

Create a model and arrive at a solution to explain the problem presented.

COLLECT

Formulate Statistical Investigative Questions

Gather information, make assumptions, and define variables related to the problem.
The Authenticity of Mathematical Modeling

- More Authentic
- Less Authentic

- Procedural Mathematics in Isolation
- Conceptual Mathematics in Isolation
- Conceptual Mathematics in Context
- Mathematical Modeling – Conceptual Mathematics in Authentic Situations

Student Engagement

Low Engagement

High Engagement
Explanation of Changes

Georgia’s K-12 Mathematics Standards
Explanation of Changes and Improvements
Transition Document

Georgia’s K-12 Mathematics Standards Transition Support Guide

This document provides transition information and support for the initial year of implementation of Georgia’s K-12 Mathematics Standards.

TEACHER SUPPORT RESOURCE

July 2022
Instructional Resources

The following resources are available for all grade levels and courses aligned to Georgia’s K-12 Mathematics Standards:

- Explanation of Changes and Improvements
- K-12 Progressions
- Curriculum Maps
- Guidance for Acceleration and Support
- Transitions Resource
- Machine Readable Standards in SuitCASE
- Comprehensive Grade-Level or Course Overviews
- K-12 Interactive Instructional Frameworks Units
- Digital Learning Plans
- K-12 Mathematics Glossary
- Supports for Numeracy Development
- K-12 Mathematical Practices
- Mathematical Modeling Framework
- Framework for Statistical Reasoning
- Mathematical Modeling Continuum
- Supports for Learner Variability
- Instructional Support Guide for Multi-lingual Learners
Instructional Resources

The following resources will be available soon for all grade levels and courses aligned to Georgia’s K-12 Mathematics Standards:

- Professional Learning Videos *(each standard and other key topics)*
- Newly Aligned State Assessments and Resources
- K-12 Parent Letters, in Multiple Languages
- Whole Child Mathematics Supports Resource Toolkit
- K-12 Interactive Instructional Frameworks Units
New K-12 Mathematics Glossary
Georgia’s K-12 Mathematics Standards

K-12 Mathematics Glossary

How to Use this Glossary  Get Started
Georgia's New K-12 Mathematics Standards Curriculum Maps

K-12 Mathematical Practices
2nd Grade
6th Grade
2nd Grade

K-12 Mathematical Modeling Framework
6th Grade

K-12 Statistical Reasoning Framework
8th Grade

Specialized Supports for Students
High School

Kindergarten
3rd Grade
4th Grade
5th Grade
7th Grade
1st Grade
# Georgia's New K-12 Mathematics Standards

## Grade Level and Course Overviews

**IMPLEMENTATION 2023-2024 SCHOOL YEAR**

### K-12 Mathematical Practices

### K-12 Mathematical Modeling Framework

### K-12 Statistical Reasoning Framework

### Whole Child Supports for Learner Variability

## Elementary (K-5)
- **Kindergarten**
- **First Grade**
- **Second Grade**
- **Third Grade**
- **Fourth Grade**
- **Fifth Grade**

## Middle (6-8)
- **Sixth Grade**
- **Seventh Grade**
- **Eighth Grade**
- **Enhanced Algebra: Concepts & Connections**

## High (9-12)
- **Algebra: Concepts & Connections**
- **Geometry: Concepts & Connections**
- **Advanced Algebra: Concepts & Connections**
- **Enhanced Advanced Algebra & Precalculus: Concepts & Connections**
- **High School Fourth Course Options**
New State Assessment Calculator Policy Georgia
New for Spring 2023 & beyond

NEW CALCULATOR POLICY

- Allowable Calculators – End of Grade
  - Grades 3-5 – No Calculators Allowed
  - Grades 6-7 – Scientific or basic four-function calculator with square root and percentage functions allowed
  - Grade 8 – Graphing calculator or Scientific
  - HS Physical Science (Grade 8 only) – Scientific or basic calculator with square root and percentage functions allowed

- Allowable Calculators – End of Course
  - Coordinate Algebra – Graphing calculator or Scientific
  - Algebra I – Graphing calculator or Scientific

All grades 6 – high school test takers should receive training in the use of the online Desmos Calculator embedded in the practice tests or at https://www.desmos.com/testing/Georgia.
Personalized Mathematics Pathways: Opportunities for ALL Georgia Students

- Open access and opportunities for all pathways for all students
- Prepares students for any path they choose aligned with their unique college and career goals
- Includes secondary courses for support and enhancement
- Multiple entry points with on-ramps and off-ramps for learners
- Enhanced mathematics learning options for all learners
First Three Required Courses

- Algebra: Concepts & Connections (or the equivalent)
- Advanced Algebra: Concepts & Connections (or the equivalent)
- Geometry: Concepts & Connections (or the equivalent)
- Enhanced Algebra: Concepts & Connections*

OR

- Enhanced Advanced Algebra and AP Precalculus: Concepts & Connections

4th Core Mathematics Course

- 4th Mathematics Course Options
  - AP Statistics
  - Statistical Reasoning
  - Linear Algebra with Computer Science Applications
  - Precalculus
  - Calculus
  - Advanced Finite Mathematics
  - Calculus
  - AP Calculus AB
  - Multivariable Calculus
  - AP Calculus BC
  - Differential Equations
  - Engineering Calculus
  - Mathematics Capstone Course
  - Advanced Financial Algebra
  - Mathematics of Industry and Government
  - History of Mathematics (elective credit ONLY)

*This course is an equivalent course to high school Algebra: Concepts and Connections for eligible Grade 8 students.

- Multiple options for 4th core mathematics courses
- Co-Requisite Support courses offered, as needed

Fourth mathematics course options may be taken simultaneously once the prerequisite for each course is satisfied.
Co-Requisite Support Courses

➢ The co-requisite support courses are offered for students, as needed, based on local school or district selection criteria.
➢ The co-requisite support courses are not stand-alone courses; these courses assist students as they work to earn the required core course credit.
➢ Co-Requisite support courses may be taken in conjunction with the core mathematics courses they are paired
➢ These co-requisite support courses provide teachers with additional time to implement wraparound interventions and supports for students in real time as the students are learning the standards in the core course required for graduation.
Acceleration in Mathematics using Gifted Services Model

• Acceleration at every grade level, K-12, with the gifted services model
• Alignment with the gifted model and definition of acceleration
• Alignment with the federal expectations of assessment and accountability
• New enhanced mathematics courses that are open-access for students interested in pursuing higher levels of mathematics
Personalized Pathways for Students interested in Advanced Calculus Options in High School

**NOTE:**
Local Districts have the flexibility to create additional pathways that support student success based on the needs in their individual districts.

Personalized, Student-Centered Decision Points

Open Access for ANY interested student

---

**Georgia’s K-12 Mathematics Standards**
Open Access Pathways for Middle and High School

| Grade 6 |
| Grade 7 |
| Grade 8 |
| Grade 9 |
| Grade 10 |
| Grade 11 |
| Grade 12 |

Student Discussion regarding Decision Point(s) may occur throughout K-12

Decision Point

4th Core Mathematics Course based on student interest

AP Calculus AB
AP Calculus BC
AP Statistics

Open Access Secondary Mathematics Pathways

**AP Calculus BC is required for the Georgia Tech Distance Mathematics Program.**
High School Enhanced Course

A new course blending option has been made available for advanced learners that includes Enhanced Advanced Algebra and Precalculus: Concepts and Connections starting in 2023-2024. All learners should have the opportunity to enroll in support courses and advanced placement mathematics courses at the high school level based on their course-taking patterns at the middle school level. All options should be made available for all students.

High School Acceleration
(Local districts may add additional options, as needed.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Content &amp; Grade Acceleration Options</td>
<td>New Acceleration Option</td>
<td>Or other Advanced 4th course options</td>
<td>Or other Advanced 4th course options</td>
</tr>
</tbody>
</table>

*Local school districts maintain the flexibility to offer courses that best meet the needs of students in their school communities.*
New Staying on Course Guidance

• The University System of Georgia and the Georgia Department of Education have partnered to revise the Staying on Course document to align with the new courses implemented as a result of the newly adopted standards.
New Course Numbers (available in SuitCASE)
New Instructional Units
Grade 7

Unit 1: Making Relevant Connections within the Number System

Students will build upon understandings of rational numbers to ultimately formalize rules for basic arithmetic operations (addition, subtraction, multiplication, and division) with rational numbers.
Model Interdisciplinary PBL

Interdisciplinary Model Unit

Unit 5: Probability on the Farm

In this unit, students will explore probability and selective breeding. Students will develop probability models that allow them to predict the possible outcomes of crosses in a selective breeding program.
Engage
Real World Hook/Introduction

How will you engage the students?
What is the real world “hook” that will intrigue their interest?

Explore
Student Engagement through Process Based Thinking

What will students be asked to do in each step of process-based thinking? What will students write and/or draw in journals for each step?
How will students connect new information to what they already know?
In what ways will the student engagement allow for open-ended exploration and inquiry?

Apply
Student Presentation

How will students share their findings?
What form of presentation will they use?
Which community partners might provide feedback?

Reflect
Student Reflection

How will students summarize their efforts in this unit and pose questions that will lead to the next one?
Instructional Design

• **Engage**

(Includes an evidence-based instructional strategy and learning task that can be used as an introduction that mentally engages students to capture their interest, provides an opportunity to communicate what they know, and allows them to connect what they know to new ideas)

  • Includes suggestions for Synchronous, Asynchronous, Unplugged/ Offline learning.

• **Explore**

(Includes an evidence-based instructional strategy and learning task that allows students to engage in hands-on activities to explore the new concept/big idea at a deep level)

  • Includes suggestions for Synchronous, Asynchronous, Unplugged/ Offline learning.

• **Apply**

(Includes an evidence-based instructional strategy and learning task that allows students to apply what they have learned in a new situation to develop a deeper understanding of the big idea)

  • Includes suggestions for Synchronous, Asynchronous, Unplugged/ Offline learning.

• **Reflect**

(Includes an evidence-based instructional strategy and learning task that allows students the opportunity to review and reflect on their own learning and new understandings)

  • Includes suggestions for Synchronous, Asynchronous, Unplugged/ Offline learning.
Customized for School Community and Needs

All content areas connected to the mathematics standards to provide inspiration for teachers to implement interdisciplinary instruction.

Interdisciplinary approaches to teaching and learning

Strong connections with mathematical modeling
Student Learning Supports
Addressing Learning Variability
Always, Sometimes, Never
Always, Sometimes, Never

All students have needs that are academic and non-academic.

All students are general education students.

At some point during their K-12 career, all students will need some supports.
What We Know About Learners

✓ All students have needs that are academic and non-academic.

✓ All students are general education students FIRST.

✓ Yes…students with disabilities are general education students.

✓ Yes…students identified as gifted or advanced are general education students.

✓ Yes…multi-lingual learners are general education students.
Georgia's System of Continuous Improvement
What do you notice?
What do you wonder?
Services Provided to Students

- Tier I: Primary Level of Prevention – Instruction/Core Curriculum
- Tier II: Secondary Level of Prevention - Intervention
- Tier III: Tertiary Level of Prevention – Intensive Intervention

Students receive services at all levels, depending on need.

- 80% of students: SWD, EL, Gifted
- 15% of students
- 3% to 5% of students
• Mathematical Practices
• Mathematical Modeling
• Framework for Statistical Reasoning
• Computational Strategies for Whole Numbers
Habits of Mind of a Productive Mathematical Thinker

MATHEMATICAL PRACTICES

The Mathematical Practices describe the reasoning behaviors students should develop as they build an understanding of mathematics — the “habits of mind” that help students become mathematical thinkers. There are eight standards, which apply to all grade levels and conceptual categories.

These mathematical practices describe how students should engage with the mathematics content for their grade level. Developing these habits of mind builds students’ capacity to become mathematical thinkers. These practices can be applied individually or together in mathematics lessons, and no particular order is required. In well-designed lessons, there are often two or more Standards for Mathematical Practice present.

<table>
<thead>
<tr>
<th>Code</th>
<th>Expectation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP.1</td>
<td>Make sense of problems and persevere in solving them.</td>
</tr>
<tr>
<td>MP.2</td>
<td>Reason abstractly and quantitatively.</td>
</tr>
<tr>
<td>MP.3</td>
<td>Construct viable arguments and critique the reasoning of others.</td>
</tr>
<tr>
<td>MP.4</td>
<td>Model with mathematics.</td>
</tr>
<tr>
<td>MP.5</td>
<td>Use appropriate tools strategically.</td>
</tr>
<tr>
<td>MP.6</td>
<td>Attend to precision.</td>
</tr>
<tr>
<td>MP.7</td>
<td>Look for and make use of structure.</td>
</tr>
<tr>
<td>MP.8</td>
<td>Look for and express regularity in repeated reasoning.</td>
</tr>
</tbody>
</table>
GEORGIA’S K-12 MATHEMATICS STANDARDS

FRAMEWORK FOR STATISTICAL REASONING

Statistical reasoning is important for learners to engage as citizens and professionals in a world that continues to change and evolve. Humans are naturally curious beings and statistics is a language that can be used to better answer questions about personal choices and make sense of naturally occurring phenomena. Statistics is a way to ask questions, explore, and make sense of the world around us.

The Framework for Statistical Reasoning should be used in all grade levels and courses to guide learners through the sense-making process, ultimately leading to the goal of statistical literacy in all grade levels and courses. Reasoning with statistics provides a context that necessitates the learning and application of a variety of mathematical concepts.

![Diagram of the Framework for Statistical Reasoning]

**Figure 1: Georgia Framework for Statistical Reasoning**

The following four-step statistical problem-solving process can be used throughout each grade level and courses to help learners develop a solid foundation in statistical reasoning and literacy:

1. **Formulate Statistical Investigative Questions**
   - Ask questions that anticipate variability.
2. **Collect & Consider the Data**
   - Ensure that data collection designs acknowledge variability.
3. **Analyze the Data**
   - Make sense of data and communicate what the data mean using pictures (graphs) and words. Give an accounting of variability, as appropriate.
4. **Interpret the Results**
   - Answer statistical investigative questions based on the collected data.

A Mathematical Modeling Framework

- **Explore & describe real-life, mathematical situations or problems.**
- **Critical thinking Communication Collaboration Creative Problem Solving**
- **Gather information, make assumptions, and define variables related to the problem.**
- **Evaluate the model and interpret solutions generated from other models. Draw and validate conclusions.**
- **Create a model and arrive at a solution to explain the problem presented.**

*Image adapted from: Sue. Masson, Schooler, 2017*
The Authenticity of Mathematical Modeling

- More Authentic
- Less Authentic

- Procedural Mathematics in Isolation
- Conceptual Mathematics in Isolation
- Conceptual Mathematics in Context
- Mathematical Modeling – Conceptual Mathematics in Authentic Situations

Student Engagement

Low Engagement

High Engagement
Addressing Learner Variability
## Supports for Learner Variability

### Supporting the Learning
- intervention activities specific to the learning experiences
- teacher actions from the Georgia Mathematics Strategy Toolkits tailored to the learning experiences

### Extending the Learning
- extension activities specific to the learning experiences
- instructional strategies that support students who are labeled gifted or demonstrated a solid understanding of the mathematical concepts within the learning experiences

### Language Supports
- teacher actions from the English Language Proficiency for English (as a 2nd language) Learners section of the Mathematics Strategy Toolkit tailored to the learning experiences
- strategies and resources included in the Mathematics Resources to Support English Learners provide specific evidence-based practices that indicate the benefits of hands-on, relevant learning experiences in the mathematics classroom
Collective Teacher Efficacy

Belief you can make a difference \( \times \) Evidence you are making a difference = Effect size of 1.57*

Georgia Mathematics Strategy Toolkits to Address Learner Variability

- K - 5
- 6 - 8
- High School
Georgia Numeracy Project
Numeracy Intervention Resource

Enter Here
Parallel Resources

Georgia Early Numeracy Project

K - 7 Resource

8 - HS Resource

Georgia Secondary Numeracy Project
Alignment to Essential Components of Georgia’s Tiered System of Supports for Students
Supporting Multilingual Learners
K-12 Digital Learning Plans

www.gpb.org/education/learn/k-12-learning-plans/math
Support for Multilingual Learners

Scaffolding Instruction for English Learners:
A Georgia Mathematics Instructional Resource Guide

October 2022
Supporting Students with Disabilities
Specially Designed Instruction

- Specially designed instruction is implemented by general education or special education teacher
- **Based on needs** arising from the student’s identified disability
- It’s “special”.
Georgia Mathematics Strategy Toolkits to Address Learner Variability

K - 5

6 - 8

High School
Introduction

“If the goal in mathematics teaching and learning is to support student success with mathematical proficiency, then we must be explicit about using instructional routines that focus on student engagement in activities that support reasoning and sense making, communication with and about mathematical ideas, making meaningful connections, building procedural fluency from conceptual understanding…”

- Thinking about Instructional Routines in Mathematics Teaching and Learning

Within this toolkit, educators will find observations of student behavior for each of the 14 identified areas for addressing learner variability. Aligned to each observation of student behavior, are evidence-based, research-based strategies intended to strengthen students’ ability in mathematics. Support resources are provided to assist educators with implementing the strategies.

- Behavior
  - Cognitive Processing
    - Attention
    - Conceptual
    - Memory
    - Reasoning
  - Executive Functioning
  - Instructional Climate and Student Mindsets
  - Language Processing
  - Language Proficiency
  - Mathematics Calculation
  - Other Exceptionalities
  - Problem-Solving
  - Visual-Spatial Processing

Looking for more evidence-based, researched based practices for mathematics? Please visit gadoe.org/mathematics.
Cognitive Processing: Memory

**Mathematics Connection:** Using rote memory to recall facts or remember the steps of an algorithm does not yield long-term learning. Students should have opportunities to use conceptual learning strategies that will lead to committing the basic computational facts to memory.

**Student Learning Expectations:** Students should have opportunities to use knowledge from their memories to perform calculations and procedures, identify geometric figures, and demonstrate basic graphing skills by using visual-spatial and numerical representations to make sense of real-life, mathematical problems to help with sustaining long-term memory.

<table>
<thead>
<tr>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observations</strong></td>
</tr>
</tbody>
</table>
| Observations reveal difficulty recalling key vocabulary terms consistently, such as: number names, the difference between area and perimeter, etc. | The teacher will facilitate meaningful discourse that allows students to repeat accurate math vocabulary while engaging in rich tasks. *(EMTP 4)* | The student will demonstrate precise communication of mathematical ideas using clear academic-language and accurate vocabulary. *(MP.6)* | **Counting Cup Lesson**  
This video shows how teachers explicitly use and reinforce vocabulary terms with manipulatives. **GA Frameworks Task on Perimeter and Area**  
This GA frameworks task allows students to demonstrate their knowledge and distinguish between concepts. |
| Observations reveal difficulty recalling prior mathematics skills or concepts previously taught. | The teacher will pose purposeful questions to assess student prior knowledge and elicit student thinking to address concepts needing review. *(EMTP 5)* | The student will use math models to build conceptual understanding of the previous skills and apply them to current content. *(MP.4)* | **GA Frameworks Video: MGSEK.CC.4**  
This video is part of the GA Frameworks video series. Here, the teacher demonstrates questioning skills that connect previous learning to new knowledge. **Addition and Subtraction Progression Video**  
This video provides the teacher with knowledge of the sequencing of skills. |
Developing Meaningful IEP Goals

✓ Follow the appropriate administration protocol
✓ Expose the strengths and the needs
✓ Identify skills using the Numeracy Intervention Instrument and use the skills to formulate Individual Education Program goals
✓ Implement the numeracy tasks and activities to address identified goal
High School Co-Requisite Support Courses
Co-Requisite Support Courses

➢ The co-requisite support courses are offered for students, as needed, based on local school or district selection criteria.
➢ The co-requisite support courses are not stand-alone courses; these courses assist students as they work to earn the required core course credit.
➢ Co-Requisite support courses may be taken in conjunction with the core mathematics courses they are paired.
➢ These co-requisite support courses provide teachers with additional time to implement wraparound interventions and supports for students in real time as the students are learning the standards in the core course required for graduation.
Written Assessment (Individual Written)

Assesses Four Knowledge Domains
1. Relational & Functional Reasoning
2. Patterning & Algebraic Reasoning
3. Statistical & Probability Reasoning
4. Geometric, Spatial & Measurement Reasoning

Diagnosic Interview (Individual Verbal)
Assesses Three Strategy Domains
- Addition/Subtraction
- Multiplication/Division
- Proportions/Ratios

Instructions
Form 1
Form 2
Form 3
Form 4
Recording Sheet

Stage Descriptions
End of Year Expectations Continuum

Georgia Secondary Numeracy Project

Intervention Tasks and Activities
(Activities for Support)

These resources provide the teacher/interventionist with the activities to support students where they are in their progression and help them move to the next level of numeracy development.

Assessment Manual
Examiner’s Manual
Intervention Manual

Numeracy Intervention Instrument
(Individual Verbal)

Deeply Assesses Strategy & Number Knowledge
Embedded Supports

Sample Unit - Structures
Grade 7

Unit 1: Making Relevant Connections within the Number System

Students will build upon understandings of rational numbers to ultimately formalize rules for basic arithmetic operations (addition, subtraction, multiplication, and division) with rational numbers.

MATHEMATICS
### Standard(s) Alignment

- **7.NR.1**: Solve relevant, mathematical problems, including multi-step problems, involving the four operations with rational numbers and quantities in any form (integers, percentages, fractions, and decimal numbers).
  - **7.NR.1.1**: Show that a number and its opposite have a sum of 0 (are additive inverses). Describe situations in which opposite quantities combine to make 0.
  - **7.NR.1.2**: Show and explain \( p + q \) as the number located a distance \(|q|\) from \( p\), in the positive or negative direction, depending on whether \( q\) is positive or negative. Interpret sums of rational numbers by describing applicable situations.
  - **7.NR.1.5**: Apply properties of operations, including part-whole reasoning, as strategies to add and subtract rational numbers.

### Mathematical Practice(s)

- **7.MP.1** Make sense of problems and persevere in solving them.
- **7.MP.2** Reason abstractly and quantitatively.
- **7.MP.3** Construct viable arguments and critique the reasoning of others.
- **7.MP.4** Model with mathematics.
- **7.MP.5** Use appropriate tools strategically.
- **7.MP.6** Attend to precision.
- **7.MP.7** Look for and make use of structure
Common Misconceptions

Visual representations may be helpful as students begin this work. If they do not have a visual to illustrate what is happening when they are adding and subtracting integers, they may get lost in the symbols and will not know how to combine the absolute value of the integers.

- Students want to subtract by just taking the counter off instead of bringing in a zero pair.
- Students do not always understand the value of a zero pair and how the value stays the same no matter how many zero pairs you bring.
- Ask students to create their own stories for integer operations and to answer the following three prompts:
  - Where did you start?
  - How far did you go?
  - Where are you now?

Teacher Notes: To combat the misconceptions students have when computing with integers, there are several tools that will aid in developing an understanding of operations with integers. Beginning with a bead string number line will help reinforce the quantity of the integers. The bead string can be created using pony beads and a pipe cleaner or string. Use a black bead to represent zero, white beads for each positive number and red beads for each negative number.
Diagnostic Assessment

Students will have an opportunity to demonstrate understanding of finding sums of two integers using a visual representation. They will be asked to justify how to determine the sum of two integers with different signs.

1. Using your knowledge of the commutative property, determine if \((-7) + 4\) is equivalent to \(4 + (-7)\)? Show the sum using a visual representation to justify your answer.

Solution: Models can vary

2. Explain how you can determine the sign of the sum of two integers if one is positive and the other is negative.

Solution: Answer can vary

Sample: If I am using counters to find the sum, I can create zero pairs. The number of counters that has the greatest value when I count them is going to be the sign of the sum.

Sample: To find the sum of a positive and a negative integer, take the absolute value of each integer and then subtract these values.
Student Learning Supports

This section provides suggested strategies to support learners before, during and/or after the learning experiences outlined within the instructional design. Teachers should use frequent formative assessment information to determine which students need additional support. For more information on supporting the learning, extending the learning and language supports, please review the information under Instructional Support Strategies within the Comprehensive Grade Level Overview.

Establish mathematics goals to focus learning.

- **Supporting the Learning:** Make explicit connections between current and prior lessons or units to integers.

Implement tasks that promote reasoning and problem solving.

- **Extending the Learning:** Make a game to practice the skills and concepts experienced today. Make a list of materials you will need. Think about rules for the game. Be prepared to explain to your teacher how the game works.

Use and connect mathematical representations.

- **Supporting the Learning:** Provide copies of notes, two color counters, number lines and utilize color coding to organize information to connect mathematical representations.
- **Supporting the Learning:** Have students to verbalize their thinking as they create the zero pairs and model the situations. Use think, pair, share as a strategy so students are able to hear and see one another’s thinking and process.
- **Supporting the Learning:** Encourage students to identify zero pairs and how they represent them using the rekenrek or bring in other models to support the understanding of the concept.
Facilitate meaningful mathematical discourse.
- **Language Supports**: Provide multiple opportunities for structured peer interactions or conversations (pairs or triads) to negotiate meaning using charts, graphic organizers, a word bank and/or sentence frames.
- **Language Supports**: Explicitly model and teach etiquette when conducting mathematical debates and how to justify answers.
- **Language Supports**: Utilize [Mathematical Language Routines](#) to support students in formulating their explanations.

Pose purposeful questions.
- **Supporting the Learning**: Pose purposeful questions to assess prior knowledge and elicit student thinking to address concepts needing review.
- **Language Supports**: The teacher will model how to construct an effective question in math by utilizing [8 Ways to Pose Better Math Questions in Math](#).

Build procedural fluency from conceptual understanding.
- **Extending the Learning**: Students can work together to develop formal rules and properties and provide justifications for why those rules and properties are applicable.

Support productive struggle in learning mathematics.
- **Supporting the Learning**: To combat the misconceptions students have when computing with integers, there are several tools that will aid in developing an understanding of operations with integers. Beginning with a bead string number line will help reinforce the quantity of the integers. The bead string can be created using pony beads and a pipe cleaner or string. Use a black bead to represent zero, white beads for each positive number and red beads for each negative number.
- **Supporting the Learning**: A modified rekenrek can help align zero pairs when adding and subtracting integers. A traditional rekenrek has two rows of 10 beads. Each row has five red beads and five white beads. They’re useful when students are developing the ideas of unitizing, quantity of numbers and number strategies for addition and subtraction of whole numbers. The modified rekenrek for use with integers has two rows of ten beads. One row has ten white beads and the second row has ten red beads. It can be constructed using red and white pony beads, two pipe cleaners and cardboard or tag board.
Additional Resources
Georgia Home Classroom

K-12 Digital Learning Plans

Let’s Learn GA!
Let’s Learn GA!

LLG Instructional Support - Mathematics

Teachers may use these videos to learn about effective teaching strategies and discover ways to engage students in mathematics.

https://www.gpb.org/education/learn/lets-learn-ga/instructional-support/mathematics
Resources for Parents

• Make Mathematics Count, GA! Parent Videos and Resources
Resources for Parents

First Grade Mathematics

Dear Parent and/or Guardian:

This letter is to help you understand what First Grade students in Georgia learn in Mathematics. We encourage you to form a partnership with your child’s first grade teacher at school to have answers to any questions you might have answered. This resource can also help you to understand what students are learning in first grade mathematics.

From the early concepts in Kindergarten mathematics to the more complete concepts in high school, we are all working together to help students become mathematically literate citizens. Additional resources are available for more information – talk to your child’s first grade teacher or visit their homepage online.

First Grade Standards

In First Grade, there are 7 mathematics standards for students to learn:

1. Mathematical Practices
   - Display perseverance and patience in problem-solving
   - Demonstrate critical thinking and reasoning skills

2. Numerical Reasoning
   - This includes counting, numbers, equality, place value, addition and subtraction
   - 1.NR.1, 1.NR.2, 1.NR.3

3. Pattern and Algebraic Reasoning
   - This includes repeating patterns, growing patterns, and shrinking patterns
   - 1.PAR.1

4. Geometry and Spatial Reasoning
   - This includes shapes, attributes, partitions of circles and rectangles
   - 1.GSR.1

5. Measurement and Data Reasoning
   - This includes length, time, money, and data
   - 1.MDR.1

First Grade Standards At-A-Glance

- 1.NR.1: Reading, writing, and representing numerical values to 120 and comparing numerical values to 120
- 1.NR.2: Explaining the relationship between addition and subtraction and applying the properties of operations to solve real-life addition and subtraction problems within 120
- 1.PAR.1: Using pictures, drawings, and equations to develop strategies for addition and subtraction within 120 by exploring strings of related problems
- 1.GSR.1: Using concrete models, the base-ten structure, and properties of operations to add and subtract within 120
- 1.GSR.2: Identifying, describing, explaining, and reasoning about the attributes of shapes, and shrinking patterns found in real-life situations
- 1.MDR.1: Investigate repeating patterns to make predictions
- 1.MDR.2: Comparing shapes, analyzing the attributes of shapes, and relating their parts to the whole
- Students are expected to:
  - Identify common two-dimensional shapes and three-dimensional figures, sort and classify them by their attributes, and build and draw two and three-dimensional figures
  - Compare two-dimensional shapes (rectangles, squares, triangles, half-circles, and quarter-circles) and three-dimensional figures (cubes, rectangular prisms, cones, and cylinders)
  - Create a shape formed of two or more common shapes and compose new shapes from the composite shape

- 1.MDR.3: Tell and write time to the hour and half-hour

- 1.MDR.4: Give the number of dimes, nickels, and pennies, and measure elapsed time to the hour on the hour using a standardized number line

89

Richard Woods, Georgia’s School Superintendent | Georgia Department of Education | Educating Georgia’s Future
Mathematics Professional Learning
Professional Learning Opportunities
Resources for Teachers and Leaders

www.gadoe.org/mathematics
Mathematics PL Series
(on the Road to RESAs)

Mathematics Professional Learning Series with RESA

(Register on each individual RESA website.)
Mathematics Virtual Specialists PL

Saturday morning sessions at 9:00 AM on select dates
(First Date Recordings Available from October 22, 2022)
Grade Bands/ Course Pathways

- **KINDERGARTEN – 1ST GRADE**
- **2ND GRADE – 3RD GRADE**
- **4TH GRADE – 5TH GRADE**
- **6TH GRADE – 7TH GRADE**
- **8TH GRADE – ALGEBRA: CONCEPTS & CONNECTIONS**
- **GEOMETRY: CONCEPTS & CONNECTIONS – ADVANCED ALGEBRA: CONCEPTS & CONNECTIONS**
- **ADVANCED CALCULUS PATHWAY**
- **MATHEMATICAL MODELING & STATISTICS PATHWAY**
GA MathCON

SAVE THE DATE

July 11 – 13, 2023
Professional Learning Videos
QUESTIONS????
Offering a holistic education to each and every child in our state.

www.gadoe.org
@georgiadeptofed
youtube.com/user/GaDOEmedia