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.

Georgia's K-12 Mathematics Standards - 2021
Overview

This document contains Georgia's 2021 K-12 Mathematics Standards for Grades K – 8.
The standards are organized into big ideas, grade level competencies/standards, and learning objectives. The grade level key competencies represent the standard expectation of learning for students in each grade level. The competencies/standards are each followed by more detailed learning objectives that further explain the expectations for learning in the specific grade levels.

New instructional supports are included, such as clarification of language and expectations, as well as detailed examples. These have been provided for teaching professionals and stakeholders through the Evidence of Student Learning Column that accompanies each learning objective.

Click on the grade level below to skip to the specific standards related to that grade level:

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

Kindergarten

The nine standards listed below are the key content competencies students will be expected to master in kindergarten. 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.

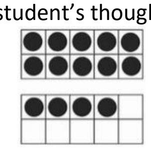
KINDERGARTEN STANDARDS
K.MP: **Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals.**
K.NR.1: **Demonstrate and explain the relationship between numbers and quantities up to 20; connect counting to cardinality (the last number counted represents the total quantity in a set).**
K.NR.2: **Use count sequences within 100 to count forward and backward in sequence.**
K.NR.3: **Use place value understanding to compose and decompose numbers from 11–19.**
K.NR.4: **Identify, write, represent, and compare numbers up to 20.**
K.NR.5: **Explain the concepts of addition, subtraction, and equality and use these concepts to solve real-life problems within 10.**
K.PAR.6: **Explain, extend, and create repeating patterns with a repetition, not exceeding 4 and describe patterns involving the passage of time.**
K.MDR.7: **Observe, describe, and compare the physical and measurable attributes of objects and analyze graphical displays of data to answer relevant questions.**
K.GSR.8: **Identify, describe, and compare basic shapes encountered in the environment, and form two-dimensional shapes and three-dimensional figures.**

Georgia's K-12 Mathematics Standards - 2021

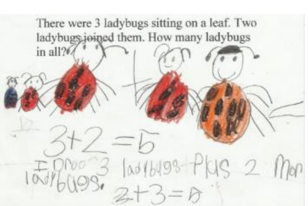
Kindergarten

***NUMERICAL REASONING** – counting, money, place value, numbers to 20, addition, subtraction and fluency*		
K.NR.1: Demonstrate and explain the relationship between numbers and quantities up to 20; connect counting to cardinality (the last number counted represents the total quantity in a set).		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
K.NR.1.1	Count up to 20 objects in a variety of structured arrangements and up to 10 objects in a scattered arrangement.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA2.4b***: *Counts at least 10 objects using one-to-one correspondence.* ● Students should count objects using one-to-one correspondence saying the number names in the standard order and communicate quantities for authentic purposes. "Authentic purposes" refers to experiences students have in their everyday lives. ● The overall goal is for students to be able to count up to 20 objects arranged in a line, a rectangle, or a circle, or up to 10 objects in a scattered arrangement. ***Relevance and Application*** ● Students should be able to count to answer "how many?" questions with up to 20 objects arranged in a variety of ways (a line, a rectangular array, or a circle), or up to 10 objects arranged in a scattered configuration. ***Strategies and Methods*** ● Dot cards, five-frames, ten-frames, rekenreks, dominoes, beads, rocks, counting bears, and playing cards are some tools that can be used for subitizing.
K.NR.1.2	When counting objects, explain that the last number counted represents the total quantity in a set (cardinality), regardless of the arrangement and order.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standards, ***CD-MA1.4e***: *Quickly recognizes and names how many items are in a set of up to four items.* and ***CD-MA2.4e***: *With adult guidance and when counting, understands and can respond with the last number counted to represent quantity (cardinality).* ● Students should know that the last number counted represents the total quantity in a set (cardinality), when counting objects regardless of the arrangement and order. ● Students should instantly see how many objects are in a group without counting (subitizing). ***Strategies and Methods*** ● Dot cards, five-frames, ten-frames, and rekenreks can be used for subitizing.
K.NR.1.3	Given a number from 1-20, identify the number that is one more or one less.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standards, ***CD-MA1.4d***: *Describes sets as having more, less, same as/equal. and* ***CD-MA1.4f:*** *Tells numbers that come before and after a given number up to 10.* ● Students should be able to understand that each successive number name refers to a quantity that is one larger and the previous number name is one less.
K.NR.1.4	Identify pennies, nickels, and dimes and know their name and value.	***Fundamentals*** ● Students should be able to identify and represent coins by name and value. ***Strategies and Methods*** ● Students can use different types of coin manipulatives to extend their understanding of counting by ones. ● Coins as manipulatives could be used for counting by ones. ***Age/Developmentally Appropriate*** ● Student is able to count five nickels. Students are not expected to find the value.

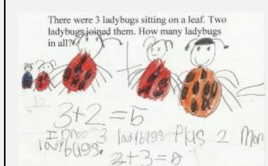
K.NR.2: Use count sequences within 100 to count forward and backward in sequence.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
K.NR.2.1	Count forward to 100 by tens and ones and backward from 20 by ones.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA1.4a***: *Recites numbers up to 20 in sequence.* ● Students should count for authentic purposes which connect to their everyday experiences. ● Students should understand that each successive number name refers to a quantity that is one larger. ● When students are rote counting forward, start the count sequence at 1. ● When students are counting backward, start the count sequence beginning at 10 and progress to counting backward beginning at 20.	***Strategies and Methods*** ● When students count backward from 20, they can use visual resources such as a number line, a 99-chart, or a 100-chart.	***Age/Developmentally Appropriate*** ● When students count by tens, they are only expected to master counting by the decade (10, 20, ...). ● This expectation does not require recognition of numerals.
K.NR.2.2	Count forward beginning from any number within 100 and count backward from any number within 20.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA1.4a***: *Recites numbers up to 20 in sequence.* ● Students should count forward and backward from a given number using the known number word sequence for authentic purposes. ● Students should be able to begin and end with any given number.	***Example*** ● Given the number 54, a student will count "54, 55, 56, 57, 58…"	***Age/Developmentally Appropriate*** ● This expectation does not require recognition of numerals.

K.NR.3: Use place value understanding to compose and decompose numbers from 11–19.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
K.NR.3.1	Describe numbers from 11 to 19 by composing (putting together) and decomposing (breaking apart) the numbers into ten ones and some more ones.	***Fundamentals*** ● Students should be able to put together (compose) and break apart (decompose) numbers into a group of ten ones and some further ones to understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones. ● Students should use strategic thinking in order to communicate quantities for authentic purposes.	***Strategies and Methods*** ● Use objects or drawings to explain and record each composition or decomposition with a drawing or equation. ● Students should be given the opportunity to use five frames, ten frames, and rekenreks with support to demonstrate each composition or decomposition.	***Example*** ● The teacher can provide students with a variety of tools to make sense of numbers during everyday instruction. One day, a teacher may ask during a Number Talk, "In what ways can you decompose the number 14?". *Possible student response:* "I decomposed 14 in my mind's eye into one full ten frame and four more on another ten frame." The teacher records the student's thoughts as follows: 

K.NR.4: Identify, write, represent, and compare numbers up to 20.			
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**	
K.NR.4.1	Identify written numerals 0-20 and represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA1.4b***: *Recognizes numerals and uses counting as part of play and as a means for determining quantity.* ● Students should be able to identify and write numerals between 0 and 20 for authentic purposes. ● Students should be able to demonstrate the relationship between written numerals and a number of objects.	
K.NR.4.2	Compare two sets of up to 10 objects and identify whether the number of objects in one group is more or less than the other group, using the words "greater than," "less than," or "the same as".	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA2.4a***: *Matches two equal sets using one-to-one correspondence and understands they are the same.* ● Students should compare the number of objects in two groups in authentic situations and identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group. ● Students should be able to explain that equal to is "the same" quantity.	***Age/Developmentally Appropriate*** ● This standard expects mastery of up to 10 objects. ● The words greater than, less than, or the same as (equal to) should be used instead of the symbols.

K.NR.5: Explain the concepts of addition, subtraction, and equality and use these concepts to solve real-life problems within 10.					
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
K.NR.5.1	Compose (put together) and decompose (break apart) numbers up to 10 using objects and drawings.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA2.4c***: *Practices combining, separating, and naming quantities.* ● 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.	***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. ○ Compose – put together numbers ○ Decompose – break apart numbers		***Strategies and Methods*** ● Teachers should use dot card images for students to explain how they see different number combinations.
K.NR.5.2	Represent addition and subtraction within 10 from a given authentic situation using a variety of representations and strategies.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standards, ***CD-MA2.4c***: *Practices combining, separating, and naming quantities.* and ***CD-MA7.4b***: *Uses simple strategies to solve mathematical*	***Age/Developmentally Appropriate*** ● Exposure to equations is expected but mastery of equations is not required. ● Drawings do not need to show details but should show the	***Strategies and Methods*** – *<u>see special note in appendix</u>* ● Representations may include objects, fingers, mental images, drawings, expressions, or equations.	***Example*** 

		problems and communicates how he/she solved it. ● Students should be able to represent relevant problems involving the addition and subtraction of whole numbers within 10 with objects and drawings. ● 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.	mathematics in the problem. ● Kindergarten students should see addition and subtraction equations, and student writing of equations in kindergarten is encouraged, but it is not required. However, please note that it is not until First Grade when "Understand the meaning of the equal sign" is an expectation.	● Student drawings and equations should show the mathematics of the solution from the given situation. ● Equations should be derived from visual depiction.	Note: The student work above shows four different representations of the student's thinking. One with pictures (3 ladybugs + 2 ladybugs) and two equations with numerals (3 + 2 and 2 + 3). The student also represented the problem with words and numbers.

K.NR.5.3	Use a variety of strategies to solve addition and subtraction problems within 10.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standards, ***CD-MA2.4c***: *Practices combining, separating, and naming quantities.* *and* ***CD-MA7.4b***: *Uses simple strategies to solve mathematical problems and communicates how he/she solved it.*	***Strategies and Methods*** – *see special note in appendix* ● Students should be able to solve authentic, mathematical problems involving the addition and subtraction of single-digit whole numbers, using a variety of strategies such as: ○ counting on ○ counting backward ○ making 10 ● Authentic, mathematical 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	***Terminology*** ● Students should be provided with a variety of problem types including Join: Result Unknown, Separate: Result Unknown, Part-Part-Whole: Whole Unknown, and Part-Part-Whole: Both Parts Unknown; however, students are not required to know or use this terminology. ● Join: Result Unknown ○ Example: 3 birds were sitting in a tree and 2 more birds flew onto the tree. How many birds were in the tree then? ● Separate: Result Unknown ○ Example: Toni had 8 guppies. She gave 3 guppies to Roger.	***Age/Developmentally Appropriate*** ● Exposure to equations is expected but mastery of equations is not required in Kindergarten.	***Example***  Note: The student work above shows four different representations that helped the student solve the problem: One with pictures (3 ladybugs + 2 ladybugs), two with numerals (3 + 2 = 5 and 2 + 3 = 5), and written form. The student also used the commutative property of addition to solve the problem.

			interesting for the learners to pique their natural, intellectual curiosity.	How many guppies does Toni have now? ● Part-Part-Whole: Whole Unknown ○ Example: 6 girls and 4 boys were playing soccer. How many children were playing soccer? ● Part-Part-Whole: Both Parts Unknown ○ Example: Ann has 15 cap erasers. Some are pink and some are blue. How many could be pink and how many could be blue?		
K.NR.5.4	Fluently add and subtract within 5 using a variety of strategies to solve practical, mathematical problems.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA7.4b***: *Uses simple strategies to solve mathematical problems and communicates how he/she solved it.*	***Strategies and Methods*** – *see special note in appendix* ● Students should be able to solve problems involving the addition and subtraction of numbers within five related to everyday life. ● 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*** ● 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. ○ Fluently/Fluency -- To achieve fluency, students should be able to choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.	***Age/Developmentally Appropriate*** ● Fluency does not lend itself to timed tests or speed. ● Exposure to equations is expected but mastery of equations is not required.	***Example*** ● When making toothpick designs to represent the various combinations of the number "5", the student writes the numerals for the various parts (such as "4" and "1") or selects a number sentence that represents that particular situation (such as 5 = 4 + 1).

PATTERNING & ALGEBRAIC REASONING _– repeating patterns and time_					
K.PAR.6: Explain, extend, and create repeating patterns with a repetition, not exceeding 4 and describe patterns involving the passage of time.					
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
K.PAR.6.1	Create, extend, and describe repeating patterns with numbers and shapes, and explain the rationale for the pattern.	**_Fundamentals_** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standards, **_CD-MA4.4c_**: _Creates and extends simple, repeating patterns._ _and **CD-MA7.4b**: Uses simple strategies to solve mathematical problems and communicates how he/she solved it._	**_Strategies and Methods_** ● Patterns should include spatial, color, location, shape, and symbols (letter/ number).	**_Age/Developmentally Appropriate_** ● This standard should be taught throughout the year. ● The repetition (iteration) of pattern should not exceed 4.	**_Examples_** ● Students are able to use shapes to create and extend patterns such as the following:  . . . In the pattern of 1 blue, 1 green,1 blue, 2 greens, students would explain that 1 blue would be next in the sequence and that the pattern increases by one for the green.
K.PAR.6.2	Describe patterns involving the passage of time using words and phrases related to actual events.	**_Fundamentals_** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, **_CD-MA3.4d_** _Associates and describes the passage of time with actual events._	**_Strategies and Methods_** ● Patterns should include yesterday, today and tomorrow, as well as morning and afternoon. ● Students should be able to use terms such as now, earlier, later, before, after, yesterday, today, tomorrow, morning, afternoon, evening, day of the week, week, month, year.	**_Age/Developmentally Appropriate_** ● This standard should be taught throughout the year.	**_Examples_** ● A student may explain: ○ "Tomorrow is Tom's birthday. Next week will be my birthday." ○ "It is sunny outside now. This morning it was rainy." ○ "I got dressed this morning. This afternoon I will ride the bus home. I will go to my ball game this evening." ○ "Today is Friday. We do not go to school on Saturday and Sunday. It is the weekend."

MEASUREMENT & DATA REASONING _– attributes of objects, classifying objects_				
K.MDR.7: Observe, describe, and compare the physical and measurable attributes of objects and analyze graphical displays of data.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
K.MDR.7.1	Directly compare, describe, and order common objects, using measurable attributes (length, height, width, or weight) and describe the difference.	**_Fundamentals_** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standards, **_CD-MA3.4a_**: _Uses mathematical terms to describe experiences involving measurement.;_ **_CD-MA3.4b_**: _Compares objects using two or more attributes, such as length, weight and size.;_ **_CD-MA3.4c_**: _Uses a variety of techniques and standard and non-standard tools to measure and compare length, volume (capacity) and weight.; and_ **_CD-MA4.4a_**:	**_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.	**_Examples_** ● Directly compare the heights of two objects and describe one object as taller/shorter. ● A student may describe a shoe as, "The red shoe is

		Independently orders objects using one characteristic and describes the criteria used. ● In Kindergarten, students should use language such as heavier, lighter, longer, taller, shorter, wider, larger, smaller. ● In Kindergarten, students may use a variety of techniques and tools to compare, describe, and order objects. Students may use a referent object being compared as a tool to describe the other object(s).	○ Attributes – characteristics (i.e., length, height, width, or weight) ○ Referent object – an object used as the standard of comparison		heavier than the blue shoe (the blue shoe is the referent in this case)! The red shoe is also longer!”
K.MDR.7.2	Classify and sort up to ten objects into categories by an attribute; count the number of objects in each category and sort the categories by count.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA4.4b***: *Sorts and classifies objects using one or more attributes or relationships.* ● Kindergarten students should be able to sort objects by characteristics such as heavier, lighter, longer, and shorter (compare to benchmark item).	***Terminology*** ● The terminology below is used to clarify expectations for the teaching professional. Students are not required to use this terminology when engaging with the learning objective. ○ Attributes – characteristics (i.e., length, height, width, or weight)	***Age/Developmentally Appropriate*** ● Categories should have no more than 10 objects.	***Example*** ● When given a collection of buttons, the student separates the buttons into different piles based on color. Then, the student counts the number of buttons in each pile. Finally, the student organizes the groups by the quantity in each group: orange buttons (3), green buttons next (4), purple buttons with the green buttons because purple also had (4), blue buttons last (5).
K.MDR.7.3	Ask questions and answer them based on gathered information, observations, and appropriate graphical displays to solve problems relevant to everyday life.	***Strategies and Methods*** ● Questions should be student generated.	***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.		

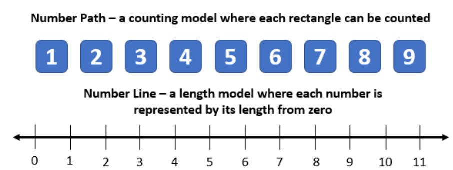
GEOMETRIC & SPATIAL REASONING *– 2D and 3D shapes, relative locations, attributes*					
K.GSR.8: Identify, describe, and compare basic shapes encountered in the environment, and form two-dimensional shapes and three-dimensional figures.					
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
K.GSR.8.1	Identify, sort, classify, analyze, and compare two-dimensional shapes and three-dimensional figures, in different sizes and orientations, using informal language to describe their similarities, differences, number of sides and vertices, and other attributes.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA6.4a***: *Recognizes and names common two-dimensional and three-dimensional shapes, their parts and attributes.*	***Age/Developmentally Appropriate*** ● Students should be able to identify basic shapes, including squares, circles, triangles, rectangles, hexagons, octagons, cubes, cones, cylinders, and spheres. ● Students begin to understand how three-dimensional figures are composed of two-dimensional shapes.	***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. ○ Attributes – characteristics (i.e., two-dimensional shapes (lying in a plane, "flat") and three-dimensional figures ("solid"), including geometric properties.). An example of an attribute is having sides of equal length. ○ Vertices – corners of a geometric figure	***Example*** ● The base and top of a cylinder is a circle.
K.GSR.8.2	Describe the relative location of an object using positional words.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standard, ***CD-MA5.4a***: *Uses appropriate directional language to indicate where things are in their environment - positions, distances, order.* ● Kindergarten students should be able to explain the location of an object in relation to another object using positional language, such as "above," "below," "beside," "in front of," "behind," or "next to."		***Age and Developmentally Appropriate*** ● Kindergarten students should be able to use various objects they come in contact with in their everyday life.	***Examples*** ● "The cup is beside the pencil." ● "The boy is behind the girl in line." ● In a sequence of pictures, the student would describe the position of a particular object.
K.GSR.8.3	Use basic shapes to represent specific shapes found in the environment by creating models and drawings.	***Age and Developmentally Appropriate*** ● Basic shapes used in kindergarten should include squares, circles, triangles, rectangles, hexagons, octagons, cubes, cones, cylinders, and spheres.	***Strategies and Methods*** ● A variety of materials can be used to create models of shapes that exist in everyday life.		***Examples*** ● *Models* – sticks with clay balls, toothpicks with marshmallows, popsicle sticks, technology, etc.
K.GSR.8.4	Use two or more basic shapes to form larger shapes.	***Age/Developmentally Appropriate*** ● Basic shapes used in kindergarten should include squares, circles, triangles, rectangles, hexagons, octagons, cubes, cones, cylinders, and spheres.	***Fundamentals*** ● This learning objective builds on the Pre-K Georgia Early Learning and Development Standards, ***CD-MA5.4b***: *Uses deliberate manipulation and describes process for fitting objects together. and* ***CD-MA6.4b***: *Combines simple shapes to form new shapes.*	***Strategies and Methods*** ● Students should be able to form (compose) larger shapes by putting together smaller shapes through exploration and play.	***Examples*** ● "Use the 7 tangram pieces to make a fox." 

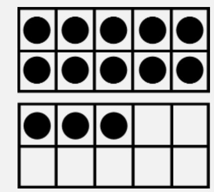
1st Grade

The seven standards listed below are the key content competencies students will be expected to master in first 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.

FIRST GRADE STANDARDS
1.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.**
1.NR.1: **Extend the count sequence to 120. Read, write, and represent numerical values to 120 and compare numerical values to 100.**
1.NR.2: **Explain the relationship between addition and subtraction and apply the properties of operations to solve real-life addition and subtraction problems within 20.**
1.PAR.3**: Identify, describe, extend, and create repeating patterns, growing patterns, and shrinking patterns found in real-life situations.**
1.GSR.4: **Compose shapes, analyze the attributes of shapes, and relate their parts to the whole.**
1.NR.5: **Use concrete models, the base ten structure, and properties of operations to add and subtract within 100.**
1.MDR.6: **Use appropriate tools to measure, order, and compare intervals of length and time, as well as denominations of money to solve real-life, mathematical problems and analyze graphical displays of data to answer relevant questions.**

1st Grade

NUMERICAL REASONING *– counting, numbers, equality, place value, addition, subtraction*				
1.NR.1: Extend the count sequence to 120. Read, write, and represent numerical values to 120 and compare numerical values to 100.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
1.NR.1.1	Count within 120, forward and backward, starting at any number. In this range, read and write numerals and represent a number of objects with a written numeral.	***Fundamentals*** • Students should understand that as the counting sequence increases, the value of each number increases by one or ten. As the counting sequence decreases, the value of each number decreases by one or ten.	***Strategies and Methods*** • Students should count forwards and backwards by 1s and 10s from any number within 120. • Students should have opportunities to explore the counting sequences using a variety of tools. These tools can include, but are not limited to 99 charts, hundred charts, number paths, number lines (predetermined and open), etc.	***Terminology*** 
1.NR.1.2	Explain that the two digits of a 2-digit number represent the amounts of tens and ones.	***Fundamentals*** • Students should be able to recognize the relationship of a digit to its place indicates the number of groups represented in that place. For example: In the number 33, the digit "3" in the tens place has a value that is equivalent to three groups of ten. Students interpret the value of each digit. The number 33 has three tens and three remaining ones. They should also see this as equivalent to 33 ones. • Students should understand the following as special cases: ○ 10 can be thought of as a bundle of ten ones — called a "ten."-Bundles could include groups of pennies, bundles of straws, or other hands-on manipulatives. ○ The numbers from 11 to 19 are composed or decomposed as a ten and one, two, three, four, five, six, seven, eight, or nine ones.	***Strategies and Methods*** • The numbers 11 to 19 can be represented on ten frames, double ten frames, rekenreks, and with pennies and dimes, etc. • The numbers 10, 20, 30, 40, 50, 60, 70, 80, and 90, can be represented using a variety of tools (popsicle sticks, linking cubes, straws, etc.)	***Age/Developmentally Appropriate*** • Students should be able to explain that the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).
1.NR.1.3	Compare and order whole numbers up to 100 using concrete models, drawings, and the symbols >, =, and <.	***Fundamentals*** • Students should understand whole numbers to 100 based on meanings of the tens and ones and record the results of comparisons with the symbols >, =, and <.	***Strategies and Methods*** • Representations should include the use of physical materials such as number paths, base-ten materials, number lines (predetermined and open), dimes and pennies, etc.	***Age/Developmentally Appropriate*** • Students should have ample experiences communicating their comparisons using words, representations AND relevant applications before using only symbols in the learning objective. • Students need practice justifying comparisons with words and models, prior to exposure and use of the comparison symbols.

<table>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">1.NR.2: Explain the relationship between addition and subtraction and apply the properties of operations to solve real-life addition and subtraction problems within 20.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr><td>1.NR.2.1</td><td>Use a variety of strategies to solve addition and subtraction problems within 20.</td><td>Fundamentals
● Students should be able to solve problems with two or more addends.
● Decomposition should include, but not be limited to tens and ones.</td><td>Strategies and Methods – see special note in appendix
● Students should be able to solve problems involving addition and subtraction using a variety of advanced counting and part-whole strategies related to everyday life.
● 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>Terminology
● First grade students should be given opportunities to use mental reasoning to solve problems with a variety of problem types within 20. Click here for a listing of all problem types.</td><td>Example
● I have scored 13 points. How many more points do I need to make 20 points?
</td></tr>
<tr><td>1.NR.2.2</td><td>Use pictures, drawings, and equations to develop strategies for addition and subtraction within 20 by exploring strings of related problems.</td><td>Fundamentals
● Students should be able to relate counting to addition and subtraction by counting all, counting on, and counting back when making sense of practical, mathematical addition and subtraction problems within 20.
● Students should be given opportunities to use mental reasoning to solve problems involving number strings within 20. Click here for a listing of all problem types.
● Students should also solve problem situations with an unknown in all positions.
● Students should be given multiple opportunities to apply strategies developed through number strings to solve practical, mathematical problems.</td><td>Terminology
● Number strings are sets of related problems crafted to support students to construct big ideas about mathematics and build their own strategies (Fosnot & Dolk, 2002).
$8 + 2$
$8 + 2 + 4$
$8 + 6$
$8 + 5$</td><td>Strategies and Methods – see special note in appendix
● Symbols can be used to represent unknown amounts in equations.
● Students should be provided with learning experiences to develop strategies such as:
○ Advanced Counting; Counting On
○ Making Ten
○ Decomposing a number leading to a ten
○ Using the relationship between addition and subtraction within 20 (knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (6 + 7 is the same as 6 + 6 + 1 = 12 + 1 = 13).
○ Counting All 5 + 2 = ☐. The student counts five counters. The student adds two more. The student counts 1, 2, 3, 4, 5, 6, 7 to get the answer.
○ Counting Back 12 – 3 = ☐. The student counts twelve counters. The</td><td>Age/Developmentally Appropriate
● Students should not be encouraged to use key/clue words because they will not work with subsequent problem types.
● The unknown quantity should be represented in all positions.</td></tr>
</table>

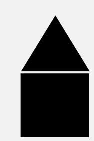
		student removes a counter and says 11, removes another counter and says 10, and removes a third counter and says 9. The student knows the answer is 9 since they counted back 3.
1.NR.2.3	Recognize the inverse relationship between subtraction and addition within 20 and use this inverse relationship to solve authentic problems.	***Age/Developmentally Appropriate*** ● Problems should be within 20. ***Fundamentals*** ● Students should understand subtraction as an unknown-addend problem. ● Students are not expected to know nor use the term inverse. ***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. ○ Addend – a number that is added to another number in an addition expression or equation. For example, in the expression 5 + 8, 5 and 8 are both addends. ○ An inverse relationship shows the relationship between addition and subtraction where addition can be used to find the quantity of a set after some in the set are removed. For example, 3+2 = 5 is related to 5 - 3 = 2 because of the inverse relationship. ***Examples*** ● There are 14 birds in the tree. 8 of them flew away. How many birds are left in the tree? The student thinks of 14 – 8 = □ as 8 + □ = 14 ● Jenny had 10 pencils and gave some to Eric. Jenny now has 8 pencils. How many pencils did she give to Eric? The student thinks of 10 - □ = 8 as □ + 8 = 10
1.NR.2.4	Fluently add and subtract within 10 using a variety of strategies.	***Terminology*** ● Fluently/Fluency – To achieve fluency, students should be able to choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently. ● Accuracy includes attending to precision. ● Efficiency includes using well-understood strategy with ease. ● Flexibility involves using strategies such as making 5 or making 10. ● For appropriate strategies and methods, see special note in appendix. ***Age/Developmentally Appropriate*** ● Fluency does not lend itself to timed tests or speed.
1.NR.2.5	Use the meaning of the equal sign to determine whether equations involving addition and subtraction are true or false.	***Fundamentals*** ● Students should explore and explain the relationship of the equal sign to quantities and orally justify if equations involving addition and subtraction are "true" (equal) or "false" (not equal). ***Example*** ● Which of the following equations are true and which are false? How do you know? ○ 6 = 6 (True/Correct Statement) ○ 7 = 8 – 1 (True/Correct Statement) ○ 5 + 2 = 2 + 5 (True/Correct Statement) ○ 4 + 1 = 5 + 2 (False/Incorrect Statement)
1.NR.2.6	Determine the unknown whole number in an addition or subtraction equation relating to three whole numbers.	***Strategies and Methods*** ● Symbols can be used to represent unknown amounts in equations. ***Example*** ● Determine the unknown number that makes the equation true in each of the equations: 8 + ? = 10, 5 = □ – 3, 3 + 4 = Δ. These are some possible ways to record equations that indicate an unknown number.
1.NR.2.7	Apply properties of operations as strategies to solve addition and	***Fundamentals*** ● Students should solve problem situations with an ***Terminology*** ● The terminology below is used to clarify expectations ***Age/Developmentally Appropriate*** ● Students should **not** be encouraged to ***Strategies and Methods*** – see special note in appendix ● When students use strategies such as make a ***Examples*** ● Example 1: Students may engage mentally using flexibility with the

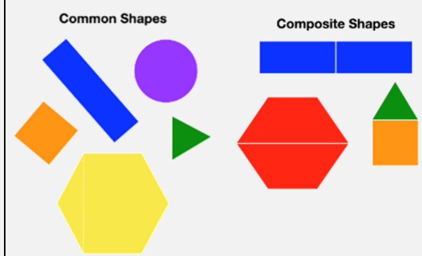
	subtraction problem situations within 20.	unknown in all positions. [Click here for a listing of all problem types.]()	for the teaching professional. Students are not required to use this terminology when engaging with the learning objective. • Addend – any number that is added to another number in an addition expression or equation. For example, in the expression 7 + 3, 7 and 3 are addends.	use key/clue words because they will not work with subsequent problem types. • The unknown quantity should be represented in all positions. • Students at this grade level are **not** expected to know the names or identify the specific properties.	ten and decompose numbers, they are using properties such as the associative property and commutative property. • Students should be given multiple opportunities to use objects, drawings, and equations to solve problems involving addition and subtraction. • Students should develop strategies involving the properties of operations by comparing problem solving strategies. • Symbols can be used to represent unknown amounts in equations.	order of the addends: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known (The Commutative Property of Addition is applied in this example). • Example 2: Students may engage mentally using flexibility with the grouping of numbers: To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12 (The Associative Property of Addition is applied in this example).

PATTERNING & ALGEBRAIC REASONING *– repeating patterns, growing, patterns, and shrinking patterns*			
1.PAR.3: Identify, describe, extend, and create repeating patterns, growing patterns, and shrinking patterns found in real-life situations.			
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**	

1.PAR.3.1	Investigate, create, and make predictions about repeating patterns with a core of up to 3 elements resulting from repeating an operation, as a series of shapes, or a number string.	***Fundamentals***
		• Students should investigate repeating patterns to make predictions.
			Example
			• Number String:
			  ○ 1, 2, 3, 1, 2, 3, 1, 2, …
			• Series of shapes:
			  ○ ▲▲●▲▲●▲▲●
			• Operation:
			  ○ 2, 4, 6, 8, … (add 2 each time)

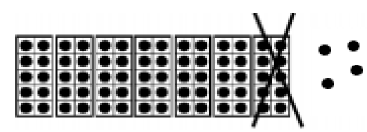
1.PAR.3.2	Identify, describe, and create growing, shrinking, and repeating patterns based on the repeated addition or subtraction of 1s, 2s, 5s, and 10s.	***Strategies and Methods*** • Students should use a number line and a hundred chart. • Students should investigate patterns found in authentic situations.	

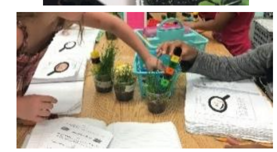
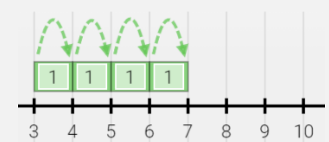
GEOMETRIC & SPATIAL REASONING *– shapes, attributes, partitions of circles and rectangles*					
1.GSR.4: Compose shapes, analyze the attributes of shapes, and relate their parts to the whole.					
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
1.GSR.4.1	Identify common two-dimensional shapes and three-dimensional figures, sort and classify them by their attributes and build and draw shapes that possess defining attributes.	***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. ○ Attributes – characteristics of two-dimensional shapes and three-dimensional figures, including geometric properties. ○ Defining attributes – include number of sides, faces, vertices (corners), and angles. ○ Non-defining attributes – include size, orientation, texture, and color.	***Fundamentals*** ● Students should identify these two-dimensional shapes based on attributes: ○ half circle ○ quarter circles ○ circles ○ triangles ○ squares ○ rectangles (Students should know that a square is a type of rectangle, based on its attributes.) ○ hexagons ● Students should identify these three-dimensional shapes based on attributes: ○ cubes ○ cones ○ cylinders ○ spheres ○ rectangular prisms ● Students should distinguish between defining attributes of two-dimensional shapes and three-dimensional figures versus non-defining attributes (e.g., triangles are closed and three-sided, a defining attribute versus triangles are red, non-defining attribute). ● Students should be able to build and draw shapes based on defining attributes. Two dimensional shapes should be limited to triangles, squares, rectangles. ● Students should be able to identify a shape's attributes, regardless of its orientation (i.e., flipped) or position (i.e., turned).	***Age/Developmentally Appropriate*** ● Students should be encouraged to sort and classify shapes based on their choice of attributes as well as attributes that may be provided. ● Students at this grade level are **not** expected to know the names of or identify specific geometric properties.	
1.GSR.4.2	Compose two-dimensional shapes (rectangles, squares, triangles, half-circles, and quarter-circles) and three-dimensional figures (cubes, rectangular prisms, cones, and cylinders) to create a shape formed of two or more common shapes and compose	***Age/Developmentally Appropriate*** ● Students do not need to learn formal names, such as, "right rectangular prism".	***Fundamentals*** ● It is important to note that the size of the shape does not necessarily distinguish between common and composite. ● Students should use these two-dimensional shapes to create composite shapes: ○ circles	***Terminology*** ● Shapes that are made up of two or more common shapes are called composite shapes.	***Example***  *(Students may compose a pentagon using a triangle and square as above.)*

	new shapes from the composite shape.		○ half-circles ○ quarter-circles ○ triangles ○ squares ○ rectangles (Students should know that a square is a type of rectangle based on its attributes.) ○ hexagons • Students should use these three-dimensional shapes to create composite shapes: ○ cubes ○ cones ○ cylinders ○ spheres ○ rectangular prisms	 • Students will be working with shapes to compose and decompose shapes to form new shapes. ○ Compose – put together ○ Decompose – break apart	
1.GSR.4.3	Partition circles and rectangles into two and four equal shares.	***Age/Developmentally Appropriate*** • Shading of the shares is not needed for this learning objective because the student is only required to partition the whole shape into equal shares. • Students are not expected to write the fraction using fraction notation in first grade.		***Fundamentals*** • Students should explore and justify reasoning about the relationship of parts to the whole. • Students should describe the shares using the words "halves," "fourths or quarters." • Students should describe the whole as "two of" or "four of" the shares. • Students should reason that partitioning a shape into more equal shares creates smaller shares.	

NUMERICAL REASONING *– base ten structure, addition and subtraction within 100*
1.NR.5: Use concrete models, the base ten structure, and properties of operations to add and subtract within 100.

Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
1.NR.5.1	Use a variety of strategies to solve applicable, mathematical addition and subtraction problems with	***Fundamentals*** • Problems can include word problems that are meaningful to a student's real environment. It is important for the applicable, mathematical problems presented to be relevant and interesting	***Terminology*** • The terms below are used to clarify expectations for the teaching professional.	***Strategies and Methods*** – see special note in appendix • Students should use concrete models, drawings, estimation, and strategies based on	***Age/Developmentally Appropriate*** • The properties of operation that should be explored in this objective are

	one- and two-digit whole numbers.	for the learners to pique their natural, intellectual curiosity. ● Students should be able to interpret and manipulate concrete mathematical models. ● Students should be given opportunities to justify their solutions to meet this learning objective. ● Students should use estimation as a strategy to find numbers that are close to the numbers they are using to add and subtract. ● Students should be able to use numerical reasoning to add and subtract within 100. ● The numerical reasoning developed should include an understanding of the base-ten structure and properties of operations. ● Students should reason that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to put together (compose) or break apart (decompose) a ten.	Students are not required to use this terminology when engaging with the learning objective. ○ Compose – put together numbers ○ Decompose – break apart numbers ○ Estimate – find a value that is close	place value, properties of operations, and/or the relationship between addition and subtraction to explain their reasoning. ● Strategies may include reasoning involving making a ten, doubles and near-doubles, think addition, and using benchmark numbers. ● Examples of different strategies and representations can be found within the *Computational Strategies for Whole Numbers* document found in the appendices.	the commutative and associative properties. ● Students are not expected to identify properties.
1.NR.5.2	Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	***Age/Developmentally Appropriate*** ● This expectation requires students to apply this mental strategy and become fluent through purposeful practice. The goal is automaticity built on a deep understanding of the patterns of tens within our base-ten system.		***Example*** ● There were 74 birds in the park. 10 of the birds flew away. How many birds are in the park, now? I pictured 7 ten-frames and 4 left over in my head. Since 10 birds flew away, I took one of the ten-frames away. That left 6 ten-frames and 4 left over. So, there are 64 birds left in the park. 	
1.NR.5.3	Add and subtract multiples of 10 within 100.	***Strategies and Methods*** *– [see special note in appendix]* ● Students should use concrete models; drawings, and strategies based on place value, properties of operations, and or/the relationship between addition and subtraction to explain their reasoning. ● Students should describe sums and differences, using concrete models (tools and manipulatives), drawings, and strategies based on place value, properties of operations and/or the relationship between addition and subtraction to explain (verbally and/or written) the reasoning used.		***Age/Developmentally Appropriate*** ● By the end of first grade, students should be able to state and write their justifications showing the relationship between their solution path and their reasoning. The focus of this standard is on thought processes, not merely on computational accuracy.	

MEASUREMENT & DATA REASONING *– length, time, money*						
1.MDR.6: Use appropriate tools to measure, order, and compare intervals of length and time, as well as denominations of money to solve real-life, mathematical problems and answer relevant questions.						
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**				
1.MDR.6.1	Estimate, measure, and record lengths of objects using non-standard units, and compare and order up to three objects using the recorded measurements. Describe the objects compared.	***Age/Developmentally Appropriate*** ● Students should learn through exploration that the length measurement of an object is the number of same-sized length units that span it with no gaps or overlaps (iteration). For example, when students are measuring the height of a vegetable plant in their classroom garden, they may use snap cubes put together to determine how tall the plant is.	***Terminology*** ● Length measurement of an object is the number of same-sized length units that span an object with no gaps or overlaps (iteration). ● *Iteration* –the process of repeating a unit length end to end along an object to obtain a measurement.	***Fundamentals*** ● Students should explore this concept with objects found in the real world to develop solid measurement reasoning. ● Students should explore this concept with objects. ● Students should express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end, by using non-standard units.	***Strategies and Methods*** ● Students should use terminology such as, but not limited to, "longer than", "shorter than", "same length as", "taller than", and "equal to". ● Appropriate tools to measure non-standard units can be items such as one-inch paper clips, one-inch tiles, centimeter cubes, etc. The units need to correspond to standard units of measurement.	***Example*** ● Students at an elementary school are maintaining an aquaponics garden. To measure the heights of the plants growing in their garden, they use snap cubes to determine how many cubes high the plant have grown.  
1.MDR.6.2	Tell and write time in hours and half-hours using analog and digital clocks, and measure elapsed time to the hour on the hour using a predetermined number line.	***Age/Developmentally Appropriate*** ● Students should tell and write time to the hour and half hour in everyday settings, paying attention to a.m. and p.m. ● Problems presented to students should avoid crossing over a.m. and p.m. ● Students are not required to know the term elapsed time at this grade level.	***Strategies and Methods*** ● Begin with a one-handed clock (just the hour hand) and use a lot of approximate language such as: ○ "It's close to 10:00." ○ "It's half-way between 11:00 and 12:00." ○ "It's just a little after 1:00." ● Video showing how to use a number line to tell time and how the number line can be curved to look like a circular clock – [Click Here]().	***Fundamentals*** ● The familiarity of the number line provides students with an opportunity to make sense of the concept of elapsed time. The connection to the traditional clock can be made by bending the clock number line into a circle.	***Examples*** ● At 3:00 PM we are going to the trampoline park. We will be there for 4 hours. What time will we be leaving the trampoline park? Represent this on a number line.  It will be 7:00 when we leave the trampoline park.	

1.MDR.6.3	Identify the value of quarters and compare the values of pennies, nickels, dimes, and quarters.	***Fundamentals*** ● Students explored the values of pennies, nickels, and dimes in Kindergarten.	***Strategies and Methods*** ● Learning experiences should be provided to help students understand that size does not always equal value.	***Example*** ● "A set of three dimes has a greater value than one quarter," or "five nickels is equal in value to one quarter".
1.MDR.6.4	Ask questions and answer them based on gathered information, observations, and appropriate graphical displays to compare and order whole numbers.	***Strategies and Methods*** ● Questions should be student generated. ● Students should have the opportunity to use concrete models, drawings, and the symbols >, <, and = when exploring comparisons.	***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.	

2nd Grade

The eight standards listed below are the key content competencies students will be expected to master in second 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.

SECOND GRADE STANDARDS
2.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.**
2.NR.1: **Using the place value structure, explore the count sequences to represent, read, write, and compare numerical values to 1000 and describe basic place-value relationships and structures.**
2.NR.2: **Apply multiple part-whole strategies, properties of operations and place value understanding to solve real-life, mathematical problems involving addition and subtraction within 1,000.**
2.NR.3: **Work with equal groups to gain foundations for multiplication through real-life, mathematical problems.**
2.PAR.4: **Identify, describe, extend, and create repeating patterns, growing patterns, and shrinking patterns.**
2.MDR.5: **Estimate and measure the lengths of objects and distance to solve problems found in real-life using standard units of measurement, including inches, feet, and yards and analyze graphical displays of data to answer relevant questions.**
2.MDR.6: **Solve real-life problems involving time and money.**
2.GSR.7: **Draw and partition shapes and other objects with specific attributes, and conduct observations of everyday items and structures to identify how shapes exist in the world.**

Georgia's K-12 Mathematics Standards - 2021

2nd Grade

***NUMERICAL REASONING** – counting within 1000, place value, addition and subtraction, fluency to 20, developing multiplication through arrays*

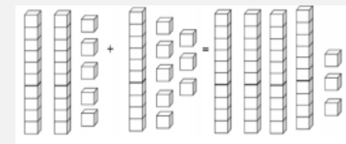
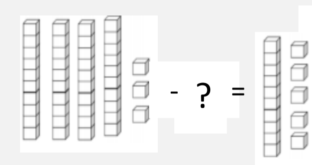
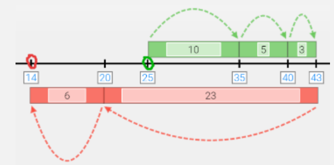
2.NR.1: Using the place value structure, explore the count sequences to represent, read, write, and compare numerical values to 1000 and describe basic place-value relationships and structures.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)	
2.NR.1.1	Explain the value of a three-digit number using hundreds, tens, and ones in a variety of ways.	***Fundamentals*** ● Students should be able to put together (compose) and break apart (decompose) three-digit numbers. ● Students should have multiple opportunities use concrete materials to develop an understanding of the place value structures, the relationship between numbers, and the value of quantities.	***Strategies and Methods*** ● Students should use base ten materials to break apart (decompose) 327 into 3 hundreds, 2 tens, and 7 ones, or into 2 hundreds, 12 tens, and 7 ones. ● Students should be able to explain that a bundle of ten 10s is equal to 100.
2.NR.1.2	Count forward and backward by ones from any number within 1000. Count forward by fives from multiples of 5 within 1000. Count forward and backward by 10s and 100s from any number within 1000. Count forward by 25s from 0.	***Strategies and Methods*** ● Students should explore patterns on a hundred-chart, starting from a given number 10-90. ● Students can also use number lines to demonstrate their understanding. ● Students should be able to use coins to count, including nickels, dimes, quarters, and dollars. Half-dollars may also be used, if available.	
2.NR.1.3	Represent, compare, and order whole numbers to 1000 with an emphasis on place value and equality. Use >, =, and < symbols to record the results of comparisons.	***Strategies and Methods*** ● Representations should include concrete materials (i.e., base ten blocks, counters, etc.), base ten numerals, words, expanded form, and pictures.	***Age/Developmentally Appropriate*** ● Students should be able to represent a quantity from word form.

2.NR.2: Apply multiple part-whole strategies, properties of operations and place value understanding to solve real-life, mathematical problems involving addition and subtraction within 1,000.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)				
2.NR.2.1	Fluently add and subtract within 20 using a variety of mental, part-whole strategies.	***Terminology*** ● Fluently/Fluency – To achieve fluency, students should be able to	***Strategies and Methods** – [see special note in appendix]* ● Students should explain their	***Relevance and Application*** ● Students should be able to use numerical reasoning to solve relevant,	***Age/Developmentally Appropriate*** ● Reaching fluency is an ongoing process that	***Example*** ● A student makes sense of 29 + 6 by flexibly thinking:

<table>
<tr>
<td></td>
<td></td>
<td>choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.
Accuracy includes attending to precision.
Efficiency includes using well-understood strategy with ease.
Flexibility involves using strategies such as making 5 or making 10.</td>
<td>approaches and produce accurate answers efficiently and appropriately using mental strategies that include counting on, making ten, decomposing a number leading to a ten, using the relationship between addition and subtraction, creating equivalent but easier or known sums.
Examples of different strategies and representations can be found within the Computational Strategies for Whole Numbers document found in the appendices.</td>
<td>mathematical problems involving all problem types. Click here for a listing of all problem types.</td>
<td>will take much of the year.
Students should know all sums of two one-digit numbers by the end of Grade 2.</td>
<td>“If I think of 6 as 1 + 5, I can add the 1 to the 29 first to make a ten (30), then add 5 more to get 35.”</td>
</tr>
<tr>
<td>2.NR.2.2</td>
<td>Find 10 more or 10 less than a given three-digit number and find 100 more or 100 less than a given three-digit number.</td>
<td colspan="5">Strategies and Methods
Tools such as a hundred chart and visual number lines may be used to help students discover the patterns of ten more and ten less.</td>
</tr>
<tr>
<td>2.NR.2.3</td>
<td>Solve problems involving the addition and subtraction of two-digit numbers using part-whole strategies.</td>
<td>Age/Developmentally Appropriate
Students should work with practical, mathematical problems involving standard units of linear measurement (inches). Note: This is an ongoing process that will take much of the year.
The sum of the numbers should be no greater than 1000.
At this grade level, students should only be</td>
<td>Relevance and Application
Authentic problems should be presented to provide students with the opportunity to make sense of the mathematics in the world around them.
Problems presented may involve money.
Students should be able to solve practical, mathematical problems involving addition and subtraction within 1,000.</td>
<td>Strategies and Methods – see special note in appendix
Students should be given the opportunity to explore and develop a variety of flexible strategies and algorithms.
Students should be able to solve one and two step mathematical problems within 100 and represent the problem by using concrete materials, drawings, and equations with a symbol for the unknown number.</td>
<td colspan="2">Example
In the morning, there are 25 students in the cafeteria. 18 more students come in. After a few minutes, some students leave. If there are 14 students still in the cafeteria, how many students left the cafeteria? Write an equation for your problem.</td>
</tr>
</table>

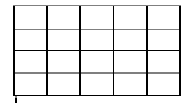
		expected to subtract up to two two-digit numbers and add up to four two-digit numbers.	• Students should be able to use numerical reasoning to solve authentic, mathematical problems involving all problem types. [Click here for a listing of all problem types.](#)	• Students should be able to use strategies that are based on a deep understanding of place-value in order to meet this expectation. • When solving problems, students should be given the opportunity to use concrete materials, drawings, tools, and part-whole reasoning strategies. • Students should be able to solve authentic, mathematical problems involving the addition of up to four two-digit numbers using strategies based on place value, properties of operations and the relationship between addition and subtraction.	  

2.NR.2.4	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.	***Terminology*** • Fluently/Fluency – To achieve fluency, students should be able to choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.	***Age/Developmentally Appropriate*** • Students should be given multiple opportunities to solve applicable, mathematical problems as they work to build fluency. • The sum of the number should be no greater than 100.	***Relevance and Application*** • Students should be able to use numerical reasoning to solve applicable, mathematical problems involving all problem types. [Click here for a listing of all problem types.](#)

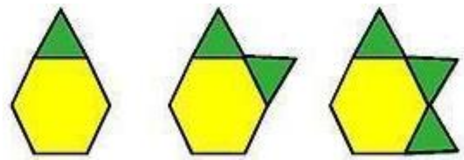
2.NR.3: Work with equal groups to gain foundations for multiplication through real-life, mathematical problems.

Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**	
2.NR.3.1	Determine whether a group (up to 20) has an odd or even number of objects. Write an equation to express an even number as a sum of two equal addends.	***Strategies and Methods*** • Students can group by pairing objects or counting them by 2s. • Students may also use doubles to determine if a quantity is even. For example, 18 is even because adding two nines equals 18 or 9 + 9 =18.	***Terminology*** • The terminology below is used to clarify expectations for the teaching professional. Students are not required to use this terminology when engaging with the learning objective. ○ Addend – any number that is added to another number in an addition expression or equation. For example, in the expression 16 + 4, 16 and 4 are addends.

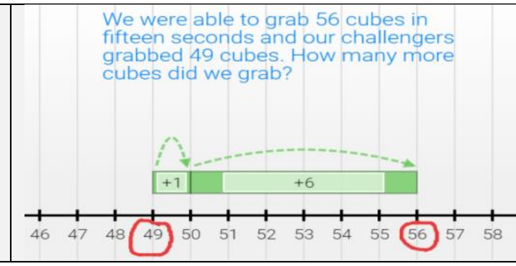
2.NR.3.2	Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express	***Fundamentals*** • Students should be able to	***Strategies and Methods*** • Students should model using	***Example*** • Beth put 5 purses on each shelf. She has 4 shelves. Draw an array to model this. Write	***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.

	the total as a sum of equal addends.	partition a rectangle into rows and columns of same-size squares and count to find the total number of them.	rectangular arrays to determine the number of objects and discuss their reasoning.	an equation to match the array.  5+5+5+5 =20	○ Rectangular array – an arrangement of objects into rows and columns that form a rectangle. ○ Addend – any number that is added to another number in an addition expression or equation. For example, in the expression 2 + 7 + 5, 2, 7 and 3 are addends.

PATTERNING & ALGEBRAIC REASONING *– patterns up to 20 and addition and subtraction within 1,000*						
2.PAR.4: Identify, describe, extend, and create repeating patterns, growing patterns, and shrinking patterns.						
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**				
2.PAR.4.1	Identify, describe, and create a numerical pattern resulting from repeating an operation such as addition and subtraction.	***Age/Developmentally Appropriate*** ● Patterns involving addition and subtraction should include sums within 1,000 through models and representations.	***Relevance and Application*** ● Problems should be presented within real applications to provide students with the opportunity to make sense of the mathematics. ● Problems presented may involve money as a tool to make sense of the patterns.	***Fundamentals*** ● Students should investigate repeating patterns to make predictions and build algebraic reasoning. ● Patterns may include exposure to even and odd. ● Students should be using any tools available such as a number line, hundred-chart, 99-chart, etc., to create and analyze the patterns. ● Patterns should be extended from 1st grade, where they explore intervals of 1s, 2s, 5s, and 10s, to also include intervals of 25s and 100s.	***Strategies and Methods*** ● Students should be given the opportunity to use a variety of strategies to identify, describe, and create numerical patterns.	***Example*** ● Start with 3 and jump by 5s to create a pattern. Change the start number and create another pattern. What do you notice about the two patterns? How did they change?

2.PAR.4.2	Identify, describe, and create growing patterns and shrinking patterns involving addition and subtraction up to 20.	***Example*** ● Describe the growing pattern below and build the next two terms in the pattern. 

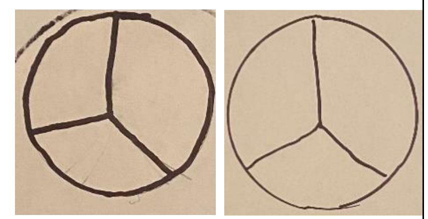
MEASUREMENT & DATA REASONING *– length, distance, time, and money*				
2.MDR.5: Estimate and measure the lengths of objects and distance to solve problems found in real-life using standard units of measurement, including inches, feet, and yards.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
2.MDR.5.1	Construct simple measuring instruments using unit models. Compare unit models to rulers.	***Strategies and Methods*** ● Students should discuss how measurement with iterating individual one-inch units, such as one-inch tiles, compares with measurement using an instrument such as a standard ruler.	***Terminology*** ● Iterating one inch units means using several individual (inch) units, such as 1-inch tiles, and setting them next to one another to measure the length of an object.	***Age/Developmentally Appropriate*** ● In Grade 1, students used one-inch items as non-standard units of measure for length. In Grade 2, students compare a constructed ruler with standard rulers and compare the use of the devices.
2.MDR.5.2	Estimate and measure the length of an object or distance to the nearest whole unit using appropriate units and standard measuring tools.	***Strategies and Methods*** ● Students should be able to use appropriate measuring tools such as rulers, yardsticks, and measuring tapes. ● Units of measure include inches, feet, and yards		
2.MDR.5.3	Measure to determine how much longer one object is than another and express the length difference in terms of a standard-length unit.	***Fundamentals*** ● This is the first time students are introduced to a standard-length unit such as an inch.	***Strategies and Methods*** ● Students should use tools such as rulers, measuring tapes, and yardsticks to obtain measurements.	***Example*** ● I measured my two pet parakeets. One was 7 inches long and one was 15 inches long. The larger one is 8 inches longer than the smaller one.
2.MDR.5.4	Ask questions and answer them based on gathered information, observations, and appropriate graphical displays to solve problems relevant to everyday life.	***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.		***Strategies and Methods*** ● Questions should be student generated.
2.MDR.5.5	Represent whole-number sums and differences within a standard unit of measurement on a number line diagram.	***Fundamentals*** ● Students should be able to represent sums and differences presented in practical,	***Age/Developmentally Appropriate*** ● This prepares students to use number lines for fractions in higher grades.	***Example***

		mathematical problems on a number line diagram.		

2.MDR.6: Solve real-life problems involving time and money.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)			
2.MDR.6.1	Tell and write time from analog and digital clocks to the nearest five minutes, and estimate and measure elapsed time using a timeline, to the hour or half hour on the hour or half hour.	***Fundamentals*** ● Students should be able to categorize daily activities by a.m. and p.m.	***Age/Developmentally Appropriate*** ● Problems involving elapsed time in second grade should be written so as to avoid crossing over a.m. and p.m.	***Strategies and Methods*** ● Video showing how to use a number line to tell time and how the number line can be curved to look like a circular clock – Click Here.	***Example*** ● Denise had soccer practice after school today. Practice began at 3:30 and ended at 6:00. How much time did she spend at soccer practice?
2.MDR.6.2	Find the value of a group of coins and determine combinations of coins that equal a given amount that is less than one hundred cents, and solve problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately.	***Age/Developmentally Appropriate*** ● This is the first time students are required to find the value of a group of coins. ● The total quantity should be based on cents and the value of a group of coins should be less than 100 cents. ● Use of written decimal numbers is not an expectation for this grade level. ● The $ symbol should only be used when referring to whole dollar amounts at this grade level. ● Students should be able to solve applicable, mathematical problems that involve either only dollars or only cents. ● Dollar bills may include $1, $5, $10, $20, and $100.	***Fundamentals*** ● Students should be able to identify the values of pennies, nickels, dimes, and quarters. Half-dollars may also be investigated, if available.	***Strategies and Methods*** ● Students should be given opportunities to explore this concept using hands-on manipulatives. Virtual manipulatives may also be used.	

GEOMETRIC & SPATIAL REASONING *– sorting shapes, lines of symmetry, partitioning circles and rectangles*		
2.GSR.7: Draw and partition shapes and other objects with specific attributes and conduct observations of everyday items and structures to identify how shapes exist in the world.		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
2.GSR.7.1	Describe, compare and sort 2-D shapes including polygons, triangles, quadrilaterals, pentagons, hexagons, and 3-D shapes including rectangular prisms and cones, given a set of attributes.	***Relevance and Application*** ● Students should be able to use spatial reasoning to analyze shapes in the environment. ***Age/Developmentally Appropriate*** ● Students should be encouraged to sort and classify shapes based on their choice of attributes as well as attributes that may be provided. ● Students at this grade level should describe shapes based on attributes. ***Terminology*** ● Attributes – characteristics of a two-dimensional or three-dimensional shape ● Vertices – corners of a geometric figure ● Rectangular prism – a three-dimensional shape that has a rectangular base (This also includes objects with square bases, such as cubes.) ***Example*** ● Describe a shape based on its attributes and compare and sort a collection of shapes based on the number of angles, vertices, sides, and equal faces.
2.GSR.7.2	Identify at least one line of symmetry in everyday objects to describe each object as a whole.	***Age/Developmentally Appropriate*** ● Students should investigate symmetry using a variety of materials, such as miras and paper folding. ● Students at this grade level should describe the everyday objects using the line of symmetry. ***Strategies and Methods*** ● Students should be provided multiple opportunities to investigate symmetry through paper folding and/or the use of mirrors. ● Students should develop an understanding of what a line of symmetry is through exploration with real-world objects. ***Example*** ● Identify lines of symmetry seen in everyday objects, such as a butterfly, stop sign, flower, or dragonfly. Identify lines of symmetry seen and how they connect to the object. ● *Sample student response: "I can see that the butterfly looks the same on each wing, but it looks backward, like a mirror, on the other side of the line of symmetry."*
2.GSR.7.3	Partition circles and rectangles into two, three, or four equal shares. Identify and describe equal-sized parts of the whole using fractional names ("halves," "thirds," "fourths", "half of," "third of," "quarter of," etc.).	***Fundamentals*** ● Students have explored quarters and halves in first grade and are extending their understanding of fractions to thirds. ***Strategies and Methods*** ● Students are not expected to precisely partition circles into thirds, but rather partition circles and rectangles into thirds close enough to be described as three equal parts. ***Age/Developmentally Appropriate*** ● Partitioning shapes prepares students to reason about fractions in upper grades. ● Shading is not an expectation within images for this grade because the student is only required to partition the whole shape into equal shares. ***Examples***  **Halves** **Thirds** **Fourths (Quarters)**

				Below is a student work sample showing a second grade student's two attempts at partitioning a circle into thirds during a mini lesson. As she is making sense of what happens when you partition a circle into thirds, she realizes that each part represents the same quantity and is one third of the whole circle (approximate partitions are sufficient for beginning phases of understanding development related to quantity): 
2.GSR.7.4	Recognize that equal shares of identical wholes may be different shapes within the same whole.	***Strategies and Methods*** ● Students should explore rectangles and circles being partitioned in multiple ways to recognize that equal shares may be different shapes within the same whole.	***Age/Developmentally Appropriate*** ● Shading is not an expectation within images for this grade because the student is only required to partition the whole shape into equal shares.	***Examples***  **Halves** **Thirds** **Fourths (Quarters)** ○ Students should be able to recognize that even though shapes may be partition differently, they still have the same relationship to the whole.

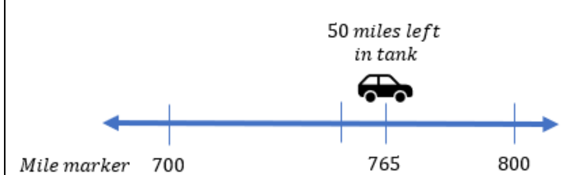
3rd Grade

The nine standards listed below are the key content competencies students will be expected to master in third 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.

THIRD GRADE STANDARDS
3.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.**
3.NR.1: **Use place value reasoning to represent, read, write, and compare numerical values up to 10,000 and round whole numbers up to 1,000.**
3.PAR.2: **Use part-whole strategies to represent and solve real-life problems involving addition and subtraction with whole numbers up to 10,000.**
3.PAR.3: **Use part-whole strategies to solve real-life, mathematical problems involving multiplication and division with whole numbers within 100.**
3.NR.4: **Represent fractions with denominators of 2, 3, 4, 6 and 8 in multiple ways within a framework using visual models.**
3.MDR.5: **Solve real-life, mathematical problems involving length, liquid volume, mass, and time and analyze graphical displays of data to answer relevant questions.**
3.GSR.6: **Identify the attributes of polygons, including parallel segments, perpendicular segments, right angles, and symmetry.**
3.GSR.7: **Identify area as a measurable attribute of rectangles and determine the area of a rectangle presented in real-life, mathematical problems.**
3.GSR.8: **Determine the perimeter of a polygon presented in real-life, mathematical problems.**

Georgia's K-12 Mathematics Standards – 2021

3rd Grade

<table>
<tr><td colspan="6">NUMERICAL REASONING – base ten numerals and place value up to 10,000, and rounding up to 1,000</td></tr>
<tr><td colspan="6">3.NR.1: Use place value reasoning to represent, read, write, and compare numerical values up to 10,000 and round whole numbers up to 1,000.</td></tr>
<tr><th colspan="2">Expectations</th><th colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>3.NR.1.1</td><td>Read and write multi-digit whole numbers up to 10,000 using base-ten numerals and expanded form.</td><td colspan="3">Strategies and Methods
● Students should be able to compose (combine) and decompose (break apart) numbers in various ways.
● Examples of different strategies and representations can be found within the Computational Strategies for Whole Numbers document found in the appendices.</td><td>Examples
● 15 tens + 13 ones = 163 OR 16 tens + 3 ones
● 568 = 500 + 50 + 18 OR 500 + 60 + 8</td></tr>
<tr><td>3.NR.1.2</td><td>Use place value reasoning to compare multi-digit numbers up to 10,000, using >, =, and < symbols to record the results of comparisons.</td><td colspan="4">Strategies and Methods
● Students should be able to compare whole numbers up to 10,000.
● Students should also create bar graphs and dot plots to represent numerical data when answering a statistical investigative question. They should be able to analyze the data presented in dot plots and bar graphs to compare multi-digit numbers using the symbols to record comparison in context.</td></tr>
<tr><td>3.NR.1.3</td><td>Use place value understanding to round whole numbers up to 1000 to the nearest 10 or 100.</td><td>Relevance and Application
● Students should be able to use place value understanding to round whole numbers for an authentic purpose within authentic situations.</td><td>Strategies and Methods
● Students should locate numbers on a number line to determine the nearest multiple of 10 or 100.</td><td>Fundamentals
● Students should be given opportunities to build understanding by exploring the concept within 100 first and then progressing to applying the same mathematical thinking within 1000.</td><td>Example
● On a road trip, there is a gas station at the 700-mile mark and the 800-mile mark. You have about 50 miles left in the tank when you hit the 765-mile mark, which gas station is the closest for you to go to?

</td></tr>
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<table>
<tr><td colspan="6">PATTERNING & ALGEBRAIC REASONING – fluency, addition and subtraction within 10,000, multiplication and division within 100, equality, properties of operations</td></tr>
<tr><td colspan="6">3.PAR.2: Use part-whole strategies to represent and solve real-life problems involving addition and subtraction with whole numbers within 10,000.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr><td>3.PAR.2.1</td><td>Fluently add and subtract within 1000 to solve problems.</td><td>Terminology
● Fluently/Fluency – To achieve fluency, students should be able to choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.
● Dot plots and line plots are similar tools with different symbols used to display the data points. They can be used interchangeably.</td><td>Relevance and Application
● Students should be able to use numerical reasoning to solve mathematical problems relevant to everyday life involving all problem types. Click here for a listing of all problem types.
● 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>Strategies and Methods – see special note in appendix
● Strategies may be based on place value, properties of operations, and/or the relationship between addition and subtraction.
● Some problems should include data obtained from measurements of objects. This will allow students to apply their problem-solving abilities to reading bar graphs, pictographs, and dot plots as they solve problems within 1000.</td><td>Age/Developmentally Appropriate
● Students should be allowed to choose an appropriate strategy to demonstrate fluency.
● Finding and using key words is not an appropriate strategy.</td></tr>
<tr><td>3.PAR.2.2</td><td>Apply part-whole strategies, properties of operations and place value understanding, to solve problems involving addition and subtraction within 10,000. Represent these problems using equations with a letter standing for the unknown quantity. Justify solutions.</td><td colspan="2">Fundamentals
● Students should add and subtract multi-digit whole numbers within 10,000 to solve authentic, mathematical problems using efficient and generalizable procedures, based on knowledge of place value and properties of operations.
● The focus of this learning objective is mathematical reasoning and sense-making.</td><td colspan="2">Strategies and Methods – see special note in appendix
● Students should be given opportunities to use variety of models and representations when extending their understanding of part-whole reasoning strategies.
● Students should be given the choice of which strategy they can use.</td></tr>
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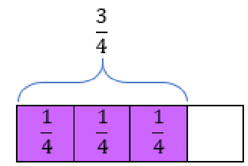
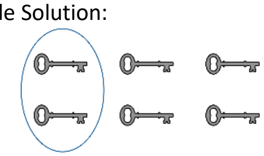
<table>
<tr><th colspan="5">3.PAR.3: Use part-whole strategies to solve real-life, mathematical problems involving multiplication and division with whole numbers within 100.</th></tr>
<tr><th colspan="2">Expectations</th><th colspan="3">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>3.PAR.3.1</td><td>Describe, extend, and create numeric patterns related to multiplication. Make predictions related to the patterns.</td><td colspan="2">Age/Developmentally Appropriate
● Identifying patterns can help students derive and automatize multiplication facts.
● Multiplication tables may be used to help students discover patterns and relationships.
● A student looking at a multiplication table may discover that multiples of even numbers (2, 4, 6, and 8) are always even; the products in each row and column increase by the same amount (skip counting); the multiples of 6 are double the multiples of 3; the multiples of any number fall on a horizontal and a vertical line due to the commutative property, etc.
● Patterns may include exposure to even and odd extending from previous work in 2nd grade.</td><td>Example
● A student highlighting the multiples of 9 on a hundreds chart might notice 2 x 9 is 2 away from 20, 3 x 9 is 3 away from 30, and so forth.</td></tr>
<tr><td>3.PAR.3.2</td><td>Represent single digit multiplication and division facts using a variety of strategies. Explain the relationship between multiplication and division.</td><td>Fundamentals
● Students should solve multiplication problems including single-digit factors and division problems including single-digit divisors and quotients.</td><td>Strategies and Methods – see special note in appendix
● Multiplication strategies may include repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting.
● Multiplication tables may be used to help students discover patterns and relationships.
● Division strategies may include repeated subtraction, equal sharing, and forming equal groups.
● Examples of different strategies and representations can be found within the Computational Strategies for Whole Numbers document found in the appendices.</td><td>Age/Developmentally Appropriate
● Students should be able to use numerical reasoning to learn multiplication and division facts through playing games and solving authentic, mathematical problems.
● Fluency does not lend itself to timed tests or speed. Students should be given opportunities to choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.
● Fluency can be assessed in different ways.</td></tr>
<tr><td>3.PAR.3.3</td><td>Apply properties of operations (i.e., commutative property, associative property, distributive property) to multiply and divide within 100.</td><td colspan="2">Age/Developmentally Appropriate
● These properties should be used organically within the daily number sense routines.
● Students at this grade level are not expected to identify the specific properties.
● Third grade students do not need to know the formal names for these properties.</td><td>Examples
● 7 x 3 is known, then 3 x 7 is also known (Commutative Property)
● 3 x 5 x 2 can be found by 3 x 5 = 15, then 15 x 2 = 30, or 5 x 2 = 10, then 3 x 10 = 30 (Associative Property)
● Knowing 8 x 5 = 40 and 8 x 2 = 16, 8 x 7 can be found as the sum of these partial products: 8 x (5 + 2) = (8 x 5) + (8 x 2) = 40 + 16 = 56 (Distributive Property)</td></tr>
<tr><td>3.PAR.3.4</td><td>Use the meaning of the equal sign to determine whether expressions involving</td><td>Age/Developmentally Appropriate
● Students build upon their prior knowledge of equality to extend to relational understanding.</td><td colspan="2">Examples
● Ten teams of 8 students signed up for a volleyball tournament. One of the teams had to drop out. Write an equation with two expressions that show how many students will be at the tournament.</td></tr>
</table>

	addition, subtraction, and multiplication are equivalent.		○ Possible solutions: 9 groups of 8 is the same as 10 groups of 8 minus one group of 8 or 9 x 8 = (10 x 8) – 8, or 9 x 8 = 8 + 8 + 8 + 8 + 8 + 8 + 8 + 8 + 8 ○ Students may also use picture drawings or models to justify their thinking.			
3.PAR.3.5	Use place value reasoning and properties of operations to multiply one-digit whole numbers by multiples of 10, in the range 10-90.	***Age/Developmentally Appropriate*** ● Students should be given an opportunity to explore that when a number is 10 times larger than another number, this does not come from adding zero. ● Students should understand that adding zero does not change the overall quantity. ● Students should explore the patterns of multiplying by ten and notice how the magnitude of the number changes. Exploring the pattern, students should uncover as numbers are multiplied by a multiple of 10, the digit shifts left, making the value ten times more with each shift.				***Example*** ● 6 times 20 is 120 because 6 groups of 20 is 120; or 6 x 20 = 6 x (10 x 2) = (6 x 10) x 2 = 60 x 2 = 120.
3.PAR.3.6	Solve practical, relevant problems involving multiplication and division within 100 using part-whole strategies, visual representations, and/or concrete models.	***Fundamentals*** ● Students should be able to solve practical, realistic division problems including "how many in each group" and "how many groups" using efficient and flexible strategies.	***Age/Developmentally Appropriate*** ● Multiplication and division within 100 means multiplication and division of two whole numbers with whole number answers, and with product or dividend in the range 0-100 (e.g., 39 ÷ 3 = 13).	***Relevance and Application*** ● 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.	***Strategies and Methods*** – *see special note in appendix* ● Some problems should include creating and reading bar graphs, pictographs, and dot plots. Data could include values obtained from measurements of objects.	***Example*** ● The store had video games on sale for $15 each. If you bought 4 games, how much would you spend?
3.PAR.3.7	Use multiplication and division to solve problems involving whole numbers to 100. Represent these problems using equations with a letter standing for the unknown quantity. Justify solutions.	***Fundamentals*** ● Students should use a variety of strategies to solve multi-step authentic, mathematical problems. ● Students should represent problems using equations with a variable standing for the unknown quantity and justify their answers. Variables can be letters used to represent the unknown. ● Students should use numerical reasoning to assess the reasonableness of answers.	***Age/Developmentally Appropriate*** ● This is limited to problems posed with whole numbers and having whole-number answers. Situations involving money should not include decimal numbers.	***Strategies and Methods*** – *see special note in appendix* ● Some problems should include creating and reading bar graphs, pictographs, and dot plots. ● Data could include values obtained from measurements of objects.		***Example*** ● At the movies, tickets cost $11 each, popcorn costs $7 each, and drinks costs $4 each. If I have $35, do I have enough to purchase 2 tickets, 1 popcorn, and 2 drinks?

***NUMERICAL REASONING** – unit fractions, equivalent fractions, fractions greater than 1*				
3.NR.4: Represent fractions with denominators of 2, 3, 4, 6 and 8 in multiple ways within a framework using visual models.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
3.NR.4.1	Describe a unit fraction and explain how multiple copies of a unit fraction form a non-unit fraction. Use parts of a whole, parts of a set, points on a number line, distances on a number line and area models.	***Age/Developmentally Appropriate*** ● This standard is limited to fractions with denominators of 2, 3, 4, 6 and 8. ● Set sizes should not exceed 24.	***Strategies and Methods*** ● Students should investigate unit fractions using area models, parts of a set, linear models, and points on a number line. ● Students should be given the opportunity to explore this concept using a variety of visual tools such as Cuisenaire rods, fraction tiles, fraction strips, fraction bars, fraction towers, number lines, etc.	***Example*** ● Understand that $\frac{3}{4}$ is composed of three pieces, each with a size of $\frac{1}{4}$. 
3.NR.4.2	Compare two unit fractions by flexibly using a variety of tools and strategies.	***Fundamentals*** ● Students should be able to recognize that comparisons are valid only when the two fractions refer to the same whole.	***Strategies and Methods*** ● Students should be able to use numerical reasoning strategies when comparing unit fractions. ● Tools and strategies could include visual fraction models. ● Students should record the results of comparisons with symbols >, =, or <, and justify the conclusions.	
3.NR.4.3	Represent fractions, including fractions greater than one, in multiple ways.	***Age/Developmentally Appropriate*** ● This standard is limited to fractions with denominators of 2, 3, 4, 6 and 8. ● Set sizes should not exceed 24.	***Strategies and Methods*** ● Students should investigate unit fractions using area models, set models (parts of a set), linear models, and points representing distances on a number line. ● Students should be given the opportunity to explore this concept using a variety of visual tools such as Cuisenaire rods, fraction tiles, fraction strips, fraction bars, fraction towers, number lines, analog clock, fraction circle, etc.	***Example*** ● There are 6 keys in Stephanie's collection. She gives two of them to her friend. What fraction of her collection did she give? Possible Solution:  She gave 1/3 of her collection.
3.NR.4.4	Recognize and generate simple equivalent fractions.	***Fundamentals*** ● Students should explore the relationship between halves, fourths, and eighths, as well as thirds and sixths to generate simple equivalent fractions.	***Age/Developmentally Appropriate*** ● This standard is limited to fractions with denominators of 2, 3, 4, 6 and 8.	***Strategies and Methods*** ● Students should determine that two fractions are equal when they are the same size or on the same location on a number line. ● Students should express whole numbers as fractions recognize fractions that are equivalent to whole numbers.

<table>
<tr><td colspan="6">MEASUREMENT & DATA REASONING – elapsed time, liquid volume, mass, lengths in half and fourth of an inch, data</td></tr>
<tr><td colspan="6">3.MDR.5: Solve real-life, mathematical problems involving length, liquid volume, mass, and time.</td></tr>
<tr><th colspan="2">Expectations</th><th colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>3.MDR.5.1</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="4">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.
● Questions should be student generated.</td></tr>
<tr><td>3.MDR.5.2</td><td>Tell and write time to the nearest minute and estimate time to the nearest fifteen minutes (quarter hour) from the analysis of an analog clock.</td><td colspan="4">Fundamentals
● Students should be given opportunities to determine relative time and predict time to the nearest fifteen minutes using only the hour hand of an analog clock.</td></tr>
<tr><td>3.MDR.5.3</td><td>Solve meaningful problems involving elapsed time, including intervals of time to the hour, half hour, and quarter hour where the times presented are only on the hour, half hour, or quarter hour within a.m. or p.m. only.</td><td colspan="2">Age/Developmentally Appropriate
● Problems should include am/pm, start unknown, end unknown, and change unknown and addition/subtraction of time intervals.
● Students should be given opportunities to use number lines to find unknowns.
● 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">Examples
● The bus comes at 7:00 a.m. It takes me 15 minutes to eat breakfast and 30 minutes to get ready. What time do I need to wake up? (e.g., start unknown)
● I went to the movies at 3:15 p.m. The movie lasted 1 hour 45 minutes. What time did the movie end? (e.g., end unknown)
● After school I went to the park at 2:30 p.m. and left to go home at 3:45 p.m. How long was I at the park? (e.g., change unknown)</td></tr>
<tr><td>3.MDR.5.4</td><td>Use rulers to measure lengths in halves and fourths (quarters) of an inch and a whole inch.</td><td colspan="4">Age/Developmentally Appropriate
● Students should use rulers marked with halves and fourths (quarters) of an inch.
● Students must have prior knowledge of fractions on a number line.</td></tr>
<tr><td>3.MDR.5.5</td><td>Estimate and measure liquid volumes, lengths and masses of objects using customary units. Solve problems involving mass, length, and volume given in the same unit, and reason about the relative sizes of measurement units within the customary system.</td><td>Fundamentals
● Students should have an opportunity to compare capacity by filling one container with something and then pouring this amount into the comparison container.
● Students should have opportunities to physically measure objects.</td><td>Age/Developmentally Appropriate
● Conversions are not expected in this grade level. The focus here should be on helping learners see the equivalence between quantities.
● Students extend understanding of measuring length in inches to measuring in feet and yards.</td><td>Terminology
● The terminology below is used to clarify expectations for the teaching professional. Students are not required to use this terminology when engaging with the learning objective.
○ Customary measurement units include weight (oz., lbs., tons) capacity (fl. oz, cups, pints, quarts, gallons), length (in., ft., yds., miles).</td><td>Example
● Students should be able to record measurement equivalents in a two-column table.</td></tr>
</table>

***GEOMETRIC & SPATIAL REASONING** – polygons, parallel line segments, perpendicular line segments, right angles, lines of symmetry, area, perimeter*		
3.GSR.6: Identify the attributes of polygons, including parallel segments, perpendicular segments, right angles, and symmetry.		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
3.GSR.6.1	Identify perpendicular line segments, parallel line segments, and right angles, identify these in polygons, and solve problems involving parallel line segments, perpendicular line segments, and right angles.	***Terminology*** ● Two lines are perpendicular if the angle formed at their intersection is a right angle (angles that form a square corner). ● Two lines are parallel if they are in the same plane and never intersect. ***Age/Developmentally Appropriate*** ● There should be a focus on the investigation of quadrilaterals, specifically, but other polygons should also be explored. ***Example*** ● Given a variety of shapes, identify whether each includes parallel line segments, perpendicular line segments, and right angles.
3.GSR.6.2	Classify, compare, and contrast polygons, with a focus on quadrilaterals, based on properties. Analyze specific 3-dimensional figures to identify and describe quadrilaterals as faces of these figures.	***Fundamentals*** ● Students should explore, compare, and contrast polygons based on properties. ● There should be a focus on the investigation of quadrilaterals, specifically, but other polygons should also be explored. ● Students should also be able to identify and name precise quadrilaterals as faces of specific 3-dimensional figures. ***Age/Developmentally Appropriate*** ● This learning objective does not require students to create a hierarchy. ***Strategies and Methods*** ● Quadrilaterals should include square, rectangle, rhombus, parallelogram, trapezoid, and kite. ***Terminology*** ● Properties may include angles, side lengths, symmetry, congruence, and the presence or absence of parallel or perpendicular lines. ● Students should be able to identify types of angles, including acute, obtuse, and right. ○ Right angle – An angle with a square corner. ○ Acute angle – An angle smaller than a right angle. ○ Obtuse angle – An angle larger than a right 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.
3.GSR.6.3	Identify lines of symmetry in polygons.	***Fundamentals*** ● There should be a focus on the investigation of quadrilaterals, specifically, but other polygons should also be explored. ***Age/Developmentally Appropriate*** ● Students should investigate symmetry using a variety of materials, such as miras and paper folding. ***Terminology*** ● Quadrilaterals are polygons with four sides and four angles.

3.GSR.7: Identify area as a measurable attribute of rectangles and determine the area of a rectangle presented in real-life, mathematical problems.		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
3.GSR.7.1	Investigate area by covering the space of rectangles presented in realistic situations using multiple copies of the same unit, with no	***Age/Developmentally Appropriate*** ● The expectation at this grade level is for students to explore areas of rectangles only. ***Strategies and Methods*** ● Students should use numerical and spatial reasoning to determine the area of rectangles presented in realistic, mathematical problems. ***Example*** ● Students can determine the area of the top of their desk or other rectangle outlined by tape on the desk by covering it using non-standard units,

	gaps or overlaps, and determine the total area (total number of units that covered the space).			such as index cards, sticky notes, tiles, etc.
3.GSR.7.2	Determine the area of rectangles (or shapes composed of rectangles) presented in relevant problems by tiling and counting.	***Age/Developmentally Appropriate*** ● The expectation at this grade level is for students to explore areas of rectangles by tiling and counting to develop the concept of area as the space (number of tiles) needed to cover the shape.	***Strategies and Methods*** ● Students should use numerical and spatial reasoning to determine the area of rectangles presented in realistic, mathematical problems by counting or tiling. ● 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.	***Example*** ● A laptop cover is being made with square vinyl stickers. There are four rows of stickers. There are 9 stickers in each row. How many square stickers were used to create the laptop cover?

3.GSR.7.3	Discover and explain how area can be found by multiplying the dimensions of a rectangle.	***Age/Developmentally Appropriate*** ● Dimensions of the rectangle could be limited to values up to 10 for each dimension. Students could explore higher values for dimensions as they show readiness.	***Fundamentals*** ● Students should have multiple opportunities to connect area to the investigations of multiplication using arrays.	***Terminology*** ● The dimensions of a rectangle can be referred to as length and width OR base and height. ● A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area (e.g., square cm, square m, square in, square ft).	***Example*** ● The area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c; 4 x 7 is the same as 4 x (2 + 5) and is the sum of 4 x 2 and 4 x 5. ● In a rectangular garden, you have four rows of peanut plants. There are 9 peanut plants in each row. How many peanut plants are there in the garden?

3.GSR.8: Determine the perimeter of a polygon presented in real-life, mathematical problems.

Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**			
3.GSR.8.1	Determine the perimeter of a polygon and explain that the perimeter represents the distance around a polygon. Solve problems involving perimeters of polygons.	***Age/Developmentally Appropriate*** ● At this grade level, students should explore perimeters of polygons with up to ten sides.	***Fundamentals*** ● Students should be given opportunities to develop a conceptual understanding of perimeter of all types of polygons including regular and irregular. ● Students should investigate perimeters of polygons with a focus on quadrilaterals. ● Students should be able to find the perimeter given the side lengths.	***Terminology*** ● The focus of this learning objective should be on developing the conceptual understanding of perimeter, rather than on 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	***Examples*** ● Your neighbor has 24 feet of fencing and wants you to help her build a rectangular pen for her dog. What are some possible dimensions for the dog pen? Which pen would you recommend and why? ● A square pizza box has a perimeter of 32 inches, what are side lengths of the box? ● If a stop sign has a side length of 4 inches, what would be its perimeter?

			● Students should be able to find the unknown side length given the perimeter.	angles are equal; and a polygon is irregular when all sides are not equal or all angles are not equal.	
3.GSR.8.2	Investigate and describe how rectangles with the same perimeter can have different areas or how rectangles with the same area can have different perimeters.	***Age/Developmentally Appropriate*** ● This learning objective is limited to rectangles only.	***Relevance and Application*** ● Students should solve authentic, mathematical problems involving perimeter and area of rectangles.	***Example*** ● I have eighteen 1-foot panels to build a raised garden bed. How many different ways can I put these eighteen panels together to build a rectangular raised garden bed? Which rectangle will have the greatest area?	

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.**

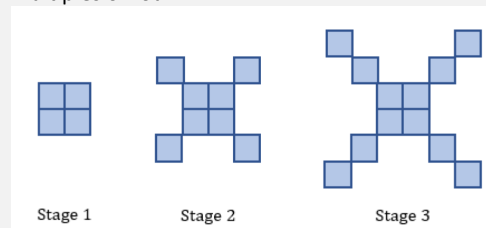
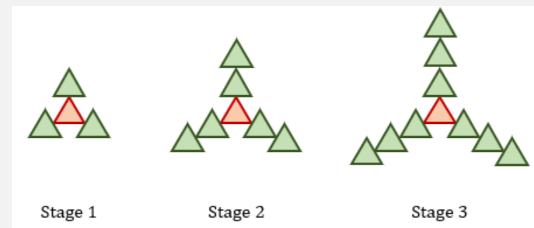
Georgia’s K-12 Mathematics Standards – 2021

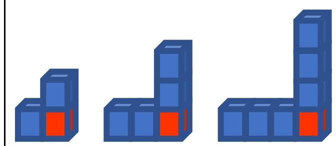
4th Grade

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: $373 \div 8 = (320 \div 8) + (40 \div 8) + (13 \div 8) = 46$ 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><th colspan="2">Expectations</th><th colspan="2">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></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>
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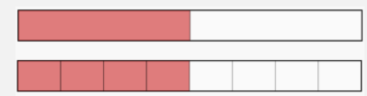
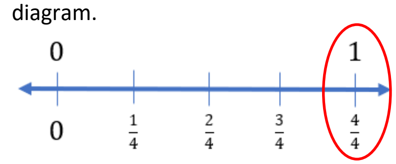
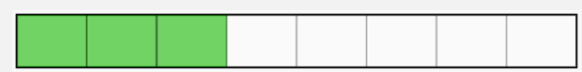
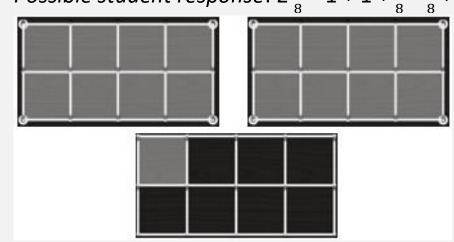
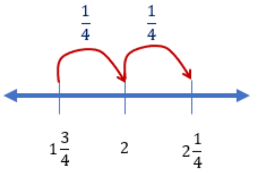
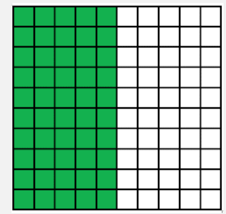
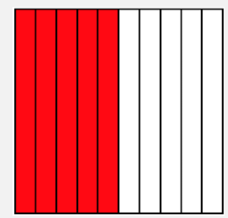
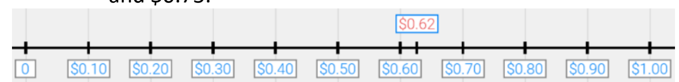
<table>
<tr><td colspan="6">NUMERICAL REASONING – fraction equivalence, comparison of fractions, and addition and subtraction of fractions with like denominators</td></tr>
<tr><td colspan="6">4.NR.4: Solve real-life problems involving addition, subtraction, equivalence, and comparison of fractions with denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100 using part-whole strategies and visual models.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr><td>4.NR.4.1</td><td>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.</td>
<td>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.</td>
<td>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.).</td>
<td>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.</td>
<td>Example
● Peter is giving half of his candy bar to four friends. Provide a mathematical representation to show this scenario.
● Possible student response: $\frac{1}{2} = \frac{(4 \times 1)}{(4 \times 2)} = \frac{4}{8}$
</td></tr>
<tr><td>4.NR.4.2</td><td>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.</td>
<td colspan="2">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.</td>
<td>Age/Developmentally Appropriate
● Students should be given fractions with common numerators to compare.</td>
<td>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</td></tr>
</table>

				colored two parts, $\frac{2}{3}$ has to be bigger than $\frac{2}{5}$. ● 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. ○ Each third (yellow) is larger than each fifth (green)
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 $\frac{5}{10} = \frac{50}{100} = \frac{1}{2}$. 

<table>
<tr>
<td>4.NR.5.2</td>
<td>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.</td>
<td>Fundamentals
• Represent decimal number values on a place value chart.</td>
<td>Age/Developmentally Appropriate
• Students are not expected to write word names of decimal numbers at this grade level.</td>
<td>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.</td>
<td>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 $0.50 and $0.75.

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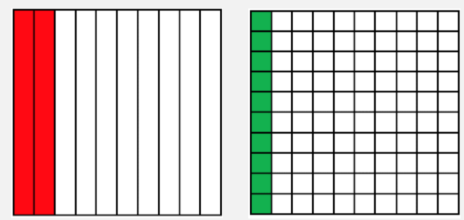
<tr>
<td>4.NR.5.3</td>
<td>Compare two decimal numbers to the hundredths place by reasoning about their size. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions.</td>
<td>Fundamentals
• Recognize that comparisons are valid only when the two decimal numbers refer to the same whole.</td>
<td colspan="2">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.</td>
<td>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, $\frac{2}{10} > \frac{10}{100}$.
</td>
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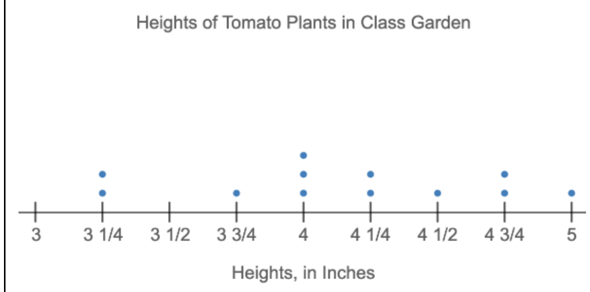
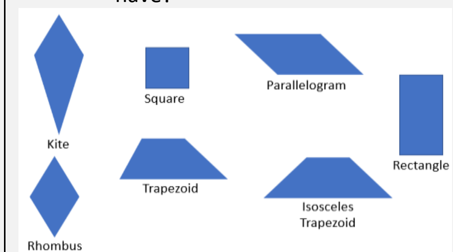
<table>
<tr><td colspan="7">MEASUREMENT & DATA REASONING – time, metric measurements, distance, elapsed time, liquid volume, mass, and length</td></tr>
<tr><td colspan="7">4.MDR.6: Measure time and objects that exist in the world to solve real-life, mathematical problems and analyze graphical displays of data to answer relevant questions.</td></tr>
<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 pentago ns.	***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.			

5th Grade

The nine standards listed below are the key content competencies students will be expected to master in fifth 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.

COURSE STANDARDS
5.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.**
5.NR.1: **Use place value understanding to solve real-life, mathematical problems.**
5.NR.2: **Multiply and divide multi-digit whole numbers to solve relevant, mathematical problems.**
5.NR.3: **Describe fractions and perform operations with fractions to solve relevant, mathematical problems using part-whole strategies and visual models.**
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.**
5.NR.5: **Write, interpret, and evaluate numerical expressions within authentic problems.**
5.PAR.6: **Solve relevant problems by creating and analyzing numerical patterns using the given rule(s).**
5.MDR.7: **Solve problems involving customary measurements, metric measurements, and time and analyze graphical displays of data to answer relevant questions.**
5.GSR.8: **Examine properties of polygons and rectangular prisms, classify polygons by their properties, and discover volume of right rectangular prisms.**

Georgia's K-12 Mathematics Standards – 2021

5th Grade

***NUMERICAL REASONING** – place value, multiplying by powers of 10, multiplication and division of multi-digit numbers, fractions, decimal numbers, numerical expressions*

5.NR.1: Use place value understanding to solve real-life, mathematical problems.

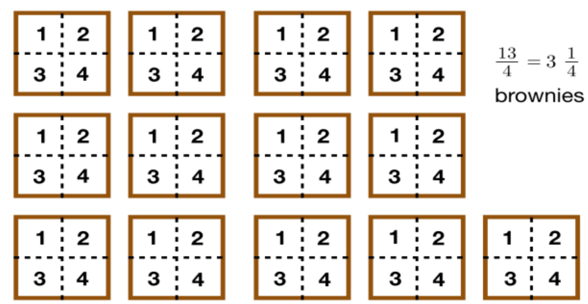
Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)	
5.NR.1.1	Explain that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.	***Fundamentals*** ● Students should identify the value of a digit up 100 times greater or $\frac{1}{1000}$ of the value of a digit.	***Examples*** ● Mara has a digital scale. He placed one playing card on the scale and it read 1.3 grams. How much would you expect 10 playing cards to weigh? ● Chris took the cards off the scale and then placed 10 pennies on the scale and the scale read 24 grams. How much would you expect one penny to weigh?
5.NR.1.2	Explain patterns in the placement of digits when multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10, up to 10^3.	***Fundamentals*** ● Students should explain what happens to the value of a digit as it shifts to the left or right and discover the decimal point remains between the ones and tenths place as the digits shift. ● Use whole-number exponents to denote powers of 10, up to 10^3.	

5.NR.2: Multiply and divide multi-digit whole numbers to solve relevant, mathematical problems.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)	
5.NR.2.1	Fluently multiply multi-digit (up to 3-digit by 2-digit) whole numbers to solve authentic problems.	***Strategies and Methods** – see special note in appendix* ● Students should be presented with realistic situations involving multiplication of multi-digit whole numbers. ● Students should fluently (flexibly, accurately, and efficiently) multiply to solve practical, mathematical problems using efficient strategies that are 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. ● Examples of different strategies and representations can be found within the *Computational Strategies for Whole Numbers* document found in the appendices.	***Age/Developmentally Appropriate*** ● Students may use but are not limited to partial products (area model). ● Students may also use a standard algorithm by making connections from previous part-whole strategies. ● Students should choose a strategy that makes sense to them based on the problem. The focus should always be on efficiency.

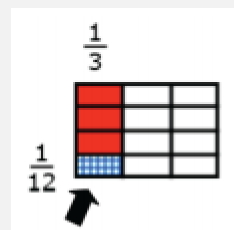
5.NR.2.2	Fluently divide multi-digit whole numbers (up to 4-digit dividends and 2-digit divisors no greater than 25) to solve practical problems.	***Strategies and Methods*** – see special note in appendix ● Students should be presented with realistic situations involving the division of multi-digit whole numbers. ● Students should be able to explain partial quotients prior to beginning to use a more formal algorithm. ● Students should fluently (flexibly, accurately, and efficiently) divide, to solve practical, mathematical problems using an efficient algorithm and flexible strategies, based on knowledge of place value and properties of operations. ● Examples of different strategies and representations can be found within the *Computational Strategies for Whole Numbers* document found in the appendices.	***Age/Developmentally Appropriate*** ● Students should divide multi-digit whole numbers up to 4-digit dividends and 2-digit divisors no greater than 25. ● Students may use but are not limited to partial quotients (area model). ● Students should choose a strategy that makes sense to them based on the problem and/or the numbers involved. The focus should always be on efficiency.

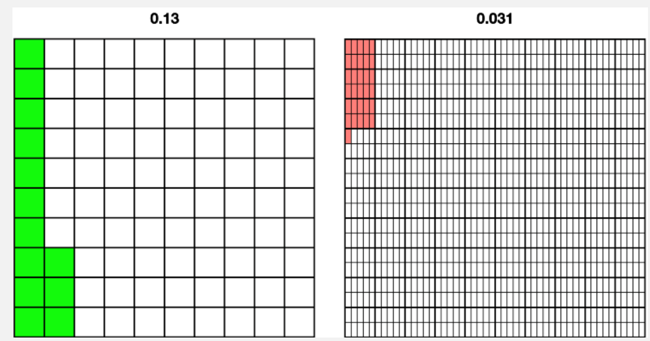
5.NR.3: Describe fractions and perform operations with fractions to solve relevant, mathematical problems using part-whole strategies and visual models.

Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
5.NR.3.1	Explain the meaning of a fraction as division of the numerator by the denominator ($\frac{a}{b} = a \div b$). Solve problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.	***Example*** ● Four children want to share 13 brownies so each child gets the same amount. How many does each child get? Possible solution: 

5.NR.3.2	Compare and order up to three fractions with different numerators and/or different denominators by flexibly using a variety of tools and strategies.	***Fundamentals*** ● Tools and strategies could include visual fraction models, create common denominators or numerators, or compare to benchmarks such as 0, 1 and 2. ● Students should compare all types of fractions, including fractions greater than one.	***Strategies and Methods*** ● Students should use familiar tools such as number lines fraction pieces, and other manipulatives to solve comparing and ordering fractions problems. ● Students should be given the opportunity to choose strategies based on the mathematical context and/or the numbers in the problem	***Examples*** ● Two customers ordered pizzas. Jamie ordered a small, and Zach ordered a large. Jamie ate $\frac{3}{4}$ of her pizza. Zach at half of his. Who ate more pizza? Since the two pizzas were different sizes, we are unable to determine who ate more without more information. ● Luke, Ella, and Janice were all given the same amount of money for their birthdays. Luke spent $\frac{3}{5}$ of his money, Ella spent $\frac{5}{8}$ of her money and Janice spent $\frac{3}{8}$ of her money. Who spent the most of their money? Who spent the least?

			to compare and order fractions. ● Students may choose strategies such as common-numerator, common denominator, using benchmark fractions, and equivalent fractions to compare and order fractions. ● 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.	*Possible student response:* "I know that $\frac{5}{8}$ is bigger than $\frac{3}{8}$ because they're both eighths and 5 is of something is more than 3. $\frac{3}{5}$ is also bigger than $\frac{3}{8}$ because fifths are bigger than eighths and there are three of each. $\frac{5}{8}$ is just a little bigger than $\frac{3}{5}$ because $\frac{15}{24}$ is just a little bigger than $\frac{15}{25}$. So, Janice spent the least, Ella spent the most, and Luke spent almost as much as Ella, but not quite."
5.NR.3.3	Model and solve problems involving addition and subtraction of fractions and mixed numbers with unlike denominators.	***Fundamentals*** ● Students should use benchmark fractions and number sense of fractions to estimate and assess the reasonableness of answers as an introduction to addition and subtraction.	***Strategies and Methods*** ● Students should use numerical reasoning to add and subtract fractions and mixed numbers with unlike denominators in authentic, mathematical problems by finding a common denominator and equivalent fractions to produce like denominators using a variety of tools and strategies. ● 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*** ● Tom is baking a cake. He added $\frac{1}{2}$ teaspoon of vanilla extract to the cake mix. He tasted the batter and determined he needed more, so he added another $\frac{3}{4}$ teaspoon of vanilla extract. How much total vanilla extract did he add to the cake mix? ● *Possible student response*: A student may decompose one of the fractions to a make a benchmark number ($\frac{1}{2}$): $\frac{1}{2}+\frac{3}{4}$ $=\frac{1}{2}+(\frac{2}{4}+\frac{1}{4})$ $=(\frac{1}{2}+\frac{2}{4})+\frac{1}{4}$ $=1\frac{1}{4}$
5.NR.3.4	Model and solve problems involving multiplication of a fraction and a whole number.	***Strategies and Methods*** ● Students should be presented with a variety of practical, mathematical problems involving multiplication of a fraction and a whole number. ● Students should use their understanding of equivalency to flexibly reason with equivalent	***Age/Developmentally Appropriate*** ● Students should explain the meaning of a fraction $\frac{a}{b}$ as a multiple of $\frac{1}{b}$. ● Students should be exposed to fractions less than 1, equal to 1, and greater than 1.	***Examples*** ● Each cupcake takes $\frac{1}{4}$ cup of frosting. If Betty wants to make 20 cupcakes for a party, how much frosting will she need? ● Mr. Rogers need to make peanut butter and jelly sandwiches for 12 children. He wants to make $\frac{3}{4}$ of a sandwich for each child. How many sandwiches does he need to make?

		fractions based on the framework of the problem. Simplifying fractions is not an expectation of this grade level. ● 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.	
5.NR.3.5	Explain why multiplying a whole number by a fraction greater than one results in a product greater than the whole number, and why multiplying a whole number by a fraction less than one results in a product less than the whole number and multiplying a whole number by a fraction equal to one results in a product equal to the whole number.	***Strategies and Methods*** ● Students should be presented with a variety of realistic, mathematical situations involving multiplication as scaling (resizing) that include fractions and whole numbers. ● 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.	***Example*** ● Mrs. Cole needs to make lunch for 12 children at a day care. Each child gets $\frac{1}{2}$ of a sandwich. How many whole sandwiches does Mrs. Cole need to make? *NOTE: The student should be able to recognize that the solution to 12 x $\frac{1}{2}$ will be less than 12 because each child only gets half of a sandwich.*
5.NR.3.6	Model and solve problems involving division of a unit fraction by a whole number and a whole number by a unit fraction.	***Strategies and Methods*** ● Students should begin with modeling for deeper understanding. ● Students should be presented with a variety of authentic problems involving division of a whole number by a unit fraction and division of a unit fraction by a whole number. ● 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. ● 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*** ● Knowing the number of groups/shares and finding how many/much in each group/share Four students sitting at a table were given $\frac{1}{3}$ of a pan of brownies to share. How much of a pan will each student get if they share the pan of brownies equally? The diagram shows the $\frac{1}{3}$ pan divided into 4 equal shares with each share equaling $\frac{1}{12}$ of the pan. 

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.			
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**	
5.NR.4.1	Read and write decimal numbers to the thousandths place using base-ten numerals written in standard form and expanded form.	***Example*** ● $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (\frac{1}{10}) + 9 \times (\frac{1}{100}) + 2 \times (\frac{1}{1000})$	***Age/Developmentally Appropriate*** ● Base-ten numerals should range between millions and thousandths. ● Students are not expected to write decimal numbers in word form. ● Exponents and decimal numbers should not be included in expanded form notation. The decimal fractions used in Grade 5 should be limited to those for which the equivalent fraction can be written as a fraction where the denominator is a power of ten.
5.NR.4.2	Represent, compare, and order decimal numbers to the thousandths place based on the meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	***Strategies and Methods*** ● Students should be presented with decimal number comparisons from relevant, mathematical situations. ● Students should have opportunities to determine and explain comparisons using a variety of tools such as concrete materials, drawings, number lines, other visual representations, and strategies.	***Example*** ● Which is greater 0.13 or 0.031? Explain. Use a visual representation to illustrate your explanation. *I think 0.13 is greater because it fills up more of the whole square than 0.031 does.* 
5.NR.4.3	Use place value understanding to round decimal numbers to the hundredths place.	***Strategies and Methods*** ● Students should round decimal numbers to the hundredths place in practical, mathematical problems using visual aids, such as a number line.	
5.NR.4.4	Solve problems involving addition and subtraction of decimal numbers to the hundredths place using a variety of strategies.	***Strategies and Methods*** ● Students should be presented with a variety of practical situations involving addition and subtraction of decimal numbers to the hundredths place. ● Students should add and subtract decimal numbers to hundredths, using concrete models, drawings, strategies based on place value, properties of operations, and the relationship between addition and subtraction; relate the	***Age/Developmentally Appropriate*** ● Students should be given the choice of which strategy they can use. ● 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.

		strategy to a written method and explain the reasoning used. ● Money may be used as a tool to aid in the student's understanding of adding and subtracting decimal numbers to the hundredths place.	

5.NR.5: Write, interpret, and evaluate numerical expressions within authentic problems.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
5.NR.5.1	Write, interpret, and evaluate simple numerical expressions involving whole numbers with or without grouping symbols to represent actual situations.	***Age/Developmentally Appropriate*** ● Simple expressions should only include two operations. ● Grouping symbols used in expressions may include parentheses, brackets, or braces. ● Nested grouping symbols (more than one grouping symbol used within another grouping symbol in an expression) should not be used within expressions at this grade level. ● Appropriate numerical expressions should be no more complex than the expressions one finds in a simple application of the associative or distributive properties. Example: 15(2 + 10)	***Strategies and Methods*** ● Students should begin with concrete models. Concrete models may include color tiles or base ten blocks for constructing area models and rods for representing numerical values.	***Example*** ● Karl brought 3 ten-packs of juice boxes to the class party. Joshua brought 4 six-packs of soda to the party. How many drinks did they bring altogether? *Possible strategy:* $(3 \times 10) + (4 \times 6)$

<table>
<tr><td colspan="5">PATTERNING & ALGEBRAIC REASONING – generating patterns, plotting ordered pairs in the first quadrant</td></tr>
<tr><td colspan="5">5.PAR.6: Solve relevant problems by creating and analyzing numerical patterns using the given rule(s).</td></tr>
<tr><th colspan="2">Expectations</th><th colspan="3">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>5.PAR.6.1</td><td>Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms by completing a table.</td><td>Fundamentals
● This standard extends the work from fourth grade, where students generate numerical patterns when they are given one rule. In Fifth Grade, students are given two rules and generate two numerical patterns.</td><td>Age/Developmentally Appropriate
● This learning objective is limited to patterns involving whole numbers.</td><td>Example
● Sam and Terri live by a lake and enjoy going fishing together every day for five days. Sam catches 2 fish every day, and Terri catches 4 fish every day. Make a chart (table) to represent the number of fish that Sam and Terri catch.
<table>
<tr><th>Days</th><th>Sam’s Total Number of Fish</th><th>Terri’s Total Number of Fish</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>2</td><td>4</td></tr>
<tr><td>2</td><td>4</td><td>8</td></tr>
<tr><td>3</td><td>6</td><td>12</td></tr>
<tr><td>4</td><td>8</td><td>16</td></tr>
<tr><td>5</td><td>10</td><td>20</td></tr>
</table></td></tr>
<tr><td>5.PAR.6.2</td><td>Represent problems by plotting ordered pairs and explain coordinate values of points in the first quadrant of the coordinate plane.</td><td colspan="2">Age/Developmentally Appropriate
● All four quadrants of the coordinate plane can be displayed, but students will only plot and label within the first quadrant.</td><td>Strategies and Methods
● Students should be provided with a variety of authentic, mathematical problems involving graphing points in the first quadrant.
● 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.
● Students should interpret coordinate values of points based on the problem or situation presented.</td></tr>
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<table>
<tr><td colspan="4">MEASUREMENT & DATA REASONING – measurements within the metric system, measurement conversions and time as a unit of measurement</td></tr>
<tr><td colspan="4">5.MDR.7: Solve problems involving customary measurements, metric measurements, and time and analyze graphical displays of data to answer relevant questions.</td></tr>
<tr><th colspan="2">Expectations</th><th colspan="2">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>5.MDR.7.1</td><td>Explore realistic problems involving different units of measurement, including distance, mass, weight, volume, and time.</td><td colspan="2">Age/Developmentally Appropriate
● Fifth grade is the first time students are expected to convert between different units within the same measurement system.
● Students should be presented with realistic problems involving distance, mass, weight, volume, and time that are practical and relevant to their everyday lives.
● Students should have opportunities to solve problems involving customary and metric measurements.
● 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></tr>
<tr><td>5.MDR.7.2</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>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>Strategies and Methods
● Questions should be student generated.</td></tr>
<tr><td>5.MDR.7.3</td><td>Convert among units within the metric system and then apply these conversions to solve multi-step, practical problems.</td><td>Age/Developmentally Appropriate
● Fifth grade is the first time students are expected to convert between different units within the same measurement system.
● Conversion chart should be provided.
● This objective is limited to the following unit conversions:
○ meters-kilo, centi, milli
○ liters-kilo, milli
○ grams - kilo, milli
● Conversions should be limited to 1000 times greater or $\frac{1}{1000}$ of the value of a given measure.</td><td>Example
● Record measurement equivalents in a two-column table.</td></tr>
<tr><td>5.MDR.7.4</td><td>Convert among units within relative sizes of measurement units within the customary measurement system.</td><td>Age/Developmentally Appropriate
● Fifth grade is the first time students are expected to convert between different units within the same measurement system.
● Conversion chart should be provided.
● This objective is limited to the following unit conversions:
○ fluid ounces, cups, pints, quarts, gallons
○ inches, feet, yards, miles
○ ounces, pounds, tons
● Conversions will be provided, such as 1 gallon = 4 quarts = 8 pints = 16 cups.
● Customary measurement units include weight (oz., lbs., tons) capacity (fl. oz, cups, pints, quarts, gallons), length (in., ft., yds., miles).</td><td>Example
● Record measurement equivalents in a two-column table.</td></tr>
</table>

GEOMETRIC & SPATIAL REASONING – *Properties of polygons and rectangular prisms, classify polygons*

5.GSR.8: Examine properties of polygons and rectangular prisms, classify polygons by their properties, and discover volume of right rectangular prisms.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)
5.GSR.8.1	Classify, compare, and contrast polygons based on properties.	***Fundamentals*** ● Students should explore, compare, and contrast polygons based on properties. ***Strategies and Methods*** ● Polygons should include triangles, quadrilaterals including kites and trapezoids (rectangles, squares, rhombuses, and other parallelograms), pentagons, hexagons, and octagons. ● Properties may include angles, side lengths, symmetry, congruence, and the presence or absence of parallel or perpendicular lines. ● Students may use a variety of tools to measure angles and side lengths to make sense of the properties of polygons. ***Age/Developmentally Appropriate*** ● This objective does not require students to create a hierarchy. ● In Georgia resources and assessments, the inclusive definitions for the classification of shapes are used.
5.GSR.8.2	Determine, through exploration and investigation, that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category.	***Age/Developmentally Appropriate*** ● This objective does not require students to create a hierarchy. ● In Georgia resources and assessments, the inclusive definitions for the classification of shapes are used. ***Example*** ● All rectangles have four right angles and squares are rectangles, so all squares have four right angles. ● Students may use a variety of tools to measure angles and side lengths to make sense of the attributes of two-dimensional figures.
5.GSR.8.3	Investigate volume of right rectangular prisms by packing them with unit cubes without gaps or overlaps. Then, determine the total volume to solve problems.	***Fundamentals*** ● Students should recognize volume as an attribute of solid figures. ***Terminology*** ● Total volume is defined as the total number of units that fill the space. ***Age/Developmentally Appropriate*** ● If students are provided with an image of a right rectangular prism, the unit cubes should be visible. ***Strategies and Methods*** ● Students should investigate authentic problems involving volume to make sense of this concept. ● Students should explore the volume of solid figures from realistic situations by packing them with unit cubes with no gaps or overlaps. ● Students should determine that a solid figure packed with n unit cubes is said to have a volume of n cubic units.
5.GSR.8.4	Discover and explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height to solve authentic, mathematical problems.	***Age/Developmentally Appropriate*** ● This objective does not require students to memorize a formula for the volume of a right rectangular prism. Rather, students are expected to use geometric and spatial reasoning to determine the volume, given the area of the base and the height. ***Fundamentals*** ● Students should explore the dimensions of all possible rectangular prisms given a total number of cubic units. ● The focus of this expectation is for students to understand the concept of volume rather than the formula. ***Terminology*** ● The dimensions of a rectangular prism can be referred to as length, width, and height. ● A cube with side length 1 unit, called "a unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume (e.g., cubic cm, cubic m, cubic in, cubic ft). ***Example*** ● We store our wooden unit cubes in a rectangular box that has a base with an area of 64 square units. The height of the box is 8 units. What is the volume of the box? Show your mathematical thinking.

Georgia’s K-12 Mathematics Standards – 2021
Mathematics Big Ideas and Learning Progressions, 6-8

Mathematics Big Ideas, 6-8

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6-8 MATHEMATICS: LEARNING PROGRESSIONS

Key Concepts	5	6	7	8	HS Algebra: Concepts & Connections	HS Geometry: Concepts & Connections
			NUMERICAL REASONING			
Numbers (rational numbers and irrational numbers)	• Multi-digit whole numbers • Fractions with unlike denominators • Fractions greater than 1 • Decimal numbers to thousandths • Powers of 10 to 10^3	• Rational numbers as a concept ○ Integers ○ Fractions ○ Decimal numbers	• All rational numbers • Simple probability	• All rational numbers • Scientific notation • Numerical expressions with integer exponents • Use appropriate counting strategies to approximate rational and irrational numbers (radicals) on a number line	• All rational numbers • Operations with radicals	• All numbers in The Real Number System
Computational Fluency	• Add & subtract fractions with unlike denominators • Add and subtract decimal numbers to the hundredths place • Multiply & divide multi-digit whole numbers • Multiply fractions and whole numbers • Divide unit fractions and whole numbers • Reason about multiplying by a fraction >, <, or = 1	• All operations with whole numbers, fractions, and decimal numbers • Write & evaluate numerical expressions • Convert fractions with denominators of 2, 4, 5 and 10 to the decimal notation	• Operations with rational numbers • Rational numbers • Convert fractions with all denominators to decimal numbers	• Operations with scientific notation • Scientific notation in real situations seen in everyday life • Expressions with integer exponents	• Operations with real numbers (rational and irrational) • Multiplication of irrational numbers	
Comparisons	• Decimal fractions to thousandths place • Fractions greater than 1	• Integers • Unit rates • Ratios • Numerical data distributions • Measures of variation • Absolute value • Display and analyze categorical and quantitative (numerical) data	• Rational numbers • Probabilities • Random sampling	• Rational and irrational numbers (radicals) • Compare proportional relationships presented in different ways	• Rate of change (slope) • Intercept • Distributions of two or more data sets	

6-8 MATHEMATICS: LEARNING PROGRESSIONS

Key Concepts	5	6	7	8	HS Algebra: Concepts & Connections	HS Geometry: Concepts & Connections
PATTERNING & ALGEBRAIC REASONING						
Patterns	• Generate two numerical patterns from a given rule • Identify relationships using a table	• Greatest common factor & least common multiple	• Constant of proportionality	• Integer exponents • Perfect squares and perfect cubes	• Arithmetic sequences • Geometric sequences	
Expressions	**Numerical Reasoning** • Simple numerical expressions involving whole numbers with or without grouping symbols • Express fractions as division problems	• Write, analyze, and evaluate numerical and algebraic expressions • Identify, generate, and evaluate algebraic expressions • Identify like terms in an algebraic expression	• Add, subtract, factor & expand linear expressions • Rewrite expressions • Fluency with combining like terms in an algebraic expression • Linear expressions with rational coefficients	• Expressions with integer exponents • Linear expressions • Operations with algebraic expressions	• Exponential expressions • Quadratic expressions	• Expressions of varying degrees • Add, subtract, multiply single variable polynomials • Adding, Subtracting and Multiplying Polynomials • Factoring and expanding polynomials
Variable Equations & Inequalities		• Write and solve one-step equations & inequalities	• Construct & solve multi-step algebraic equations and inequalities	• Analyze and solve linear equations and inequalities	• Exponential equations • Quadratic equations • Equations of parallel and perpendicular lines • Analyze and solve linear inequalities	• Equations involving geometric measurement
Ratios & Rates		**Numerical Reasoning with ratios and rates:** • Concept of ratio and rate • Equivalent ratios, percentages, unit rates • Convert within measurement systems	• Compute unit rates associated with ratios of fractions • Determine unit rates	• Interpret unit rate as the slope of a graph	• Convert units and rates given a conversion factor	• Side ratios of similar triangles • Trigonometric ratios
Proportional Relationships			• Use proportional relationships • Solve multi-step ratio and percent problems • Scale drawings of geometric figures • Use similar triangles to explain slope			
Graphing	• Plot order pairs in first quadrant	• Plot order pairs in all four quadrants • Show rational numbers on a number line • Draw polygons on a coordinate grid • Find the side length of a polygon graphed on the coordinate plane (same x- or y- coordinate)	• Proportional relationships	• Linear functions • Comparing linear and non-linear functions • Systems of linear equations (including parallel and perpendicular) • Linear inequalities • Analyze data distributions	• Linear functions with function notation • Exponential functions • Quadratic functions • Systems of linear inequalities	• Equations of circles in standard form

6-8 MATHEMATICS: LEARNING PROGRESSIONS						
Key Concepts	**5**	**6**	**7**	**8**	**HS Algebra: Concepts & Connections**	**HS Geometry: Concepts & Connections**
FUNCTIONAL & GRAPHICAL REASONING						
Function Families				• Linear functions • Line of best fit	• Linear functions with function notation • Parent graphs of function families • Exponential functions • Quadratic functions	• Function notation to represent transformations
GEOMETRIC & SPATIAL REASONING						
Shapes & Properties	• Classify polygons based on geometric properties		• Measure angles using non-standard and standard tools • Write & solve equations using supplementary, complementary, vertical, and adjacent angles	• Introduction to Pythagorean Theorem and the converse		• Develop and use precise definitions to prove theorems and solve geometric problems • Prove slope criteria for parallel and perpendicular lines • Transform polygons using rotations, reflections, dilations, and translations. • Congruence and trans-formations • Triangle congruence • Use congruence to prove relationships in geometric figures • Similarity and dilations • Similar triangles • Use similarity to prove relationships in geometric figures • Formal proofs & theorems about triangles • Trigonometric ratios (Sin, Cos, & Tan)

6-8 MATHEMATICS: LEARNING PROGRESSIONS						
Key Concepts	**5**	**6**	**7**	**8**	**HS Algebra: Concepts & Connections**	**HS Geometry: Concepts & Connections**
GEOMETRIC & SPATIAL REASONING (cont.)						
Geometric Measurement	• Volume of right rectangular prisms	• Area of triangles, quadrilaterals, and polygons • Surface area • Volume of right rectangular prisms with fractional edge lengths	• Relationship between parts of a circle • Area & circumference of a circle • Area and surface area of figures decomposed into triangles, quadrilaterals & circles • Volume of cubes, right prisms & cylinders	• Pythagorean Theorem to determine distance between two points • Volume of cones, cylinders, and spheres	• Use distance formula, midpoint formula, and slope to calculate perimeter and area of triangles and quadrilaterals	• Volumes of prisms, cones, cylinders, pyramids, and spheres • Approximate volumes of irregular objects • Approximate density of irregular objects
PROBABILITY REASONING						
Probability			• Represent probability • Approximate probability • Develop probability models (uniform & not uniform) • Find probabilities of simple events			• Categorical data & two-way frequency tables • Interpret probabilities in context

6th Grade

The nine standards listed below are the key content competencies students will be expected to master in sixth 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.

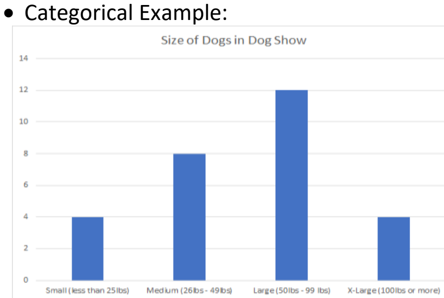
COURSE STANDARDS
6.MP: **Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals.**
6.NR.1: **Solve relevant, mathematical problems involving operations with whole numbers, fractions, and decimal numbers.**
6.NR.2: **Apply operations with whole numbers, fractions and decimals within relevant applications.**
6.NR.3: **Solve a variety of problems involving whole numbers and their opposites; model rational numbers on a number line to describe problems presented in relevant, mathematical situations.**
6.NR.4: **Solve a variety of contextual problems involving ratios, unit rates, equivalent ratios, percentages, and conversions within measurement systems using proportional reasoning.**
6.GSR.5: **Solve relevant problems involving area, surface area, and volume.**
6.PAR.6: **Identify, write, evaluate, and interpret numerical and algebraic expressions as mathematical models to explain relevant situations.**
6.PAR.7: **Write and solve one-step equations and inequalities as mathematical models to explain authentic, realistic situations.**
6.PAR.8: **Graph rational numbers as points on the coordinate plane to represent and solve contextual, mathematical problems; draw polygons using the coordinates for their vertices and find the length of a side of a polygon.**

Georgia’s K-12 Mathematics Standards – 2021

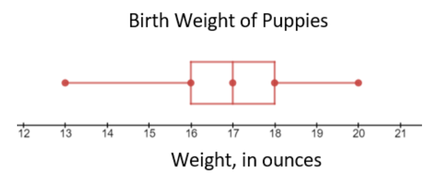
6TH GRADE

NUMERICAL REASONING *– multiplication and division of whole numbers and fractions, and all four operations with decimal numbers*				
6.NR.1: Solve relevant, mathematical problems involving operations with whole numbers, fractions, and decimal numbers.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
6.NR.1.1	Fluently add and subtract any combination of fractions to solve problems.	***Terminology*** ● Fluently/Fluency – Students choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.	***Strategies and Methods*** ● Students should be able to use numerical reasoning to interpret applicable, mathematical situations involving fractions. ● Students should be given the opportunity to apply reasoning strategies while solving problems. ● 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.	***Age/Developmentally Appropriate*** ● Students should be allowed to choose an appropriate strategy to demonstrate fluency.
6.NR.1.2	Multiply and divide any combination of whole numbers, fractions, and mixed numbers using a student-selected strategy. Interpret products and quotients of fractions and solve word problems.	***Strategies and Methods*** ● Students should be able to utilize fractions with denominators including 2, 3, 4, 5, 6, 8, 10, and 12. ● Students should be able to use numerical reasoning to interpret applicable, mathematical situations involving fractions. ● Students can use a variety of strategies, including but not limited to concrete models, visual fraction models, student-generated strategies, a standard algorithm, or other strategies based on numerical reasoning to represent and solve problems. ● Students should be given the opportunity to apply reasoning strategies and use written methods that make sense to them. ● Students should use flexible, accurate, and efficient written methods to express computational thinking based on numerical reasoning and sense-making developed from learning experiences that focus on the numbers as quantities. ● 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.	***Fundamentals*** ● Students should use their understanding of equivalency to flexibly reason with equivalent fractions based on the context of the problem. Simplifying fractions is not an expectation of this grade level. ● Students should be able to use the meanings of fractions, multiplication, division and the inverse relationship between multiplication and division to make sense of multiplying and dividing fractions.	***Example*** ● How many $\frac{3}{4}$-cup servings are in $\frac{2}{3}$ of a cup of yogurt?

<table>
<tr>
<td>6.NR.1.3</td>
<td>Perform operations with multi-digit decimal numbers fluently using models and student-selected strategies.</td>
<td>Fundamentals
● Fluently/Fluency – Students choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.</td>
<td>Strategies and Methods
● Students should be able to use a variety of part-whole strategies to compute efficiently (area model, partial product, partial quotient).
● The part-whole strategies used should be flexible and extend from previous computation strategies and future work with computation.
● Students should use models and student-selected strategies as an efficient written method of demonstrating place value understanding for each operation (addition, subtraction, multiplication, and division).
● 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.</td>
<td>Terminology
● Decimal number – a number whose whole number part and fractional part are separated by a decimal point.</td>
</tr>
</table>

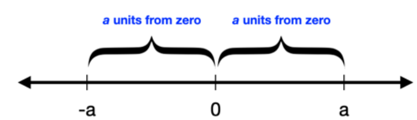
<table>
<tr><td colspan="6">6.NR.2: Apply operations with whole numbers, fractions and decimals within relevant applications.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr>
<td>6.NR.2.1</td>
<td>Describe and interpret the center of the distribution by the equal share value (mean).</td>
<td colspan="2">Age/Developmentally Appropriate
● The concept of mean should be explored visually and conceptually before introducing the formula.
● This is the beginning of the progression of the concept of measures of center and will continue to be developed in 6th grade.</td>
<td>Strategies and Methods
● Students should be given the opportunity to use manipulatives such as: snap cubes, tiles, etc...to model equal share value.</td>
<td>Example
● “If we combined all of the 5th grade students’ candies and shared them equally with each student so everyone has the same number of candies.” (This is the mean or equal share value.)</td>
</tr>
<tr>
<td>6.NR.2.2</td>
<td>Summarize categorical and quantitative (numerical) data sets in relation to the context: display the distributions of quantitative (numerical) data in plots on a number line, including dot plots, histograms, and box plots and display the distribution of categorical data using bar graphs.</td>
<td>Fundamentals
● Students have experience with displaying categorical data using bar graphs from elementary grades. In sixth grade, students are extending their understanding of analyzing categorical data</td>
<td>Strategies and Methods
● As a result of an investigation, students should summarize categorical and quantitative (numerical) data sets in relation to the context.
● Students should be able to describe the</td>
<td>Age/Developmentally Appropriate
● Sixth grade students should be able to create dot plots and box plots to analyze the results of an investigation.
● Sixth grade students should focus on describing and interpreting data displayed.
● Students should be able to identify that each quartile presented in a box plot</td>
<td>Examples
● Categorical Example:


What could be the weight of the smallest dog? The largest?</td>
</tr>
</table>

		displayed on histograms.	nature of the attribute under investigation, including how it was measured and its units of measurement.	represents 25% of the data set.	● Quantitative (Numerical) Example: Here are the birth weights, in ounces, of all the puppies born at a kennel in the past month.  What do you notice and wonder about the distribution of the puppy weights?
6.NR.2.3	Interpret numerical data to answer a statistical investigative question created. Describe the distribution of a quantitative (numerical) variable collected, including its center, variability, and overall shape.	***Fundamentals*** ● In sixth grade, students should explore the conceptual idea of MAD – not the formula. ● Students should be able to determine the number of observations from a context or diagram. ● Students should be able to describe the distribution of a quantitative (numerical) variable collected, including its center (median, mean), variability (interquartile range (IQR), mean absolute deviation (MAD), and range), and overall shape (symmetrical vs non-symmetrical).	***Terminology*** ● Students should be able to apply their understanding of absolute value (rather than use operations on negative integers) in the context of MAD.	***Strategies and Methods*** ● Students should explore conceptually the measures of center (mean, median) and variability (interquartile range and range) for a set of numerical data gathered from relevant, mathematical situations and use these measures to describe the shape of the data presented in various forms.	***Example*** ● Arthur and Aaron are on the same 6th grade basketball team. Both players have scored an average of ten points over the past ten games. Here are the students' number of points scored during each of the last ten games. Arthur: 9, 10, 10, 11, 11, 9, 10, 10, 10, 10 Aaron: 16, 18, 4, 3, 5, 13, 18, 3, 13, 7 Which student is more consistent? Possible Student Response/Solution: Arthur is more consistent because his MAD is smaller than Aaron's MAD; Arthur has less variability than Aaron.

		● Data sets can be limited to no more than 10 data points when exploring the mean absolute deviation. ● Students should be able to describe the nature of the attribute under investigation, including how it was measured and its units of measurement.			
6.NR.2.4	Design simple experiments and collect data. Use data gathered from realistic scenarios and simulations to determine quantitative measures of center (median and/or mean) and variability (interquartile range and range). Use these quantities to draw conclusions about the data, compare different numerical data sets, and make predictions.	***Fundamentals*** ● Students should be able to use quantitative measures of center and variability to draw conclusions about data sets and make predictions based on comparisons. ● Students should be able to identify that each quartile represents 25% of the data set.		***Strategies and Methods*** ● Students should apply understanding of the measures of center (mean, median) and variability (interquartile range and range) to determine quantitative measures of center and variability, draw conclusions about the data, compare different-numerical data sets and make predictions using data gathered from realistic scenarios and simulations.	
6.NR.2.5	Relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.	***Fundamentals*** ● Students should understand the concept of outliers.		***Strategies and Methods*** ● Students should be able to analyze the shape of a data distribution and determine which measure of center and variability best describes the data based on the shape of the data and the context in which the data was gathered.	
6.NR.2.6	Describe the impact that inserting or deleting a data point has on the mean and the median of a data set. Create data displays using a dot plot or box plot to examine this impact.	***Strategies and Methods*** ● Students should be able to analyze the shape of a data distribution and determine the impact single data points have on the data set represented visually.			

6.NR.3: Solve a variety of problems involving whole numbers and their opposites; model rational numbers on a number line to describe problems presented in relevant, mathematical situations.

Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
6.NR.3.1	Identify and compare integers and explain the meaning of zero based on multiple authentic situations.	***Relevance and Application*** ● Students should be able to use numerical reasoning to explain that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, debits/credits, positive/negative electric charge). ● Students should be able to use positive and negative numbers to represent quantities in authentic situations and explain the meaning of zero based on each situation. ● Students should be able to interpret relevant, mathematical problems related to positive and negative numbers.	***Example*** ● Write –5°C > –9°C to express the fact that –5°C is warmer than –9°C.	
6.NR.3.2	Order and plot integers on a number line and use distance from zero to discover the connection between integers and their opposites.	***Strategies and Methods*** ● Students should have opportunities to explore this concept using visual models to develop a deeper understanding. ● Number lines should be indicated both vertically and horizontally.	***Example*** ● Students should be able to recognize that -a is the same distance from zero as a, and therefore, are opposites of each other.  	
6.NR.3.3	Recognize and explain that opposite signs of integers indicate locations on opposite sides of zero on the number line; recognize and explain that the opposite of the opposite of a number is the number itself.	***Fundamentals*** ● Students should be able to explain that zero is its own opposite. ● Students should be able to explain that the sign of an integer represents its position relative to zero on a number line. ● Students should be able to show and explain why –(–a) = a. Which is read as, "The opposite of the opposite of a is the same as a."		
6.NR.3.4	Write, interpret, and explain statements of order for rational numbers in authentic, mathematical situations. Compare rational	***Strategies and Methods*** ● Students should be able to use numerical reasoning to interpret and explain the meaning of numerical statements of inequality as the	***Terminology*** ● Rational numbers are numbers that can be written as a fraction where the numerator and denominator are integers.	***Examples*** ● Write –3 degrees Celsius > –7 degrees Celsius to express the fact that –3 degree Celsius is warmer than –7 degrees Celsius.

	numbers, including integers, using equality and inequality symbols.	relative position of two integers positioned on a number line. ● Students are introduced to rational numbers. Students should connect their understanding of fractions and integers to comprehend rational numbers as numbers that can be written as a fraction where the numerator and denominator are integers.		● Interpret –8.3 > –12.3 as a statement that –8.3 is located to the right of –12.3 on a number line oriented from left to right.
6.NR.3.5	Explain the absolute value of a rational number as its distance from zero on the number line; interpret absolute value as distance for a positive or negative quantity in a relevant situation.	***Terminology*** ● Absolute value is a number's distance from zero (0) on a number line.	***Fundamentals*** ● Students should be introduced to the absolute value symbol with this learning objective, i.e., $\lvert -\frac{3}{4} \rvert$. ● Students should conclude through exploration that absolute value and distance are always expressed as a positive value.	***Example*** For an account balance of –51.25 dollars, write |–51.25| = 51.25 to describe the size of the debt in dollars.
6.NR.3.6	Distinguish comparisons of absolute value from statements about order.	***Example*** ● Recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.		

6.NR.4: Solve a variety of contextual problems involving ratios, unit rates, equivalent ratios, percentages, and conversions within measurement systems using proportional reasoning.		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
6.NR.4.1	Explain the concept of a ratio, represent ratios, and use ratio language to describe a relationship between two quantities.	***Strategies and Methods*** ● Students should be able to solve problems involving ratios found in everyday situations. ● Students should be given the opportunity to represent and explain the concept of a ratio and the relationship between two quantities using concrete materials, drawings, tape diagrams (bar models), double number line diagrams, equations, and standard fractional notation. ***Fundamentals*** ● Students should be able to explain the concept of a ratio, such as using part-to-part or part-to-whole. ● Students should be able to fluently use ratio language to describe a ratio relationship between two quantities. ● Students should be able to identify standard fractional notation to compare. ***Example*** ● The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak. ● For every vote candidate A received, candidate C received nearly three votes.
6.NR.4.2	Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.	***Strategies and Methods*** ● Students should be able to solve problems involving ratios found in realistic situations.
6.NR.4.3	Solve problems involving proportions using a variety of student-selected strategies.	***Strategies and Methods*** ● Students should be given opportunities to utilize student-selected strategies to solve applicable, mathematical problems involving proportions. ● Students should be given the opportunity to use concrete materials, drawings, tables of equivalent ratios, tape diagrams (bar models), double number line diagrams, and equations when solving problems. ● Students can choose a strategy from a variety of strategies developed to solve a specific problem depending on the situation presented in the problem.
6.NR.4.4	Describe the concept of rates and unit rate in the context of a ratio relationship.	***Strategies and Methods*** ● Students should create a table of values displaying the ratio relationships to graph ordered pairs of distances and times. ● Students should write equations to represent ***Fundamentals*** ● When asked practical, mathematical questions, students should demonstrate an understanding of ***Terminology*** ● Students should understand a unit rate as a relationship of a:b where b = 1 ($\frac{a}{b}$ associated ***Examples*** ● We paid $75 for 15 hamburgers, which is a rate of $5 per one hamburger? ● In a problem involving motion at a constant speed, list and graph

		the relationship between distance and time where the unit rate is the simple multiplicative relationship. ● Students should be able to determine the independent and dependent relationship of rate relationships within authentic, mathematical situations.	simple multiplicative relationships involving unit rates.	with a ratio a: b with b ≠ 0 (b not equal to zero), and use rate language).	ordered pairs of distances and times, and write an equation such as d = 65t to represent the relationship between distance and time. In this example, 65 is the unit rate or simple multiplicative relationship.
6.NR.4.5	Solve unit rate problems including those involving unit pricing and constant speed.	***Example*** ● If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?			
6.NR.4.6	Calculate a percent of a quantity as a rate per 100 and solve everyday problems given a percent.	***Strategies and Methods*** ● Students should be able to calculate the percentage of a number using proportional reasoning developed through working with ratios and rates. ● Students should be able to solve contextual problems involving finding the whole given a part and the part given the whole. ● Students should determine what percent one number is of another number to solve authentic, mathematical problems.			***Fundamentals*** ● Students should have opportunities to explore the concept of percentage and recognize the connection between fractions, decimal numbers, and percentages, such as, 25% of a quantity means $\frac{25}{100}$ or .25 times the quantity. ● Students should be able to convert fractions with denominators of 2, 4, 5 and 10 to the decimal notation.
6.NR.4.7	Use ratios to convert within measurement systems (customary and metric) to solve authentic problems that exist in everyday life.	***Strategies and Methods*** ● Students should be able to use flexible, strategic thinking to manipulate and transform units appropriately when multiplying or dividing quantities to solve practical, mathematical problems. ● Students should be able to convert measurement units when given a conversion factor within one system of measurement and between two systems of measurement (customary and metric) using proportional reasoning developed through working with ratios and rates.			***Example*** ● Given 1 in. = 2.54 cm, how many centimeters are in 6 inches?

GEOMETRIC & SPATIAL REASONING *– area of polygons, volume of right rectangular prisms, surface area of 3-D figures*				
6.GSR.5: Solve relevant problems involving area, surface area, and volume.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
6.GSR.5.1	Explore area as a measurable attribute of triangles, quadrilaterals, and other polygons conceptually by composing or decomposing into rectangles, triangles, and other shapes. Find the area of these geometric figures to solve problems.	***Age and Developmentally Appropriate*** ● Students should build on prior knowledge of area to investigate the area of other polygons through geometric and spatial reasoning tasks.	***Strategies and Methods*** ● Students should be able to use knowledge of area of a rectangle to determine the area of a triangle. ● Students should have opportunities to find the area of a triangle by decomposing the rectangle into two triangles. ● Students should conclude the area of the triangle is half the area of the rectangle and the area of the rectangle is twice the area of the triangle. Therefore, the formula for the area of a triangle is $\frac{1}{2}$ x base x height or $\frac{base\ x\ height}{2}$. ● Students should be able to use geometric and spatial reasoning to calculate the area of a triangle, quadrilateral, and regular polygon by composing or decomposing into shapes, such as, but not limited to triangles, rectangles, trapezoids, rhombi, etc. ● Students should be presented with mathematical problems found in the real world. ● Students should be able to decompose regular and irregular polygons into triangles and quadrilaterals in a way that makes sense from their perspective.	***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.

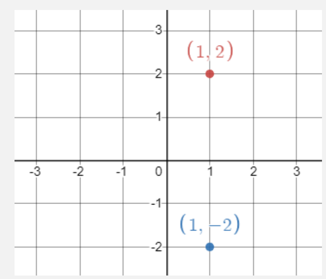
<table>
<tr><td>6.GSR.5.2</td><td>Given the net of three-dimensional figures with rectangular and triangular faces, determine the surface area of these figures.</td><td colspan="2">Strategies and Methods
Students should use various tools and strategies including a picture or physical model of a net to measure the surface area of three-dimensional figures that are composed of rectangular and triangular faces when solving practical, mathematical problems.</td><td colspan="2">Age and Developmentally Appropriate
Students should be provided the net of three-dimensional figures to ensure developmental appropriateness.</td></tr>
<tr><td>6.GSR.5.3</td><td>Calculate the volume of right rectangular prisms with fractional edge lengths by applying the formula, V = (area of base) x (height).</td><td>Age and Developmentally Appropriate
Fractional edge lengths should be limited to fractions with a denominator of 2, 3, and 5.
At this grade level, problems should not include volume displacement.</td><td colspan="2">Fundamentals
Students should make the connection between (length) x (width) and the area of the base to connect this formula to other three-dimensional volume formulas.</td><td>Strategies and Methods
Students should be able to calculate the volume of a right rectangular prism with fractional edge lengths and show that the volume is the same as would be found by multiplying the edge lengths of the prism.
Students should apply the formula for the volume of a right rectangular prism in the context of solving authentic, mathematical problems to meet this learning objective.</td></tr>
</table>

<table>
<tr><td colspan="5">PATTERNING & ALGEBRAIC REASONING – numerical and algebraic expressions, factors, multiples, algebraic expressions, plotting points in all four quadrants, rational numbers on a number line, polygons in the coordinate plane</td></tr>
<tr><td colspan="5">6.PAR.6: Identify, write, evaluate, and interpret numerical and algebraic expressions as mathematical models to explain authentic situations.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="3">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr><td>6.PAR.6.1</td><td>Write and evaluate numerical expressions involving rational bases and whole-number exponents.</td><td colspan="3">Strategies and Methods
Students should interpret relevant, mathematical situations to write and evaluate numerical expressions.</td></tr>
<tr><td>6.PAR.6.2</td><td>Determine greatest common factors and least common multiples using a variety of strategies to make sense of applicable problems.</td><td>Strategies and Methods
Investigate the distributive property using sums and its use in adding numbers 1-100 with a common factor.
Students should apply these strategies to solve applicable, mathematical problems.</td><td>Age/Developmentally Appropriate
Students should also be able to apply the least common multiple of two whole numbers less than or equal to 12 to solve applicable, mathematical problems.
Students should be able to determine the greatest common factor of 2 whole numbers (from</td><td>Example
Hotdogs come in a package of 8 and buns in a package of 12. How many packages of hot dogs and packages of buns would you need to purchase to have an equal number of hot dogs and buns?</td></tr>
</table>

			1-100) and use the distributive property to express a sum of two whole numbers with a common factor as a multiple of a sum of two whole numbers with no common factors (GCF).
6.PAR.6.3	Write and read expressions that represent operations with numbers and variables in realistic situations.	***Strategies and Methods*** ● Students should identify parts of an expression using mathematical terms (sum, difference, term, product, factor, quotient, coefficient, variable, constant); view one or more parts of an expression as a single entity. ● Students should translate from a word form into variable expression. ● Students should understand letters called variables represent unknown numbers and the same rules apply in operations with numbers also apply in operations with variables.	***Examples*** ● Express the calculation “Subtract x from 9” as 9 – x. ● Describe the expression 2(8+7) as a product of two factors; view (8+7) as both a single entity and a sum of two terms. ● Some of the students at Georgia Middle School like to walk to and from school. They always walk unless it rains. Let d be the distance in miles from a student's home to the school. Write two different expressions that represent how far a student travels by walking in a two-week period if there is one rainy day each week. ● Possible Solution: The distance to school, and therefore home, is d. Thus, the student rides (d + d) miles in one day. Equivalently, she rides (2d) miles in one day. Repeatedly adding the distance traveled in one day for each school day of the week, we find that in one week the student travels (2d + 2d + 2d + 2d + 2d) miles. Equivalently, she travels 5(2d) or (10d) miles in a normal, rain free week.
6.PAR.6.4	Evaluate expressions when given values for the variables, including expressions that arise in everyday situations.	***Fundamentals*** ● Students should evaluate algebraic expressions for a given value of a variable, using the order of operations. ● Students should perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).	
6.PAR.6.5	Apply the properties of operations to identify and generate equivalent expressions.	***Example*** ● Apply the distributive property to the expression 3(2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6(4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.	***Age/Developmentally Appropriate*** ● This standard includes distributive property and combining like terms.

6.PAR.7: Write and solve one-step equations and inequalities as mathematical models to explain authentic, realistic situations.		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
6.PAR.7.1	Solve one-step equations and inequalities involving variables when values for the variables are given. Determine whether an equation and inequality involving a variable is true or false for a given value of the variable.	***Strategies and Methods*** ● Students should be able to use algebraic reasoning to solve an equation as a process of answering an authentic question and explain their reasoning. ● When solving an equation or inequality as a process of answering a question, students should be able to explain why specific values from a specified set, if any, make the equation or inequality true. ● Students should use substitution to determine whether a given number in a specified set makes an equation or inequality true.
6.PAR.7.2	Write one-step equations and inequalities to represent and solve problems; explain that a variable can represent an unknown number or any number in a specified set.	***Age/Developmentally Appropriate*** ● Students should be able to represent equations involving positive variables and rational numbers. ● Students should have opportunities to solve relevant, mathematical problems. ***Strategies and Methods*** ● Students should have an opportunity to solve problem situations with variables in all positions. ● Students should be able to explain that a variable can represent an unknown number, or depending on the purpose at hand, any number in a specified set.
6.PAR.7.3	Solve problems by writing and solving equations of the form $x \pm p = q$, $px = q$ and $\frac{x}{p} = q$ for cases in which p, q and x are all nonnegative rational numbers.	***Strategies and Methods*** ● Students should have opportunities to use concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction and multiplication and division when solving one-step equations. ● Students should be able to solve equations presented in applicable, mathematical problems involving positive rational numbers using number sense, properties of arithmetic and the idea of maintaining equality on both sides of the equation. ● Students should be able to interpret a solution in the original context and assess the reasonableness of results.
6.PAR.7.4	Recognize and generate inequalities of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ to explain situations that have infinitely many solutions; represent solutions of such inequalities on a number line.	***Strategies and Methods*** ● Students should represent authentic, mathematical situations using inequalities involving variables. ● Students should be able to create practical, mathematical situations corresponding to specific inequalities. ● This objective includes the use of the symbols: <, >, =, ≤, ≥.

6.PAR.8: Graph rational numbers as points on the coordinate plane to represent and solve contextual, mathematical problems; draw polygons using the coordinates for their vertices and find the length of a side of a polygon.

<table>
<tr><th colspan="2">Expectations</th><th colspan="3">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>6.PAR.8.1</td><td>Locate and position rational numbers on a horizontal or vertical number line; find and position pairs of integers and other rational numbers on a coordinate plane.</td><td colspan="2">Fundamentals
● Students should use numerical and graphical reasoning to plot points in all four quadrants on the coordinate plane.</td><td>Strategies and Methods
● Students should extend understanding of number lines and coordinate axes from previous grades to represent points on the line and in the plane with negative number coordinates.</td></tr>
<tr><td>6.PAR.8.2</td><td>Show and explain that signs of numbers in ordered pairs indicate locations in quadrants of the coordinate plane and determine how two ordered pairs may differ based only on the signs.</td><td>Fundamentals
● Students should use numerical and graphical reasoning to interpret points in all four quadrants on the coordinate plane based on the signs.</td><td>Strategies and Methods
● Students should use numerical and graphical reasoning to show and explain the relationship between ordered pairs and location in quadrants of the coordinate plane.</td><td>Example
● A student is able to compare and explain that (1, 2) is in the first quadrant whereas (1, -2) is in the fourth quadrant because the y-coordinate is negative and the two points are the same distance from the horizontal axes in different directions.

</td></tr>
<tr><td>6.PAR.8.3</td><td>Solve problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same x-coordinate or the same y-coordinate.</td><td colspan="2">Relevance and Application
● Students should be able to solve relevant, mathematical problems when graphing points.</td><td>Strategies and Methods
● Students should be expected to solve relevant problems within the context of a graph only.</td></tr>
<tr><td>6.PAR.8.4</td><td>Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same x-coordinate or the same y-coordinate.</td><td colspan="2">Relevance and Application
● Students should apply the techniques of graphing in the coordinate plane to solve relevant problems involving the application of algebra through geometry.</td><td>Strategies and Methods
● Students should be able to solve problems with polygons when given coordinate pairs with or without a coordinate grid.</td></tr>
</table>

7th Grade

The seven standards listed below are the key content competencies students will be expected to master in seventh 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.

COURSE STANDARDS
7.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.**
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.PAR.2: **Use properties of operations, generate equivalent expressions and interpret the expressions to explain relevant situations.**
7.PAR.3: **Represent authentic situations using equations and inequalities with variables; solve equations and inequalities symbolically, using the properties of equality.**
7.PAR.4: **Recognize proportional relationships in relevant, mathematical problems; represent, solve, and explain these relationships with tables, graphs, and equations.**
7.GSR.5: **Solve practical problems involving angle measurement, circles, area of circles, surface area of prisms and cylinders, and volume of cylinders and prisms composed of cubes and right prisms.**
7.PR.6: **Using mathematical reasoning, investigate chance processes and develop, evaluate, and use probability models to find probabilities of simple events presented in authentic situations.**

Georgia’s K-12 Mathematics Standards – 2021

7^{TH} Grade

***NUMERICAL REASONING** – integers, percentages, fractions, decimal numbers*

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).

	Expectations	Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)
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.	***Terminology*** • In the equation 3 + −3 = 0, 3 and −3 are additive inverses of each other. ***Example*** • Your bank account balance is − \$25.00. You deposit \$25.00 into your account. The net balance is \$0.00.
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.	***Strategies and Methods*** • Students should be able to add and subtract integers and other rational numbers presented within relevant, mathematical problems, using strategic thinking and a variety of tools. ***Example*** • 6 + (–4) is 4 units to the left of 6 on a horizontal number line or 4 units down from 6 on a vertical number line.
7.NR.1.3	Represent addition and subtraction with rational numbers on a horizontal or a vertical number line diagram to solve authentic problems.	***Strategies and Methods*** • Students should represent a variety of types of rational numbers on a number line diagram presented both horizontally and vertically.
7.NR.1.4	Show and explain subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference and apply this principle in contextual situations.	***Examples*** • Find the distance between a submarine submerged at a depth of $27\frac{3}{4}$ feet below sea level and an airplane flying at an altitude of $1262\frac{1}{2}$ feet above sea level. • $-\frac{1}{2} - (-2)$ is the same expression as $-\frac{1}{2} + - (-2)$, which is 2 units to the right of $-\frac{1}{2}$ on a horizontal number line or 2 units up from $-\frac{1}{2}$ on a vertical number line.
7.NR.1.5	Apply properties of operations, including part-whole reasoning, as strategies to add and subtract rational numbers.	***Fundamentals*** • Students should be allowed to explore the signs of integers and what they really mean to discover integer rules. ***Strategies and Methods*** • Students should be able to use the Commutative and Associative properties to combine more than two rational numbers flexibly. ***Terminology*** • Part-whole reasoning refers to how numbers can be split into parts to add and subtract numbers more efficiently. ***Example*** • (–8) + 5 + (–2) may be solved as (–8) +(–2) + 5 to first make –10 by using the Commutative Property.

<table>
<tr>
<td>7.NR.1.6</td>
<td>Make sense of multiplication of rational numbers using realistic applications.</td>
<td colspan="2">Strategies and Methods
● Student should have opportunities to use concepts of repeated addition and the meaning of a negative sign as the “opposite of,” with both models and representations, leading to deriving the rules for multiplying signed numbers.
● Models may include, but are not limited to, number lines and counters.</td>
<td colspan="2">Examples
● 4 * (–5) is 4 groups of (–5) and (–4) * (–3) is the opposite of 4 * (–3).
● If yellow counters represent positive amounts and red counters represent negative amounts, you can model 3 * (–2) as three groups of two red counters.
● David has a $0.00 balance in his bank account. He makes three withdrawals of $1.46 each. What is his bank account balance after the three withdrawals?</td>
</tr>
<tr>
<td>7.NR.1.7</td>
<td>Show and explain that integers can be divided, assuming the divisor is not zero, and every quotient of integers is a rational number.</td>
<td colspan="2">Fundamentals
● If p and q are integers (q ≠ 0), then $-\left(\frac{p}{q}\right) = \frac{(-p)}{q} = \frac{p}{(-q)}$.</td>
<td colspan="2">Example
● $-\left(\frac{20}{5}\right) = -4$ is the same as $\frac{(-20)}{5} = -4$ and $\frac{20}{(-5)} = -4$</td>
</tr>
<tr>
<td>7.NR.1.8</td>
<td>Represent the multiplication and division of integers using a variety of strategies and interpret products and quotients of rational numbers by describing them based on the relevant situation.</td>
<td>Fundamentals
● Students should be allowed to explore the signs of integers and what they really mean to discover integer rules.</td>
<td>Strategies and Methods
● Students can represent multiplication and division using number lines, counters, etc.</td>
<td colspan="2">Example
● Create a model and realistic situations for each of the products. Write and model the family of equations related to 2 × 3 = 6.
<table>
<tr><th>Equation</th><th>Number Line Model</th><th>Context</th></tr>
<tr><td>$2 \times 3 = 6$</td><td>0 3 6</td><td>Selling two packages of apples at $3.00 per pack</td></tr>
<tr><td>$2 \times -3 = -6$</td><td>-6 -3 0</td><td>Spending 3 dollars each on 2 packages of apples</td></tr>
<tr><td>$-2 \times 3 = -6$</td><td>-6 -4 -2 0</td><td>Owing 2 dollars to each of your three friends</td></tr>
<tr><td>$-2 \times -3 = 6$</td><td>0 2 4 6</td><td>Forgiving 3 debts of $2.00 each</td></tr>
</table></td>
</tr>
<tr>
<td>7.NR.1.9</td>
<td>Apply properties of operations as strategies to solve multiplication and division problems involving rational numbers represented in an applicable scenario.</td>
<td colspan="2">Fundamentals
● Students should be allowed to explore the signs of integers and what they really mean to discover integer rules.
● Students should be able to reason about direction on a number line when representing multiplication and division using the tool.</td>
<td>Strategies and Methods
● Students should be able to use the Commutative and Associative properties to combine more than two rational numbers flexibly.</td>
<td>Example
● (– 8) * 2 * (–5) may be solved as (– 8) * (2*(–5)) to multiply by negative ten, using the Associative Property.</td>
</tr>
<tr>
<td>7.NR.1.10</td>
<td>Convert rational numbers between forms to include fractions, decimal numbers and percentages, using understanding of the part divided by the whole. Know that the decimal form of a rational number terminates in 0s or eventually repeats.</td>
<td colspan="2">Fundamentals
● This is an extension of previous understanding from 6th grade of writing common fractions as decimal numbers and percentages.</td>
<td colspan="2">Age/Developmentally Appropriate
● Students should know that every rational number can be written as the ratio of two integers, terminating decimal numbers, or repeating decimal numbers.</td>
</tr>
</table>

7.NR.1.11	Solve multi-step, contextual problems involving rational numbers, converting between forms as appropriate, and assessing the reasonableness of answers using mental computation and estimation strategies.	***Example*** ● If Sara makes $25 an hour gets a 10% raise, she will make an additional $\frac{1}{10}$ of her salary an hour, or $2.50, for a new salary of $27.50.

***PATTERNING & ALGEBRAIC REASONING** – linear expressions with rational coefficients, complex unit rates, proportional relationships*

7.PAR.2: Use properties of operations, generate equivalent expressions and interpret the expressions to explain relevant situations.

Expectations		Evidence of Student Learning **(not all inclusive; see Grade Level Overview for more details)**	
7.PAR.2.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	***Fundamentals*** ● Building on work in Grade 6, where students used conventions about the order of operations to rewrite simple expressions such as 2(3 + 8x) as 6 +16x and 10p-2 as 2(5p-1), students now encounter linear expressions with more operations that require an understanding of integers, such as 7 - 2(3 - 8x).	***Examples*** ● A rectangle is twice as long as it is wide. One way to write an expression to find the perimeter would be w + w + 2w + 2w. Write the expression in two other ways. ● Write an equivalent expression for 9 – 7(2x + 4).
7.PAR.2.2	Rewrite an expression in different forms from a contextual problem to clarify the problem and show how the quantities in it are related.	***Example*** ● If Madison and Brenda both get paid a wage of $11 per hour, but Madison was paid an additional $55 for overtime, the expression 11(M+B) + 55 may be more clearly interpreted as 11M+55+11B for purposes of understanding Brenda's pay separated from Madison's pay.	

7.PAR.3: Represent authentic situations using equations and inequalities with variables; solve equations and inequalities symbolically, using the properties of equality.

Expectations		Evidence of Student Learning **(not all inclusive; see Grade Level Overview for more details)**				
7.PAR.3.1	Construct algebraic equations to solve practical problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Interpret the solution based on the situation.	***Strategies and Methods*** ● Students should be able to represent relationships in various practical, mathematical situations with equations involving variables and positive and negative rational numbers and explain the	***Fundamentals*** ● Students should be able to fluently solve equations of the specified forms presented in	***Terminology*** ● Fluently/Fluency – Students choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.	***Age/Developmentally Appropriate*** ● Continue to build on 6th grade objectives of writing and solving one-step equations from a problem situation to multi-step	***Examples*** ● Vicky and Bob went to a store to buy school supplies. Vicky spent a total of $22 on school supplies. She spent $13 on a book and spent the rest of the money on notebooks. The store sells notebooks for $1.50 each. Without using a variable,

		meaning of the solution based on the situation. • Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.	the learning objective. • Students should use the properties of equality to solve for the value of a variable.		problem situations. This is another opportunity for students to practice using rational numbers including: integers, and positive and negative fractions and decimal numbers.	determine the number of notebooks Vicky bought. • Write an equation that can be used to find the number of notebooks Vicky bought. Use the variable v for the number of notebooks. Solve the equation. Explain the similarities and differences between finding the number of notebooks Vicky bought with and without a variable, paying attention to the sequence of your operations.

7.PAR.3.2	Construct algebraic inequalities to solve problems, leading to inequalities of the form $px \pm q > r$, $px \pm q < r$, $px \pm q \leq r$, or $px \pm q \geq r$, where p, q, and r are specific rational numbers. Graph and interpret the solution based on the realistic situation that the inequalities represent.	***Strategies and Methods*** • Students should be able to represent relationships in various authentic, mathematical situations with inequalities involving variables and positive and negative rational numbers. • Students should be able to fluently solve inequalities of the specified forms. To achieve fluency, students should be able to choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently. • Students should use the properties of inequality to solve for the value of a variable. • When identifying a specific value for p, q, and r, any rational number can be used. • Students should be able to graph and interpret the solution of an inequality used as a model to explain real phenomena.	***Example*** • As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make and describe the solutions.

7.PAR.4: Recognize proportional relationships in relevant, mathematical problems; represent, solve, and explain these relationships with tables, graphs, and equations.

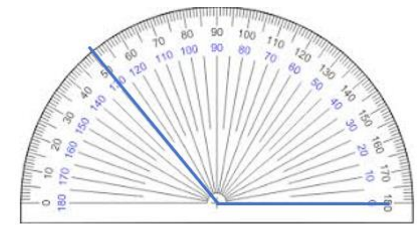
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**	
7.PAR.4.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units presented in realistic problems.	***Strategies and Methods*** • Students should be able to solve problems involving unit rate presented in practical, everyday situations.	***Example*** • If a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $(\frac{1}{2})/(\frac{1}{4})$ miles per hour, equivalently 2 miles per hour.

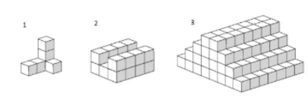
7.PAR.4.2	Determine the unit rate (constant of proportionality) in tables, graphs (1, r), equations, diagrams, and verbal descriptions of proportional relationships to solve realistic problems.	***Age/Developmentally Appropriate*** • In seventh grade, students are expected to understand that unit rate and constant of proportionality are the same.	***Examples*** • Jennifer rides on a train for 6 hours and travels 360 miles. How many miles per hour does she travel? • Mary deposits $115 into her bank account every month, represented by the equation d = 115m. Identify the unit rate from this situation.
7.PAR.4.3	Determine whether two quantities presented in authentic problems are in a proportional relationship.	***Strategies and Methods*** • Students should be able to analyze and make decisions about relationships using proportional reasoning strategies, which may include but not limited to graphing on a coordinate plane and/or observing whether a graph is a straight line passing through the origin.	***Examples*** • If Tina uses 2 eggs to make 6 pancakes and Allison uses 4 eggs to make 12 pancakes, is this proportional? • Jane runs 12 miles in 2.5 hours. Sarah runs 14 miles 3.5 hours. Are Jane and Sarah running at the same rate? Justify your answer.
7.PAR.4.4	Identify, represent, and use proportional relationships.	***Strategies and Methods*** • Student should be able to identify, represent, and use proportional relationships between quantities using verbal descriptions, tables of values, equations, and graphs to model applicable, mathematical problems: translate from one representation to another. • Students should be able to model authentic, mathematical relationships involving constant rates where the initial condition starts at 0 using tables of values and graphs. • Students should be able to represent proportional relationships using equations.	***Example*** • If the total cost, t, is proportional to the number, n, of items purchased at a constant price, p, the relationship between the total cost and the number of items can be expressed as t = np.
7.PAR.4.5	Use context to explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.	***Example*** • Erik feeds stray cats near his house. A graph shows different amounts of cat food he puts out based on the number of cats near his house. Erik graphs point P to represent the unit rate. What does point P mean in terms of the situation? Cups of cat food per cat.	
7.PAR.4.6	Solve everyday problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	***Strategies and Methods*** • Students should have opportunities to use proportional reasoning to compute unknown lengths by setting up proportions in tables or equations, or they can reason about how the lengths compare multiplicatively. • Students should be able to determine the dimensions of figures when given a scale and identify the impact of a scale on actual length (one-dimension) and area (two–dimensions). Students should be able to identify the scale factor given two figures.	***Fundamentals*** • Students should be given opportunities to explore the concept of similarity informally when learning about scale drawings of geometric figures. They should be able to make informal connections between scale drawings and similarity.

<table>
<tr>
<td></td>
<td></td>
<td colspan="2">● Using a given scale drawing, students should be able to reproduce the drawing at a different scale. Students should understand that the lengths will change by a factor equal to the product of the magnitude of the two size transformations.
● Students should be given opportunities to explore the concept of similarity by exploring the congruence of corresponding angles and the proportions of corresponding side lengths of geometric figures using hands-on, concrete tools to understand similarity (i.e., patty paper, geometric software).</td>
<td></td>
</tr>
<tr>
<td>7.PAR.4.7</td>
<td>Use similar triangles to explain why the slope, m, is the same between any two distinct points on a non-vertical line in the coordinate plane.</td>
<td colspan="3">Strategies and Method
● Students should be able to use proportional reasoning to explain why the slope, m, is the same between any two distinct points.</td>
</tr>
<tr>
<td>7.PAR.4.8</td>
<td>Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.</td>
<td>Fundamentals
● Students should demonstrate a conceptual understanding of slope.
● Students should be able to use graphical reasoning to represent proportional relationships. The proportional relationships explored by students should represent practical, realistic situations.</td>
<td colspan="2">Examples
● Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
● Mark was looking to fertilize his lawn, which is 432 sq. ft. He read the packages of 2 different fertilizer bags to see how much should be used. Bag A stated 2 ounces per 4 square feet and Bag B can be represented using the table below:
<table>
<tr><td>Ounces</td><td>2</td><td>4</td><td>12</td></tr>
<tr><td>Square Feet</td><td>3</td><td>6</td><td>18</td></tr>
</table>
What is the unit rate for each bag? Which bag should Mark purchase for his lawn? Why?</td>
</tr>
<tr>
<td>7.PAR.4.9</td>
<td>Use proportional relationships to solve multi-step ratio and percent problems presented in applicable situations.</td>
<td>Strategies and Methods
● Students may use flexible strategies such as a + 0.05a = 1.05a with the understanding that adding a 5% tax to a total is the same as multiplying the total by 1.05.</td>
<td colspan="2">Terminology
● Simple interest – a quick and easy method of calculating the interest charge on a loan. Simple interest is determined by multiplying the daily interest rate by the principal by the number of days that elapse between payments. Simple Interest = (principal) * (rate) * (# of periods)
● Tax – money that people must pay to the government
● Markups and markdowns - increase and decrease in the amount of a quantity
● Gratuities - a tip given to a waiter, taxicab driver, etc.
● Commissions - a fee paid to an agent as compensation for completing a transaction</td>
</tr>
<tr>
<td>7.PAR.4.10</td>
<td>Predict characteristics of a population by examining the characteristics of a representative sample. Recognize the potential limitations and scope of the sample to the population.</td>
<td colspan="3">Strategies and Methods
● Students can generate questions about things they notice and wonder from a relevant situation. Questions posed should be ones that requires data that will vary.
● Students should have opportunities to create and answer statistical investigative questions about a population by collecting data from a representative sample, using random sampling techniques to collect the data.
● Students should be able to create a statistical investigative question that can be answered by gathering data from practical situations and determine strategies for gathering data to answer the statistical investigative question.
● Potential limitations may include how the sample was selected and/or how the questions were asked.</td>
</tr>
</table>

<table>
<tr><td>7.PAR.4.11</td><td>Analyze sampling methods and conclude that random sampling produces and supports valid inferences.</td><td colspan="2">Strategies and Methods
● Students should have opportunities to critique examples of sampling techniques.
● Students should conclude when conditions of sampling methods may be biased, random, and not representative of the population.</td></tr>
<tr><td>7.PAR.4.12</td><td>Use data from repeated random samples to evaluate how much a sample mean is expected to vary from a population mean. Simulate multiple samples of the same size.</td><td>Fundamentals
● Students should use sample data collected to draw inferences.</td><td>Examples
● Estimate the mean word length in a book by randomly sampling words from the book. Gauge how far off the estimate is from the actual mean.
● Predict the winner of a school election based on randomly sampled survey data. Gauge how far off the prediction might be.</td></tr>
</table>

<table>
<tr><td colspan="6">GEOMETRIC & SPATIAL REASONING – vertical, adjacent, complementary, and supplementary angles, circumference and area of circles, area and surface area, volume of cubes, right prisms, and cylinders</td></tr>
<tr><td colspan="6">7.GSR.5: Solve practical problems involving angle measurement, circles, area of circles, surface area of prisms and cylinders, and volume of cylinders and prisms composed of cubes and right prisms.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr><td>7.GSR.5.1</td><td>Measure angles in whole non-standard units.</td><td colspan="3">Fundamentals
● Students should be able to recognize angles as geometric shapes formed when two rays share a common endpoint. In previous grades, students learned to draw and measure right, acute, and obtuse angles.
● To understand measurement, students should measure in non-standard units, such as unit angles or wedges, before being introduced to tools with abstract units such as degrees.
● Students should also be able to explore this learning objective by investigating angles within circles.</td><td>Example
● Fold a circle of patty paper or waxed paper in half four times to create an angle measuring tool with 16 wedges. This protractor can be used to determine the number of units (wedges) in an angle.</td></tr>
<tr><td>7.GSR.5.2</td><td>Measure angles in whole number degrees using a protractor.</td><td>Age/Developmentally Appropriate
● Students should be able to use a 180° protractor to draw or measure an angle to the nearest whole degree.</td><td>Fundamentals
● In previous grades, students measured angles in reference to a circle with the center at the common endpoint of two rays. They should be able to use this knowledge to determine an angle’s measure in relation to the 360</td><td>Strategies and Methods
● Students should be able to use hand-held and virtual protractors.
● Student should be able to use angle measurement tools that help them connect non-standard units (wedges, unit angles, etc.) to standard units of angle measurement (degrees).</td><td>Examples
● Students may be given angles to find precise measurements of angles. Here is an example of how students may use a protractor and measurement reasoning to determine precise angle measurements.</td></tr>
</table>

			degrees in a circle through division or as a missing factor problem.	 *Sample student response:* *The angle measures 130 degrees.*
7.GSR.5.3	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve equations for an unknown angle in a figure.	***Age and Developmentally Appropriate*** ● Students should be able to use a 180° protractor to draw or measure an angle to the nearest whole degree to write and solve equations. ● Reflex angles are not an expectation at this grade level.	***Fundamentals*** ● In previous grades, students have studied angles by type according to size: acute, obtuse, and right, and their role as an attribute in polygons. Now angles are considered based upon the special relationships that exist among them: supplementary, complementary, vertical, and adjacent angles. ● Students should be able to use relationships to write and solve equations for multi-step problems.	***Terminology*** ● Supplementary angles – two angles add up to 180 degrees ● Complementary angles – two angles add up to 90 degrees ● Vertical angles – angles opposite each other when two lines intersect. ● Adjacent angles – Two angles that have a common side and a common vertex (corner point), and do not overlap.
7.GSR.5.4	Explore and describe the relationship between pi, radius, diameter, circumference, and area of a circle to derive the formulas for the circumference and area of a circle.	***Strategies and Methods*** ● Students should use proportional reasoning to explain the relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is π in order to derive the formulas for the circumference and area of a circle.	***Age/Developmentally Appropriate*** ● Square roots are an 8th grade expectation.	***Terminology*** ● ***Special Note:*** The terms pi, radius, diameter, and circumference are new academic vocabulary for students. ● Pi - The ratio of a circle's circumference to its diameter. ● Radius - The distance from the center to the circumference of a circle. ● Diameter - The distance from one point on a circle through the center to another point on the circle. ● Circumference - The distance around the edge of a circle.
7.GSR.5.5	Given the formula for the area and circumference of a circle, solve problems that exist in everyday life.	***Age/Developmentally Appropriate*** ● Students should be given the formula for area and circumference of a circle when solving problems.	***Example*** ● The seventh-grade class is building a mini golf game for the school carnival. The end of the putting green will be a circle. If the circle is 10 feet in diameter, how many square feet of grass carpet will they need to buy to cover the circle? How might you communicate this information to the salesperson to make sure you receive a piece of carpet that is the correct size? $A = \pi r^2$ OR $C = 2\pi r$	

7.GSR.5.6	Solve realistic problems involving surface area of right prisms and cylinders.	***Age/Developmentally Appropriate*** ● Students should solve problems involving surface areas of prisms with triangles, rectangles, and other polygons as bases. ● Students are not expected to memorize formulas to solve problems involving surface area.	***Strategies and Methods*** ● Students should have an opportunity to solve single to multi-step authentic, mathematical problems. ● Students should have opportunities to apply knowledge of the area of triangles, rectangles, and other polygons to solve problems involving surface area of prisms. ● Students should have opportunities to discover the surface area of a cylinder by decomposing the figure into circles and rectangles. ● Students should use geometric and spatial reasoning to solve problems involving surface area.	***Terminology*** ● Cylinder – any three-dimensional figure with two congruent, opposite faces called bases connected by adjacent curved or flat faces (bases can include circles, triangles, rectangles, or other shapes). The bases can be connected by two lines that are parallel to each other. ● Right prism – any three-dimensional figure with two polygons for bases that are opposite, congruent, and perpendicular to the adjacent faces ● The inclusive definition of a cylinder classifies prisms as special types of cylinders used to derive formulas that apply to all types of cylinders and prisms alike. (Van de Walle, Karp, & Bay-Williams, 2010) ● All prisms are cylinders, but not all cylinders are prisms. (Van de Walle, Karp, Lovett & Bay-Williams, 2010)	***Example*** ● Cole is planning to cover a cylindrical drum in leather. The diameter of the drum is 10 inches, and its height is 16 inches. What is the minimum amount of leather Cole will need? 
7.GSR.5.7	Describe the two-dimensional figures (cross sections) that result from slicing three-dimensional figures, as in the plane sections of right rectangular prisms, right rectangular pyramids, cones, cylinders, and spheres.	***Age/Developmentally Appropriate*** ● Cross-sections should be limited to horizontal and vertical slices.	***Strategies and Methods*** ● Students should have opportunities to explore models of right rectangular prisms, right rectangular pyramids, cones, cylinders, and spheres that can be sliced. ● Students should determine the different planes that can be created with the slices.	***Fundamentals*** ● Students should conclude the resulting two-dimensional shape created after the slice is not the entire three-dimensional shape that remains. ● In seventh grade, cross sections should be limited to horizontal and vertical slices.	***Terminology*** ● Prism – a solid figure that has the same cross section all along its length
7.GSR.5.8	Explore volume as a measurable attribute of cylinders and right prisms. Find the volume of these geometric figures using concrete problems.	***Strategies and Methods*** ● Students should apply knowledge of cross sections as a strategy for revealing a base of cylinders including right prisms.	***Terminology*** ● Cylinder – any three-dimensional figure with two congruent, opposite faces called bases connected by adjacent curved or flat	***Age/Developmentally Appropriate*** ● Cylinders explored in Grade 7 should be limited to right circular	***Examples*** ● Identical toy building cubes were used to make the stacks shown below. 

		● Students should apply reasoning about the volume of rectangular prisms to explore the volume of cylinders and other three-dimensional objects composed of cubes and right prisms. ● Students should apply their knowledge of area of a circle when finding the volume of a cylinder. ● Students should use the formula Volume = area of the base times height or V = B x h to find the volume of a cylinder.	faces (bases can include circles, triangles, rectangles, or other shapes). The bases can be connected by two lines that are parallel to each other. ● Right prism – any three-dimensional figure with two polygons for bases that are opposite, congruent, and perpendicular to the adjacent faces. ● The inclusive definition of a cylinder classifies prisms as special types of cylinders used to derive formulas that apply to all types of cylinders and prisms alike. (Van de Walle, et.al., 2010) ● All prisms are cylinders, but not all cylinders are prisms. (Van de Walle, Karp, Lovett & Bay-Williams, 2010) ● The formula for volume used in Grade 7 is V = B (area of the base) x h (height), where B=area of the base, h = height.	cylinders. Right circular cylinders are three-dimensional solid figures with two congruent, parallel, circular bases that are connected by a curved face that is perpendicular to each base. ● Students should explore experimentally and conceptually the hierarchy of cylinders and prisms.	Which stack takes up the least space? Which stack takes up the most space? Order the stacks from the one that takes up the least space to the one that takes up the most space. ● A farmer is storing ground corn in a silo during the winter months. What is the maximum capacity of the cylindrical part of each silo that has a 20-foot diameter and a 55-foot height for which the farmer can store the ground corn? 

***PROBABILITY REASONING** – likelihood, theoretical and experimental probability*		
7.PR.6: Using mathematical reasoning, investigate chance processes and develop, evaluate, and use probability models to find probabilities of simple events presented in authentic situations.		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
7.PR.6.1	Represent the probability of a chance event as a number between 0 and 1 that expresses the likelihood of the event occurring. Describe that a probability near 0 indicates an unlikely event, a probability around $\frac{1}{2}$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.	***Strategies and Methods*** • Students should be able to represent the probability as a fraction, decimal numbers, or percentage. ***Terminology*** • Descriptions may include impossible, unlikely, equally likely, likely, and certain.
7.PR.6.2	Approximate the probability of a chance event by collecting data on an event and observing its long-run relative frequency will approach the theoretical probability.	***Strategies and Methods*** • Students should be able to predict the approximate, relative frequency given the theoretical probability. ***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.
7.PR.6.3	Develop a probability model and use it to find probabilities of simple events. Compare experimental and theoretical probabilities of events. If the probabilities are not close, explain possible sources of the discrepancy.	***Strategies and Methods*** • Probability models may include various random generation devices including, but not limited to, bag pulls, spinners, number cubes, coin toss, and colored chips. • Students should have multiple opportunities to collect data using physical objects, graphing calculators, or web-based simulations. ***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.
7.PR.6.4	Develop a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events.	***Example*** • If a student is selected at random from a class, find the probability a student with long hair will be selected.
7.PR.6.5	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.	***Terminology*** • Uniform probability models are those where the likelihood of each outcome is equal. ***Examples*** • Find the approximate probability of each outcome in a spinner with unequal sections. • Find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?
7.PR.6.6	Use appropriate graphical displays and numerical summaries from data distributions with categorical or quantitative (numerical) variables as probability models to draw	***Strategies and Methods*** • Students should use side by side bar graphs or segmented bar graphs to compare categorical data distributions ***Age/Developmentally Appropriate*** • Limit category counts to be less than or equal to ten. ***Example*** • Compare the heights of the basketball and the tennis teams.

	informal inferences about two samples or populations.	of samples from two populations. ● Students should compare data of two samples or populations displayed in box plots and dot plots to make inferences using probabilistic reasoning. ● Students should be able to draw inferences using measures of central tendency (mean, median, mode) and/or variability (range, mean absolute deviation and interquartile range) from random samples. ● Conclusions should be made related to a population, using a random sample, by describing a distribution using measures of central tendency (mean, median, mode) and/or variability (range, mean absolute deviation, and interquartile range). ● Students should be given multiple opportunities to compare quantitative data distributions of samples from two populations.	● Limit quantitative variables to less than or equal to 20.	Basketball team's heights (in inches): 72, 75, 76, 76, 79, 79, 80, 80, 81, 81, 81 Tennis team's height (in inches): 67, 67, 68, 70, 70, 71, 72, 75, 76, 76, 77 1) How much taller is the basketball team than the tennis team? 2) Two students are trying out for the basketball team. What is the probability their height will be greater than 79 inches?

8th Grade

The eight standards listed below are the key content competencies students will be expected to master in eighth 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.

COURSE STANDARDS
8.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.**
8.NR.1: **Solve problems involving irrational numbers and rational approximations of irrational numbers to explain realistic applications.**
8.NR.2: **Solve problems involving radicals and integer exponents including relevant application situations; apply place value understanding with scientific notation and use scientific notation to explain real phenomena.**
8.PAR.3: **Create and interpret expressions within relevant situations. Create, interpret, and solve linear equations and linear inequalities in one variable to model and explain real phenomena.**
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.**
8.FGR.5: **Describe the properties of functions to define, evaluate, and compare relationships, and use functions and graphs of functions to model and explain real phenomena.**
8.FGR.6: **Solve practical, linear problems involving situations using bivariate quantitative data.**
8.FGR.7: **Justify and use various strategies to solve systems of linear equations to model and explain realistic phenomena.**
8.GSR.8: **Solve contextual, geometric problems involving the Pythagorean Theorem and the volume of geometric figures to explain real phenomena.**

Georgia's K-12 Mathematics Standards - 2021

8TH Grade

<table>
<tr><td colspan="6">NUMERICAL REASONING – rational and irrational numbers, decimal expansion, integer exponents, square and cube roots, scientific notation</td></tr>
<tr><td colspan="6">8.NR.1: Solve problems involving irrational numbers and rational approximations of irrational numbers to explain realistic applications.</td></tr>
<tr><th colspan="2">Expectations</th><th colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr>
<td>8.NR.1.1</td>
<td>Distinguish between rational and irrational numbers using decimal expansion. Convert a decimal expansion which repeats eventually into a rational number.</td>
<td>Strategies and Methods
● Students should be provided with experiences to use numerical reasoning when describing decimal expansions.
● Students should be able to classify real numbers as rational or irrational.
● Students should know that when a square root of a positive integer is not an integer, then it is irrational.
● Students should use prior knowledge about converting fractions to decimals learned in 6th and 7th grade to connect changing decimal expansion of a repeating decimal into a fraction and a fraction into a repeating decimal.
● Emphasis is placed on how all rational numbers can be written as an equivalent decimal. The end behavior of the decimal determines the classification of the number.</td>
<td>Age/Developmentally Appropriate
● This specific example is limited to the tenths place; however, the concept for this grade level extends to the hundredths place.</td>
<td>Terminology
● Rational numbers are those with decimal expansions that terminate in zeros or eventually repeat.
● Irrational numbers are non-terminating, non-repeating decimals.</td>
<td>Example
● Change $0.\overline{4}$ to a fraction
1. Let x = 0.4444444 …
2. Multiply both sides so that the repeating digits will be in front of the decimal. In this example, one digit repeats so both sides are multiplied by 10, giving
10x = 4.4444444 …

3. Subtract the original equation from the new equation.

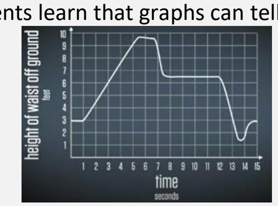
10x = 4.4444444 …
x = 0.44444 …
9x = 4
4. Solve the equation to determine the equivalent fraction.
9x = 4
x = 4/9</td>
</tr>
<tr>
<td>8.NR.1.2</td>
<td>Approximate irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions.</td>
<td>Strategies and Methods
● Students should use visual models and numerical reasoning to approximate irrational numbers.</td>
<td colspan="3">Example
● By estimating the decimal expansion of $\sqrt{17}$, show that $\sqrt{17}$ is between 4 and 5 and closer to 4 on a number line.</td>
</tr>
</table>

8.NR.2: Solve problems involving radicals and integer exponents including relevant application situations; apply place value understanding with scientific notation and use scientific notation to explain real phenomena.

Expectations		Evidence of Student Learning **(not all inclusive; see Grade Level Overview for more details)**
8.NR.2.1	Apply the properties of integer exponents to generate equivalent numerical expressions.	***Strategies and Methods*** ● Students should use numerical reasoning to identify patterns associated with properties of integer exponents. ● The following properties should be addressed: product rule, quotient rule, power rule, power of product rule, power of a quotient rule, zero exponent rule, and negative exponent rule. ***Example*** $3^2 \times 3^{(-5)} = 3^{(-3)} = \frac{1}{(3^3)} = \frac{1}{27}$
8.NR.2.2	Use square root and cube root symbols to represent solutions to equations. Recognize that $x^2 = p$ (where p is a positive rational number and $\lvert x\rvert \le 25$) has two solutions and $x^3 = p$ (where p is a negative or positive rational number and $\lvert x\rvert \le 10$) has one solution. Evaluate square roots of perfect squares ≤ 625 and cube roots of perfect cubes ≥ -1000 and ≤ 1000.	***Strategies and Methods*** ● Students should be able to find patterns within the list of square numbers and then with cube numbers. ● Students should be able to recognize that squaring a number and taking the square root of a number are inverse operations; likewise, cubing a number and taking the cube root are inverse operations. ***Fundamentals*** ● Equations should include rational numbers such as $x^2 = \frac{1}{4}$. ***Example*** ● $\sqrt{64} = \sqrt{8^2} = 8$ and $\sqrt[3]{(5^3)} = 5$. Since $\sqrt{p}$ is defined to mean the positive solution to the equation $x^2 = p$ (when it exists). It is not mathematically correct to say $\sqrt{64} = \pm 8$ (as is a common misconception). In describing the solutions to $x^2 = 64$, students should write $x = \pm\sqrt{64} = \pm 8$.
8.NR.2.3	Use numbers expressed in scientific notation to estimate very large or very small quantities, and to express how many times as much one is than the other.	***Strategies and Methods*** ● Students should use the magnitude of quantities to compare numbers written in scientific notation to determine how many times larger (or smaller) one number written in scientific notation is than another. ● Students should have opportunities to compare numbers written in scientific notation in contextual, mathematical problems, including scientific situations. ***Example*** ● Estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9 and determine that the world population is more than 20 times larger.
8.NR.2.4	Add, subtract, multiply and divide numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology (e.g., calculators or online technology tools).	***Fundamentals*** ● Students should use place value reasoning which supports the understanding of digits shifting to the left or right when multiplied by a power of 10. ***Strategies and Methods*** ● Students combine knowledge of integer exponent rules and scientific notation to perform operations with numbers expressed in scientific notation. ● Students should solve realistic problems involving scientific notation.

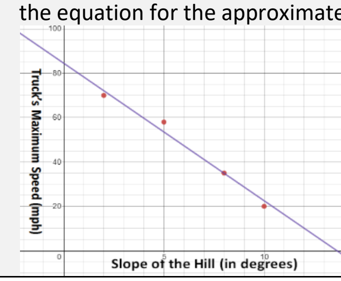
<table>
<tr><td colspan="4">PATTERNING & ALGEBRAIC REASONING – expressions, linear equations, and inequalities</td></tr>
<tr><td colspan="4">8.PAR.3: Create and interpret expressions within relevant situations. Create, interpret, and solve linear equations and linear inequalities in one variable to model and explain real phenomena.</td></tr>
<tr><th colspan="2">Expectations</th><th colspan="2">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>8.PAR.3.1</td><td>Interpret expressions and parts of an expression, in context, by utilizing formulas or expressions with multiple terms and/or factors.</td><td>Fundamentals
● Students should build on their prior knowledge of understanding the parts of an expression to extend their understanding to more complex expressions with multiple terms and/or factors.</td><td>Terminology
● Parts of an expression include terms, factors, coefficients, and operations.</td></tr>
<tr><td>8.PAR.3.2</td><td>Describe and solve linear equations in one variable with one solution (x = a), infinitely many solutions (a = a), or no solutions (a = b). Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).</td><td colspan="2">Strategies and Methods
● Students should use algebraic reasoning in their descriptions of the solutions to linear equations.
● Building upon skills from grade 7, students combine like terms on the same side of the equal sign and use the distributive property to simplify the equation when solving. Emphasis in this standard is also on using rational coefficients. Solutions of certain equations may elicit infinitely many or no solutions.</td></tr>
<tr><td>8.PAR.3.3</td><td>Create and solve linear equations and inequalities in one variable within a relevant application.</td><td colspan="2">Strategies and Methods
● Students should use algebraic reasoning in their descriptions of the solutions to linear equations.
● Include linear equations and inequalities with rational number coefficients and whose solutions require expanding expressions using the distributive property and collecting like terms.</td></tr>
<tr><td>8.PAR.3.4</td><td>Using algebraic properties and the properties of real numbers, justify the steps of a one-solution equation or inequality.</td><td colspan="2">Strategies and Methods
● Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.</td></tr>
<tr><td>8.PAR.3.5</td><td>Solve linear equations and inequalities in one variable with coefficients represented by letters and explain the solution based on the contextual, mathematical situation.</td><td>Strategies and Methods
● Students should use algebraic reasoning to solve linear equations and inequalities in one variable.</td><td>Example
● Given ax + 3 = 7, solve for x.</td></tr>
<tr><td>8.PAR.3.6</td><td>Use algebraic reasoning to fluently manipulate linear and literal equations expressed in various forms to solve relevant, mathematical problems.</td><td>Strategies and Methods
● To achieve fluency, students should be able to choose flexibly among methods and strategies to solve mathematical problems accurately and efficiently.
● Students should rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. Interpret and explain the results.</td><td>Example
● Find the radius given the formula $V=\pi r^2 h$ by rearranging the equation to solve for the radius, r.</td></tr>
</table>

<table>
<tr><td colspan="5">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.</td></tr>
<tr><td colspan="2">Expectations</td><td colspan="3">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</td></tr>
<tr><td>8.PAR.4.1</td><td>Use the equation y = mx (proportional) for a line through the origin to derive the equation y = mx + b (non-proportional) for a line intersecting the vertical axis at b.</td><td>Fundamentals
● Students should be given opportunities to explore how an equation in the form y = mx + b is a translation of the equation y = mx.
● In Grade 7, students had multiple opportunities to build a conceptual understanding of slope as they made connections to unit rate and analyzed the constant of proportionality for proportional relationships.
● Students should be given opportunities to explore and generalize that two lines with the same slope but different intercepts, are also translations of each other.
● Students should be encouraged to attend to precision when discussing and defining b (i.e., b is not the intercept; rather, b is the y-coordinate of the y-intercept). Students must understand that the x-coordinate of the y-intercept is always 0.</td><td>Strategies and Methods
● Students should be given the opportunity to explore and discover the effects on a graph as the value of the slope and y-intercept changes using technology.</td><td>Example
● The business model for a company selling a service with no flat cost charges $3 per hour. What would the equation be as a proportional equation? If the company later decides to charge a flat rate of $10 for each transaction with the same per hour cost, what would be the new equation? How do these two equations compare when analyzed graphically? What is the same? What is different? Why?</td></tr>
<tr><td>8.PAR.4.2</td><td>Show and explain that the graph of an equation representing an applicable situation in two variables is the set of all its solutions plotted in the coordinate plane.</td><td colspan="3">Strategies and Methods
● Students should use algebraic reasoning to show and explain that the graph of an equation represents the set of all its solutions.
● Students continue to build upon their understanding of proportional relationships, using the idea that one variable is conditioned on another.
● Students should relate graphical representations to contextual, mathematical situations.
● Students should use tables to relate solution sets to graphical representations on the coordinate plane.</td></tr>
</table>

FUNCTIONAL & GRAPHICAL REASONING *–relate domain to linear functions, rate of change, linear vs. nonlinear relationships, graphing linear functions, systems of linear equations, parallel and perpendicular lines*		
8.FGR.5: Describe the properties of functions to define, evaluate, and compare relationships, and use functions and graphs of functions to model and explain real phenomena.		
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**
8.FGR.5.1	Show and explain that a function is a rule that assigns to each input exactly one output.	***Strategies and Methods*** ● Students should be able to use algebraic reasoning when formulating an explanation or justification regarding whether or not a relationship is a function or not a function. ● Describe the graph of a function as the set of ordered pairs consisting of an input and the corresponding output.
8.FGR.5.2	Within realistic situations, identify and describe examples of functions that are linear or nonlinear. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	***Strategies and Methods*** ● Students should be able to model practical situations using graphs and interpret graphs based on the situations. ● Students should model functions that are nonlinear and explain, using precise mathematical language, how to tell the difference between linear (functions that graph into a straight line) and nonlinear functions (functions that do not graph into a straight line). ● Students should analyze a graph by determining whether the function is increasing or decreasing, linear or non-linear. ● Students should have the opportunity to explore a variety of graphs including time/distance graphs and time/velocity graphs. **Examples** ● The function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line. ● Examples such as this can be used to help students learn that graphs can tell stories. 
8.FGR.5.3	Relate the domain of a linear function to its graph and where applicable to the quantitative relationship it describes.	***Example*** ● If the function h(n) gives the number of hours it takes a person to assemble n engines in a factory, then the set of positive integers would be an appropriate domain for the function.
8.FGR.5.4	Compare properties (rate of change and initial value) of two functions used to model an authentic situation each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	***Example*** ● Given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
8.FGR.5.5	Write and explain the equations $y = mx + b$ (slope-intercept form), $Ax + By = C$ (standard form), and $(y - y_1) = m(x-x_1)$ (point-slope form) as defining a linear function whose graph is a straight line to reveal and explain different properties of the function.	***Strategies and Methods*** ● Students should be able to rewrite linear equations written in different forms depending on the given situation. ***Terminology*** ● Forms of linear equations: standard, slope-intercept, and point-slope forms.

8.FGR.5.6	Write a linear function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	***Strategies and Methods*** ● Problems should be practical and applicable to represent real situations, providing a purpose for analyzing equivalent forms of an expression. ● Rewrite a function expressed in standard form to slope-intercept form to make sense of a meaningful situation.
8.FGR.5.7	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, including reading these from a table or from a graph.	***Strategies and Methods*** ● This learning objective also includes verbal descriptions and scenarios of equations, tables, and graphs.
8.FGR.5.8	Explain the meaning of the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	***Strategies and Methods*** ● This learning objective also includes verbal descriptions and scenarios of equations, tables, and graphs.
8.FGR.5.9	Graph and analyze linear functions expressed in various algebraic forms and show key characteristics of the graph to describe applicable situations.	***Strategies and Methods*** ● Use verbal descriptions, tables and graphs created by hand and/or using technology. ***Terminology*** ● Various forms of linear functions include standard, slope-intercept, and point-slope forms. ● Key features include rate of change (slope), intercepts, strictly increasing or strictly decreasing, positive, negative, and end behavior.

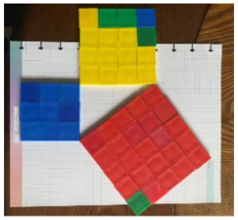
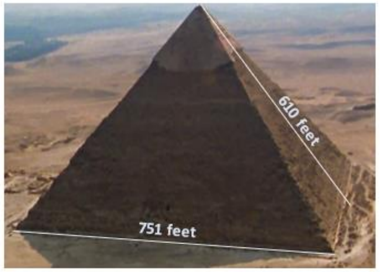
8.FGR.6: Solve practical, linear problems involving situations using bivariate quantitative data.

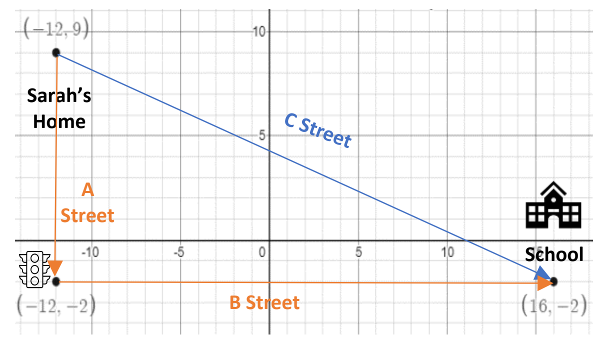
Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)		
8.FGR.6.1	Show that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, visually fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line of best fit.	***Strategies and Methods*** ● Students should discover the line of best fit as the one that comes closest to most of the data points.	***Terminology*** ● The line of best fit shows the linear relationship between two variables in a data set.	***Example*** ● Given a set of data points, a student creates a scatter plot (see below), approximates a line of best fit, and writes the equation for the approximated line. 

<table>
<tr><td>8.FGR.6.2</td><td>Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercepts.</td><td>Strategies and Methods
● Students should solve practical, linear problems involving situations using bivariate quantitative data.</td><td>Terminology
● A linear model shows the relationship between two variables in a data set, such as lines of best fit.</td></tr>
<tr><td>8.FGR.6.3</td><td>Explain the meaning of the predicted slope (rate of change) and the predicted intercept (constant term) of a linear model in the context of the data.</td><td>Terminology
● It is important to indicate ‘predicted’ to indicate this is a probabilistic interpretation in context, and not deterministic.</td><td>Example
● In a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.</td></tr>
<tr><td>8.FGR.6.4</td><td>Use appropriate graphical displays from data distributions involving lines of best fit to draw informal inferences and answer the statistical investigative question posed in an unbiased statistical study.</td><td colspan="2">Fundamentals
● Students should be given opportunities to analyze the data distribution displayed graphically to answer the statistical investigative question generated from a realistic situation.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">8.FGR.7: Justify and use various strategies to solve systems of linear equations to model and explain realistic phenomena.</td></tr>
<tr><th colspan="2">Expectations</th><th colspan="2">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>8.FGR.7.1</td><td>Interpret and solve relevant mathematical problems leading to two linear equations in two variables.</td><td>Strategies and Methods
● Students should have a variety of opportunities to explore problems using technology and tools in order to strengthen their conceptual understanding of systems of linear equations as they visually analyze what happens when the variables are manipulated in the problem.</td><td>Examples
● A trampoline park that you frequently go to is $9 per visit. You have the option to purchase a monthly membership for $30 and then pay $4 for each visit. Explain whether you will buy the membership, and why.

Option A: y=$9x
Option B: y= $30 + $4x
● Anya is traveling from out of town. This is the only time she will visit this trampoline park. Which option should she choose?
● Jin plans on going to the trampoline park seven times this month. Which option should he choose? What does the point of intersection of the graphs represent?</td></tr>
<tr><td>8.FGR.7.2</td><td>Show and explain that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because the points of</td><td colspan="2">Strategies and Methods
● Students should be provided with opportunities to explore systems of equations represented on interactive graphs to analyze and interpret the solutions to the systems.
● Students should be able to analyze and explain solutions to systems of equations presented numerically, algebraically, and graphically.</td></tr>
</table>

	intersection satisfy both equations simultaneously.		
8.FGR.7.3	Approximate solutions of two linear equations in two variables by graphing the equations and solving simple cases by inspection.	***Strategies and Methods*** ● Students should be provided with opportunities to explore systems of equations represented on interactive graphs to analyze and interpret the solutions to the systems. ● Students should have opportunities to analyze and explore problems using technology and tools to strengthen their conceptual understanding of systems of linear equations.	***Example*** ● A student can graph two linear equations that represent a culturally relevant problem using digital graphing tools (i.e., Desmos) and visually make sense of the graphed lines based on a given context. A student can provide a verbal or written explanation of their reasoning.
8.FGR.7.4	Analyze and solve systems of two linear equations in two variables algebraically to find exact solutions.	***Strategies and Methods*** ● Students should be able to analyze and solve pairs of simultaneous linear equations (systems of linear equations) within realistic situations and an expressed phenomenon. ● Students should validate their graphical approximations using algebraic strategies. ● Students should use substitution and elimination to solve systems of linear equations.	***Example*** ● Given coordinates for two pairs of points, a student can determine whether the line through the first pair of points intersects the line through the second pair.
8.FGR.7.5	Create and compare the equations of two lines that are either parallel to each other, perpendicular to each other, or neither parallel nor perpendicular.	***Strategies and Methods*** ● Students should have the opportunity to explore visual graphs of equations that are parallel, perpendicular or neither parallel nor perpendicular to develop a deep, conceptual understanding. ● As students are comparing parallelism and perpendicularity of lines, they should see the connection as a system of equations. ● Students should be able to explain if systems are consistent or inconsistent.	***Example*** ● A student can recognize that there is no solution to the system of equations formed by $3x + 2y = 5$ and $3x + 2y = 6$ because the lines are parallel and $3x + 2y$ cannot simultaneously be 5 and 6.

GEOMETRIC & SPATIAL REASONING – *Pythagorean theorem and volume of triangles, rectangles, cones, cylinders, and spheres*				
8.GSR.8: Solve geometric problems involving the Pythagorean Theorem and the volume of geometric figures to explain real phenomena.				
Expectations		**Evidence of Student Learning** **(not all inclusive; see Grade Level Overview for more details)**		
8.GSR.8.1	Explain a proof of the Pythagorean Theorem and its converse using visual models.	***Age/Developmentally Appropriate*** ● Students are not limited to a particular proof for the Pythagorean Theorem or its converse.	***Strategies and Methods*** ● Geometric and spatial reasoning should be used when explaining the Pythagorean Theorem.	***Example*** 
8.GSR.8.2	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles within authentic, mathematical problems in two and three dimensions.	***Age/Developmentally Appropriate*** ● Triangle dimensions may be rational or irrational numbers.	***Strategies and Methods*** ● Geometric and spatial reasoning should be used to solve problems involving the Pythagorean theorem. ● Models and drawings may be useful as students solve contextual problems in two- and three-dimensions.	***Example***  How tall is the Great Pyramid of Giza?
8.GSR.8.3	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system in practical, mathematical problems.	***Age/Developmentally Appropriate*** ● Students should apply their understanding of the Pythagorean Theorem to find the distance. Use of the distance formula is not an expectation for this grade level.	***Strategies and Methods*** ● Students should be provided opportunities to solve problems using a variety of strategies.	***Example*** ● There are two paths that Sarah can take when walking to school. One path is to take is to take A Street from home to the traffic light and then walk on B street from the traffic light to the school, and the other way is for her to take C street directly to the school. How much shorter is the direct path along C Street?

				 To answer this question, students may use what they learned in 6th grade to find the distance between (-12,9) and (-12, -2) representing A street and the distance between (-12, -2) and (16, -9) representing B street. Then, students could use those two distances to find the sum of the distances for the first path. Then, students can apply the Pythagorean theorem to determine the distance between the final two points, (-12,9) and (16,-2) to determine the answer to the question.
8.GSR.8.4	Apply the formulas for the volume of cones, cylinders, and spheres and use them to solve in relevant problems.	***Age/Developmentally Appropriate*** ● This learning objective is limited to right circular cones, right cylinders, and spheres.	***Strategies and Methods*** ● Given the volume, solve for an unknown dimension of the figure. Students will need to be able to express the answer in terms of pi and as a decimal approximation. ● Students should be able to use their knowledge of cube roots to solve for unknown dimensions of geometric figures.	***Relevance and Application*** ● Students should be given opportunities to find missing dimensions of a right circular cone (e.g., slant height, radius, etc.). ● Students should be able to make connections between the Pythagorean Theorem and solving relevant problems related to volume of cones.

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 Standards for Mathematical Practice 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.

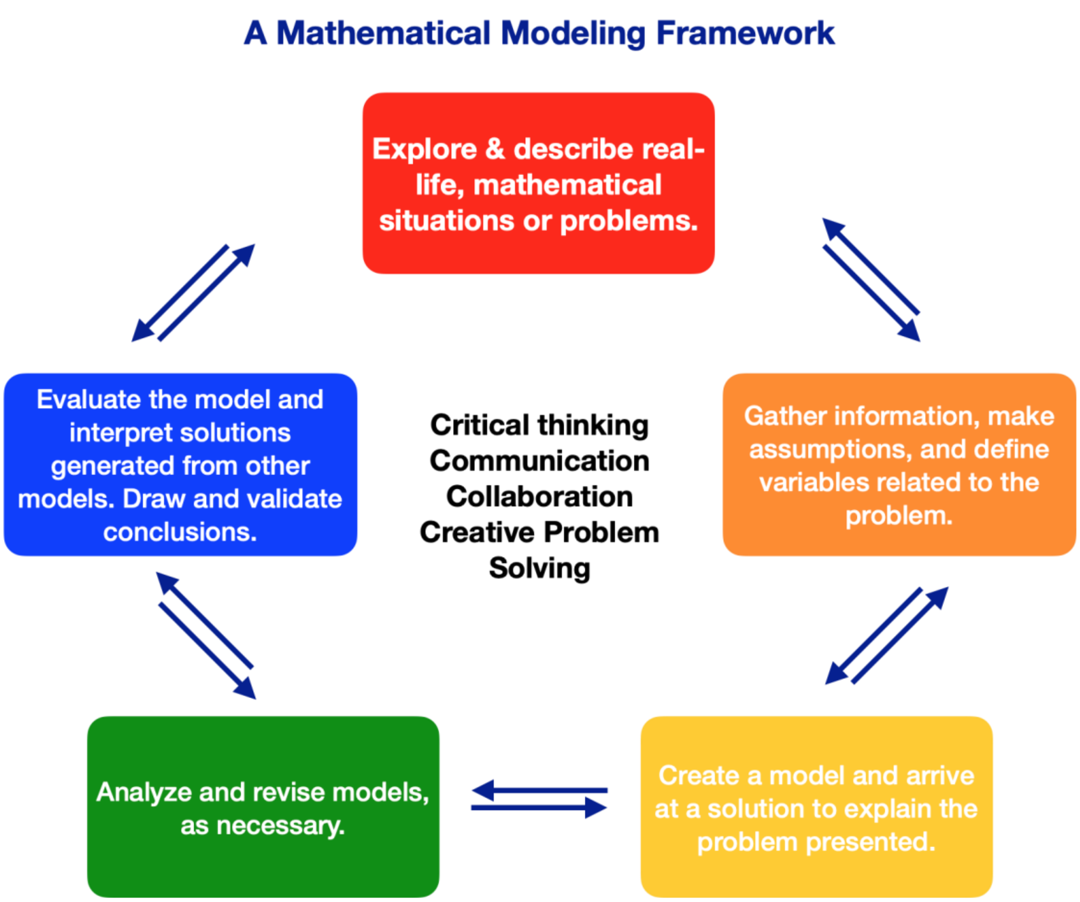


Image adapted from: Suh, Matson, Seshaiyer, 2017

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.

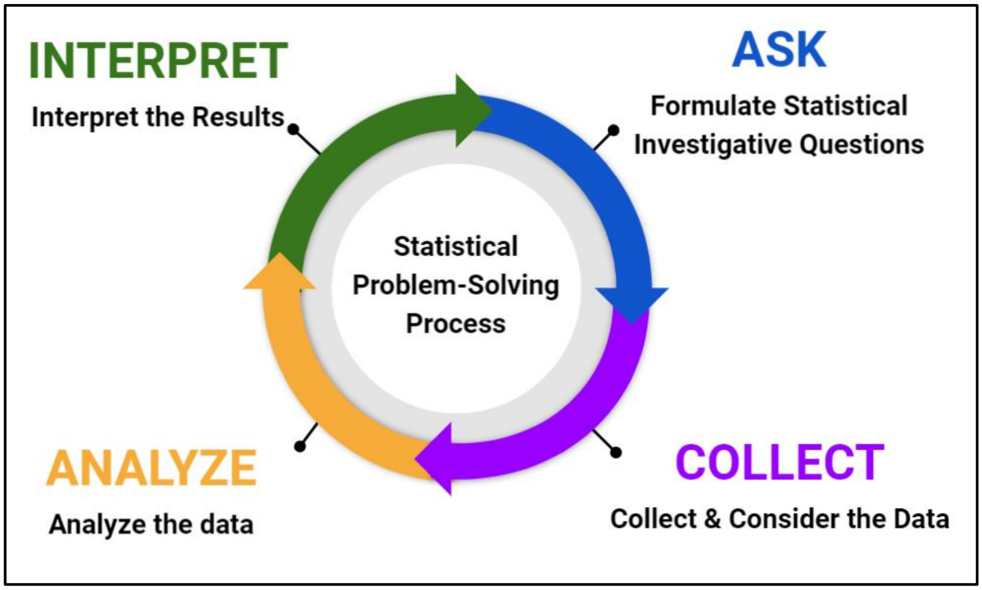


FIGURE 1: GEORGIA FRAMEWORK FOR STATISTICAL REASONING

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.

Kindergarten: Create statistical investigative questions that can be answered by collecting, analyzing, and interpreting data with **up to 10 data points.**

Ask	Collect	Analyze	Interpret
Generate and ask questions to investigate situations within the classroom.	**Collect data to answer a statistical investigative question.**	**Represent the findings from generated questions using objects and pictures.**	**Explain the findings based on the data collected and represented on graphs.**

Instructional Supports

- Expectations in this grade level should be taught throughout the year and applied contextually to the current expectation and everyday events.
- 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.
- Limit category counts to be less than or equal to ten.
- At this grade level, more support is needed with formulating statistical questions. Students should be given guidance when developing statistical investigative questions. Students should be provided with support strategies for collecting and organizing their data.
- Students will display their data using objects and pictures. In later grades, students will represent data in pictographs and bar graphs.
- In Kindergarten, students should be able to use friendly language to explain their data and answer the overall question.
- The terminology below is used to clarify expectations for the teaching professional. Students are not required to use this terminology when engaging with the learning objective.
- A statistical investigative question is one that requires data that will vary. Examples: "How did you get to school today?"; "What is your favorite ____?"

1st Grade: Create a statistical investigative question that can be answered using data involving numerical values **within 20**. Collect, analyze, and interpret **categorical data** presented as **picture graphs** and **bar graphs** (with single-unit scales) with **up to three categories** from actual situations to answer the question posed.

Ask	Collect	Analyze	Interpret
Create a statistical investigative question that can be answered by gathering, representing, and interpreting data.	**Determine strategies for collecting and organizing data within 20 to answer a statistical investigative question.**	**Create a picture graph and a bar graph (with single-unit scale) to represent a data set with up to three categories. Analyze the information by asking and answering questions about the data.**	**Interpret categorical data to answer the statistical investigative question created, including total number of data points, how many in each category, and how many more or less are in one category than another.**

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 formulate a statistical investigative question to explore a realistic situation in their classroom. Ex. "How many pets do you have?" is a statistical investigative question because it anticipates variability in students' responses.
- Students should be able to organize the data collected, represent the data on a table, and ask questions about the data generated. This expectation is limited to data with up to three categories presented in tables and charts. Students should be using tally marks and numerical values to organize and represent data.
- Students should use tally marks and numerical values within 20 to organize and represent the data. Students should be able to summarize the number of tally marks in each category.
- Students should be able to analyze and interpret categorical data on a provided pictograph or bar graph to answer the formulated statistical investigative question. On a picture graph, one symbol stands for a value of 1 at this grade level.
- Developing strategies for collecting data include students collaborating to determine ways to collect data. Data can be gathered from a variety of sources to answer the statistical investigative question posed.

2nd Grade: Create statistical investigative questions that can be answered using data. Collect, analyze, and interpret categorical data presented as picture graphs and bar graphs (with single-unit scales) with **up to four categories** from real situations to answer questions.

Ask	Collect	Analyze	Interpret
Create a statistical investigative question that can be answered by gathering, representing, and interpreting data.	**Determine strategies for collecting and organizing data to answer a statistical investigative question.**	**Create a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Analyze the information by asking and answering questions about the data.**	**Interpret categorical 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 real events.
- Students should formulate a statistical investigative question to explore an authentic situation in their classroom.
- The data collection can occur through the use of surveys and scientific observations. Tables and tally marks can be used to organize data.
- Pictographs and bar graphs used at this grade level should represent a data set with no more than four categories.
- Students should solve simple join, separate, and compare problems using information presented.
- Students should use addition and subtraction to create and obtain information from tables, pictographs, bar graphs, and tally charts.

3rd Grade: Create statistical investigative questions that can be answered using data. Collect, analyze, and interpret numerical and categorical data involving **whole number values** obtained from real situations to answer questions.

Ask	Collect	Analyze	Interpret
Create a statistical investigative question that can be answered using data from authentic situations.	**Determine strategies for collecting and organizing numerical data and categorical data involving whole number values to answer a statistical investigative question.**	**Create pictographs, bar graphs, and dot plots with a variety of scales, using appropriate titles, labels, and units within the graphical display.**	**Interpret categorical and 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 life events.
- In previous grade levels, students analyzed categorical data. In third grade, this is extended to include numerical data analysis.
- Students should formulate a statistical investigative question to explore a real situation in their classroom.
- Students should be provided with learning experiences to collect and analyze both numerical data and categorical data.
- Some problems should include reading bar graphs, pictographs, and dot plots, as well as measurements in grams, kilograms, liters. Dot plots and line plots can be used interchangeably. Dot plots should be used for numerical data representation on a number line.
- Developing strategies for collecting data include students collaborating to determine ways to collect data. Data can be gathered from a variety of sources to answer the statistical investigative question posed. Data sets for categorical data may include several categories.
- The scales of the pictographs, bar graphs, and dot plots should depend on the data collected. On a pictograph, one symbol may stand for a value greater than 1 to allow students to apply their understanding of single digit multiplication and division facts.
- Students should use a ruler that is marked at halves and fourths only to create an evenly spaced number line for the dot plot.
- *Numerical data* - data that can be 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* - a type of data 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.

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.

6th Grade: Formulate an investigative question, and collect, model, and analyze **data distributions** for **variability** to answer statistical questions and solve problems in context.

Ask	Collect	Analyze	Interpret
Create a statistical investigative question that can be answered by gathering data from real situations and determine strategies for gathering data to answer the statistical investigative question. **Distinguish between statistical and non-statistical questions.** **Write a statistical investigative question as one that anticipates variability in the data.**	**Summarize categorical and quantitative (numerical) data sets in relation to the context: display the distributions of quantitative (numerical) data in plots on a number line, including dot plots, histograms, and box plots and display the distribution of categorical data using bar graphs.** **Design simple experiments and collect data. Use data gathered from realistic scenarios and simulations to determine quantitative measures of center (median and/or mean) and variability (interquartile range and range). Use these quantities to draw conclusions about the data, compare different numerical data sets, and make predictions.**	**Relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.** **Describe the impact that inserting or deleting a data point has on the mean and the median of a data set. Create data displays using a dot plot or box plot to examine this impact.**	**Interpret numerical data to answer the statistical investigative question created.** **Describe the distribution of a quantitative (numerical) variable collected, including its center, variability, and overall shape, to answer a statistical investigative question.**

Instructional Supports

- Students should be able to use the statistical process to formulate questions. The statistical process involves asking a statistical investigative question, collecting the data, analyzing the data, and interpreting the results. As a result of an investigation, students should summarize categorical and quantitative (numerical) data sets in relation to the context.
- Students have experience with displaying categorical data using bar graphs from elementary grades. In sixth grade, students are extending their understanding of analyzing categorical data displayed on histograms. Students should be able to determine the number of observations from a context or diagram. Students should be able to analyze the shape of a data distribution and determine the impact single data points have on the data set represented visually.
- To develop solid statistical reasoning, students should be able to use quantitative measures of center and variability to draw conclusions about data sets and make predictions based on comparisons.
- Students should explore conceptually the measures of center (mean, median) and variability (interquartile range and range) for a set of numerical data gathered from contextual, mathematical situations and use these measures to describe the shape of the data presented in various forms.
- In sixth grade, students should explore the conceptual idea of MAD – not the formula. Data sets can be limited to no more than 10 data points when exploring the mean absolute deviation. Students should be able to apply their understanding of absolute value (rather than use operations on negative integers) in the context of MAD. Strategies and Methods
- Students should be able to describe the distribution of a quantitative (numerical) variable collected to answer a statistical investigative question, including its center (median, mean), variability (interquartile range (IQR), mean absolute deviation (MAD), and range), and overall shape (symmetrical vs non-symmetrical). Students should be able to identify that each quartile represents 25% of the data set. Students should understand the concept of outliers.
- Students should be able to describe the nature of the statistical attribute under investigation, including how it was measured and its units of measurement.
- Students should apply understanding of the measures of center (mean, median) and variability (interquartile range and range) to determine quantitative measures of center and variability, draw conclusions about the data, compare different numerical data sets and make predictions using data gathered from realistic scenarios and simulations.

7th Grade: Create statistical investigative questions that can be answered using quantitative data, collect data through **random sampling** to make **inferences about population distributions** using **data distributions**, and interpret data to answer statistical investigative questions.			
Ask	**Collect**	**Analyze**	**Interpret**
Create a statistical investigative question that can be answered by gathering data from real situations and determine strategies for gathering data to answer the statistical investigative question.	**Use statistical reasoning and methods to predict characteristics of a population by examining the characteristics of a representative sample. Recognize the potential limitations and scope of the sample to the population.** **Analyze sampling methods and conclude that random sampling produces and supports valid inferences.**	**Use data from repeated random samples to evaluate how much a sample mean is expected to vary from a population mean. Simulate multiple samples of the same size.**	**Use appropriate graphical displays and numerical summaries from data distributions with categorical or quantitative (numerical) variables to draw informal inferences about two samples or populations.**

Instructional Supports

- Students should have opportunities to create and answer statistical investigative questions about a population by collecting data from a representative sample, using random sampling techniques to collect the data.
- Students should have opportunities to critique examples of sampling techniques. Students should conclude when conditions of sampling methods may be biased, random, and not representative of the population. Students should use sample data collected to draw inferences.
- Students should use side by side bar graphs or segmented bar graphs to compare categorical data distributions of samples from two populations. Students should compare data of two samples or populations displayed in box plots and dot plots to make inferences.
- Students should be able to draw inferences using measures of central tendency (mean, median, mode) and/or variability (range, mean absolute deviation and interquartile range) from random samples. Conclusions should be made related to a population, using a random sample, by describing a distribution using measures of central tendency (mean, median, mode) and/or variability (range, mean absolute deviation, and interquartile range).

8th Grade: Create statistical investigative questions that can be answered using quantitative data. Collect, analyze, and interpret patterns of bivariate data and interpret linear models to answer statistical questions and solve real problems.			
Ask	**Collect**	**Analyze**	**Interpret**
Create a statistical investigative question that can be answered by gathering data from real situations and determine strategies for gathering data to answer the statistical investigative question.	**Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercepts.**	**Construct and interpret scatter plots for bivariate quantitative data to investigate patterns of association between two quantities.** **Explain the meaning of the predicted slope (rate of change) and the predicted intercept (constant term) of a linear model in the context of the data.**	**Show that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, visually fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line of best fit.** **Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercepts.** **Use appropriate graphical displays from data distributions involving lines of best fit to draw informal inferences and answer the statistical investigative question posed in an unbiased statistical study.**

Instructional Supports

- Students should be able to use statistical reasoning to describe patterns of association, such as clustering, outliers, positive or negative association, linear association, and nonlinear association through the analysis of data presented in multiple ways.
- Students should be given opportunities to analyze the data distribution displayed graphically to answer the statistical investigative question generated from a real situation.
- Students should solve practical, linear problems involving situations using bivariate quantitative data. A linear model shows the relationship between two variables in a data set, such as lines of best fit. Students should discover the line of best fit as the one that comes closest to most of the data points and shows the linear relationship between two variables in a data set.
- It is important to indicate ‘predicted’ slope to indicate this is a probabilistic interpretation in context, and not deterministic.

Georgia Department of Education

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:

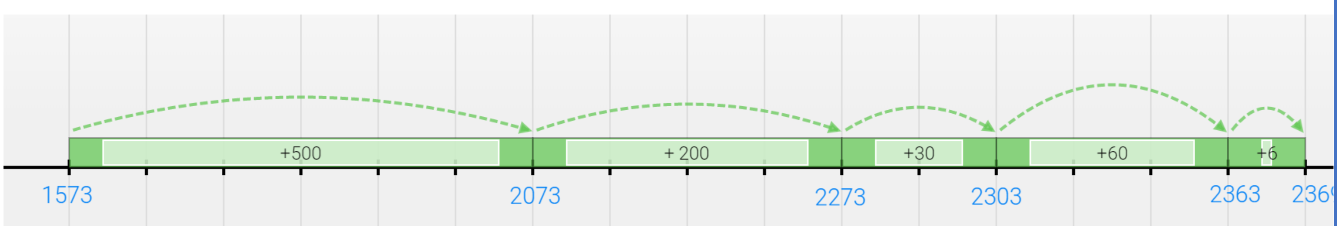
	1	1		
	1	5	7	3
+		7	9	6
	2	3	6	9

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!

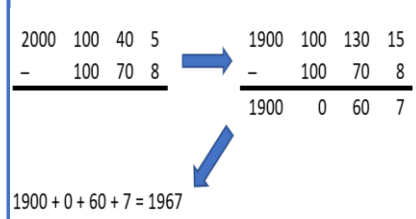
Place Value Algorithm:

	1	5	7	3
+		7	9	6
				9
+		1	6	0
+	1	2	0	0
+	1	0	0	0
	2	3	6	9

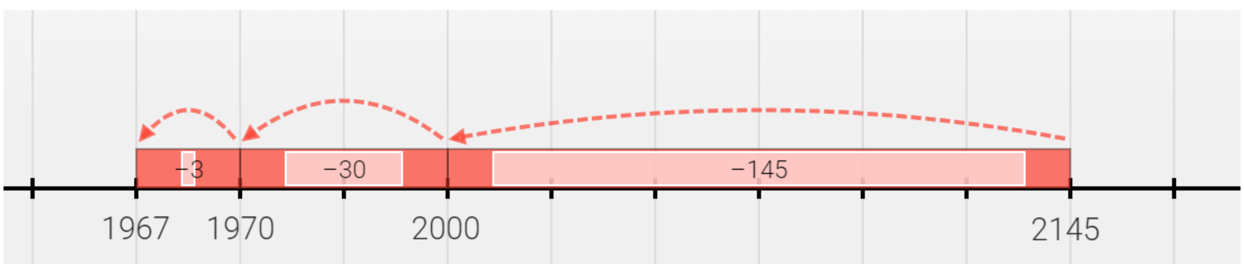
Number Line Representation:



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: $\begin{array}{rcccc} & & 0 & 13 & 15 \\ & 2 & \cancel{1} & \cancel{4} & \cancel{5} \\ - & & 1 & 7 & 8 \\ \hline & 1 & 9 & 6 & 7 \end{array}$	**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:

$$
\begin{array}{rr}
 & {}^{1}{}_{2} \\
 & 25 \\
\times & 24 \\
\hline
 & 100 \\
+ & 500 \\
\hline
 & 600
\end{array}
$$

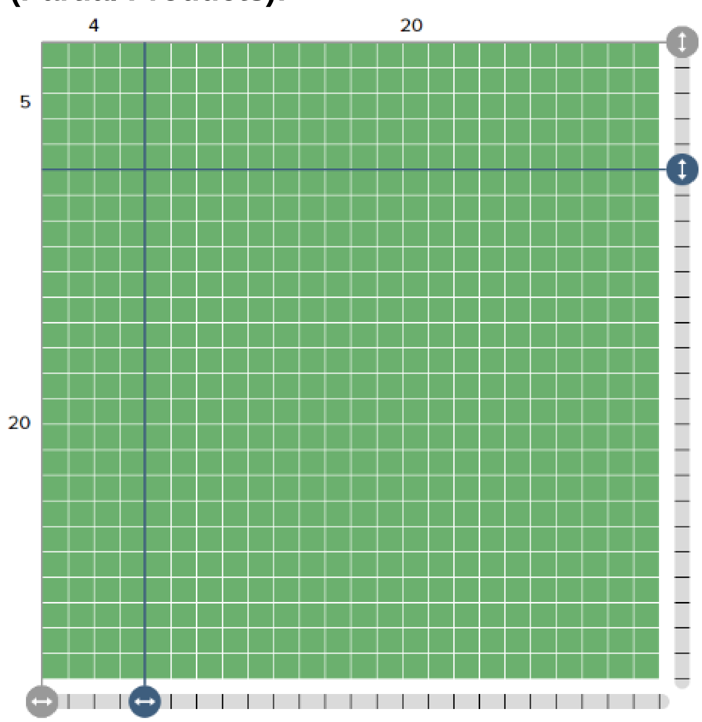
Description:

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):

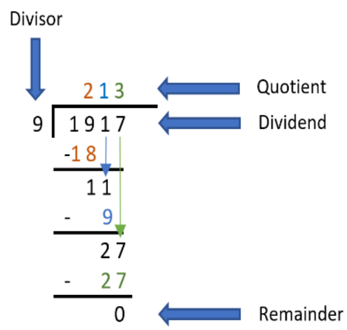


(5 × 4) + (5 × 20) + (20 × 4) + (20 × 20) = **(25 x 24)**

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:



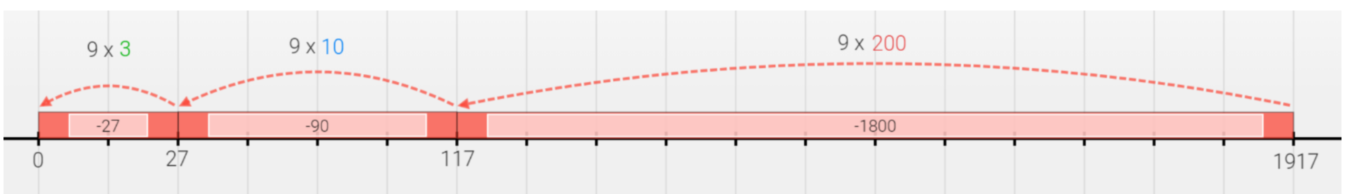
Description:

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	1 9 1 7	
	-1 8 0 0	200
	1 1 7	
	- 9 0	+ 10
	2 7	
	- 2 7	+ 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.