GEORGIA'S K-12 MATHEMATICS STANDARDS 2021

Governor Kemp and Superintendent Woods are committed to the best set of academic standards for Georgia's students – laying a strong foundation of the fundamentals, ensuring age- and developmentally appropriate concepts and content, providing instructional supports to set our teachers up for success, protecting and affirming local control and flexibility regarding the use of mathematical strategies and methods, and preparing students for life. These Georgia-owned and Georgia-grown standards leverage the insight, expertise, experience, and efforts of thousands of Georgians to deliver the very best educational experience for Georgia's 1.7 million students.

In August 2019, Governor Brian Kemp and State School Superintendent Richard Woods announced the review and revision of Georgia's K-12 mathematics standards. Georgians have been engaged throughout the standards review and revision process through public surveys and working groups. In addition to educator working groups, surveys, and the Academic Review Committee, Governor Kemp announced a new way for Georgians to provide input on the standards: the Citizens Review Committee, a group composed of students, parents, business and community leaders, and concerned citizens from across the state. Together, these efforts were undertaken to ensure Georgians will have buy-in and faith in the process and product.

The Citizens Review Committee provided a charge and recommendations to the working groups of educators who came together to craft the standards, ensuring the result would be usable and friendly for parents and students in addition to educators. More than 14,000 Georgians participated in the state's public survey from July through September 2019, providing additional feedback for educators to review. The process of writing the standards involved more than 200 mathematics educators -- from beginning to veteran teachers, representing rural, suburban, and metro areas of our state.

Grade-level teams of mathematics teachers engaged in deep discussions; analyzed stakeholder feedback; reviewed every single standard, concept, and skill; and provided draft recommendations. To support fellow mathematics teachers, they also developed learning progressions to show when key concepts were introduced and how they progressed across grade levels, provided examples, and defined age/developmentally appropriate expectations.

These teachers reinforced that strategies and methods for solving mathematical problems are classroom decisions -- not state decisions -- and should be made with the best interest of the individual child in mind. These recommended revisions have been shared with the Academic Review Committee, which is composed of postsecondary partners, age/development experts, and business leaders, as well as the Citizens Review Committee, for final input and feedback.

Based on the recommendation of Superintendent Woods, the State Board of Education will vote to post the draft K-12 mathematics standards for public comment. Following public comment, the standards will be recommended for adoption, followed by a year of teacher training and professional learning prior to implementation.

Use of Mathematical Strategies and Methods & Affirming Local Control

These standards preserve and affirm local control and flexibility regarding the use of the "standard algorithm" and other mathematical strategies and methods. Students have the right to use any strategy that produces accurate computations, makes sense, and is appropriate for their level of understanding.

Therefore, the wording of these standards allows for the "standard algorithm" as well as other cognitive strategies deemed developmentally appropriate for each grade level. Revised state tests will not measure the students' use of specific mathematical strategies and methods, only whether students understand the key mathematical skills and concepts in these standards.

Teachers are afforded the flexibility to support the individual needs of their students. It is critical that teachers and parents remain partners to help each child grow to become a mathematically literate citizen.

Georgia's K-12 Mathematics Standards - 2021
Mathematics Big Ideas and Learning Progressions, K-5

Mathematics Big Ideas, K-5

K	1	2	3	4	5
MATHEMATICAL PRACTICES & MODELING					
DATA & STATISTICAL REASONING					
NUMERICAL REASONING (NR)					
PATTERNING & ALGEBRAIC REASONING (PAR)					
GEOMETRIC & SPATIAL REASONING (GSR)					
MEASUREMENT & DATA REASONING (MDR)					

K-5 MATHEMATICS: LEARNING PROGRESSIONS

Key Concepts	K	1	2	3	4	5
NUMERICAL REASONING						
Numbers (whole numbers, fractions, and decimal numbers)	• Whole numbers to 100	• Whole numbers to 120 • Partition shapes into halves and quarters/fourths (fourths) with no shading	• Whole numbers to 1000 • Partition shapes into halves, thirds and quarters (fourths) with no shading	• Whole numbers to 10,000 • Unit fractions with denominators of 2, 3, 4, 6, and 8 • Represent fractions • Equivalence of simple fractions • Introduce shading to identify and compare fractional parts	• Whole numbers to 100,000 • Non-unit fractions with denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100 • Fractions with like denominators • Decimal fractions (tenths and hundredths)	• Multi-digit whole numbers • Fractions with unlike denominators • Fractions greater than 1 • Decimal fractions to thousandths
Counting	• Counting forward to 100 • Counting backward from 20 • Counting objects to 20	• Counting forward and backward within 120 • Skip counting by 2s, 5s, and 10s • Counting objects to 120	• Counting forward and backward within 1000 • Skip counting by 2s, 5s, 10s, 25s, and 100s • Counting objects to 1000	• Counting unit fractions	• Counting non-unit fractions	• Counting decimal numbers
Place Value	• Compose and decompose numbers within 20 • Identify and write numerals to 20	• Compose and decompose 2-digit numbers	• Hundreds, tens and ones in 3-digit numbers	• Round numbers to 1000 to nearest 10 or 100 • Read & write multi-digit whole numbers to thousands	• Magnitude of place value • Multi-digit whole numbers to 100,000 • Round multi-digit whole numbers • Fractions with • denominators of 10 or 100	• Magnitude of place value extended to decimal numbers • Powers of 10 to 10^3 • Read & write decimal numbers to thousandths place • Round decimal numbers to hundredths place
Comparisons	• Comparing objects up to 10 • Comparing numbers of objects in a set from 1-10	• Comparing numbers to 100	• Comparing numbers to 1,000	• Comparing numbers to 10,000 • Unit fractions	• Multi-digit numbers • Fractions less than 1 • Decimal fractions to hundredths place	• Decimal fractions to thousandths place • Fractions greater than 1
Computational Fluency	• Fluency with addition and subtraction within 5	• Fluency with addition and subtraction within 10	• Fluency using mental math up to 20 • Fluency with strategies within 100	• Fluency with multiplication and division with single-digit numbers • Fluency with addition and subtraction within 1,000	• Fluency with addition and subtraction with multi-digit whole numbers	• Fluency with multiplication and division with multi-digit whole numbers
Addition & Subtraction	• Single-digit numbers within 10	• Within 20 (using properties of operations) • Within 100 (using base ten understanding)	• Within 1,000 (using tools and strategies)	• Within 10,000	• Within 100,000 • Fractions with like denominators	• Fractions with unlike denominators • Decimal fractions to the hundredths place
Multiplication & Division			• Building arrays	• Within 100 • Multiply by multiples of 10	• Factors and multiples • Prime and composite numbers • Multiply by multi-digit whole numbers • Divide by 1-digit divisors	• Multiply multi-digit whole numbers • Multiply fractions and whole numbers • Divide unit fractions and whole numbers • Reason about multiplying by a fraction >, <, or = 1
Expressions						• Simple numerical expressions involving whole numbers with or without grouping symbols • Express fractions as division problems

K-5 MATHEMATICS: LEARNING PROGRESSIONS

Key Concepts	K	1	2	3	4	5
PATTERNING & ALGEBRAIC REASONING						
Patterns	• Repeating patterns with numbers and shapes • Explain the rationale for the pattern.	• Growing and repeating patterns of 1s, 5s, and 10s • Repeated operations, shapes or numbers	• Numerical patterns involving addition and subtraction	• Numerical patterns related to multiplication • Make predictions based on patterns	• Generate number and shape patterns that follow a rule • Represent and describe patterns	• Generate two numerical patterns using a given rule • Identify relationships using a table
Graphing						• Plot order pairs in first quadrant
GEOMETRIC & SPATIAL REASONING						
Shapes and Properties	• Identify, sort, classify, analyze, and compare 2D & 3D based on attributes using informal language • Positional words	• Identify, sort, and classify 2D & 3D shapes based on specific attributes using formal language and geometric properties • Compose 2D shapes & 3D shapes	• Describe, compare and sort 2-D and 3-D shapes given a set of attributes • Identify lines of symmetry in everyday objects	• Quadrilaterals • Parallel & perpendicular line segments, points, lines, line segments, & right angles and presence or absence of these in quadrilaterals • Lines of symmetry with quadrilaterals	• Points, lines, line segments, rays, angles, and parallel & perpendicular line segments • Classify, compare, & contrast polygons based on presence or absence of parallel or perpendicular line segments, angles of a specified size or side lengths.	• Classify polygons based on geometric properties • Relationships between categories and subcategories of shapes
Geometric Measurement				• Area of rectangles • Perimeter of rectangles	• Area and perimeter of composite rectangles • Angle measurement	• Volume of right rectangular prisms
MEASUREMENT & DATA REASONING						
Measurement & Data	• Measurable attributes of length, height, width and weight • Classify and sort up to 10 objects by attributes • Display and interpret categorical data with up to 10 data points on graphs	• Measure length in non-standard units • Compare, describe and order up to 3 objects using length in non-standard units • Display and interpret categorical data (with up to 3 categories)	• Measure length to nearest whole unit • Use tools such as constructed rulers and standard rulers • Choose units (in, ft, yd) appropriately • Display and interpret categorical data (with up to 4 categories)	• Measure liquid volume, length and mass in customary units • Use rulers to measure lengths in halves and fourths of an inch • Analyze numerical and categorical data with whole number values	• Measure liquid volume, distance, and mass using the metric measurement system • Use rulers to measure lengths to nearest $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ of an inch • Analyze data using dot plots (with values to the nearest 1/8 of a unit)	• Measure length and weight in metric units • Convert between units of measurement • Create and analyze dot plots (line plots) with fraction measurements
Money	• Identify pennies, nickels and dimes and know the value of each coin	• Identify value of pennies, nickels, dimes and quarters	• Combination of coins • Problems involving dollars and all coins	• Using money to solve problems	• Using money as a tool or manipulative to solve problems	• Using money as a tool to solve problems involving decimals
Time		• Tell & write time in hours and half hours • Measure elapsed time to the hour	• Time to the nearest five minutes • Distinguish between a.m. & p.m. • Elapsed time to hour or half hour	• Tell time to the nearest minute • Estimate relative time • Elapsed time to hour, half hour & quarter hour	• Intervals of time • Elapsed time to the nearest minute	• Solving problems involving time

4th Grade

The nine standards listed below are the key content competencies students will be expected to master in fourth grade. Additional clarity and details are provided through the classroom-level learning objectives and evidence of student learning details for each grade-level standard found on subsequent pages of this document. As teachers are planning instruction and assessing mastery of the content at the grade level, the focus should remain on the key competencies listed in the table below.

FOURTH GRADE STANDARDS
4.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.**
4.NR.1: **Recognize patterns within the base ten place value system with quantities presented in real-life situations to compare and round multi-digit whole numbers through the hundred-thousands place.**
4.NR.2: **Using part-whole strategies, solve problems involving addition and subtraction through the hundred-thousands place, as well as multiplication and division of multi-digit whole numbers presented in real-life, mathematical situations.**
4.PAR.3: **Generate and analyze patterns, including those involving shapes, input/output diagrams, factors, multiples, prime numbers, and composite numbers.**
4.NR.4: **Solve real-life problems involving addition, subtraction, equivalence, and comparison of fractions with denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100 using part-whole strategies and visual models.**
4.NR.5: **Solve real-life problems involving addition, equivalence, comparison of fractions with denominators of 10 and 100, and comparison of decimal numbers as tenths and hundredths using part-whole strategies and visual models.**
4.MDR.6: **Measure time and objects that exist in the world to solve real-life, mathematical problems and analyze graphical displays of data to answer relevant questions.**
4.GSR.7: **Investigate the concepts of angles and angle measurement to estimate and measure angles.**
4.GSR.8: **Identify and draw geometric objects, classify polygons based on properties, and solve problems involving area and perimeter of rectangular figures.**

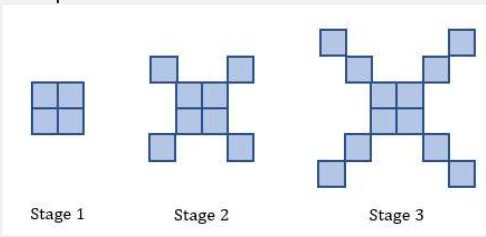
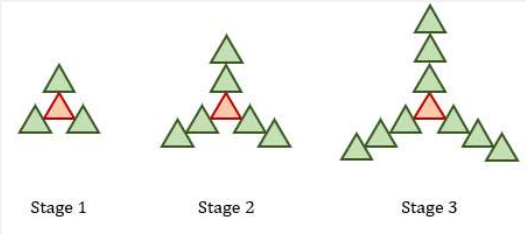
Georgia's K-12 Mathematics Standards – 2021

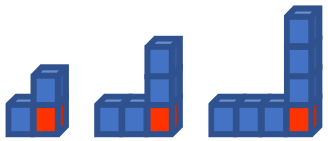
4th Grade

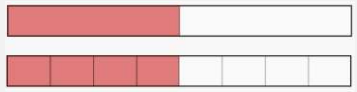
NUMERICAL REASONING *– place value, rounding, comparisons with multi-digit numbers, addition and subtraction, multiplicative comparisons, multiplication, and division involving whole numbers*			
4.NR.1: Recognize patterns within the base ten place value system with quantities presented in real-life situations to compare and round multi-digit whole numbers through the hundred-thousands place.			
Expectations		**Evidence of Student Learning** (not all inclusive; see Grade Level Overview for more details)	
4.NR.1.1	Read and write multi-digit whole numbers to the hundred-thousands place using base-ten numerals and expanded form.	***Age/Developmentally Appropriate*** ● Students are not expected to write numbers in word form.	
4.NR.1.2	Recognize and show that a digit in one place has a value ten times greater than what it represents in the place to its right and extend this understanding to determine the value of a digit when it is shifted to the left or right, based on the relationship between multiplication and division.	***Fundamentals*** ● Students should be able to use numerical reasoning to represent and explain using concrete materials, the relationship among the numbers 1, 10, 100, and 1,000. Students should be able to extend the pattern to the hundred-thousands place. ● Students should be able to recognize the relationship of same digits located in different places in a whole number.	***Example*** ● The population of Atlanta is about 500,000 people and the population of Valdosta is about 50,000 people. How many times greater is the population of Atlanta than Valdosta?
4.NR.1.3	Use place value reasoning to represent, compare, and order multi-digit numbers, using >, =, and < symbols to record the results of comparisons.	***Fundamentals*** ● Students should be able to order up to 5 whole numbers less than 1,000,000 through the hundred-thousands place.	***Age/Developmentally Appropriate*** ● Students are not expected to use more than two inequality symbols when recording comparisons (< or >).
4.NR.1.4	Use place value understanding to round multi-digit whole numbers.	***Age/Developmentally Appropriate*** ● Grade 4 students should explore rounding within multiple authentic situations. ● Students should be able to round whole numbers to the 1,000s, 10,000s and 100,000s.	***Strategies and Methods*** ● Students should locate numbers on a number line to determine the nearest multiple of 1,000s, 10,000s or 100,000s.

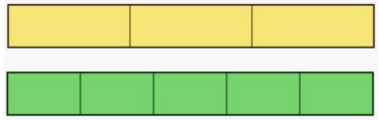
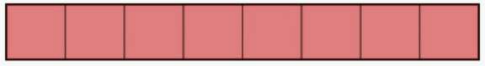
4.NR.2: Using part-whole strategies, solve problems involving addition and subtraction through the hundred-thousands place, as well as multiplication and division of multi-digit whole numbers presented in real-life, mathematical situations.					
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
4.NR.2.1	Fluently add and subtract multi-digit numbers to solve practical, mathematical problems using place value understanding, properties of operations, and relationships between operations.	***Fundamentals*** ● Students should fluently (flexibly, accurately, and efficiently) add and subtract multi-digit whole numbers, to solve relevant, mathematical problems using efficient and flexible procedures, based on knowledge of place value and properties of operations. ● Relevant problems can include word problems that are meaningful to a student's real environment. It is important for the problems presented to be relevant and interesting for the learners to pique their natural, intellectual curiosity.	***Terminology*** ● Efficiency in mathematics is the ability to produce answers relatively easily with a minimal number of steps. ● Flexibility is the ability to think about a problem in more than one way and to adapt or adjust thinking, if necessary. ● Accuracy is the ability to produce mathematically precise answers. ● Appropriateness is the ability to select and apply a strategy that is appropriate for solving a given problem efficiently.	***Age/Developmentally Appropriate*** ● Efficiency means the student is able to flexibly use strategies appropriate for the given problem with ease. ● Efficiency does not mean students should be timed.	***Strategies and Methods*** ● An efficient strategy is one that the student can carry out easily, keeping track of sub-problems and making use of intermediate results to solve the problem. Efficiency means the student is able to flexibly use strategies appropriate for the given problem with ease. ● Students should be given the choice of which procedure they can use. ● Students should add and subtract multi-digit whole numbers within 100,000, to solve relevant, mathematical problems using efficient and generalizable procedures, based on knowledge of place value and properties of operations.
4.NR.2.2	Interpret, model, and solve problems involving multiplicative comparison.	***Fundamentals*** ● Students should be able to solve relevant, mathematical problems involving multiplicative comparison. ● Students should be able to distinguish multiplicative comparison from additive comparison.	***Strategies and Methods*** – *see special note in appendix* ● Students should be able to demonstrate an understanding of simple multiplicative relationships by using concrete materials, drawings, and equations with a variable for the unknown number to represent the problem.	***Terminology*** ● The terms below are used to clarify expectations for the teaching professional. Students are not required to use this terminology when engaging with the learning objective. ○ Multiplicative comparison – a comparison situation based on one set of a quantity being a particular multiple of the other set within the comparison. ○ Additive comparison – involves two distinct quantities and the difference between them.	***Example*** ● Mara has four pencils. Josh has three times as many pencils as Mara. How many pencils does Josh have?
4.NR.2.3	Solve relevant problems involving multiplication of a number with up to four digits by a 1-digit whole number or involving multiplication	***Strategies and Methods*** – *see special note in appendix* ● Students should be able to solve relevant, mathematical problems involving the multiplication of a number with up to four digits by a 1-digit whole number. ● Students should be able to illustrate and explain their calculations using equations, rectangular arrays, and/or area models for all numbers included in the learning objective.		***Examples*** ● There are 7 boxes of chocolates. Each box contains 16 chocolates. How many chocolates are there all together? ● The school bought thirty-nine cases of popcorn for the school carnival. Each case contained 15 bags of popcorn. How many bags of popcorn is that all together?	

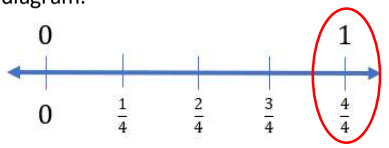
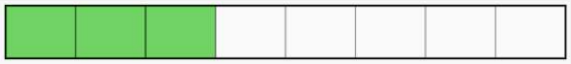
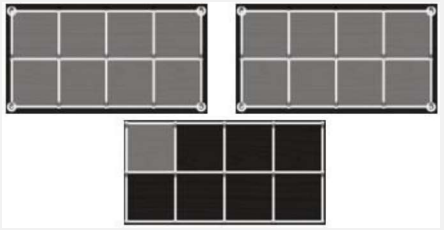
	of two two-digit numbers using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	• Relevant problems can include word problems that are meaningful to a student's real environment. It is important for the problems presented to be relevant and interesting for the learners to pique their natural, intellectual curiosity.			
4.NR.2.4	Solve authentic division problems involving up to 4-digit dividends and 1-digit divisors (including whole number quotients with remainders) using strategies based on place-value understanding, properties of operations, and the relationships between operations.	***Fundamentals*** • Students should be able to solve mathematical problems related to everyday life involving division of whole numbers. • Authentic problems can include word problems that are meaningful to a student's real environment. It is important for the problems presented to be relevant and interesting for the learners to pique their natural, intellectual curiosity.	***Strategies and Methods*** – *see special note in appendix* • Students should be able to illustrate and explain their calculations using equations, rectangular arrays, and/or area models. • Examples of different strategies and representations can be found within the *Computational Strategies for Whole Numbers* document found in the appendices.	***Age/Developmentally Appropriate*** • Long division is not an expectation at this grade level.	***Example*** • Antonio won a jar of 373 jellybeans in a school contest. He wants to share them. He and his 7 friends will share them. How many jellybeans will each of the friends get? • Possible solution: 373 ÷ 8 = (320 ÷ 8) + (40 ÷ 8) + (13 ÷ 8) = 46 with 5 jellybeans left over.
4.NR.2.5	Solve multi-step problems using addition, subtraction, multiplication, and division involving whole numbers. Use mental computation and estimation strategies to justify the reasonableness of solutions.	***Fundamentals*** • Students should be able to use the four operations with whole numbers to solve authentic, mathematical problems.	***Strategies and Methods*** – *see special note in appendix* • Students should represent and model problems using equations and diagrams with a variable for the unknown quantity.	***Age/Developmentally Appropriate*** • Problems should include solutions in which remainders must be interpreted.	

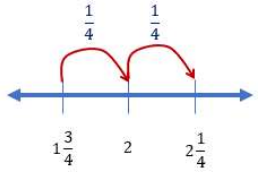
PATTERNING & ALGEBRAIC REASONING *– patterns, input-output tables, factors, multiples, composite numbers, prime numbers*				
4.PAR.3: Generate and analyze patterns, including those involving shapes, input/output diagrams, factors, multiples, prime numbers, and composite numbers.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
4.PAR.3.1	Generate both number and shape patterns that follow a provided rule.	***Fundamentals*** • Within numeric patterns, students should be able to connect each term in a growing or shrinking pattern with its term number (e.g., in the sequence 1, 4, 7, 10, …, the first term is 1, the second term is 4, the third term is 7, and so on), and record the patterns in a table of values that shows the term number. • Students should be provided with opportunities to explore and extend growing patterns using shapes. • Students should be provided with opportunities to explore and extend numerical patterns using a given rule. • Students should be able to identify features of the pattern that were not explicit in the rule itself. • Students should be able to explain, informally, why a pattern will continue to develop as it does.	***Age/Developmentally Appropriate*** • Students are not expected to determine the rule but instead are expected to extend the pattern or complete a pattern. • Patterns are limited to 8 elements.	***Examples*** • Given the rule "Add 3" and a starting number of 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. • Use square tiles to generate a growing pattern that shows multiples of four.  • Use the rule, multiply by 3 and add 1 to find the next two stages in the following growing pattern:  • Where does the pattern multiply by 3? Where is the "1" that is being added as this pattern grows? Create a different growing pattern using this rule. Identify where it multiplies by three and where one is added.

<table>
<tr><td colspan="4">PATTERNING & ALGEBRAIC REASONING – patterns, input-output tables, factors, multiples, composite numbers, prime numbers</td></tr>
<tr><td colspan="4">4.PAR.3: Generate and analyze patterns, including those involving shapes, input/output diagrams, factors, multiples, prime numbers, and composite numbers.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="2">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr><td>4.PAR.3.2</td><td>Use input-output rules, tables, and charts to represent and describe patterns, find relationships, and solve problems.</td><td>Strategies and Methods
Students should be able to analyze numerical patterns and use input-output tables and charts to represent patterns, find relationships and solve authentic problems.</td><td>Example
 
<table><tr><th>Stage</th><th>Red</th><th>Blue</th><th>Total</th></tr><tr><td>1</td><td>1</td><td>2</td><td>3</td></tr><tr><td>2</td><td>1</td><td>4</td><td>5</td></tr><tr><td>3</td><td>1</td><td>6</td><td>7</td></tr><tr><td>4</td><td>1</td><td>8</td><td>9</td></tr><tr><td>5</td><td>1</td><td>10</td><td>11</td></tr><tr><td>…</td><td>…</td><td>…</td><td>…</td></tr><tr><td>9</td><td>1</td><td>18</td><td>19</td></tr></table></td></tr>
<tr><td>4.PAR.3.3</td><td>Find factor pairs in the range 1–100 and find multiples of single-digit numbers up to 100.</td><td>Fundamentals
Students should be able to recognize that a whole number is a multiple of each of its factors.</td><td>Examples
If there are 24 students in a class, how many unique ways can they be arranged into equal-sized groups?
Every 8th person of the first hundred people in line for a concert will get a free T-shirt. Which places in the line will get a T-shirt?</td></tr>
<tr><td>4.PAR.3.4</td><td>Identify composite numbers and prime numbers and explain the relationship with the factor pairs.</td><td>Fundamentals
Determine whether a given whole number in the range 1–100 is prime or composite or neither.
Students should be able to describe the relationship between the numbers related to the factor pairs.</td><td>Terminology
Prime number – A whole number greater than 1 that with two unique factors, 1 and itself.
Composite number – A whole number greater than 1 that has at least one whole-number factor other than 1 and itself.</td></tr>
</table>

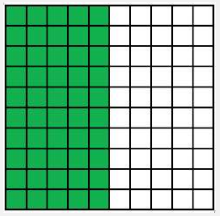
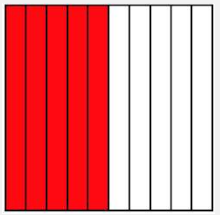
NUMERICAL REASONING *– fraction equivalence, comparison of fractions, and addition and subtraction of fractions with like denominators*					
4.NR.4: Solve real-life problems involving addition, subtraction, equivalence, and comparison of fractions with denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100 using part-whole strategies and visual models.					
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
4.NR.4.1	Using concrete materials, drawings, and number lines, demonstrate and explain the relationship between equivalent fractions, including fractions greater than one, and explain the identity property of multiplication as it relates to equivalent fractions. Generate equivalent fractions using these relationships.	***Age/Developmentally Appropriate*** ● This expectation includes fractions greater than 1. ● Fractions should be limited to denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100.	***Strategies and Methods*** ● Students should be provided with opportunities to demonstrate mastery of this expectation through solving and discussing genuine, mathematical problems related to everyday life. ● Concrete materials may include fraction circles, fraction strips, pattern blocks. ● Students may represent their problems and explain their reasoning with drawing and number lines. ● Students should be able to discover, explain, and generalize the relationship between the identity property of multiplication and equivalent fractions (i.e., paper folding activities, number lines, etc.).	***Fundamentals*** ● Students should be able to describe how the number and size of the parts differ even though the fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. ● Students should be able to explain fraction equivalence as a multiplicative relationship, not additive. ● Students should be able to explain why $\frac{a}{b} = \frac{(n \times a)}{(n \times b)}$ is a true mathematical statement, whereas $\frac{a}{b} = \frac{(n+a)}{(n+b)}$ is NOT a true mathematical statement.	***Example*** ● Peter is giving half of his candy bar to four friends. Provide a mathematical representation to show this scenario. ● *Possible student response:* $\frac{1}{2} = \frac{(4 \times 1)}{(4 \times 2)} = \frac{4}{8}$ 
4.NR.4.2	Compare two fractions with the same numerator or the same denominator by reasoning about their size and recognize that comparisons are valid only when the two fractions refer to the same whole.	***Fundamentals*** ● Students should be able to recognize that comparisons are valid only when the two fractions refer to the same whole. ● Students should record the results of comparisons with symbols >, =, or <, and justify the conclusions.	***Age/Developmentally Appropriate*** ● Students should be given fractions with common numerators to compare.	***Examples*** ● Jamie and Kendra each had the same grid to color using any pattern they wished. Jamie colored $\frac{2}{3}$ of her grid pattern and Kendra colored $\frac{2}{5}$ of her grid pattern. Who colored more? ○ Jamie colored more because thirds are bigger than fifths and since they both	

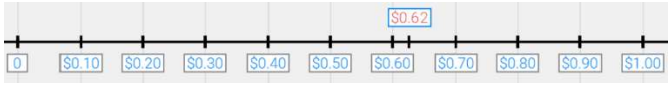
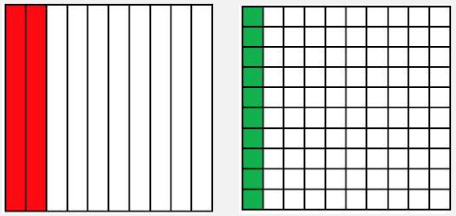
				colored two parts, $\frac{2}{3}$ has to be bigger than $\frac{2}{5}$.  ○ Each third (yellow) is larger than each fifth (green) ● Kennedy ran $\frac{5}{8}$ of a mile during practice and Alice ran $\frac{7}{8}$ of a mile. Who ran farther? ○ Alice ran farther because the distances they ran were both the same unit (eighths), so whoever had more eighths ran the greatest distance.  ○ Each section above represents one-eighth of a mile. All 8 pieces represent the whole mile. Kennedy ran the length of 5 pieces and Alice ran the length of 7 pieces, so Alice ran the greater distance.
4.NR.4.3	Compare two fractions with different numerators and/or different denominators by flexibly using a variety of tools and strategies and recognize that comparisons are valid only when the two fractions refer to the same whole.	***Fundamentals*** ● Students should be able to reason with the fractional parts to make decisions involving comparisons. ● Students should record the results of comparisons with symbols >, =, or <, and justify the conclusions. ● Students should be able to recognize that comparisons are valid only when the two fractions refer to the same whole.	***Strategies and Methods*** ● Tools and strategies could include visual fraction models, create common denominators or numerators, or compare to benchmarks such as 0, ½ and 1 or missing parts to a whole.	***Example*** ● Compare $\frac{5}{6}$ and $\frac{7}{8}$. *Possible student response:* When comparing $\frac{5}{6}$ and $\frac{7}{8}$, each are one part away from a whole, and $\frac{1}{8}$ is a smaller piece so $\frac{7}{8}$ is greater than $\frac{5}{6}$. Students should be able to reason with the fractional parts to make decisions involving comparisons.

4.NR.4.4	Represent whole numbers and fractions as the sum of unit fractions.	***Fundamentals*** • Students should be able to break apart (decompose) whole numbers and fractions as the sum of unit fractions.	***Strategies and Methods*** • Students can justify their work using a visual fraction representation. • 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.	***Example*** • Alex has a whole pizza. How can it be cut so that it can be shared with (4, 6, 8, 12) people? What fraction of the whole pizza will each person get? • Express 1 in the form $1 = \frac{4}{4}$ (1 whole is equal to four fourths $\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=\frac{4}{4}=1$) recognize that additional wholes cut into fourths can also be written as the sum of unit fractions (2 wholes is equal to eight fourths $\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=\frac{4}{4}+\frac{4}{4}=\frac{8}{4}$; recognize that $\frac{4}{1}=4$ because $4=\frac{1}{1}+\frac{1}{1}+\frac{1}{1}+\frac{1}{1}=\frac{4}{1}$ • Locate $\frac{4}{4}$ and 1 at the same point of a number line diagram.  • Express $\frac{5}{4}$ as the sum of unit fractions. ○ $\frac{5}{4}=\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}$
4.NR.4.5	Represent a fraction as a sum of fractions with the same denominator in more than one way, recording with an equation.	***Fundamentals*** • Break apart (decompose) a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation.	***Strategies and Methods*** • Students can justify their work using a visual fraction representation. • 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.	***Examples*** • A piece of ribbon was cut into eighths for a classroom art project. Three pieces were left at the end of the day. Show a mathematical representation of the ribbon that is left. *Possible student response:* $\frac{3}{8}=\frac{1}{8}+\frac{1}{8}+\frac{1}{8}$; $\frac{3}{8}=\frac{1}{8}+\frac{2}{8}$  • Three pans of brownies were cut into eighths to sell at a school function. $\frac{7}{8}$ of one pan were sold. How many eighths are left to sell? Show a mathematical representation of the brownies that are left. *Possible student response*: $2\frac{1}{8}=1+1+\frac{1}{8}=\frac{8}{8}+\frac{8}{8}+\frac{1}{8}$ 

4.NR.4.6	Add and subtract fractions and mixed numbers with like denominators using a variety of tools.	***Fundamentals*** ● Students should be able to add and subtract fractions and mixed numbers with the same (like) denominators by joining and separating parts referring to the same whole while solving genuine, mathematical problems related to everyday life.	***Strategies and Methods*** ● Tools include fraction concrete materials, such as Cuisenaire rods, drawings, and number lines. ● Students should be flexible in their choice of strategy when subtracting fractions. Reasoning about the sizes of the fractions and their relationships is the expectation here rather than memorizing regrouping procedures. ● 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.	***Example*** ● Luisa needs to know how much bigger her $2\frac{1}{4}$ inch piece of cardstock is than her $1\frac{3}{4}$ inch piece of cardstock in order to finish her project. ○ *Possible student response:* The $2\frac{1}{4}$ inch piece is $\frac{2}{4}$ inch bigger than the $1\frac{3}{4}$ inch piece. 

4.NR.5: Solve real-life problems involving addition, equivalence, comparison of fractions with denominators of 10 and 100, and comparison of decimal numbers as tenths and hundredths using part-whole strategies and visual models.

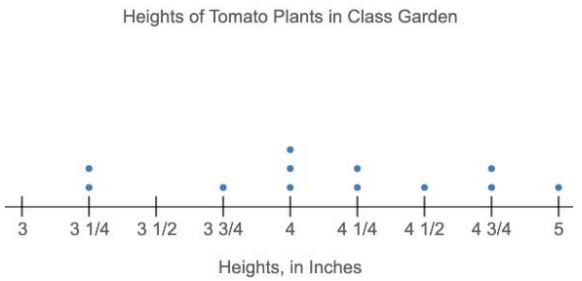
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
4.NR.5.1	Demonstrate and explain the concept of equivalent fractions with denominators of 10 and 100, using concrete materials and visual models. Add two fractions with denominators of 10 and 100.	*Fundamentals* • Students should also use mixed numbers and fractions greater than 1. • Students should express fractions such as $\frac{3}{10}$ as $\frac{30}{100}$, and add fractions such as $\frac{3}{10} + \frac{4}{100} = \frac{34}{100}$.	*Strategies and Methods* • Students should be able to solve authentic, mathematical problems involving the addition of two fractions with denominators of 10 and 100. • Students should be given multiple opportunities to use visual models to develop part-whole reasoning when building an understanding of equivalent fractions.	*Example* • Colin wants to use $\frac{5}{10}$ of a board for a project. He is wondering how he can cut his whole board into pieces that are equivalent to $\frac{5}{10}$. What fraction(s) of the whole board can Colin cut the board that are equivalent to $\frac{5}{10}$? Use visual models to support your reasoning.  • *Possible student response:* I know that $\frac{5}{10}$ is the same as $\frac{50}{100}$ because they both take up the same amount of space in the decimal squares below. So, $\frac{5}{10} = \frac{50}{100}$. I also notice that half of each square is shaded, so I think that $\frac{5}{10} = \frac{50}{100} = \frac{1}{2}$. 

4.NR.5.2	Represent, read, and write fractions with denominators of 10 or 100 using decimal notation, and decimal numbers to the hundredths place as fractions, using concrete materials and drawings.	***Fundamentals*** • Represent decimal number values on a place value chart.	***Age/Developmentally Appropriate*** • Students are not expected to write word names of decimal numbers at this grade level.	***Strategies and Methods*** • Concrete materials could include base ten block where the "flat" or hundred square is considered one whole or a ten frame where the whole frame is considered one whole.	***Example*** • Eric overpaid his medical bill by \$0.62. When businesses write refund checks, they often write the cents as a fraction. What fraction will the doctor's office use to represent the \$0.62 on the check? • *Possible student response:* I wrote 62 cents (\$0.62) as $\frac{62}{100}$ because \$0.62 is sixty-two hundredths of a dollar. If I place \$0.62 on a number line, it would be between \$0.60 and \$0.70. 
4.NR.5.3	Compare two decimal numbers to the hundredths place by reasoning about their size. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions.	***Fundamentals*** • Recognize that comparisons are valid only when the two decimal numbers refer to the same whole.	***Strategies and Methods*** • Decimal quantities should be presented within an authentic situation. • Students should be given multiple opportunities to use visual models to develop part-whole reasoning when comparing decimal numbers. • Students should be able to determine and explain, through investigation, the relationship between decimal numbers, using a variety of tools (e.g., concrete materials, drawings, number lines) and strategies.	***Example*** • What do you notice about the fractions $\frac{2}{10}$ and $\frac{10}{100}$? Write a comparison statement about the two fractions and use visual models to support your reasoning. ○ *Possible student response*: I know that $\frac{2}{10}$ is greater than $\frac{10}{100}$ because $\frac{2}{10}$ takes up more space in the decimal squares below. So, $\frac{2}{10} > \frac{10}{100}$. 	

MEASUREMENT & DATA REASONING *– time, metric measurements, distance, elapsed time, liquid volume, mass, and length*

4.MDR.6: Measure time and objects that exist in the world to solve real-life, mathematical problems and analyze graphical displays of data to answer relevant questions.

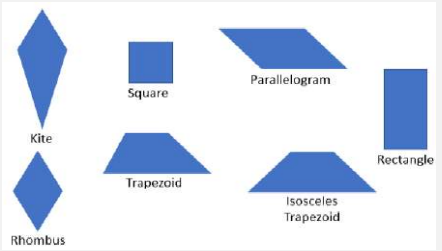
<table>
<tr><th colspan="2">Expectations</th><th colspan="5">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>4.MDR.6.1</td><td>Use the four operations to solve problems involving elapsed time to the nearest minute, intervals of time, metric measurements of liquid volumes, lengths, distances, and masses of objects, including problems involving fractions with like denominators, and also problems that require expressing measurements given in a larger unit in terms of a smaller unit, and expressing a smaller unit in terms of a larger unit based on the idea of equivalence.</td><td>Strategies and Methods
Represent measurement quantities, such as time, using number line diagrams that feature a measurement scale.
Students should reason about the relative sizes of measurement units within the metric system.
Students should be able to accurately record measurement equivalents in a two-column table.</td><td>Fundamentals
Students should express larger units in terms of smaller units within the same measurement system and smaller units in terms of larger units within the same measurement system.
When expressing measurements given in a larger unit in terms of a smaller unit and expressing a smaller unit in terms of a larger unit, students should be able to explain this conceptually without being expected to use decimal notation.
Conversions are not expected in this grade level. The focus here should be on helping learners see the equivalence between quantities represented in different measurement units.</td><td>Age/Developmentally Appropriate
Fractions should be limited to denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100.
Time measurement should be to the nearest minute.
Multiplication and division of fractions is not a requirement of this grade level.</td><td>Terminology
Metric measurement units include weight (grams and kilograms), capacity (milliliters and liters), and length (centimeter, meter, and kilometer).</td><td>Examples
What time does Eric have to leave his house to get to the concert by quarter after nine, if the trip takes 90 minutes?
If you have a prescription for 5,000 mg of medicine, and upon getting it filled, the dosage reads 5 g of medicine, did the pharmacist make a mistake?</td></tr>
<tr><td>4.MDR.6.2</td><td>Ask questions and answer them based on gathered information, observations, and appropriate graphical displays to solve problems relevant to everyday life.</td><td colspan="3">Fundamentals
Relevant problems can include word problems that are meaningful to a student’s real environment. It is important for the problems presented to be relevant and interesting for the learners to pique their natural, intellectual curiosity.</td><td colspan="2">Strategies and Methods
Questions should be student generated.</td></tr>
</table>

4.MDR.6.3	Create dot plots to display a distribution of numerical (quantitative) measurement data.	***Age/Developmentally Appropriate*** • Students should only use rulers marked to the nearest $\frac{1}{8}$ of an inch.	***Fundamentals*** • Students should be able to ask and answer questions involving addition and subtraction of fractions with common denominators by using the information presented in dot plots and find the range of the data. Dot plots and line plots can be used interchangeably.	***Strategies and Methods*** • Use rulers to measure lengths and record numerical measurement data to the nearest $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ of an inch. Students should be able to create dot plots to display a distribution of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$).	***Example*** 

GEOMETRIC & SPATIAL REASONING *– polygons, points, lines, line segments, rays, angles, perpendicular lines, area, perimeter*				
4.GSR.7: Investigate the concepts of angles and angle measurement to estimate and measure angles.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
4.GSR.7.1	Recognize angles as geometric shapes formed when two rays share a common endpoint. Draw right, acute, and obtuse angles based on the relationship of the angle measure to 90 degrees.	***Age/Developmentally Appropriate*** • Students should have opportunities to measure right angles using non-standard units of measurement, such as wedges and unit angles, and standard units of measurement, such as protractors. • Students at this grade level are not expected to know that straight lines represent 180° angles.	***Fundamentals*** • Students at this grade level should determine whether an angle is acute, obtuse, or right using a known right angle. • Students should also be able to explore this learning objective by investigating angles within circles. • Students should be able to represent angle measures using the degree symbol.	
4.GSR.7.2	Measure angles in reference to a circle with the center at the common endpoint of two rays. Determine an angle's measure in	***Age/Developmentally Appropriate*** • Students should be provided opportunities to explore angle measurement using non-standard units (wedges of a circle) to make sense of how angles are measured.	***Fundamentals*** • Angle measurement should be introduced with non-standard tools such as pattern blocks, unit angles, and/or wedges prior to introducing protractors. 360-degree	***Example*** • The student can place four squares around the center of a circle. Since there are 360 degrees in a circle, 360 ÷ 4 = 90, so

	relation to the 360 degrees in a circle through division or as a missing factor problem.	• Students at this grade level should determine an angle's measure through problem solving using multiplication or division and the fact that a circle has 360 degrees. • Students can but are not expected to use 180° protractors.	protractors would make an explicit connection to the degrees of a circle and builds conceptual understanding of angles.	each square has 90-degree angles.

4.GSR.8: Identify and draw geometric objects, classify polygons based on properties, and solve problems involving area and perimeter of rectangular figures.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)				
4.GSR.8.1	Explore, investigate, and draw points, lines, line segments, rays, angles (right, acute, obtuse), perpendicular lines, parallel lines, and lines of symmetry. Identify these in two-dimensional figures.	***Age and Developmentally Appropriate*** • Students should explore these concepts using visual tools.	***Fundamentals*** • The intent of this learning objective is for students to investigate specific properties such as perpendicular line segments, lines of symmetry, etc. as they work with two-dimensional figures. • Students should draw points, lines, line segments, rays, angles (right, acute, and obtuse), and perpendicular lines.	***Terminology*** • Right angle – An angle measuring exactly 90°. • Acute angle – An angle larger than 0° and smaller than 90°. • Obtuse angle – An angle larger than 90° and smaller than 180°. • Perpendicular lines – Two lines that meet to form an intersection at a right angle	***Strategies and Methods*** • Students should investigate lines of symmetry in two dimensional figures as a property. This is an extension from work in third grade.	***Examples*** • How many lines of symmetry do each of the quadrilaterals below have? 
4.GSR.8.2	Classify, compare, and contrast polygons based on lines of symmetry, the presence or absence of parallel or perpendicular line segments, or the presence or absence of angles of a specified size and based on side lengths.	***Age and Developmentally Appropriate*** • The intent of this learning objective is for students to classify shapes based on specific properties such as perpendicular line segments, lines of symmetry, congruent angles or sides, or a lack of these attributes. The focus should not be on having students memorize terminology. • This objective does not require students to create a hierarchy.	***Fundamentals*** • Right angles should be indicated with a square symbol. • Polygons should include triangles, quadrilaterals including kites, trapezoids, rectangles, squares, rhombuses, and other parallelograms, and pentagons.	***Strategies and Methods*** • Students should investigate lines of symmetry in two dimensional figures as a property. This is an extension from work in third grade.	***Terminology*** • A polygon is a closed figure with at least three straight sides and angles; a polygon is regular only when all sides are equal and all angles are equal; and a polygon is irregular when all sides are not equal or all angles are not equal. • Isosceles triangle – A triangle containing at least two equal length sides and two equal interior angle measures. Sub-class includes equilateral triangles. • Equilateral triangle – A triangle with three equal-length sides and three 60-degree interior angles. Also known as an equiangular triangle. • Scalene triangle – A triangle containing three unequal side lengths and three unequal angle measures. • Right triangle – a triangle with one right angle.	

					• Acute triangle – a triangle containing three acute angles. • Obtuse triangle – a triangle containing one obtuse angle. • In Georgia resources and assessments, the inclusive definitions for the classification of shapes are used. Therefore, trapezoids are defined using the inclusive definition: at least one pair of parallel sides.
4.GSR.8.3	Solve problems involving area and perimeter of composite rectangles involving whole numbers with known side lengths.	*Age/Developmentally Appropriate* • Students should not be expected to find unknown side lengths when exploring composite rectangles.			

ESSENTIAL INSTRUCTIONAL GUIDANCE

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 Mathematical Practices present.

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

MATHEMATICAL MODELING

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. For these reasons, mathematical modeling should be incorporated at every level of a student's education. This is important not only to develop a deep understanding of mathematics itself, but more importantly 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.

The diagram below is a mathematical modeling framework depicting a cycle of how students can engage in mathematical modeling when solving a realistic problem or task.

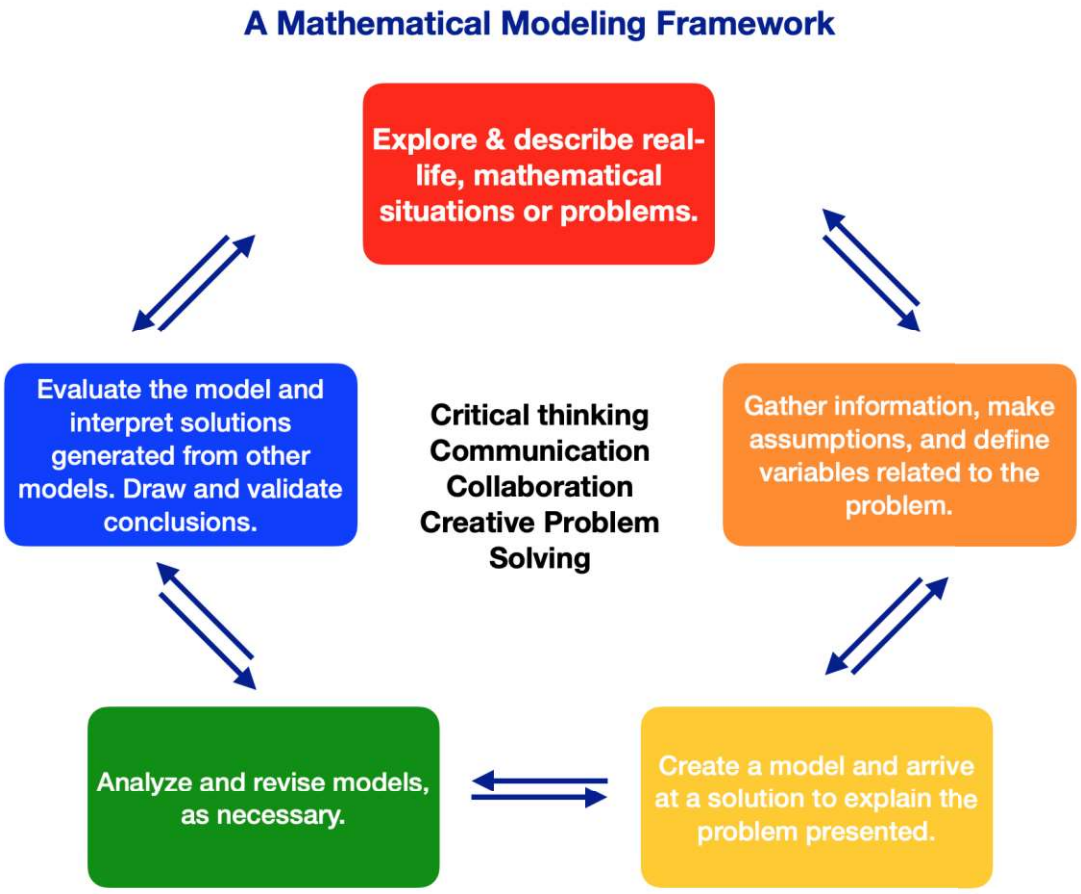


Image adapted from: Suh, Matson, Seshaiyer, 2017

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/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.

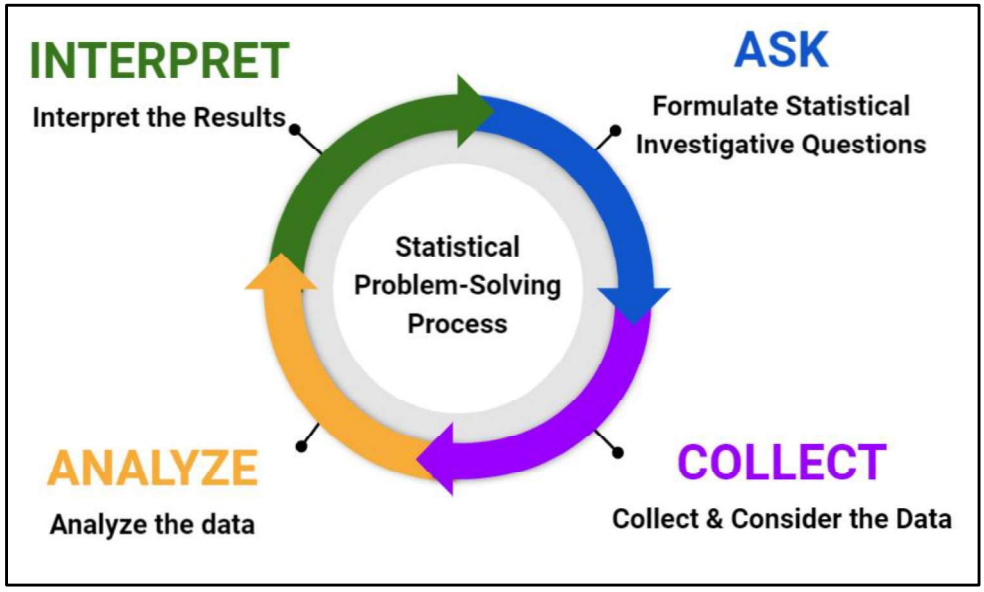


FIGURE 1: GEORGIA FRAMEWORK FOR STATISTICAL REASONING

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.

4th Grade: Create statistical investigative questions that can be answered using data. Collect, analyze, and interpret data from real situations to answer questions using **dot plots** displaying **numerical data to the nearest 1/8 of a unit.**

Ask	Collect	Analyze	Interpret
Create a statistical investigative question that can be answered using data from real situations.	**Determine strategies for gathering data. Collect numerical (quantitative) data by measuring repeatedly to the nearest $\frac{1}{8}$ of a unit.**	**Determine the appropriate representation of the data based on the nature of the data (bar graphs, pictographs, and dot plots).** **Determine the difference between categorical and numerical data.**	**Create dot plots to display a distribution of numerical (quantitative) measurement data.** **Interpret numerical data to answer the statistical investigative question created.**

Instructional Supports

- Expectations in this grade level should be taught throughout the year and applied contextually to the current expectation and actual events.
- Students should be given opportunities to generate a statistical investigative question based on things they notice and wonder about an everyday situation.
- Based on the statistical investigative question, they should create a plan that determines the appropriate population to survey and how to collect that data.
- Students should have opportunities to determine the difference between representations for categorical data and numerical data presented. Representations for data should include bar graphs, pictographs, and dot plots (line plots).
- Students should be able to measure objects found in everyday life to collect data and use rulers to measure to the nearest 1/8.
- Students should record observations they notice about the shape of the distribution using informal language such as spread out and/or grouped.
- *Numerical data:* A data type expressed in numbers rather than natural language descriptions. This is sometimes called quantitative data.

5th Grade: Create statistical investigative questions that can be answered by using **quantitative (numerical)** and **categorical data**. Determine strategies for gathering data to answer questions. Collect, analyze, and interpret data presented on **dot plots** and **bar graphs** from real situations to answer questions about the **data distribution, spread,** and **center.**

Ask	Collect	Analyze	Interpret
Create a statistical investigative question that can be answered by gathering data from real situations.	**Develop up to five survey questions that would yield the data needed to answer the statistical investigative question.**	**Graphically represent and describe the distribution of the numerical data through dot plots and line plots or categorical data through bar graphs.**	**Describe and interpret the center of the distribution by the equal share value (mean).**

Instructional Supports

- Expectations in this grade level should be taught throughout the year and applied contextually to the current expectation and actual events.
- Students can generate questions about things they notice and wonder from an authentic situation. Based on the posed question, create a plan that determines the appropriate population to survey and how to collect that data. Students should be provided with learning experiences to collect and analyze both numerical data and categorical data from a variety of sources.
- Students should be given ample experience with organizing, representing, and analyzing data from everyday contexts. Data should not be limited to numerical data collected from linear measurements. Students should be given the opportunity to use manipulatives such as: snap cubes, tiles, etc...to model equal share value.
- Students should continue to create dot plots (line plots) with measurements in fractions of a unit (1/2, 1/4, 1/8).
- This is the beginning of the progression of the concept of measures of center and will continue to be developed in 6th grade. The mean formula is not an expectation in 5th grade. This concept should be explored visually and conceptually.
- Distribution refers to how the data is spread across the graph.
- Dot plots and line plots can be used interchangeably. Dot plots should be used for numerical data representation on a number line.
- *Numerical data* is data that expressed in numbers rather than natural language. An example of numerical data that could be collected is the number of people who attended the movie theater over the course of a month. *Categorical data* is a type of data that is used to group information with similar characteristics. Examples of categorical data that could be collected might be marital status, favorite sport, or favorite type of movie.

COMPUTATIONAL STRATEGIES FOR WHOLE NUMBERS

Mathematics Place-Value Strategies and US Traditional Algorithms

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. These standards preserve and affirm local control and flexibility.

In mathematics, the emphasis is on the reasoning and thinking about the quantities within mathematical contexts. Algorithms, tape diagrams (bar models), and number line representations are a few examples of ways that students communicate their strategic thinking in a written form.

Addition Example: 1573 + 796

US Traditional Algorithm:

$$\begin{array}{r} {\scriptstyle 1\ \ 1\ \ \ \ } \\ 1\ 5\ 7\ 3 \\ +\ \ 7\ 9\ 6 \\ \hline 2\ 3\ 6\ 9 \end{array}$$

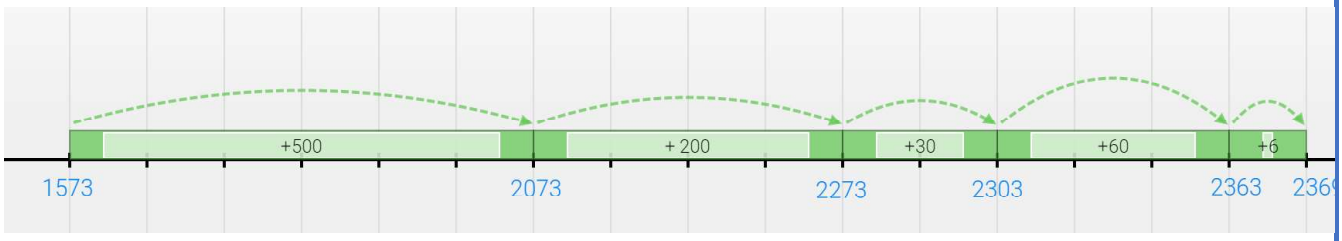
Description:

As students make sense of and use addition strategies and algorithms, it is important for them to be given the flexibility to use a part-whole strategy such as place value partitioning, adding on in parts, estimation and compensation, and friendly numbers to communicate their thinking using a written recording of that strategy that is most comfortable for and makes sense to them. Students should be able to demonstrate a deep understanding of the relationship between the quantities presented in the mathematics number sentence and to attend to precision in their explanations. Flexibility in thinking is key!

Place Value Algorithm:

$$\begin{array}{rrrr} 1 & 5 & 7 & 3 \\ + & 7 & 9 & 6 \\ \hline & & & 9 \\ + & 1 & 6 & 0 \\ + & 1 & 2 & 0 & 0 \\ + & 1 & 0 & 0 & 0 \\ \hline 2 & 3 & 6 & 9 \end{array}$$

Number Line Representation:



It is important to note that the examples of strategies provided in the tables are not all inclusive. 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.

Subtraction Example: 2145 - 178

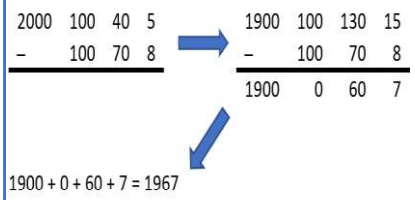
US Traditional Algorithm:

$$\begin{array}{r} {\scriptstyle 0\ \ 13\ \ 15} \\ 2\ \ \not{1}\ \ \not{4}\ \ \not{5} \\ -\quad 1\ \ 7\ \ 8 \\ \hline 1\ \ 9\ \ 6\ \ 7 \end{array}$$

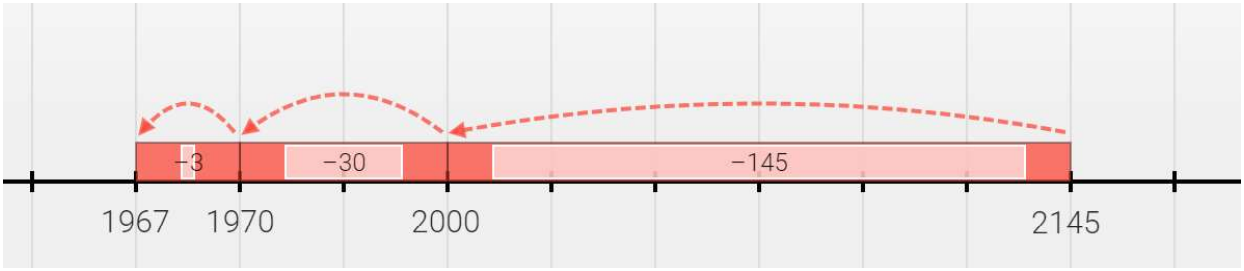
Description:

As students make sense of and use subtraction strategies and algorithms, it is important for them to be given the flexibility to use a part-whole strategy such as place value partitioning, adding up, counting back in chunks, and same difference and communicate their thinking using a written recording of that strategy that is most comfortable for and makes sense to them. Students should be able to demonstrate a deep understanding of the relationship between the quantities presented in the mathematics number sentence and to attend to precision in their explanations. Flexibility in thinking is key!

Place Value Algorithm:



Number Line Representation:



It is important to note that the examples of strategies provided in the tables are not all inclusive. 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.

Multiplication Example: 25 x 24

US Traditional Algorithm:

$$\begin{array}{r} {\scriptstyle 1\ \ 2}\ 25 \\ \times\ 24 \\ \hline 100 \\ +\ 500 \\ \hline 600 \end{array}$$

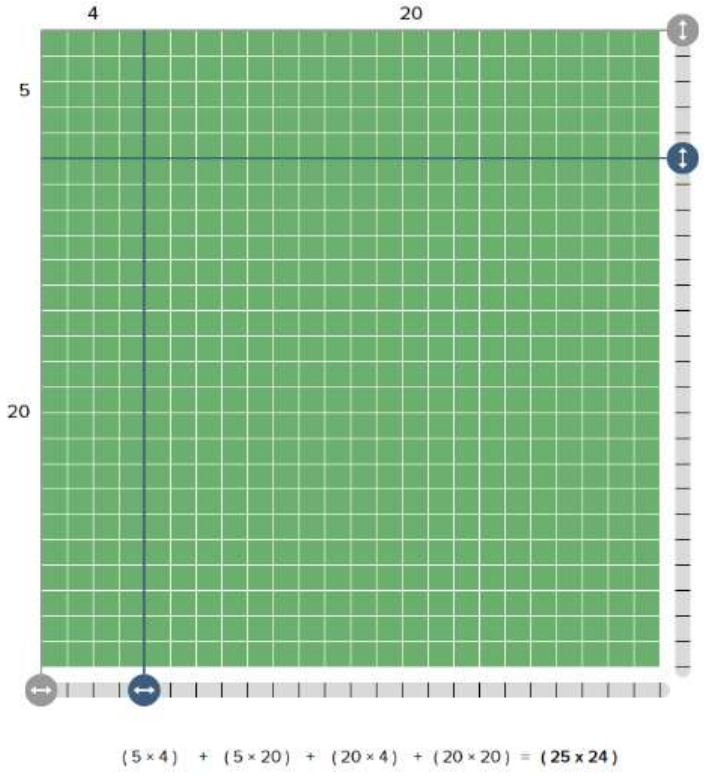
Description:

As students make sense of and use multiplication strategies and algorithms, it is important for them to demonstrate a deep understanding of the relationship between the quantities presented in the mathematics number sentence and to attend to precision in their explanations. Students are encouraged to use strategies such as partial products, friendly numbers, and a combination of known facts to determine solutions to new problems. It is also important for students to maintain the ability to choose which part-whole strategy is best to communicate their mathematical thinking. Flexibility in thinking is key!

Place Value Algorithm:

$$\begin{array}{rrl} & 25 & \\ \times & 24 & \\ \hline & 400 & (20 \times 20) \\ + & 100 & (20 \times 5) \\ + & 80 & (4 \times 20) \\ + & 20 & (4 \times 5) \\ \hline & 600 & \end{array}$$

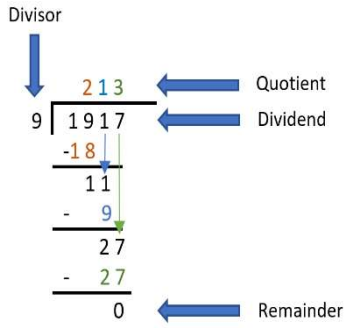
Area Representation (Partial Products):



It is important to note that the examples of strategies provided in the tables are not all inclusive. 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.

Division Example: 1917 ÷ 9

US Traditional Algorithm:



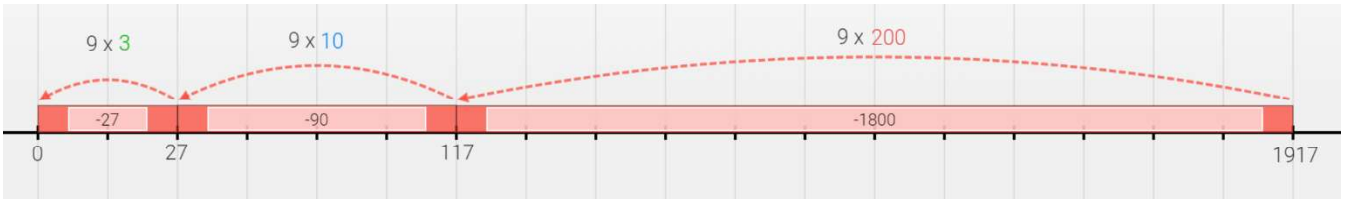
Description:

As students make sense of and use division strategies and algorithms, it is important for them to demonstrate a deep understanding of the relationship between the quantities. Students are encouraged to use strategies such as partial quotients, friendly numbers, and repeated subtraction to determine solutions to new problems. It is also important for students to maintain the ability to choose which strategy is best to communicate their mathematical thinking. Flexibility in thinking is key!

Place Value Algorithm:

9 | 1917	
-1800	200
117	
-90	+ 10
27	
-27	+ 3
0	213

Number Line Representation:



200 + 10 + 3 = 213

It is important to note that the examples of strategies provided in the tables are not all inclusive. 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.