Draft 3 - Kindergarten

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Kindergarten

Elementary math builds a strong foundation of mathematical understanding that will be applied in later grades. Throughout the early elementary years, students develop number sense and fluency with operations using conceptual models. Students develop an understanding of the properties of operations and apply them to problem-solving. Shapes and their properties, including partitioning shapes, are explored throughout the elementary years. Students build a foundation of measurement concepts, including time, money, and length. Understanding of the data investigation cycle develops through the collection, representation, and analysis of data in various ways. These experiences provide a strong mathematical foundation that prepares students for success in upper elementary mathematics and beyond.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Second Grade mathematics.

North Carolina Mathematical and Statistical Practices

Teachers and Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical Thinker

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
K.ANR.1 Understand the relationship between numbers and quantities when counting objects within 20.	• **K.ANR.1.1** Count a collection of objects using the correct number sequence within 20.

	• **K.ANR.1.2** Demonstrate one-to-one correspondence by matching each object to one spoken number word while keeping track of objects without skipping or double-counting. • **K.ANR.1.3** Recognize that the last number said when counting is the total number of objects in the set (cardinality). • **K.ANR.1.4** Represent a counted set of objects with a written numeral 0-20, with 0 representing a count of no objects. • **K.ANR.1.5** Produce a set of objects that represents the quantity when given a number 0-20. • **K.ANR.1.6** Identify the next successive number when an object is added, recognizing the quantity is one more/greater. • **K.ANR.1.7** Write numbers 0-20. • **K.ANR.1.8** State the number of objects in a group within 5, without counting the objects (perceptual subitizing).
Standard	**Objectives**
K.ANR.2 Make use of structure in the number system to count within 100.	• **K.ANR.2.1** Count to 100 by ones. • **K.ANR.2.2** Count forward by ones from any given number within 100. • **K.ANR.2.3** Count backward by ones from any given number within 10. • **K.ANR.2.4** Count to 100 by tens.
Standard	**Objectives**
K.ANR.3 Reason abstractly and quantitatively to describe relationships between two quantities within 20.	• **K.ANR.3.1** Compare two sets of objects to determine which has more, fewer, or the same (equal) number of objects within 20. • **K.ANR.3.2** Produce a set of objects that has more, fewer, or the same (equal) number of objects as a given set within 20. • **K.ANR.3.3** Compare two numerals to determine which is greater than, less than, or has the same value (equal) within 20. • **K.ANR.3.4** Produce a set of objects that has more, fewer, or the same (equal) number of objects as a given numeral within 20.
Standard	**Objectives**
K.ANR.4 Make sense of addition and subtraction within 10 using objects and drawings.	• **K.ANR.4.1** Recognize the combination of small groups with totals within 10 without counting (conceptual subitizing).

	● **K.ANR.4.2** Demonstrate addition and subtraction situations within 10 using objects by: ○ Joining/adding to quantities ○ Separating/taking from quantities ● **K.ANR.4.3** Apply appropriate strategies to add and subtract within 10 using objects or drawings, including: ○ Counting all ○ Counting on ○ Counting back ○ One more, one less ○ Combinations of 10 ● **K.ANR.4.4** Represent addition and subtraction word problems within 10, using objects or drawings, including the following problem types: ○ Add To/Take From (Result Unknown) ○ Put Together/Take Apart (Total Unknown and Two Addends Unknown) ● **K.ANR.4.5** Solve addition and subtraction word problems within 10, using drawings, numbers, and/or words, including the following problem types: ○ Add To/Take From (Result Unknown) ○ Put Together/Take Apart (Total Unknown and Two Addends Unknown) ● **K.ANR.4.6** Connect composition and decomposition to addition and subtraction by recording written expressions with (+) as a symbol for addition and (-) as a symbol for subtraction. ● **K.ANR.4.7** Apply part-part-whole relationships to compose and decompose numbers within 10 in more than one way using objects or drawings. ● **K.ANR.4.8** Find the number that makes 10 when added to a given number using objects or drawings.
Standard	**Objectives**
K.ANR.5 Use repeated reasoning to develop fluency with addition and subtraction.	● **K.ANR.5.1** Demonstrate fluency with addition and subtraction of 0 or 1 within 10. ● **K.ANR.5.2** Demonstrate fluency with addition and subtraction within 5.

Standard	Objectives
K.ANR.6 Make sense of the structure of teen numbers (11-19).	• **K.ANR.6.1** Compose numbers as a group of ten ones and additional ones using objects and/or drawings. • **K.ANR.6.2** Decompose numbers as a group of ten ones and additional ones using objects and/or drawings. • **K.ANR.6.3** Represent the composition and decomposition of teen numbers as a group of ten ones and additional ones with numbers or expressions.
Standard	**Objectives**
K.ANR.7 Use repeated reasoning to make sense of repeating patterns with colors, shapes, sounds, movements, pictures, or objects.	• **K.ANR.7.1** Identify the core unit in a repeating pattern (AB, AAB, ABB, ABC). • **K.ANR.7.2** Extend a repeating pattern (AB, AAB, ABB, ABC) by repeating the core unit two additional times. • **K.ANR.7.3** Create a repeating pattern (AB, AAB, ABB, ABC).

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
K.SGMR.1 Describe shapes and their attributes.	• **K.SGMR.1.1** Name two-dimensional and three-dimensional shapes, regardless of their orientations or overall size, including triangles, squares, rectangles, hexagons, circles, cubes, cones, cylinders, and spheres. • **K.SGMR.1.2** Classify shapes as two-dimensional or three-dimensional. • **K.SGMR.1.3** Compare two-dimensional shapes in different sizes and orientations based on their attributes.
Standard	**Objectives**
K.SGMR.2 Create two-dimensional shapes.	• **K.SGMR.2.1** Draw triangles, rectangles, squares, and circles. • **K.SGMR.2.2** Build triangles, rectangles, squares, and circles. • **K.SGMR.2.3** Compose two-dimensional figures by combining triangles, rectangles, and/or squares.
Standard	**Objectives**
K.SGMR.3 Compare the measurable attributes of two objects.	• **K.SGMR.3.1** Describe measurable attributes of objects, including length, height, and weight. • **K.SGMR.3.2** Compare two objects using the same measurable attribute, including length, height, and weight, using comparative language.

Domain: Reasoning with Data

Standard	Objectives
K.RD.1 Use repeated reasoning to sort and classify based on attributes.	● **K.RD.1.1** Sort up to 20 pictures and/or objects based on one attribute. ● **K.RD.1.2** Describe the attribute used to sort a set of objects.
Standard	**Objectives**
K.RD.2 Apply the data cycle with a focus on simple object graphs and picture graphs.	● **K.RD.2.1** Determine the data needed to answer a question posed by the teacher with up to 20 data points within three categories. ● **K.RD.2.2** Collect categorical data based on a question posed by the teacher. ● **K.RD.2.3** Represent a data set (vertically or horizontally) by organizing and structuring collected data on an object graph and/or a picture graph. ● **K.RD.2.4** Count to determine how many are in each category and the total number of data points. ● **K.RD.2.5** Compare the counts in each category using comparison language, such as more than, less than, and the same (equal) amount. ● **K.RD.2.6** Communicate observations, conclusions, and/or decisions based on the question posed and data collected.

Draft 3 - First Grade

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - First Grade

Elementary math builds a strong foundation of mathematical understanding that will be applied in later grades. Throughout the early elementary years, students develop number sense and fluency with operations using conceptual models. Students develop an understanding of properties of operations and apply the properties to problem solving. Shapes and their properties, including partitioning shapes, are explored throughout the elementary years. Students build a foundation of measurement concepts, including time, money, and length. Understanding of the data investigation cycle develops through collecting, representing, and analyzing data in various ways. These experiences provide a strong mathematical foundation that prepares students for success in upper elementary mathematics and beyond.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework that will guide each PSU in developing the First Grade mathematics curriculum.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
1.ANR.1 Make use of structure in the number system to count within 120.	• **1.ANR.1.1** Count forward from any given number by ones within 120 and by tens within 100. • **1.ANR.1.2** Count backward from any given number by ones within 120 and by tens within 100. • **1.ANR.1.3** Count forward by 5s from any multiple of 5 within 100.

	● **1.ANR.1.4** Analyze numerical patterns of skip counting sequences by 5s and 10s within 100 to describe how the numbers increase by a constant amount.
Standard	**Objectives**
1.ANR.2 Make use of structure to count objects within 120.	● **1.ANR.2.1** Count a collection of objects using grouping strategies to determine the total. ● **1.ANR.2.2** Represent a set of objects with a written numeral.
Standard	**Objectives**
1.ANR.3 Make use of structure to develop place value understanding for two-digit numbers.	● **1.ANR.3.1** Unitize a collection of ten ones into a group of ten. ● **1.ANR.3.2** Represent the composition and decomposition of two-digit numbers as groups of tens and additional ones. ● **1.ANR.3.3** Apply place value understanding to read and write numbers in standard and expanded form.
Standard	**Objectives**
1.ANR.4 Make use of place value structure to reason about the magnitude of whole numbers within 100.	● **1.ANR.4.1** Represent whole numbers as distances from 0 on a pre-marked number line within 20. ● **1.ANR.4.2** Compare numbers within 100 by reasoning about the values of tens and ones digits, the location of the numbers on a number line, and using symbols (>, <, =). ● **1.ANR.4.3** Estimate the location of numbers within 100 on a number line by reasoning about their relationship to benchmark numbers.
Standard	**Objectives**
1.ANR.5 Make sense of addition and subtraction within 20.	● **1.ANR.5.1** Apply appropriate strategies to add and subtract within 20, including: ○ Counting on/back ○ Using doubles/near doubles ○ Making ten/decomposing a number leading to a ten ○ Using the relationship between addition and subtraction ○ Creating equivalent sums or differences ○ Using the commutative property

	● **1.ANR.5.2** Represent addition and subtraction word problems within 20, using equations with a symbol for the unknown number, including the following problem types: ○ Add To/Take From (Change Unknown) ○ Put Together/Take Apart (Addend Unknown) ○ Compare (Difference Unknown) ● **1.ANR.5.3** Solve addition and subtraction word problems within 20, using representations, including the following problem types: ○ Add To/Take From (Change Unknown) ○ Put Together/Take Apart (Addend Unknown) ○ Compare (Difference Unknown) ● **1.ANR.5.4** Apply the commutative and associative properties to solve addition problems within 20 involving three addends with and without context.
Standard	**Objectives**
1.ANR.6 Use repeated reasoning to develop fluency with addition and subtraction foundational facts.	● **1.ANR.6.1** Demonstrate fluency with addition and subtraction within 10. ● **1.ANR.6.2** Demonstrate fluency with 10 plus (10 + __) facts and doubles within 20.
Standard	**Objectives**
1.ANR.7 Apply understanding of the equal sign to explain the relationship between quantities within 20 by reasoning abstractly and quantitatively.	● **1.ANR.7.1** Describe the equal sign (=) as showing the quantities on both sides have the same value. ● **1.ANR.7.2** Justify whether two addition and/or subtraction expressions within 20 are equal or not equal using representations. ● **1.ANR.7.3** Determine the unknown whole number in an addition or subtraction equation with the unknown in all positions.
Standard	**Objectives**
1.ANR.8 Make use of place value structure to add and subtract within 100 with and without context.	● **1.ANR.8.1** Apply place value strategies and/or properties of operations using representations to add and subtract a two-digit number and a one-digit number. ● **1.ANR.8.2** Apply place value strategies and/or properties of operations using representations to add and subtract a two-digit number and a multiple of 10.

	• **1.ANR.8.3** Explain why addition and subtraction strategies work based on place value and/or number relationships within 100. • **1.ANR.8.4** Apply place value understanding to mentally determine 10 more or 10 less than a two-digit number, without having to count.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
1.SGMR.1 Make use of structure to describe and create shapes based on their defining attributes.	• **1.SGMR.1.1** Distinguish between defining and non-defining attributes of triangles, rectangles, squares, hexagons, and circles. • **1.SGMR.1.2** Describe triangles, rectangles, squares, hexagons, and circles based on their defining attributes, including the number of sides, vertices, and angles. • **1.SGMR.1.3** Draw triangles, rectangles, squares, hexagons, and circles. • **1.SGMR.1.4** Name three-dimensional shapes, including cubes, rectangular prisms, spheres, cones, and cylinders, using the shapes of their faces and whether their surfaces are flat or curved as defining attributes. • **1.SGMR.1.5** Build three-dimensional shapes, including cubes, rectangular prisms, spheres, cones, and cylinders. • **1.SGMR.1.6** Compare cubes, rectangular prisms, spheres, cones, and cylinders by describing the shapes of their faces and whether their surfaces are flat or curved.
Standard	**Objectives**
1.SGMR.2 Make sense of the relationship between a whole and its equal shares (halves and fourths) in real-world situations.	• **1.SGMR.2.1** Partition circles and rectangles into two and four equal shares. • **1.SGMR.2.2** Describe equal shares of circles and rectangles as halves and fourths, using the language “half of” and “fourth of.” • **1.SGMR.2.3** Describe a whole as two halves or four fourths. • **1.SGMR.2.4** Explain why partitioning the same whole into four equal parts creates smaller pieces than partitioning it into two equal parts.
Standard	**Objectives**
1.SGMR.3 Reason about length using non-standard units.	• **1.SGMR.3.1** Order three objects by length. • **1.SGMR.3.2** Compare the lengths of two objects indirectly by using a third object.

Standard	Objectives
1.SGMR.4 Measure lengths using non-standard units.	• **1.SGMR.4.1** Express the length of an object as a whole number of non-standard length units. • **1.SGMR.4.2** Measure by laying multiple copies of a shorter object (the length unit) end to end (iterating) with no gaps or overlaps.
Standard	**Objectives**
1.SGMR.5 Tell time to the nearest hour and half-hour.	• **1.SGMR.5.1** Describe units of time represented on a clock as minutes and hours. • **1.SGMR.5.2** Determine time to the nearest hour and half-hour using analog and digital clocks.
Standard	**Objectives**
1.SGMR.6 Develop an understanding of the value of coins.	• **1.SGMR.6.1** Identify quarters, dimes, nickels, and pennies. • **1.SGMR.6.2** Determine the value of quarters, dimes, nickels, and pennies. • **1.SGMR.6.3** Count by 1s, 5s, or 10s to determine the value of a collection of like coins (pennies, nickels, or dimes) up to 100 cents.

Domain: Reasoning with Data

Standard	Objectives
1.RD.1 Use repeated reasoning to sort and classify objects based on similarities and differences.	• **1.RD.1.1** Sort up to 20 pictures and/or objects based on one or two attributes. • **1.RD.1.2** Describe the attribute(s) used to sort a set of objects.
Standard	**Objectives**
1.RD.2 Apply the data cycle with a focus on object graphs and picture graphs.	• **1.RD.2.1** Generate questions, within a given context, that require the collection of categorical data. • **1.RD.2.2** Determine the data needed to answer a posed question with up to 20 data points within four categories. • **1.RD.2.3** Collect categorical data using various methods to answer a question. • **1.RD.2.4** Represent a data set (vertically or horizontally) by organizing and structuring collected data on an object graph and/or picture graph. • **1.RD.2.5** Analyze categorical data to describe, compare, and draw conclusions.

	• **1.RD.2.6** Communicate observations, conclusions, and/or decisions based on the question posed and data collected.

Draft 3 - Second Grade

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Second Grade

Elementary math builds a strong foundation of mathematical understanding that will be applied in later grades. Throughout the early elementary years, students develop number sense and fluency with operations using conceptual models. Students develop an understanding of the properties of operations and apply them to problem-solving. Shapes and their properties, including partitioning shapes, are explored throughout the elementary years. Students build a foundation of measurement concepts, including time, money, and length. Understanding of the data investigation cycle develops through the collection, representation, and analysis of data in various ways. These experiences provide a strong mathematical foundation that prepares students for success in upper elementary mathematics and beyond.

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North Carolina Mathematical and Statistical Practices

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4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
2.ANR.1 Apply patterns and structure in numbers to reason about quantities.	• **2.ANR.1.1** Solve problems, with and without context, by counting forward and backward by 1s, 2s, 5s, 10s, and 100s from any given number within 1,000.

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	● **2.ANR.1.2** Determine whether a group within 20 has an odd or even number of objects using strategies such as pairing objects and counting by 2s, forming two equal groups, and/or expressing an even number as a sum of two equal addends in an equation. ● **2.ANR.1.3** Determine the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns using skip-counting and/or repeated addition.
Standard	**Objectives**
2.ANR.2 Make use of structure to develop place value understanding for three-digit numbers.	● **2.ANR.2.1** Unitize a collection of ten tens into a group of a hundred. ● **2.ANR.2.2** Represent the composition and decomposition of three-digit numbers as groups of hundreds, groups of tens, and additional ones. ● **2.ANR.2.3** Apply place value understanding to determine the value of each digit in a three-digit number. ● **2.ANR.2.4** Apply place value reasoning to compose and decompose numbers within 200 to show equivalent forms using representations. ● **2.ANR.2.5** Apply place value understanding to read and write numbers within 1,000 in standard, expanded, and word form.
Standard	**Objectives**
2.ANR.3 Make use of place value structure to reason about magnitude of whole numbers within 1,000.	● **2.ANR.3.1** Apply place value understanding to compare and order numbers within 1,000, by: ○ Reasoning about the values of hundreds, tens, and ones digits ○ Reasoning about the location of the numbers on a number line ○ Representing comparisons using symbols (>, <, =) ● **2.ANR.3.2** Estimate the location of numbers within 1,000 on a number line by reasoning about their relationship to benchmark numbers.
Standard	**Objectives**
2.ANR.4 Use repeated reasoning to develop fluency with addition and subtraction using mental strategies.	● **2.ANR.4.1** Demonstrate fluency with addition and subtraction within 20. ● **2.ANR.4.2** Apply place value understanding within 1,000, to add 10 or 100 and subtract 10 or 100.

Standard	Objectives
2.ANR.5 Make use of place value structure and properties of operations to fluently add and subtract within 100.	● **2.ANR.5.1** Apply appropriate strategies to fluently add and subtract within 100, including: ○ Composing and decomposing numbers based on place value ○ Commutative and associative properties ○ Relationship between addition and subtraction ○ Creating equivalent sums or differences ● **2.ANR.5.2** Represent one-step addition and subtraction word problems within 100, using equations with a symbol for the unknown number, including the following problem types: ○ Add To/Take From (Start Unknown) ○ Compare (Bigger Unknown) ○ Compare (Smaller Unknown) ● **2.ANR.5.3** Represent two-step addition and subtraction word problems within 100, using equations with a symbol for the unknown number, including the following problem types: ○ Add To/Take From (Change Unknown) ○ Add To/Take From (Result Unknown) ● **2.ANR.5.4** Solve one- and two-step addition and subtraction word problems within 100, using place value understanding, commutative and associative properties of addition, and/or the relationship between addition and subtraction. ● **2.ANR.5.5** Analyze number relationships to justify efficient strategy selection for addition and subtraction.
Standard	**Objectives**
2.ANR.6 Apply understanding of the equal sign to explain the relationship between quantities and expressions as equal or not equal within 100.	● **2.ANR.6.1** Justify whether two addition and/or subtraction expressions within 100 are equal or not equal using representations. ● **2.ANR.6.2** Determine the unknown whole number in addition or subtraction equations within 100 with the unknown in all positions.

Standard	Objectives
2.ANR.7 Make use of place value structure and properties of operations to add and subtract within 1,000 with and without context.	● **2.ANR.7.1** Apply place value strategies and/or properties of operations using representations to add three two-digit numbers by: ○ Composing and decomposing numbers ○ Using the commutative and associative properties of addition ○ Creating equivalent sums ● **2.ANR.7.2** Apply place value strategies and/or properties of operations using representations to add and subtract within 1,000 by: ○ Composing and decomposing numbers ○ Using the commutative and associative properties of addition ○ Using the relationship between addition and subtraction ○ Creating equivalent sums and differences ● **2.ANR.7.3** Explain why addition and subtraction strategies work based on place value and/or number relationships within 1,000.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
2.SGMR.1 Reason with two-dimensional shapes and their attributes.	● **2.SGMR.1.1** Compare triangles, quadrilaterals, pentagons, hexagons, octagons, and circles based on the number of sides, vertices, and angles. ● **2.SGMR.1.2** Describe the attributes of the new shape when composing three or more two-dimensional shapes. ● **2.SGMR.1.3** Identify the individual shapes created when decomposing a two-dimensional figure. ● **2.SGMR.1.4** Justify whether a shape or composite figure has a line of symmetry.
Standard	**Objectives**
2.SGMR.2 Make sense of the relationship between a whole and its equal shares (halves, thirds, fourths) in real-world situations.	● **2.SGMR.2.1** Partition circles and rectangles into two, three, and four equal shares. ● **2.SGMR.2.2** Describe equal shares of circles and rectangles as halves, thirds, and fourths, using the language “half of,” “third of,” “fourth of,” and “quarter of." ● **2.SGMR.2.3** Describe a whole as two halves, three thirds, or four fourths.

	• **2.SGMR.2.4** Explain why equal shares of the same whole may look different but represent equal amounts. • **2.SGMR.2.5** Explain why partitioning the same whole into more equal shares results in smaller shares.
Standard	**Objectives**
2.SGMR.3 Apply understanding of customary and metric units to reason about length.	• **2.SGMR.3.1** Measure object length to the nearest customary unit (inch, foot, yard) and metric unit (centimeter, meter) using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. • **2.SGMR.3.2** Measure the same object with two different units within the same system (customary or metric) to explain how the size of the unit chosen relates to the length measurement of the object. • **2.SGMR.3.3** Choose an appropriate customary unit (inch, foot, yard) or metric unit (centimeter, meter) to measure the length of an object. • **2.SGMR.3.4** Estimate length with customary units (inches, feet, yards) or metric units (centimeters, meters) using measurement benchmarks. • **2.SGMR.3.5** Measure to compare the lengths of two objects.
Standard	**Objectives**
2.SGMR.4 Develop an understanding of time to the nearest minute.	• **2.SGMR.4.1** Tell time to the nearest 5 minutes and 1 minute on analog and digital clocks, using a.m. and p.m. appropriately. • **2.SGMR.4.2** Write times shown on analog and digital clocks to the nearest 5 minutes and 1 minute, using a.m. and p.m. appropriately.
Standard	**Objectives**
2.SGMR.5 Apply understanding of the value of money using coins.	• **2.SGMR.5.1** Compose a set of coins to match a given amount within 100 cents ($1.00). • **2.SGMR.5.2** Determine the value of a given combination of quarters, dimes, nickels, and pennies within 100 cents ($1.00).

Domain: Reasoning with Data

Standard	Objectives
2.RD.1 Use repeated reasoning to sort and classify objects based on one or two attributes.	• **2.RD.1.1** Sort up to 30 pictures and/or objects based on one or two attributes. • **2.RD.1.2** Describe the attribute(s) used to sort a set of objects.

Standard	Objectives
2.RD.2 Apply the data cycle with a focus on single-scaled picture and bar graphs.	● **2.RD.2.1** Generate questions, within a given context, that require the collection of categorical data. ● **2.RD.2.2** Determine the data needed to answer a posed question with up to 30 data points within four categories. ● **2.RD.2.3** Collect categorical data using various methods to answer a question. ● **2.RD.2.4** Represent a data set (vertically or horizontally) by organizing and structuring collected data on a picture graph and/or bar graph. ● **2.RD.2.5** Analyze categorical data to describe, compare, and draw conclusions. ● **2.RD.2.6** Communicate observations, conclusions, and/or decisions based on the question posed and data collected.

Draft 3 - Third Grade

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Third Grade

Elementary math builds a strong foundation of mathematical understanding that will be applied in later grades. Throughout the upper elementary years, students continue to develop number sense and fluency with operations using conceptual models. Students develop an understanding of the properties of operations and apply them to problem solving. Building on partitioning shapes in K-2, students develop an understanding of fractions as a quantity that deepens understanding of units and relationships. Measurement, geometry, and number concepts become increasingly integrated as students apply perimeter, area, volume, and unit relationships to solve problems. Understanding of the data investigation cycle deepens through collecting, representing, and analyzing data in various ways to make predictions and generalizations. These experiences provide a strong mathematical foundation that prepares students for success in middle school mathematics and beyond.

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North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

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4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
3.ANR.1 Make use of structure to extend and apply place value.	• **3.ANR.1.1** Apply place value understanding to read, write, and determine the place and value of each digit in a whole number within 10,000.

	● **3.ANR.1.2** Make connections between different forms, including standard, expanded, and word forms of whole numbers within 10,000. ● **3.ANR.1.3** Apply place value reasoning to compose and decompose numbers within 1,000 to show equivalent forms using representations. ● **3.ANR.1.4** Apply place value reasoning to fluently add or subtract multiples of 10, 100, or 1,000 to a given number within 10,000 using mental strategies. ● **3.ANR.1.5** Apply place value understanding to compare and order whole numbers within 10,000 with representations using symbols (>, <, =, ≠) and/or words to record the results of comparisons.
Standard	**Objectives**
3.ANR.2 Make sense of whole number addition and subtraction within 1,000.	● **3.ANR.2.1** Apply addition and subtraction strategies to represent and solve one-step problems in context with whole numbers within 1,000. ● **3.ANR.2.2** Apply reasoning strategies to add and subtract within 1,000, including expanded form, properties of operations, and/or the relationship between addition and subtraction. ● **3.ANR.2.3** Analyze addition and subtraction strategies to develop procedural fluency.
Standard	**Objectives**
3.ANR.3 Make sense of multiplication with whole numbers.	● **3.ANR.3.1** Interpret factors as representing the number of equal groups and the number of objects in each group for products of whole numbers with two factors within 10. ● **3.ANR.3.2** Represent strategies, including repeated addition, skip-counting, decomposing a factor, and the commutative property, for products of whole numbers with two factors within 10. ● **3.ANR.3.3** Apply multiplication strategies using representations to solve one-step multiplication word problems with factors within 10, including the following problem types: ○ Equal Groups ○ Arrays & Area ● **3.ANR.3.4** Connect multiplication problems in context with equations using a symbol for the unknown number.

	● **3.ANR.3.5** Describe patterns of multiplication using visual tools such as hundred boards, multiplication tables, two-column tables, and number lines. ● **3.ANR.3.6** Find the product of a one-digit whole number by a multiple of 10 in the range 10–90 by using representations, based on place value and the properties of operations.
Standard	**Objectives**
3.ANR.4 Make sense of division with whole numbers.	● **3.ANR.4.1** Interpret the divisor and quotient within 10 in a division equation as representing the number of equal groups and the number of objects in each group. ● **3.ANR.4.2** Represent strategies, including repeated addition or subtraction, skip-counting, and decomposing a factor, for division with a divisor and quotient within 10. ● **3.ANR.4.3** Apply division strategies using representations to solve one-step division word problems involving a divisor and quotient within 10, including the following problem types: ○ Equal Groups ○ Arrays & Area ● **3.ANR.4.4** Connect division problems in context with equations using a symbol for the unknown number.
Standard	**Objectives**
3.ANR.5 Reason quantitatively to make connections between multiplication and division with whole numbers.	● **3.ANR.5.1** Construct an argument to explain the connection of a multiplication or division problem in context to the meaning of the operations. ● **3.ANR.5.2** Apply the inverse relationship between multiplication and division. ● **3.ANR.5.3** Justify whether two multiplication and/or division expressions within 100 are equal or not equal using representations. ● **3.ANR.5.4** Develop fluency with multiplication facts through 10 × 10 and the corresponding division facts by applying reasoning strategies (e.g., doubling, add-a-group, subtract-a-group, near squares, and inverse relationships). ● **3.ANR.5.5** Recall foundational multiplication facts (0s, 1s, 2s, 5s, and 10s) with automaticity.

Standard	Objectives
3.ANR.6 Make sense and persevere in solving problems involving whole-number operations.	● **3.ANR.6.1** Apply addition, subtraction, and multiplication strategies to represent and solve two-step problems in context. ● **3.ANR.6.2** Estimate sums, differences, products, and quotients in one- and two-step problems in context.
Standard	**Objectives**
3.ANR.7 Make sense of fractions.	● **3.ANR.7.1** Explain that a unit fraction is one part formed when a whole is partitioned into equal parts using denominators 2, 3, 4, 6, and 8. ● **3.ANR.7.2** Identify unit fractions using area and length models with denominators 2, 3, 4, 6, and 8. ● **3.ANR.7.3** Explain with an area model that the numerator of a fraction represents the number of equal parts of the unit fraction using fractions with denominators 2, 3, 4, 6, and 8. ● **3.ANR.7.4** Explain with a number line that the numerator of a fraction represents the number of lengths of the unit fraction from 0 using fractions with denominators 2, 3, 4, 6, and 8. ● **3.ANR.7.5** Determine equivalent fractions by composing and decomposing with area and length models using related fractions: halves, fourths, and eighths; thirds and sixths. ● **3.ANR.7.6** Explain that a fraction with the same numerator and denominator equals one whole using fractions with denominators 2, 3, 4, 6, and 8. ● **3.ANR.7.7** Demonstrate equivalency of whole numbers up to 4 using fractions greater than 1 with denominators 2, 3, 4, 6, and 8. ● **3.ANR.7.8** Recognize that comparisons are valid only when the two fractions refer to the same whole using related fractions: halves, fourths, and eighths; thirds and sixths. ● **3.ANR.7.9** Reason about the size of fractions to compare and order fractions with the same numerator or the same denominator using area and length models, and using symbols (>, <, =) with denominators 2, 3, 4, 6, and 8.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
3.SGMR.1 Reason with quadrilaterals and their attributes.	• **3.SGMR.1.1** Construct points, lines, line segments, and perpendicular and parallel lines. • **3.SGMR.1.2** Identify points, lines, line segments, and perpendicular and parallel lines within two-dimensional figures and in context. • **3.SGMR.1.3** Describe angles as geometric shapes that are formed when two rays share a common endpoint. • **3.SGMR.1.4** Identify angles as acute, obtuse, right, or straight based on the relationship to perpendicular or straight lines. • **3.SGMR.1.5** Construct examples and non-examples of quadrilaterals. • **3.SGMR.1.6** Identify types of quadrilaterals, including parallelograms, rhombuses, rectangles, squares, and trapezoids based on their attributes.
Standard	**Objectives**
3.SGMR.2 Make sense of time and customary measurement.	• **3.SGMR.2.1** Solve problems in context involving addition and subtraction of time intervals within the same hour to find an end time, amount of time passed, or a start time. • **3.SGMR.2.2** Estimate customary measurements of length, capacity, and weight using measurement benchmarks. • **3.SGMR.2.3** Measure lengths in customary units to the quarter-inch and half-inch, and feet and yards to the whole unit. • **3.SGMR.2.4** Measure capacity in customary units with cups, pints, quarts, and gallons. • **3.SGMR.2.5** Measure weight in customary units with ounces and pounds. • **3.SGMR.2.6** Solve one-step problems in context involving whole-number measurements of length, weight, and capacity within the same customary units using the four operations.
Standard	**Objectives**
3.SGMR.3 Make sense of area and perimeter.	• **3.SGMR.3.1** Measure the area of a rectangle with whole-number side lengths by tiling without gaps or overlaps and counting unit squares.

	• **3.SGMR.3.2** Find the area of rectangles with whole-number side lengths, including problems in context. • **3.SGMR.3.3** Find the area of a rectangle by partitioning it into two smaller rectangles where the area of the large rectangle is the sum of the two smaller rectangles by using tiles and/or arrays. • **3.SGMR.3.4** Find the perimeter of polygons with no more than 8 sides, including problems in context, by measuring the distance around a shape in length units. • **3.SGMR.3.5** Apply understandings of the attributes of quadrilaterals and regular polygons to find the length of an unknown side when given the perimeter.

Domain: Reasoning with Data

Standard	Objectives
3.RD.1 Apply the data cycle with a focus on frequency tables, scaled bar graphs, and picture graphs.	• **3.RD.1.1** Generate questions that require the collection of categorical data. • **3.RD.1.2** Determine the data needed to answer a posed question with up to 5 categories. • **3.RD.1.3** Design a plan to collect categorical data to answer a question. • **3.RD.1.4** Collect categorical data using various methods to answer a question. • **3.RD.1.5** Represent a data set (vertically or horizontally) by organizing and structuring collected data on a frequency table, scaled bar graph, and/or picture graph. • **3.RD.1.6** Analyze categorical data to describe, compare, draw conclusions, and construct arguments supported by evidence from the data. • **3.RD.1.7** Look for and express regularity in repeated reasoning to generalize and make predictions based on patterns in the data.

Draft 3 - Fourth Grade

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Fourth Grade

Elementary math builds a strong foundation of mathematical understanding that will be applied in later grades. Throughout the upper elementary years, students continue to develop number sense and fluency with operations using conceptual models. Students develop an understanding of the properties of operations and apply them to problem-solving. Building on partitioning shapes in K-2, students develop an understanding of fractions as a quantity that deepens understanding of units and relationships. Measurement, geometry, and number concepts become increasingly integrated as students apply perimeter, area, volume, and unit relationships to solve problems. Understanding of the data investigation cycle deepens through collecting, representing, and analyzing data in various ways to make predictions and generalizations. These experiences provide a strong mathematical foundation that prepares students for success in middle school mathematics and beyond.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Fourth Grade mathematics.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
4.ANR.1 Make use of structure to extend and apply place value.	• **4.ANR.1.1** Apply place value understanding to read, write, and determine the place and value of each digit in a whole number within 100,000.

	● **4.ANR.1.2** Make connections between equivalent forms of whole numbers, including non-traditional, standard, expanded, and word forms within 100,000. ● **4.ANR.1.3** Apply the patterns of the base-ten system to explain that in a multi-digit whole number, a digit in one place represents 10 times as much as it represents in the place to its right within 100,000. ● **4.ANR.1.4** Apply place value understanding to compare and order whole numbers within 100,000 using symbols (>, <, =, ≠) and/or words to record the results of comparisons.
Standard	**Objectives**
4.ANR.2 Use repeated reasoning to make sense of whole number addition and subtraction within 100,000.	● **4.ANR.2.1** Connect addition and subtraction strategies within 1,000, including expanded form, properties of operations, and/or the relationship between addition and subtraction to the standard algorithm. ● **4.ANR.2.2** Apply place value understanding of the standard algorithm to add and subtract multi-digit whole numbers within 100,000.
Standard	**Objectives**
4.ANR.3 Make sense of multiplication and division with whole numbers.	● **4.ANR.3.1** Generate factor pairs for a whole number within 50 using representations. ● **4.ANR.3.2** Determine whether a whole number within 50 is prime, composite, or neither. ● **4.ANR.3.3** Recognize that a whole number is a multiple of each of its factors. ● **4.ANR.3.4** Determine whether a given whole number is a multiple of a given one-digit number. ● **4.ANR.3.5** Demonstrate fluency with multiplication facts through 10 x 10 with reasoning strategies. ● **4.ANR.3.6** Recall multiplication facts through 10 x 10 with automaticity. ● **4.ANR.3.7** Distinguish multiplicative comparison from additive comparison. ● **4.ANR.3.8** Apply multiplication and division strategies using representations to solve one-step multiplication and division word problems with factors within 10, including the following problem types: ○ Compare

	• **4.ANR.3.9** Apply place value strategies and/or the properties of multiplication, to multiply a whole number of up to three digits by a one-digit whole number or up to two two-digit whole numbers using visual and/or symbolic representations, including the area model. • **4.ANR.3.10** Apply place value strategies, properties of operations, and/or the relationship between multiplication and division to find whole-number quotients and remainders with up to three-digit dividends and one-digit divisors using visual and/or symbolic representations. • **4.ANR.3.11** Interpret the meaning of the remainder when solving up to three-digit by one-digit division problems in context.
Standard	**Objectives**
4.ANR.4 Make sense and persevere in solving two-step problems involving operations with whole numbers.	• **4.ANR.4.1** Solve two-step problems in context involving the four operations using a variety of representations, including equations with a letter standing for the unknown quantity. • **4.ANR.4.2** Justify that an answer is reasonable using estimation strategies.
Standard	**Objectives**
4.ANR.5 Make sense of fractions and decimals.	• **4.ANR.5.1** Explain why a fraction is equivalent to another fraction using area and length models with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100. • **4.ANR.5.2** Apply reasoning about the size of fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100 to compare and order fractions using area and length models, and using symbols (>, <, =). • **4.ANR.5.3** Apply reasoning about benchmark fractions 0, ½, and one whole to compare and order fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100 using symbols (>, <, =). • **4.ANR.5.4** Apply reasoning about equivalent fractions using related fractions: halves, fourths, and eighths; thirds, sixths, and twelfths; fifths, tenths, and hundredths to compare and order fractions using symbols (>, <, =). • **4.ANR.5.5** Represent decimals less than 2 wholes using tenths and hundredths with visual and/or symbolic representations, making connections between fractions and decimals. • **4.ANR.5.6** Recognize that comparisons are valid only when the two decimals refer to the same whole.

	• **4.ANR.5.7** Apply place value reasoning to compare and order decimals to the hundredths place using area and length models and symbols (>, <, =).
Standard	**Objectives**
4.ANR.6 Make sense of operations with fractions.	• **4.ANR.6.1** Apply area models, length models, and equations to represent the addition and subtraction of fractions with like denominators as joining and separating parts referring to the same whole using fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100. • **4.ANR.6.2** Decompose a fraction into a sum of unit fractions and a sum of fractions with the same denominator in more than one way using area models, length models, and equations using fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100. • **4.ANR.6.3** Apply understanding of properties of operations and the relationship between addition and subtraction to add and subtract fractions, including mixed numbers, with like denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100. • **4.ANR.6.4** Solve one- and two-step problems in context involving addition and subtraction of fractions, including mixed numbers, with like denominators of 2, 3, 4, 5, 6, 8, 10, 12, and 100. • **4.ANR.6.5** Explain using area and length models that fractions can be represented by multiplying a whole number within 12 by a unit fraction with denominators of 2, 3, 4, 5, 6, 8, 10, and 12. • **4.ANR.6.6** Apply understanding of multiplying a whole number within 12 by a unit fraction to multiplying a whole number by any fraction less than one with denominators of 2, 3, 4, 5, 6, 8, 10, and 12. • **4.ANR.6.7** Determine a fraction of a set using set models and arrays by multiplying a fraction with denominators of 2, 3, 4, 5, 6, 8, 10, and 12 by a whole number within 12. • **4.ANR.6.8** Solve one-step problems in context involving multiplication of fractions and whole numbers, with whole numbers within 12 and denominators 2, 3, 4, 5, 6, 8, 10, and 12.

Standard	Objectives
4.ANR.7 Reason about patterns.	● **4.ANR.7.1** Generate a shape or number pattern that follows a given rule. ● **4.ANR.7.2** Analyze the relationships in a shape or number pattern to determine the rule. ● **4.ANR.7.3** Analyze a pattern to determine if it is a growing or a repeating pattern to extend the pattern, including problems in context.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
4.SGMR.1 Reason about angles and their measurement.	● **4.SGMR.1.1** Demonstrate an understanding that angles are measured in degrees with reference to the degrees of a circle. ● **4.SGMR.1.2** Estimate angle measurements using types of angles (acute, obtuse, right, or straight) and angle benchmarks. ● **4.SGMR.1.3** Use a protractor to measure angles in whole-number degrees. ● **4.SGMR.1.4** Solve addition and subtraction problems to find unknown angles on a diagram or in one- or two-step problems in context.
Standard	**Objectives**
4.SGMR.2 Reason with triangles and quadrilaterals and their attributes.	● **4.SGMR.2.1** Construct points, lines, rays, angles, and parallel and perpendicular lines using symbolic notation within two-dimensional figures and in context. ● **4.SGMR.2.2** Construct examples of triangles based on angle types (obtuse, right, acute) and side lengths (equilateral, isosceles, scalene), including cross-classifying. ● **4.SGMR.2.3** Name triangles based on angle types (obtuse, right, acute) and side lengths (equilateral, isosceles, scalene), including cross-classifying. ● **4.SGMR.2.4** Classify quadrilaterals and triangles based on angle measure, side lengths, and the presence or absence of parallel or perpendicular lines.
Standard	**Objectives**
4.SGMR.3 Make sense of time and metric measurement.	● **4.SGMR.3.1** Solve problems in context involving addition and subtraction of time intervals that cross over the hour to find an end time, amount of time passed, or a start time.

	• **4.SGMR.3.2** Estimate metric measurements of length, capacity, and weight using measurement benchmarks. • **4.SGMR.3.3** Measure lengths in metric units with centimeters and meters. • **4.SGMR.3.4** Measure capacity in metric units with liters and milliliters. • **4.SGMR.3.5** Measure weight in metric units with grams and kilograms. • **4.SGMR.3.6** Solve one-step problems in context involving whole-number measurements of length, weight, and capacity that are given within the same metric unit using the four operations. • **4.SGMR.3.7** Use place value understanding and representations, including tables, to apply multiplicative reasoning to convert metric measurements from a larger unit to a smaller unit with a given conversion chart.
Standard	**Objectives**
4.SGMR.4 Reason abstractly and quantitatively to apply understandings of area and perimeter.	• **4.SGMR.4.1** Apply the area and perimeter formulas of rectangles to solve problems in context. • **4.SGMR.4.2** Find the area of rectilinear figures with known side lengths composed of two or three non-overlapping rectangles. • **4.SGMR.4.3** Solve problems in context involving a fixed area and varying perimeters or a fixed perimeter and varying areas of rectangles.

Domain: Reasoning with Data

Standard	Objectives
4.RD.1 Apply the data cycle with a focus on frequency tables, line plots, and single and double bar graphs.	• **4.RD.1.1** Generate questions that require the collection of categorical or numerical data. • **4.RD.1.2** Determine whether a question will yield categorical or numerical data. • **4.RD.1.3** Design a plan to collect categorical or numerical data to answer a question. • **4.RD.1.4** Collect categorical or numerical data using various methods to answer a question. • **4.RD.1.5** Represent a data set by organizing and structuring collected data on a frequency table, line plot, or single and double bar graph.

	● **4.RD.1.6** Make sense of the range as a measure of spread and the mode as the most common value in a data set. ● **4.RD.1.7** Make sense of the median as the middle value of the data set. ● **4.RD.1.8** Analyze categorical or numerical data to describe, compare, draw conclusions, and construct arguments supported by evidence from the data. ● **4.RD.1.9** Look for and express regularity in repeated reasoning to generalize and make predictions based on patterns in the data.

Draft 3 - Fifth Grade

North Carolina Standard Course Of Study- DRAFT

K-12 Mathematics - Fifth Grade

Elementary math builds a strong foundation of mathematical understanding that will be applied in later grades. Throughout the upper elementary years, students continue to develop number sense and fluency with operations using conceptual models. Students develop an understanding of the properties of operations and apply them to problem-solving. Building on partitioning shapes in K-2, students develop an understanding of fractions as a quantity that deepens understanding of units and relationships. Measurement, geometry, and number concepts become increasingly integrated as students apply perimeter, area, volume, and unit relationships to solve problems. Understanding of the data investigation cycle deepens through collecting, representing, and analyzing data in various ways to make predictions and generalizations. These experiences provide a strong mathematical foundation that prepares students for success in middle school mathematics and beyond.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Fifth Grade mathematics.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
5.ANR.1 Make sense of numerical expressions.	• **5.ANR.1.1** Evaluate two-step numerical expressions by applying the order of operations.

	• **5.ANR.1.2** Explain numerical expressions by relating them to the commutative, associative, and distributive properties. • **5.ANR.1.3** Connect numerical expressions to a variety of representations.
Standard	**Objectives**
5.ANR.2 Make use of structure to extend and apply place value.	• **5.ANR.2.1** Apply place value understanding to read, write, and determine the place and value of each digit in a whole number within one million. • **5.ANR.2.2** Apply place value understanding to read, write, and determine the place and value of each digit in decimal numbers to the thousandths place. • **5.ANR.2.3** Make connections between equivalent forms, including standard, expanded, and word forms of decimal numbers to the thousandths place. • **5.ANR.2.4** Explain patterns in products and quotients when numbers are multiplied by 1,000, 100, 10, 0.1, and 0.01 and/or divided by 10 and 100. • **5.ANR.2.5** Apply the patterns within the base-ten system from the thousandth place through one million to 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 of what it represents in the place to its left. • **5.ANR.2.6** Apply place value understanding to compare and order decimal numbers to the thousandths, using symbols (>, <, =, ≠) and/or words to record the results of comparisons.
Standard	**Objectives**
5.ANR.3 Use repeated reasoning to operate with multi-digit numbers.	• **5.ANR.3.1** Apply place value reasoning and/or the properties of multiplication to multiply up to a three-digit by a two-digit whole number using symbolic and/or visual representations, including the area model and the standard algorithm. • **5.ANR.3.2** Apply place value strategies, properties of operations, and/or the relationship between multiplication and division to find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors using visual and/or symbolic representations. • **5.ANR.3.3** Connect previous understandings and strategies to develop the algorithm, including long division, to divide whole numbers up to a four-digit dividend with a one-digit divisor.

	• **5.ANR.3.4** Interpret the meaning of the remainder when solving up to four-digit by one-digit division problems in context. • **5.ANR.3.5** Solve multi-step problems in context involving the four operations using whole numbers. • **5.ANR.3.6** Justify that an answer is reasonable using estimation strategies.
Standard	**Objectives**
5.ANR.4 Make sense of operations with decimal numbers.	• **5.ANR.4.1** Solve addition and subtraction problems up to six total digits and numbers to the thousandths place using visual and symbolic representations. • **5.ANR.4.2** Multiply a whole number within 4 and a decimal to the hundredths place using visual and symbolic representations. • **5.ANR.4.3** Divide a whole number within 4 and a decimal to the hundredths place using visual and symbolic representations. • **5.ANR.4.4** Solve two-step problems in context involving two operations with decimal numbers. • **5.ANR.4.5** Justify an answer is reasonable using estimation strategies.
Standard	**Objectives**
5.ANR.5 Make sense of operations with fractions.	• **5.ANR.5.1** Apply understanding of equivalent fractions, properties of operations, and the relationship between addition and subtraction to add and subtract fractions using representations, including mixed numbers, with unlike denominators using related fractions: halves, fourths, and eighths; thirds, sixths, and twelfths; fifths, tenths, and hundredths. • **5.ANR.5.2** Solve one- and two-step problems in context involving addition and subtraction of fractions, including mixed numbers, with unlike denominators using related fractions: halves, fourths, and eighths; thirds, sixths, and twelfths; fifths, tenths, and hundredths. • **5.ANR.5.3** Interpret a fraction as the division of the numerator by the denominator with denominators 2, 3, 4, 5, 6, 8, 10, and 12, using area, length, and set models, equal sharing contexts, and equations. • **5.ANR.5.4** Multiply a whole number within 12 by a fraction or a mixed number with denominators 2, 3, 4, 5, 6, 8, 10, and 12 using representations. • **5.ANR.5.5** Multiply two fractions or mixed numbers within 12 with denominators 2, 3, and 4 using representations.

	• **5.ANR.5.6** Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number and when multiplying a given number by a fraction less than 1 results in a product smaller than the given number. • **5.ANR.5.7** Divide unit fractions by non-zero whole numbers and divide whole numbers within 10 by unit fractions that include denominators of 2, 3, 4, 5, 6, 8, 10, and 12, using area and/or length models and equations.
Standard	**Objectives**
5.ANR.6 Reason with patterns and relationships.	• **5.ANR.6.1** Generate two numerical patterns using two given rules. • **5.ANR.6.2** Analyze the relationships between corresponding terms in two patterns using words and numerical expressions. • **5.ANR.6.3** Analyze the relationships between terms and patterns in problems in context.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
5.SGMR.1 Reason with shapes and their attributes.	• **5.SGMR.1.1** Classify quadrilaterals in a hierarchy based on properties. • **5.SGMR.1.2** Explain that attributes belonging to a category of quadrilaterals also belong to all subcategories of that category.
Standard	**Objectives**
5.SGMR.2 Reason about location and patterns in the first quadrant of the coordinate plane.	• **5.SGMR.2.1** Graph points on a coordinate plane. • **5.SGMR.2.2** Solve problems on a coordinate plane, including traveling from one point to another and identifying the coordinates of missing points in geometric figures. • **5.SGMR.2.3** Create ordered pairs using corresponding terms that follow given rules to graph points on a coordinate plane. • **5.SGMR.2.4** Solve problems in context using the patterns graphed on a coordinate plane.
Standard	**Objectives**
5.SGMR.3 Reason abstractly	• **5.SGMR.3.1** Justify the reasonableness of metric and customary unit conversions within a given measurement system in context.

and quantitatively to apply understandings of customary and metric measurement.	• **5.SGMR.3.2** Apply multiplicative reasoning to solve one- or two-step problems in context involving conversions between two units within the customary system (inches, feet, yards, ounces, pounds, fluid ounces, cups, pints, quarts, gallons, minutes, hours) with a given conversion and technology. • **5.SGMR.3.3** Apply multiplicative reasoning to solve one- or two-step problems in context involving conversions between two units within the metric system (millimeters, centimeters, meters, kilometers, milligram, gram, kilogram, milliliter, liter) with a given conversion and technology.
Standard	**Objectives**
5.SGMR.4 Reason abstractly and quantitatively to apply understandings of volume of rectangular prisms.	• **5.SGMR.4.1** Recognize volume as an attribute of solid figures by filling rectangular prisms using cubic units, cubic centimeters, cubic inches, and cubic feet. • **5.SGMR.4.2** Find the volume of a rectangular prism with whole-number side lengths by packing it with unit cubes. • **5.SGMR.4.3** Connect the operations of multiplication and addition to the volume formula for a rectangular prism, by modeling that volume can be found by multiplying the edge lengths or by multiplying the area of the base by the height. • **5.SGMR.4.4** Apply understanding of the volume formula for rectangular prisms with whole-number edge lengths in figures and in context. • **5.SGMR.4.5** Apply understanding of the attributes of rectangular prisms to find an unknown dimension when given the volume. • **5.SGMR.4.6** Find the volume of solid figures with one-digit dimensions composed of two non-overlapping rectangular prisms in context.

Domain: Reasoning with Data

Standard	Objectives
5.RD.1 Apply the data cycle with a focus on line graphs, line plots, and bar graphs.	• **5.RD.1.1** Generate questions that require the collection of categorical or numerical data, including numerical data that change over time. • **5.RD.1.2** Determine whether a question will yield categorical or numerical data, including numerical data that change over time.

	• **5.RD.1.3** Design a plan to collect categorical or numerical data, including numerical data that change over time, to answer a question. • **5.RD.1.4** Collect categorical or numerical data, including numerical data that change over time, using various methods to answer a question. • **5.RD.1.5** Represent a data set by organizing and structuring collected data on a line graph, line plot, or bar graph. • **5.RD.1.6** Analyze categorical or numerical data to describe, compare, draw conclusions, and construct arguments supported by evidence from the data. • **5.RD.1.7** Look for and express regularity in repeated reasoning to generalize and make predictions based on patterns and trends in the data.

Draft 3 - Sixth Grade

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Sixth Grade

Middle School mathematics connects and applies previous elementary mathematical understanding to current learning while building more efficient processes and skills to prepare students for future mathematical learning. Throughout the middle school years, students extend their number sense to the system of rational numbers, which includes negative numbers and radicals. An understanding of ratio and proportional reasoning is developed and applied as well as reasoning about expressions and equations to support problem solving. Middle school mathematics prepares students for advanced work with algebraic concepts, functions, geometric, and probabilistic relationships. Students explore real-world contexts by engaging in the data investigation cycle through collecting, representing, and analyzing data in various ways to make predictions and generalizations. Additionally, the Mathematical Practices become increasingly integrated to develop and support student thinking, proficiency, and agency as they engage in mathematics learning. These learning experiences continue to strengthen students' mathematical foundation, preparing them for success in future academic and real-life experiences.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Sixth Grade mathematics.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Ratio and Proportional Reasoning

Standard	Objectives
6.RPR.1 Understand the concept of equivalent ratios.	• **6.RPR.1.1** Make use of structure to describe the multiplicative relationships between the two quantities of a ratio, including part to part and part to whole relationships, using ratio language in context. • **6.RPR.1.2** Represent a ratio relationship using ratio language, written expressions, colon, ratio tables, and fraction notation. • **6.RPR.1.3** Reason quantitatively to determine the two distinct unit ratios that relate two quantities with reciprocal relationships. • **6.RPR.1.4** Make sense of the two distinct unit ratios that relate two quantities in context.
Standard	**Objectives**
6.RPR.2 Apply ratio reasoning to represent and solve problems involving ratios and percentages using multiple representations.	• **6.RPR.2.1** Construct tables and graphs to compare ratios composed of whole numbers. • **6.RPR.2.2** Reason with patterns within ratio tables, double number lines, tape diagrams, contexts, and coordinate graphs to determine unknown values. • **6.RPR.2.3** Reason quantitatively to manipulate measurements using given ratios for single unit conversions within the same measurement system. • **6.RPR.2.4** Reason quantitatively to connect multiplicative relationships between independent and dependent variables in multiple representations. • **6.RPR.2.5** Represent multiplicative relationships to solve problems with independent and dependent variables, using multiple representations. • **6.RPR.2.6** Demonstrate an understanding of a percent as a ratio per 100 by expressing percents, using multiple representations. • **6.RPR.2.7** Solve one-step problems determining an unknown part, whole, or percent of a given quantity, reasoning quantitatively with benchmark percentages or equivalent ratios.

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
6.ANR.1 Determine the relationships between factors and multiples for mathematical problems.	• **6.ANR.1.1** Reason quantitatively to determine the least common multiple of two whole numbers less than or equal to 12 for mathematical problems. • **6.ANR.1.2** Make use of structure to rewrite whole numbers as products of their unique prime factors using exponential form when applicable. • **6.ANR.1.3** Reason quantitatively to determine the greatest common factor of two whole numbers using strategies, including prime factorization, for mathematical problems. • **6.ANR.1.4** Make use of structure to rewrite the sum of two whole numbers by using the distributive property and common factors.
Standard	**Objectives**
6.ANR.2 Apply numerical reasoning to perform operations with fractions with denominators 12 or less.	• **6.ANR.2.1** Represent the sum, difference, and quotient of two positive fractions and mixed numbers, using physical and visual models, and common denominators. • **6.ANR.2.2** Express repeated reasoning to evaluate the product of two positive fractions and mixed numbers using an algorithm. • **6.ANR.2.3** Make sense of quotients and remainders of positive fractions and mixed numbers in terms of their context and relation to the divisor and dividend. • **6.ANR.2.4** Solve problems by reasoning quantitatively with positive fractions and mixed numbers with the four operations. • **6.ANR.2.5** Construct a viable argument for the reasonableness of solutions to contextual problems involving positive fractions and mixed numbers using estimation, mental math, and understanding of the context.
Standard	**Objectives**
6.ANR.3 Apply numerical reasoning to perform operations with positive decimals.	• **6.ANR.3.1** Express repeated reasoning to evaluate the sum and difference of two decimals to the thousandths place, extending previous understandings to develop and fluently use an algorithm. • **6.ANR.3.2** Express repeated reasoning to evaluate the product and quotient of two decimals to the hundredths place, extending previous understandings to develop and fluently use an algorithm.

	• **6.ANR.3.3** Construct a viable argument for the reasonableness of a sum, difference, product, or quotient of two decimals using strategies to extend previous understandings, including estimation, mental math, and understanding of the context. • **6.ANR.3.4** Solve problems involving decimals, reasoning quantitatively with the four operations. • **6.ANR.3.5** Construct a viable argument for the reasonableness of solutions to contextual problems involving positive decimals using estimation, mental math, and understanding of the context.
Standard	**Objectives**
6.ANR.4 Apply numerical reasoning to perform operations with integers within -20 and 20.	• **6.ANR.4.1** Reason abstractly to describe situations in which opposite quantities combine to make zero, conveying that a number and its additive inverse create a zero pair. • **6.ANR.4.2** Make use of structure to represent the inverse relationship between addition and subtraction using multiple strategies, including physical and visual models. If p and q are integers, then $p - q = p + (-q)$ and $p + q = p - (-q)$. • **6.ANR.4.3** Express repeated reasoning to represent addition and subtraction of two integers using models. • **6.ANR.4.4** Express repeated reasoning to represent multiplication and division of two integers using models. • **6.ANR.4.5** Evaluate the sum, difference, product, and quotient of two integers. • **6.ANR.4.6** Construct a viable argument for the reasonableness of a sum, difference, product, or quotient of two integers in mathematical problems, using strategies including estimation and mental math. • **6.ANR.4.7** Solve contextual problems reasoning quantitatively with the four operations involving integers, using efficient and flexible strategies. • **6.ANR.4.8** Construct a viable argument for the reasonableness of solutions to contextual problems involving integers using estimation, mental math, and understanding of the context.
Standard	**Objectives**
6.ANR.5 Apply numerical reasoning to compare and	• **6.ANR.5.1** Reason about the equivalence between rational numbers, using models and place value.

order integers, fractions, mixed numbers, and decimals.	• **6.ANR.5.2** Make use of structure to locate and position rational numbers on a number line. • **6.ANR.5.3** Make sense of statements of inequality as statements about the relative position of two rational numbers on a number line. • **6.ANR.5.4** Make sense of statements of order for rational numbers in context. • **6.ANR.5.5** Reason abstractly to describe rational numbers having opposite directions or values in real-world context. • **6.ANR.5.6** Demonstrate an understanding of the opposite signs of rational numbers as indicating locations on the opposite sides of zero, that the opposite of the opposite of a number is the number itself, and that zero is its own opposite. • **6.ANR.5.7** Represent rational numbers in the real-world context, explaining the meaning of zero in each situation. • **6.ANR.5.8** Make sense of the absolute value of rational numbers as magnitude for a positive or negative quantity in context.
Standard	**Objectives**
6.ANR.6 Create and evaluate numerical and algebraic expressions.	• **6.ANR.6.1** Demonstrate an understanding of whole-number exponents greater than zero. • **6.ANR.6.2** Reason quantitatively to evaluate numerical expressions that may include whole number exponents greater than zero, using the order of operations with and without grouping symbols. • **6.ANR.6.3** Construct numerical and algebraic expressions that may include whole number exponents greater than zero to solve problems. • **6.ANR.6.4** Make use of structure to translate between mathematical expressions and written representations, with and without whole-number exponents. • **6.ANR.6.5** Make use of structure to identify parts of an algebraic expression, with and without whole-number exponents, using mathematical terms. • **6.ANR.6.6** Reason quantitatively to evaluate algebraic expressions, with or without whole number exponents, derived from problems. • **6.ANR.6.7** Make use of structure to generate equivalent expressions, without exponents, using combining like terms and mathematical properties.

	• **6.ANR.6.8** Construct a viable argument for the equivalence of two algebraic expressions using mathematical reasoning, combining like terms, and the commutative, associative, identity, and distributive properties.
Standard	**Objectives**
6.ANR.7 Apply algebraic reasoning to represent one-variable equations and inequalities and solve one-variable equations using the four operations with positive fractions, positive decimals, and integers within -20 and 20.	• **6.ANR.7.1** Construct a viable argument to determine whether a given number in a specified set makes an equation true, using substitution. • **6.ANR.7.2** Reason quantitatively to represent one-step equations to solve contextual problems. • **6.ANR.7.3** Make use of structure and properties of equality to solve one-step equations. • **6.ANR.7.4** Construct a viable argument for the reasonableness of the solution of one-step equations using estimation, mental math, and understanding of the context. • **6.ANR.7.5** Construct a viable argument to determine whether a given number in a specified set makes an inequality true, using substitution. • **6.ANR.7.6** Make use of structure to translate between verbal descriptions and mathematical representations of inequalities of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$, given a constraint or condition. • **6.ANR.7.7** Make use of structure to recognize that inequalities of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ have infinitely many solutions. • **6.ANR.7.8** Represent solutions of inequalities of the form $x > c$, $x \geq c$, $x < c$ or $x \leq c$ on number line diagrams. • **6.ANR.7.9** Construct a viable argument for the reasonableness of solutions of inequalities on number line diagrams.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
6.SGMR.1 Apply geometric reasoning to represent and solve real-world and	• **6.SGMR.1.1** Construct a model to find the area of a triangle using composition and decomposition of parallelograms.

mathematical problems involving the area of two-dimensional figures.	• **6.SGMR.1.2** Construct a model to find the area of a triangle using decomposition of special quadrilaterals and polygons. • **6.SGMR.1.3** Construct models to find the area of special quadrilaterals and polygons by decomposing them into triangles or rectangles. • **6.SGMR.1.4** Solve problems by extending structural understanding of areas of triangles, special quadrilaterals, and polygons, using efficient and flexible strategies. • **6.SGMR.1.5** Construct a viable argument for the solutions of contextual problems involving areas of two-dimensional figures by comparing different geometric representations, estimating or checking for reasonableness, and explaining how the result applies to the context.
Standard	**Objectives**
6.SGMR.2 Apply geometric reasoning to represent and solve real-world and mathematical problems using the coordinate plane.	• **6.SGMR.2.1** Make use of structure to identify the location of a point given as an ordered pair. • **6.SGMR.2.2** Make use of structure to graph ordered pairs in all four quadrants and axes of a coordinate plane to solve problems. • **6.SGMR.2.3** Make use of structure in recognizing that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes on a coordinate plane. • **6.SGMR.2.4** Reason quantitatively to determine the distances between points with the same x-coordinate or same y-coordinate, using coordinates and the absolute value of numbers. • **6.SGMR.2.5** Make use of structure to recognize and represent polygons in the coordinate plane, given coordinates for the vertices, to solve problems. • **6.SGMR.2.6** Determine the lengths of segments or the sides of a triangle or a quadrilateral on a coordinate plane, with the same x-coordinate or the same y-coordinate, to solve problems involving perimeter and area.
Standard	**Objectives**
6.SGMR.3 Apply geometric reasoning to represent and solve problems involving surface area and volume of	• **6.SGMR.3.1** Construct geometric nets, using rectangles and triangles, to build, recognize, and represent right prisms and right pyramids. • **6.SGMR.3.2** Solve problems involving the surface area of right rectangular and triangular prisms using nets, efficiently and flexibly.

three-dimensional figures.	• **6.SGMR.3.3** Construct a viable argument for the solutions of contextual problems involving surface area of right rectangular and triangular prisms by comparing different geometric representations, estimating or checking for reasonableness, and explaining how the result applies to the context. • **6.SGMR.3.4** Solve problems by extending structural understanding of the volume of right rectangular prisms with rational edge lengths, efficiently and flexibly. • **6.SGMR.3.5** Construct a viable argument for the solutions of contextual problems involving volume of right rectangular prisms with rational edge lengths by comparing different geometric representations, estimating or checking for reasonableness, and explaining how the result applies to the context.

Domain: Reasoning with Data

Standard	Objectives
6.RD.1 Investigate chance processes and evaluate their probabilities for simple events and uniform (equally likely) probabilities.	• **6.RD.1.1** Construct a viable argument to describe the likelihood of a chance event using appropriate probability language and values from zero to one. • **6.RD.1.2** Reason quantitatively to determine the theoretical probability of a simple event with equally likely probabilities, comparing the number of favorable outcomes to the total number of outcomes. • **6.RD.1.3** Conduct experiments with simple events that have equally likely probabilities to compare the experimental results with the theoretical probabilities.
Standard	**Objectives**
6.RD.2 Formulate and investigate statistical questions to make inferences about univariate data for a population.	• **6.RD.2.1** Categorize statistical and non-statistical questions to investigate a topic of interest given a context for univariate data. • **6.RD.2.2** Construct a viable argument to determine whether a question is statistical or non-statistical by analyzing the presence of anticipated variability in the data and accounting for this variability in the answer. • **6.RD.2.3** Evaluate statistical questions and their results for potential bias when investigating univariate data in a single population. • **6.RD.2.4** Collect data on a single variable for a representative sample of a population.

	• **6.RD.2.5** Organize univariate data for a representative sample of a group or population using representations, accurately and clearly, when investigating a real-world topic of interest.
Standard	**Objectives**
6.RD.3 Examine a set of numerical data in plots on a number line considering center and spread.	• **6.RD.3.1** Make use of structure to describe the key features in line plots, histograms, and box plots. • **6.RD.3.2** Reason quantitatively to describe what information can be deduced from line plots, histograms, and box plots, examining the center, spread, and shape. • **6.RD.3.3** Construct line plots, histograms, and box plots to represent a distribution of univariate data, by hand within 10 values and using technology within 25 values. • **6.RD.3.4** Make use of structure to describe measures of center represented in line plots, histograms, and box plots. • **6.RD.3.5** Make use of structure to describe variability represented in line plots, histograms, and box plots. • **6.RD.3.6** Make sense of non-standard data visualizations describing univariate data in a single population from real-world sources, describing what information is shown and what conclusions can be drawn.
Standard	**Objectives**
6.RD.4 Model and analyze a set of numerical data considering center and spread.	• **6.RD.4.1** Represent the mean as the balance point of data distributions using visual representations and physical models. • **6.RD.4.2** Determine mean and median for data distributions, by hand within 10 values and using technology within 25 values. • **6.RD.4.3** Make use of structure to compare line plots, histograms, and box plots of different data distributions displayed on the same scale with similar measures of center and different spreads to describe and interpret differences in variability. • **6.RD.4.4** Compare different representations of the same data distribution by analyzing their center, spread, and shape.

	• **6.RD.4.5** Construct a viable argument about which measure of center best represents a data distribution based on its shape and the context in which the data were gathered.
Standard	**Objectives**
6.RD.5 Summarize and interpret results from an investigation (data cycle) of univariate data to make predictions and draw conclusions.	• **6.RD.5.1** Draw inferences about the overall pattern of a data distribution based on its measures of center and variability, its representation, and the context in which the data were gathered. • **6.RD.5.2** Summarize the distribution of univariate data by describing measures of center and variability, identifying overall patterns, and noting any striking deviations from the pattern. • **6.RD.5.3** Communicate findings using quantitative measures of center and variability, describing patterns, and noting how the findings relate to the context. • **6.RD.5.4** Reflect on findings to evaluate whether the original question and methods were appropriate, refining the investigative question, data collection plan, or analysis approach based on results.

Draft 3 - Seventh Grade

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Seventh Grade

Middle School mathematics connects and applies previous elementary mathematical understanding to current learning while building more efficient processes and skills to prepare students for future mathematical learning. Throughout the middle school years, students extend their number sense to the system of rational numbers, which includes negative numbers and radicals. An understanding of ratio and proportional reasoning is developed and applied, as well as reasoning about expressions and equations to support problem solving. Middle school mathematics prepares students for advanced work with algebraic concepts, functions, geometric, and probabilistic relationships. Students explore real-world contexts by engaging in the data investigation cycle through collecting, representing, and analyzing data in various ways to make predictions and generalizations. Additionally, the Mathematical Practices become increasingly integrated to develop and support student thinking, proficiency, and agency as they engage in mathematics learning. These learning experiences continue to strengthen students' mathematical foundation, preparing them for success in future academic and real-life experiences.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Seventh Grade mathematics.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Ratio and Proportional Reasoning

Standard	Objectives
7.RPR.1 Apply the concept of a unit rate (constant of proportionality) in proportional relationships.	• **7.RPR.1.1** Reason quantitatively to determine invariant relationship(s) present in a problem. • **7.RPR.1.2** Solve problems by reasoning quantitatively with unit rates, including those with ratios of fractions, using mathematical models and written descriptions. • **7.RPR.1.3** Construct a viable argument for determining whether two quantities are in a proportional relationship, given a situation involving unit rate (constant of proportionality), using multiple representations. • **7.RPR.1.4** Represent proportional relationships using multiple representations. • **7.RPR.1.5** Compare two different proportional relationships using multiple representations. • **7.RPR.1.6** Make sense of any coordinate point of a proportional relationship in context.
Standard	**Objectives**
7.RPR.2 Apply proportional reasoning to solve scale and percent problems in context.	• **7.RPR.2.1** Solve problems by converting one or both units reasoning quantitatively with unit rates or scale factors given the conversion ratios. • **7.RPR.2.2** Construct scale drawings and models from actual lengths to determine that corresponding side lengths are proportional and corresponding angle measures are the same. • **7.RPR.2.3** Solve problems with scale drawings of geometric figures by computing actual lengths and areas or constructing a scale drawing at a different scale. • **7.RPR.2.4** Express repeated reasoning to determine the effect of scale factor on the area of scaled geometric figures. • **7.RPR.2.5** Solve ratio and percent problems involving one or more steps by reasoning quantitatively with tax, markups/markdowns, tips, commissions, and percent increase/decrease.
Standard	**Objectives**
7.RPR.3 Apply proportional reasoning to solve problems involving circles.	• **7.RPR.3.1** Make sense of the part-to-whole relationships in circle graphs to relate degree measures in multiples of 30 and 45, benchmark fractional parts of circles in multiples of ¼ and ⅓, and benchmark percents.

	• **7.RPR.3.2** Solve problems by reasoning quantitatively to connect degree measures with portions of the whole in circle graphs. • **7.RPR.3.3** Reason quantitatively to demonstrate an understanding of the ratio relationship between circumference, pi (π), and diameter of a circle, using informal reasoning, visual models and physical models. • **7.RPR.3.4** Solve problems involving the relationships between radius, diameter, and/or circumference of circles.

Domain: Algebraic and Numerical Reasoning

Standard	Objectives
7.ANR.1 Apply numerical reasoning to perform operations with integers, fractions and decimals.	• **7.ANR.1.1** Construct a viable argument demonstrating a rational number can be expressed as a quotient of two integers and as a decimal that either terminates or repeats. • **7.ANR.1.2** Express repeated reasoning to fluently evaluate the sum, difference, product, or quotient of rational numbers and/or absolute values of rational numbers, using the properties of operations by extending previous understandings of integer operations. • **7.ANR.1.3** Construct a viable argument for the reasonableness of sums, differences, products, and quotients involving rational numbers and/or absolute values of rational numbers by using estimation, contextual reasoning, and previous understandings of integer operations. • **7.ANR.1.4** Make use of structure to convert fractions to decimals to the thousandths place, extending previous understanding of division.
Standard	**Objectives**
7.ANR.2 Apply algebraic reasoning to generate equivalent linear expressions using properties of operations.	• **7.ANR.2.1** Make use of structure to generate equivalent linear expressions with rational coefficients by factoring, combining like terms, and using the distributive property and area model. • **7.ANR.2.2** Construct a viable argument to demonstrate that equivalent expressions can represent and reveal mathematical and real-world relationships. • **7.ANR.2.3** Make sense of the meaning of the parts of equivalent expressions in context to reveal real-world and mathematical relationships.

Standard	Objectives
7.ANR.3 Apply numeric and algebraic reasoning to solve problems involving expressions, equations, and inequalities with integers, fractions, and decimals.	• **7.ANR.3.1** Reason quantitatively to fluently solve multi-step problems, using properties of operations of algebraic expressions to justify your solution process. • **7.ANR.3.2** Construct multi-step equations with the same variable on one side of the equation to represent quantities and relationships in real-world problems. • **7.ANR.3.3** Make use of structure to compare arithmetic and algebraic solution processes when solving multi-step equations with variables on one side. • **7.ANR.3.4** Convert between rational numbers in different forms and equivalent forms of expressions when solving multi-step problems, using flexible and efficient strategies. • **7.ANR.3.5** Make use of structure and the properties of equality to solve multi-step equations with variables on one side of the equation, using flexible and efficient strategies. • **7.ANR.3.6** Construct a viable argument for the reasonableness of the solutions of multi-step equations. • **7.ANR.3.7** Construct one-step inequalities to represent quantities and relationships in real-world problems. • **7.ANR.3.8** Make use of structure and the properties of inequalities to solve one-step inequalities, using flexible and efficient strategies. • **7.ANR.3.9** Construct multi-step inequalities using the same variable on one side of the inequality to represent quantities and relationships in real-world problems. • **7.ANR.3.10** Make use of structure and the properties of equality to solve multi-step inequalities with the variable on one side of the inequality. • **7.ANR.3.11** Make use of structure and properties of equality to compare the solution processes for equations and inequalities. • **7.ANR.3.12** Make use of structure to represent solutions of inequalities with the same variable on one side of the inequality on number line diagrams. • **7.ANR.3.13** Construct a viable argument for the reasonableness of the solution set of an inequality. • **7.ANR.3.14** Construct a viable argument for determining whether an equation or inequality best represents the relationship between quantities in a contextual situation.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
7.SGMR.1 Apply geometric reasoning to solve problems involving areas of two-dimensional figures composed of triangles, quadrilaterals, circles, and polygons.	• **7.SGMR.1.1** Make use of structure to understand the relationships between circumference, pi (π), diameter, and area of a circle, using informal reasoning, visual and physical models. • **7.SGMR.1.2** Solve problems by reasoning quantitatively about the area of a circle when given the radius, diameter, or circumference. • **7.SGMR.1.3** Solve problems by reasoning quantitatively about the perimeter and area of two-dimensional figures composed of triangles, rectangles, and circles. • **7.SGMR.1.4** Construct a viable argument for the solutions of contextual problems involving area and perimeter of two-dimensional figures by comparing different geometric representations, estimating or checking for reasonableness, and explaining how the result applies to the context.
Standard	**Objectives**
7.SGMR.2 Apply geometric reasoning to solve real-world and mathematical problems involving volume and surface area of three-dimensional figures.	• **7.SGMR.2.1** Make use of structure to demonstrate an understanding of the surface area of right prisms and cylinders as the sum of the areas of the faces, using models. • **7.SGMR.2.2** Solve problems by reasoning quantitatively about the surface area of right prisms, cylinders, or three-dimensional objects composed of cubes, cylinders, and right prisms, efficiently and flexibly. • **7.SGMR.2.3** Construct a viable argument for the solutions of contextual problems involving surface area of right prisms and cylinders by comparing different geometric representations, estimating or checking for reasonableness, and explaining how the result applies to the context. • **7.SGMR.2.4** Make use of structure to demonstrate an understanding of the volume of right prisms and cylinders as multiple layers of the base, using models. • **7. SGMR.2.5** Solve problems by reasoning quantitatively about the volume of right prisms, cylinders, or three-dimensional objects composed of cubes, cylinders, and right prisms, efficiently and flexibly. • **7.SGMR.2.6** Construct a viable argument for the solutions of contextual problems involving volume of right prisms and cylinders by comparing different geometric representations, estimating or checking for reasonableness, and explaining how

	the result applies to the context.
Standard	**Objectives**
7.SGMR.3 Apply geometric reasoning based on angle relationships to determine unknown angles.	• **7.SGMR.3.1** Make use of structure to describe relationships among pairs of angles that are vertical, adjacent, supplementary, or complementary. • **7.SGMR.3.2** Reason quantitatively to determine an unknown angle in a figure using the relationships between supplementary, complementary, vertical, and adjacent angles, efficiently and flexibly. • **7.SGMR.3.3** Construct multi-step equations to determine an unknown angle in a figure using the relationships between complementary, supplementary, vertical, and adjacent angles, efficiently and flexibly. • **7.SGMR.3.4** Solve multi-step problems with unknown angles formed by intersecting lines, reasoning quantitatively about the relationships between vertical, adjacent, complementary, and supplementary angles.

Domain: Reasoning with Data

Standard	Objectives
7.RD.1 Investigate chance processes and evaluate their probabilities for compound events and unequally likely probabilities.	• **7.RD.1.1** Reason quantitatively to determine the theoretical probability of simple events with unequally likely outcomes as the ratio of favorable outcomes to total outcomes. • **7.RD.1.2** Conduct experiments of compound events that have equally likely probabilities to compare the experimental results with the theoretical probabilities. • **7.RD.1.3** Make use of structure to determine probabilities of compound events using organized lists, tables, tree diagrams, and simulations. • **7.RD.1.4** Make use of structure to identify outcomes in a sample space for compound events in context, using organized lists, tables, and tree diagrams. • **7.RD.1.5** Design simulations to collect data for the frequencies of compound events to approximate probabilities. • **7.RD.1.6** Predict theoretical probabilities based on relative frequencies from experiments, using proportional reasoning. • **7.RD.1.7** Predict approximate relative frequencies based on theoretical probabilities, using proportional reasoning.

	• **7.RD.1.8** Express repeated reasoning to determine that the experimental probability of a chance event gets closer to the theoretical probability as the number of trials increases. • **7.RD.1.9** Construct a viable argument for the similarities and differences between experimental results and theoretical probabilities from physical and visual models.
Standard	**Objectives**
7.RD.2 Formulate and investigate statistical questions to make inferences about univariate data from two groups or populations.	• **7.RD.2.1** Categorize statistical or non-statistical questions to investigate a topic of interest given a context for univariate data across two groups or populations. • **7.RD.2.2** Create statistical questions to consider numerical or categorical data that explore variability between two groups or populations. • **7.RD.2.3** Construct a viable argument to determine the validity of a sample representing a population. • **7.RD.2.4** Evaluate statistical questions for biases in the data and responses from two groups or populations. • **7.RD.2.5** Construct a viable argument for how a random sample increases the likelihood that the sample represents the population. • **7.RD.2.6** Use simulations to create random, representative samples to make predictions or estimates about a population parameter. • **7.RD.2.7** Collect data on a single variable for representative samples of two groups or populations. • **7.RD.2.8** Generate multiple random samples of the same size to evaluate the validity of inferences about a population with an unknown characteristic of interest. • **7.RD.2.9** Organize univariate data for representative samples of two groups or populations using representations, accurately and clearly, when investigating a real-world topic of interest.
Standard	**Objectives**
7.RD.3 Examine two sets of numerical data in plots on a number line considering the center and spread of univariate data.	• **7.RD.3.1** Make use of structure to compare two distributions of univariate data, informally examining the shape, center, and variability seen in given line plots, box plots, and/or histograms. • **7.RD.3.2** Construct line plots, histograms, and box plots to represent two distributions of univariate data on one plot, by hand within 10 values and using technology within 25 values.

	• **7.RD.3.3** Make sense of non-standard data visualizations describing two groups or populations from real-world sources, such as infographics and media-based displays, describing what information is shown and what conclusions can be drawn.
Standard	**Objectives**
7.RD.4 Model and analyze the center and spread of up to two sets of numerical data.	• **7.RD.4.1** Represent range, interquartile range (IQR), and mean absolute deviation (MAD) as measures that describe the spread of data using visual representations and physical models. • **7.RD.4.2** Determine the range, interquartile range (IQR), and mean absolute deviation (MAD) for data distributions, by hand within 10 values and using technology within 25 values. • **7.RD.4.3** Construct a viable argument expressing why both a measure of center and variability are necessary to describe or compare distributions of data. • **7.RD.4.4** Construct a viable argument for the use of the appropriate measure(s) of variability (range, interquartile range (IQR), and mean absolute deviation (MAD)) based on the shape of a data distribution. • **7.RD.4.5** Compare two data distributions considering their measures of center (mean and median) using technology and visual representations. • **7.RD.4.6** Compare two data distributions considering their measures of variability (range, IQR, and MAD), using technology and visual representations. • **7.RD.4.7** Reason quantitatively to describe the effect of an extreme value on the measures of center and variability of a data distribution. • **7.RD.4.8** Reason quantitatively to determine which representation (line plot, box plot, histogram) most accurately represents certain characteristics of a data distribution.
Standard	**Objectives**
7.RD.5 Summarize and interpret results from an investigation (data cycle) of univariate data to make predictions and draw	• **7.RD.5.1** Draw comparative inferences between two groups or populations based on their measures of center and spread, their representations, and the context in which the data were gathered. • **7.RD.5.2** Summarize the distribution of univariate data between two groups or populations by comparing measures of center and variability, identifying overall patterns, and noting any striking deviations from the pattern.

conclusions.	• **7.RD.5.3** Communicate findings using qualitative and quantitative measures of center and variability, describing patterns, and noting how the findings relate to the context. • **7.RD.5.4** Reflect on findings to evaluate whether the original question and methods were appropriate, refining the investigative question, data collection plan, or analysis approach based on results.

Draft 3 - Eighth Grade

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Eighth Grade

Middle School mathematics connects and applies previous elementary mathematical understanding to current learning while building more efficient processes and skills to prepare students for future mathematical learning. Throughout the middle school years, students extend their number sense to the system of rational numbers, which includes negative numbers and radicals. An understanding of ratio and proportional reasoning is developed and applied as well as reasoning about expressions and equations to support problem solving. Middle school mathematics prepares students for advanced work with algebraic concepts, functions, geometric, and probabilistic relationships. Students explore real-world contexts by engaging in the data investigation cycle through collecting, representing, and analyzing data in various ways to make predictions and generalizations. Additionally, the Mathematical Practices become increasingly integrated to develop and support student thinking, proficiency, and agency as they engage in mathematics learning. These learning experiences continue to strengthen students' mathematical foundation, preparing them for success in future academic and real-life experiences.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Eighth Grade mathematics.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Algebraic and Numerical Reasoning

Standard	Objectives

8.ANFR.1 Apply properties of operations to solve real-world and mathematical problems using equations and inequalities in one variable.	• **8.ANFR.1.1** Construct linear equations with the same variable on both sides of the equation to represent quantities and relationships from a given context. • **8.ANFR.1.2** Make use of structure and properties of equality to solve linear equations with the same variable on both sides of the equation, using flexible and efficient strategies. • **8.ANFR.1.3** Construct a viable argument demonstrating whether one-variable equations have one solution, infinitely many solutions, or no solutions in a real-world context. • **8.ANFR.1.4** Construct linear inequalities with the same variable on both sides of the inequality to represent quantities and relationships from a given context. • **8.ANFR.1.5** Make use of structure and properties of equality to solve linear inequalities with the same variable on both sides of the inequality, using flexible and efficient strategies. • **8.ANFR.1.6** Construct a viable argument for the reasonableness of the solutions of equations and inequalities with the same variables on both sides of the equation or inequality in context.
Standard	**Objectives**
8.ANFR.2 Analyze patterns of change across different function types to make use of structure.	• **8.ANFR.2.1** Make use of structure to recognize a function as a rule that assigns to each input in the domain exactly one output in the range, when represented as a graph, table, or set of ordered pairs. • **8.ANFR.2.2** Make use of structure to determine where a function is increasing or decreasing and linear or non-linear when represented in a graph, table, or set of ordered pairs. • **8.ANFR.2.3** Represent the qualitative features of a real-world function on a coordinate plane.
Standard	**Objectives**
8.ANFR.3 Analyze linear functions and their key characteristics to represent and solve problems in mathematical and real-world contexts.	• **8.ANFR.3.1** Make use of structure to identify linear functions represented in tables, equations, graphs, or in context. • **8.ANFR.3.2** Construct an equation in slope-intercept form to represent a linear relationship given a graph, at least two coordinates, or written context. • **8.ANFR.3.3** Construct a graph of a linear relationship given an equation in slope-intercept form.

	• **8.ANFR.3.4** Make sense of the rate of change (slope) and initial value (y-intercept) of a linear function in terms of the situation it models represented by a graph, table, equation, or written context. • **8.ANFR.3.5** Construct viable arguments in comparing properties of two linear functions each represented in a different way.
Standard	**Objectives**
8.ANFR.4 Describe and represent the relationships among the subsets of the real number system.	• **8.ANFR.4.1** Reason quantitatively to categorize a number as irrational when it cannot be expressed as the ratio of two integers and its decimal expansion neither terminates nor repeats. • **8.ANFR.4.2** Reason quantitatively to compare irrational numbers on a number line, estimating their values between consecutive integers and approximating their values to the nearest whole number. • **8.ANFR.4.3** Make use of structure to approximate the value of expressions involving pi (π) to the nearest hundredth.
Standard	**Objectives**
8.ANFR.5 Develop and apply properties of radicals and integer exponents.	• **8.ANFR.5.1** Express repeated reasoning to generate equivalent numerical expressions using the properties of integer exponents. • **8.ANFR.5.2** Evaluate square roots of perfect squares and cube roots of perfect cubes for positive numbers within 400. • **8.ANFR.5.3** Make use of structure to approximate the value of expressions involving square roots and cube roots to the nearest whole number. • **8.ANFR.5.4** Make use of structure and properties of equality to solve one-step equations written in the form x^2 = p and x^3 = p, where p is a positive, whole number. • **8.ANFR.5.5** Make use of structure to represent and approximate very large or very small quantities using scientific notation. • **8.ANFR.5.6** Construct viable arguments to determine how many times greater or less one number, written in scientific notation, is compared to another based on properties of exponents and other algebraic properties.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives

8.SGMR.1 Describe rigid transformations between two triangles or two quadrilaterals in the coordinate plane.	• **8.SGMR.1.1** Make use of structure to describe up to two rigid transformations - translations, reflections across the x- or y-axis, and 90° rotations about the origin - of triangles and quadrilaterals, revealing the relationship between a preimage and its image. • **8.SGMR.1.2** Represent up to two rigid transformations - translations, reflections across the x- or y-axis, and 90° rotations about the origin - of triangles and quadrilaterals, revealing the relationship between a preimage and its image.
Standard	**Objectives**
8.SGMR.2 Describe nonrigid transformations between two triangles or two quadrilaterals.	• **8.SGMR.2.1** Investigate dilations using a geometric model and applying a scale factor from a center of dilation, demonstrating that corresponding points remain on the same rays and distances are proportional, revealing the relationship between the preimage and image. • **8.SGMR.2.2** Make use of structure to determine the scale factor of the preimage and image after a dilation about the origin for mathematical problems. • **8.SGMR.2.3** Make use of structure to describe a dilation about the origin, revealing the relationship of a preimage and its image in context. • **8.SGMR.2.4** Represent a dilation about the origin on a coordinate plane, revealing the relationship of a preimage and its image.
Standard	**Objectives**
8.SGMR.3 Investigate characteristics of triangles that determine a unique triangle, more than one triangle, or no triangle.	• **8.SGMR.3.1** Make use of structure to determine whether a unique triangle, more than one triangle, or no triangle can be formed when given combinations of side lengths. • **8.SGMR.3.2** Construct a viable argument verifying that the sum of the interior angles of a triangle is 180 degrees. • **8.SGMR.3.3** Construct a viable argument for the combinations of sides and angles that create a unique triangle, more than one triangle, or no triangle, using visual and physical models.
Standard	**Objectives**
8.SGMR.4 Apply geometric reasoning based on angle relationships to solve problems.	• **8.SGMR.4.1** Make use of structure to describe relationships between interior and exterior angles in triangles. • **8.SGMR.4.2** Reason quantitatively to determine missing interior or exterior angle measures of a triangle using their relationships.

	• **8.SGMR.4.3** Make use of structure, extending previous understanding of angle relationships, to identify angles based on their relationship between angles formed when parallel lines are cut by a transversal. • **8.SGMR.4.4** Reason quantitatively to determine missing angle measures, using angle relationships formed when parallel lines are cut by a transversal. • **8.SGMR.4.5** Solve multi-step problems reasoning quantitatively about angle relationships formed by parallel lines, transversals, triangles, and intersecting lines.
Standard	**Objectives**
8.SGMR.5 Apply the Pythagorean Theorem and its converse to solve real-world and mathematical problems.	• **8.SGMR.5.1** Construct a viable argument verifying the Pythagorean Theorem using diagrams, concrete objects, and measurement. • **8.SGMR.5.2** Solve problems by reasoning quantitatively about the Pythagorean Theorem and its converse, using efficient and flexible strategies. • **8.SGMR.5.3** Make use of structure to determine the distance between two points on the coordinate plane using the Pythagorean Theorem.
Standard	**Objectives**
8.SGMR.6 Apply geometric reasoning to solve real-world and mathematical problems involving volume and surface area of three-dimensional figures.	• **8.SGMR.6.1** Make use of structure to demonstrate an understanding of the surface area of right pyramids as the sum of the areas of the faces, using visual and physical models and formulas. • **8.SGMR.6.2** Solve problems by reasoning quantitatively about the surface area of right pyramids or three-dimensional objects composed of cubes, cylinders, prisms, and right pyramids, efficiently and flexibly. • **8.SGMR.6.3** Construct a viable argument for the solutions of contextual problems involving surface area of right pyramids by comparing different geometric representations, estimating or checking for reasonableness, and explaining how the result applies to the context. • **8.SGMR.6.4** Represent the relationship between the volumes of cylinders and cones with the same base area and height, using visual and physical models. • **8.SGMR.6.5** Represent the relationship between the volumes of cylinders and spheres with the same radius and height, using visual and physical models. • **8.SGMR.6.6** Represent the relationship between the volumes of pyramids and prisms with the same base area and height, using visual and physical models.

	• **8.SGMR.6.7** Solve problems by reasoning quantitatively about the volume of pyramids, cones, spheres, or three-dimensional objects composed of pyramids, cones, and/or spheres. • **8.SGMR.6.8** Construct a viable argument for the solutions of contextual problems involving volume of pyramids, cones, and spheres by comparing different geometric representations, estimating or checking for reasonableness, and explaining how the result applies to the context.

Domain: Reasoning with Data

Standard	Objectives
8.RD.1 Investigate mutually exclusive and inclusive events to determine probability.	• **8.RD.1.1** Determine whether two events are mutually exclusive or inclusive. • **8.RD.1.2** Construct a viable argument for the probabilities discovered in mutually exclusive events using models. • **8.RD.1.3** Construct a viable argument for the probabilities discovered in mutually inclusive events using models.
Standard	**Objectives**
8.RD.2 Formulate and investigate statistical questions to make inferences about univariate data from three or four populations.	• **8.RD.2.1** Categorize statistical or non-statistical questions to investigate a topic of interest given a context for univariate data across three or four populations. • **8.RD.2.2** Create statistical questions to consider numerical or categorical data that explore variability within multiple populations. • **8.RD.2.3** Evaluate statistical questions and their results for potential bias when comparing three or four populations. • **8.RD.2.4** Use simulations to create random, representative samples to make predictions or estimates about a population parameter. • **8.RD.2.5** Construct a viable argument to determine the validity of a sample representing a population. • **8.RD.2.6** Collect data on a single variable for representative samples of three or four groups or populations. • **8.RD.2.7** Generate multiple random samples of the same size to evaluate the validity of inferences about three or four populations with an unknown characteristic of interest. • **8.RD.2.8** Organize univariate data for representative samples of three or four

	populations using representations, accurately and clearly, when investigating a real-world topic of interest.
Standard	**Objectives**
8.RD.3 Examine three or four sets of numerical data in plots on a number line, considering the center and spread of univariate data.	• **8.RD.3.1** Make use of structure to compare the distribution of a single variable within four different populations, informally examining the shape, center, and variability seen in given line plots, box plots, and histograms. • **8.RD.3.2** Construct line plots, histograms, and box plots to represent multiple distributions of univariate data on one plot. • **8.RD.3.3** Make sense of non-standard data visualizations describing three or four populations from real-world sources, such as infographics and media-based displays, describing what information is shown and what conclusions can be drawn.
Standard	**Objectives**
8.RD.4 Analyze the center and spread of three or four sets of numerical data.	• **8.RD.4.1** Make sense of standard deviation as a measure of variability that describes a set of univariate data, recognizing that it is the square root of the variance. • **8.RD.4.2** Determine the standard deviation using technology for data distributions containing up to 25 values. • **8.RD.4.3** Compare three or four numerical data distributions considering their measures of center (mean and median) and spread (interquartile range, MAD, standard deviation), using technology and visual representations. • **8.RD.4.4** Reason quantitatively to analyze the effects of outliers on the shape, center, and spread of a data distribution in context. • **8.RD.4.5** Reason quantitatively to compare the shape, center, and spread of three or four data sets using multiple representations in context. • **8.RD.4.6** Construct a viable argument for determining which measure of variability best describes the spread (interquartile range, MAD, standard deviation) of a distribution.
Standard	**Objectives**
8.RD.5 Summarize and interpret results from an investigation (data cycle) to	• **8.RD.5.1** Draw comparative inferences between three or four populations based on their measures of center and spread, their representations, and the context in which the data were gathered.

make predictions and draw conclusions about the data.	• **8.RD.5.2** Summarize the distribution of univariate data between three or four groups or populations by comparing measures of center and variability, identifying overall patterns, and noting any striking deviations from the pattern. • **8.RD.5.3** Communicate findings using qualitative and quantitative measures of center and variability, describing patterns, and recommending a data collection plan or analysis approach based on the results. • **8.RD.5.4** Reflect on findings to evaluate whether the original question and methods were appropriate, refining the investigative question, data collection plan, or analysis approach based on results.

Draft 3 - NC Math 1

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - NC Mathematics 1

The purpose of high school mathematics content is to establish a foundation in mathematical and statistical learning for students as they prepare for postsecondary experiences. NC Math 1 and NC Math 2 emphasize problem solving using algebraic reasoning, mathematical modeling, geometric applications, statistical thinking, and data science. The courses are designed to prepare all students, whether they go on to two- or four-year institutions, trade schools, direct entry into the workforce, or military service.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for NC Mathematics 1

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Reasoning with Mathematics Modeling

Standard	Objectives
NCM1.RMM.1 Find and defend solutions to real-world scenarios using the mathematical modeling process.	• **NCM1.RMM.1.1** Identify a real-world scenario that requires analysis. • **NCM1.RMM.1.2** Describe essential quantities, relationships, assumptions, constraints, and questions in a mathematical situation. • **NCM1.RMM.1.3** Decontextualize the mathematical situation to construct a model. • **NCM1.RMM.1.4** Use appropriate tools to analyze the model. • **NCM1.RMM.1.5** Make conjectures and explore their validity using mathematics.

	• **NCM1.RMM.1.6** Recontextualize the conclusions to determine appropriateness and to modify the model as needed. • **NCM1.RMM.1.7** Construct a viable argument that details the steps for creating and modifying the model and drawing conclusions. • **NCM1.RMM.1.8** Critique the reasoning used in another's modeling process and solution.

Domain: Algebraic, Numerical, and Functional Reasoning

Standard	Objectives
NCM1.ANFR.1 Apply the properties of operations to rewrite algebraic expressions into equivalent forms.	• **NCM1.ANFR.1.1** Look for and make use of structure to rewrite algebraic expressions with integer exponents using the properties of exponents. • **NCM1.ANFR.1.2** Compare the polynomial operations of addition, subtraction, and multiplication with the corresponding integer operations. • **NCM1.ANFR.1.3** Look for and make use of structure to rewrite polynomial expressions into equivalent forms using addition, subtraction, and multiplication. • **NCM1.ANFR.1.4** Represent the distributive property using an area model to multiply two linear expressions.
Standard	**Objectives**
NCM1.ANFR.2 Look for and make use of structure to analyze patterns of change across different function types.	• **NCM1.ANFR.2.1** Distinguish between linear and exponential relationships by examining patterns of change in various representations. • **NCM1.ANFR.2.2** Construct a viable argument that distinguishes linear and exponential relationships from other types of relationships (e.g., quadratic, cubic, absolute value). • **NCM1.ANFR.2.3** Construct a viable argument that identifies a pattern as arithmetic or geometric. • **NCM1.ANFR.2.4** Predict the values and behavior of linear and exponential functions represented in graphs and tables based on patterns.
Standard	**Objectives**
NCM1.ANFR.3 Analyze linear and exponential functions to interpret their	• **NCM1.ANFR.3.1** Use technology to investigate the parameters of exponential functions. • **NCM1.ANFR.3.2** Represent relationships between quantities using function notation.

key features.	• **NCM1.ANFR.3.3** Interpret the inputs and outputs of linear and exponential functions in context using function notation. • **NCM1.ANFR.3.4** Evaluate functions in context using function notation. • **NCM1.ANFR.3.5** Determine a reasonable domain and range for a linear or exponential function based on its context. • **NCM1.ANFR.3.6** Justify whether a linear or exponential relationship should be represented by a discrete or continuous function. • **NCM1.ANFR.3.7** Interpret the initial value, growth and decay rates, intercepts, domain and range of exponential functions presented in various representations. • **NCM1.ANFR.3.8** Interpret the average rate of change over an interval for an exponential function. • **NCM1.ANFR.3.9** Compare key features of an exponential function with other linear and/or exponential functions presented in various representations in context.
Standard	**Objectives**
NCM1.ANFR.4 Use representations of linear and exponential functions to examine multiple math points of view.	• **NCM1.ANFR.4.1** Look for and make use of structure to write a recursive function in function notation to represent arithmetic and geometric sequences. • **NCM1.ANFR.4.2** Decontextualize a mathematical situation to write linear and exponential functions. • **NCM1.ANFR.4.3** Rewrite linear functions in slope-intercept form to reveal key features. • **NCM1.ANFR.4.4** Construct a viable argument that a context is best represented by a linear or exponential function.
Standard	**Objectives**
NCM1.ANFR.5 Reason with one-variable linear and exponential equations and linear inequalities in context.	• **NCM1.ANFR.5.1** Construct viable arguments and critique the reasoning of others that support the chosen solution method and each step used to solve linear equations and inequalities. • **NCM1.ANFR.5.2** Solve for a desired quantity in mathematical and scientific formulas using the properties of equality. • **NCM1.ANFR.5.3** Decontextualize a mathematical situation to write a one-variable equation that represents an exponential relationship. • **NCM1.ANFR.5.4** Determine the number of real solutions of an exponential equation by analyzing graphs.

	• **NCM1.ANFR.5.5** Solve exponential equations with technology. • **NCM1.ANFR.5.6** Recontextualize the solutions to an exponential equation.
Standard	**Objectives**
NCM1.ANFR.6 Represent a mathematical situation using linear inequalities in two variables.	• **NCM1.ANFR.6.1** Decontextualize a mathematical situation involving two variables to write a linear inequality. • **NCM1.ANFR.6.2** Graph a solution to a linear inequality in two variables with technology. • **NCM1.ANFR.6.3** Recontextualize the solutions to linear inequalities in two variables.
Standard	**Objectives**
NCM1.ANFR.7 Reason with systems of equations and inequalities in context.	• **NCM1.ANFR.7.1** Decontextualize a mathematical situation to build a system of linear equations or inequalities. • **NCM1.ANFR.7.2** Use technology to identify the solution to a system of linear equations or inequalities by graphing. • **NCM1.ANFR.7.3** Determine the number of solutions to a system of linear equations. • **NCM1.ANFR.7.4** Solve systems of linear equations using substitution. • **NCM1.ANFR.7.5** Recontextualize the solution(s) to a system of linear equations or inequalities.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
NCM1.SGMR.1 Apply rigid transformations to figures on the coordinate plane.	• **NCM1.SGMR.1.1** Use technology to experimentally verify the properties of rotations, reflections, and translations. • **NCM1.SGMR.1.2** Represent rigid transformations that map a preimage to its image using function notation. • **NCM1.SGMR.1.3** Find the image or preimage of a figure on the coordinate plane given a reflection about a line, a rotation by multiples of 90 degrees about the origin, or a translation. • **NCM1.SGMR.1.4** Describe the center of rotation, angle of rotation, and/or line of reflection of a preimage and its image.

	• **NCM1.SGMR.1.5** Construct a viable argument that two figures are congruent by specifying a sequence of rigid motions that transforms one figure onto the other on the coordinate plane.
Standard	**Objectives**
NCM1.SGMR.2 Apply the properties of triangle congruence.	• **NCM1.SGMR.2.1** Use appropriate tools to develop criteria for triangle congruence in terms of rigid motions. • **NCM1.SGMR.2.2** Construct a viable argument that two triangles are congruent or not congruent.
Standard	**Objectives**
NCM1.SGMR.3 Analyze geometric figures on the coordinate plane by applying properties of points, lines, and shapes.	• **NCM1.SGMR.3.1** Construct a viable argument classifying lines and line segments as parallel, perpendicular, or intersecting using coordinates. • **NCM1.SGMR.3.2** Find the equation of a line parallel or perpendicular to a given line that passes through a given point. • **NCM1.SGMR.3.3** Construct a viable argument classifying triangles and quadrilaterals using the relationships among their sides on the coordinate plane. • **NCM1.SGMR.3.4** Find the midpoint or endpoint of a segment using coordinates. • **NCM1.SGMR.3.5** Construct a viable argument classifying parallelograms on the coordinate plane using their diagonals. • **NCM1.SGMR.3.6** Find the perimeter and area of triangles and quadrilaterals using coordinates.

Domain: Statistics and Data Science Reasoning

Standard	Objectives
NCM1.SDSR.1 Investigate probability using contingency tables and sample spaces.	• **NCM1.SDSR.1.1** Summarize data in a contingency table with two or three categorical variables collected from the same subjects. • **NCM1.SDSR.1.2** Use the structure of contingency tables to find missing elements. • **NCM1.SDSR.1.3** Represent events as subsets of a sample space, including unions, intersections, and complements. • **NCM1.SDSR.1.4** Calculate joint and marginal probabilities from contingency tables. • **NCM1.SDSR.1.5** Interpret joint and marginal probabilities in context to draw conclusions about a population or sample.

Standard	Objectives
NCM1.SDSR.2 Formulate statistical questions about real-world issues to make inferences about multivariate data.	● **NCM1.SDSR.2.1** Generate statistical questions about a topic of interest from a multivariate dataset. ● **NCM1.SDSR.2.2** Construct a viable argument to determine whether a question is statistical or non-statistical. ● **NCM1.SDSR.2.3** Evaluate statistical questions for potential sources of bias in data collection or response.
Standard	**Objectives**
NCM1.SDSR.3 Explore and evaluate multivariate datasets to investigate a statistical question.	● **NCM1.SDSR.3.1** Evaluate the credibility of a data source by considering how the data were collected, who collected them, and what potential biases or limitations exist. ● **NCM1.SDSR.3.2** Select relevant variables from a multivariate dataset to investigate a statistical question. ● **NCM1.SDSR.3.3** Examine whether separating data by a third categorical variable produces models with better fit and predictability.
Standard	**Objectives**
NCM1.SDSR.4 Create and interpret standard and non-standard visualizations of multivariate data from real-world sources and media.	● **NCM1.SDSR.4.1** Create scatter plots of multivariate data using technology. ● **NCM1.SDSR.4.2** Describe the form, direction, and strength of the relationship between two quantitative variables displayed in a scatter plot. ● **NCM1.SDSR.4.3** Make predictions using a sketch of an informal line of best fit for a given scatter plot. ● **NCM1.SDSR.4.4** Interpret non-standard data visualizations from real-world sources, such as heat maps, infographics, and media-based displays, describing what information is shown and what conclusions can be drawn. ● **NCM1.SDSR.4.5** Critique real-world data visualizations, including non-standard forms, by evaluating data collection, display choices, potential bias, and how the visualization supports or misleads an argument.
Standard	**Objectives**
NCM1.SDSR.5 Analyze relationships in multivariate quantitative data using	● **NCM1.SDSR.5.1** Find a least-squares regression line for data using technology. ● **NCM1.SDSR.5.2** Find an exponential regression model for data in context using technology.

linear and exponential regression.	• **NCM1.SDSR.5.3** Determine the strength and direction of a linear relationship using the correlation coefficient. • **NCM1.SDSR.5.4** Compare the fit of linear and exponential models by analyzing residual plots to select the most appropriate model. • **NCM1.SDSR.5.5** Identify outliers in data from an identified relationship. • **NCM1.SDSR.5.6** Describe how outliers affect the form, direction, and strength of an identified relationship in context. • **NCM1.SDSR.5.7** Distinguish between correlation and causation, including identifying potential confounding variables. • **NCM1.SDSR.5.8** Interpret the key features of linear and exponential regression models. • **NCM1.SDSR.5.9** Make predictions using linear and exponential regression models by interpolating and extrapolating, and assess the validity of predicted values.
Standard	**Objectives**
NCM1.SDSR.6 Communicate the application of the statistical modeling process, conclusions, and limitations of a multivariate data investigation.	• **NCM1.SDSR.6.1** Evaluate the application of the statistical modeling process used to investigate multivariate data. • **NCM1.SDSR.6.2** Communicate conclusions about multivariate data through narratives and presentations that describe the statistical modeling process conducted. • **NCM1.SDSR.6.3** Critique claims in the media by analyzing the statistical modeling process used.

Draft 3 - NC Math 2

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - NC Mathematics 2

The purpose of high school mathematics content is to establish a foundation in mathematical and statistical learning for students as they prepare for postsecondary experiences. NC Math 1 and NC Math 2 emphasize problem solving using algebraic reasoning, mathematical modeling, geometric applications, statistical thinking, and data science. The courses are designed to prepare all students, whether they go on to two- or four-year institutions, trade schools, direct entry into the workforce, or military service.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for NC Mathematics 2.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Reasoning with Mathematics Modeling

Standard	Objectives
NCM2.RMM.1 Find and defend solutions to real-world scenarios using the mathematical modeling process.	● **NCM2.RMM.1.1** Identify a real-world scenario that requires analysis. ● **NCM2.RMM.1.2** Describe essential quantities, relationships, assumptions, constraints, and questions in a mathematical situation. ● **NCM2.RMM.1.3** Decontextualize the mathematical situation to construct a model. ● **NCM2.RMM.1.4** Use appropriate tools to analyze the model. ● **NCM2.RMM.1.5** Make conjectures and explore their validity using mathematics. ● **NCM2.RMM.1.6** Recontextualize the conclusion to determine appropriateness and to modify the model as needed. ● **NCM2.RMM.1.7** Construct a viable argument that details the steps for creating and modifying the model and drawing conclusions. ● **NCM2.RMM.1.8** Critique the reasoning used in another's modeling process and solution.

Domain: Algebraic, Numerical, and Functional Reasoning

Standard	Objectives
NCM2.ANFR.1 Apply the properties of operations to rewrite polynomial expressions into equivalent forms.	● **NCM2.ANFR.1.1** Look for and make use of structure to rewrite quadratic expressions in factored form using the area model when the leading coefficient is 1 or prime. ● **NCM2.ANFR.1.2** Use repeated reasoning to develop the process of “completing the square” using the area model. ● **NCM2.ANFR.1.3** Describe the relationship between factoring and polynomial multiplication.
Standard	**Objectives**
NCM2.ANFR.2 Look for and make use of structure to analyze patterns of change across different function types.	● **NCM2.ANFR.2.1** Distinguish between linear, exponential, quadratic, and reciprocal relationships by examining patterns of change in various representations. ● **NCM2.ANFR.2.2** Construct a viable argument that distinguishes linear, exponential, quadratic, and reciprocal relationships from other types of relationships (e.g., cubic, absolute value, sinusoidal). ● **NCM2.ANFR.2.3** Predict the values and behavior of quadratic and reciprocal

	functions represented in graphs and tables based on patterns.
Standard	**Objectives**
NCM2.ANFR.3 Analyze exponential, quadratic, and reciprocal functions to interpret their key features.	• **NCM2.ANFR.3.1** Use technology to investigate the parameters of quadratic and reciprocal functions. • **NCM2.ANFR.3.2** Interpret the inputs and outputs of quadratic and reciprocal functions in context. • **NCM2.ANFR.3.3** Determine a reasonable domain and range for a quadratic or reciprocal function based on its context. • **NCM2.ANFR.3.4** Justify whether a quadratic or reciprocal relationship should be represented by a discrete or continuous function. • **NCM2.ANFR.3.5** Interpret the maximum, minimum, line of symmetry, intercepts, zeros, domain, and range of quadratic and reciprocal functions presented in various representations. • **NCM2.ANFR.3.6** Interpret the average rate of change over an interval for a quadratic function. • **NCM2.ANFR.3.7** Compare the key features of linear, exponential, quadratic, and reciprocal functions presented in various representations in context.
Standard	**Objectives**
NCM2.ANFR.4 Use representations of quadratic and reciprocal functions to examine multiple math points of view.	• **NCM2.ANFR.4.1** Look for and make use of structure to write a recursive function in function notation to represent quadratic sequences across multiple representations. • **NCM2.ANFR.4.2** Decontextualize a mathematical situation to write quadratic and reciprocal functions. • **NCM2.ANFR.4.3** Rewrite quadratic functions in factored form to reveal key features. • **NCM2.ANFR.4.4** Explain how the linear factors of a quadratic function relate to its zeros. • **NCM2.ANFR.4.5** Rewrite quadratic functions in vertex form to reveal key features using the area model. • **NCM2.ANFR.4.6** Build a function by transforming an exponential, quadratic, or reciprocal parent function.

Standard	Objectives
NCM2.ANFR.5 Reason with one-variable quadratic and reciprocal equations and quadratic inequalities in context.	• **NCM2.ANFR.5.1** Construct viable arguments and critique the reasoning of others that support the chosen solution method and each step used to solve quadratic equations. • **NCM2.ANFR.5.2** Decontextualize a mathematical situation to write one-variable equations that represent quadratic and reciprocal relationships. • **NCM2.ANFR.5.3** Decontextualize a mathematical situation to write one-variable inequalities that represent quadratic relationships. • **NCM2.ANFR.5.4** Determine the number of real solutions to quadratic and reciprocal equations by analyzing graphs. • **NCM2.ANFR.5.5** Solve quadratic equations by taking square roots, factoring, or completing the square. • **NCM2.ANFR.5.6** Explain how the linear factors of a quadratic expression relate to the solutions of the corresponding quadratic equation. • **NCM2.ANFR.5.7** Solve quadratic and reciprocal equations using technology. • **NCM2.ANFR.5.8** Graph one-variable quadratic inequalities with technology to represent solutions. • **NCM2.ANFR.5.9** Recontextualize the solutions to one-variable quadratic and reciprocal equations and quadratic inequalities.
Standard	**Objectives**
NCM2.ANFR.6 Reason with systems of linear and quadratic equations in context.	• **NCM2.ANFR.6.1** Decontextualize a mathematical situation to build a system of linear and quadratic equations. • **NCM2.ANFR.6.2** Use technology to identify the solution to a system involving linear and quadratic equations. • **NCM2.ANFR.6.3** Determine the number of real solutions to a system of linear and quadratic equations. • **NCM2.ANFR.6.4** Recontextualize the solutions to a system of linear and quadratic equations.

Domain: Spatial, Geometric, and Measurement Reasoning

Standard	Objectives
NCM2.SGMR.1 Apply rigid and non-rigid transformations to figures on the coordinate plane.	• **NCM2.SGMR.1.1** Use technology to compare the effects of a rigid transformation with those of a non-rigid transformation on the same geometric figure. • **NCM2.SGMR.1.2** Use technology to experimentally verify the properties of dilations given a center and scale factor. • **NCM2.SGMR.1.3** Represent transformations that map a preimage to its image using function notation. • **NCM2.SGMR.1.4** Find the image or preimage of a figure on the coordinate plane given a dilation about a point. • **NCM2.SGMR.1.5** Describe the center and scale factor of a dilation of a preimage and its image. • **NCM2.SGMR.1.6** Construct a viable argument by specifying a sequence of rigid and/or non-rigid transformations that transforms one figure onto the other on the coordinate plane.
Standard	**Objectives**
NCM2.SGMR.2 Apply properties of congruence and similarity to solve problems.	• **NCM2.SGMR.2.1** Use appropriate tools to develop criteria for triangle similarity in terms of non-rigid transformations. • **NCM2.SGMR.2.2** Construct a viable argument that two triangles are congruent, similar, or neither. • **NCM2.SGMR.2.3** Solve problems using similar and congruent figures.
Standard	**Objectives**
NCM2.SGMR.3 Apply proportional relationships in right triangles.	• **NCM2.SGMR.3.1** Develop properties of special right triangles using the Pythagorean Theorem. • **NCM2.SGMR.3.2** Develop the trigonometric ratios for acute angles in right triangles using proportional reasoning. • **NCM2.SGMR.3.3** Describe the relationships among the trigonometric ratios in a right triangle using multiple representations in context. • **NCM2.SGMR.3.4** Write an equation using an appropriate trigonometric ratio to represent a relationship in a right triangle.

Standard	Objectives
NCM2.SGMR.4 Solve problems involving right triangles.	● **NCM2.SGMR.4.1** Find missing sides in right triangles using trigonometric ratios. ● **NCM2.SGMR.4.2** Find missing angles in right triangles using trigonometric ratios. ● **NCM2.SGMR.4.3** Solve problems using the properties of special right triangles. ● **NCM2.SGMR.4.4** Solve real-world problems using trigonometric ratios, the Pythagorean Theorem, and angles of elevation or depression.

Domain: Statistics and Data Science Reasoning

Standard	Objectives
NCM2.SDSR.1 Investigate conditional probability and independence using contingency tables, Venn diagrams, and probability rules.	● **NCM2.SDSR.1.1** Find the conditional probability of an event using a contingency table or other representation. ● **NCM2.SDSR.1.2** Interpret conditional probability in context. ● **NCM2.SDSR.1.3** Construct a viable argument about whether events in context are independent or dependent.
Standard	**Objectives**
NCM2.SDSR.2 Formulate and investigate statistical questions about real-world issues to make inferences about multivariate data.	● **NCM2.SDSR.2.1** Generate statistical questions about a topic of interest from a multivariate dataset. ● **NCM2.SDSR.2.2** Construct a viable argument to determine whether a question is statistical or non-statistical. ● **NCM2.SDSR.2.3** Evaluate statistical questions for potential sources of bias in data collection or response.
Standard	**Objectives**
NCM2.SDSR.3 Explore and evaluate multivariate datasets to investigate a statistical question.	● **NCM2.SDSR.3.1** Evaluate the credibility of a data source by considering how the data were collected, who collected them, and what potential biases or limitations exist. ● **NCM2.SDSR.3.2** Select relevant variables from a multivariate dataset to investigate a statistical question. ● **NCM2.SDSR.3.3** Examine whether separating data by a third categorical variable produces models with better fit and predictability.

Standard	Objectives
NCM2.SDSR.4 Create and interpret standard and non-standard visualizations of multivariate data from real-world sources and media.	● **NCM2.SDSR.4.1** Create and select appropriate visualizations for multivariate data, including scatter plots, using technology. ● **NCM2.SDSR.4.2** Describe the form, direction, and strength of a relationship between two quantitative variables in a scatter plot, including non-linear patterns. ● **NCM2.SDSR.4.3** Interpret non-standard data visualizations from real-world sources, such as heat maps, infographics, and media-based displays, describing what information is shown and what conclusions can be drawn. ● **NCM2.SDSR.4.4** Critique real-world data visualizations, including non-standard forms, by evaluating data collection, display choices, potential bias, and how the visualization supports or misleads an argument.
Standard	**Objectives**
NCM2.SDSR.5 Analyze relationships in multivariate quantitative data using statistical measures and linear, exponential, and quadratic regression models.	● **NCM2.SDSR.5.1** Find a quadratic regression model for data using technology. ● **NCM2.SDSR.5.2** Construct a viable argument for using the correlation coefficient (r) and/or the coefficient of determination (r^2) when evaluating and comparing the fit of statistical models. ● **NCM2.SDSR.5.3** Compare the fit of linear, exponential, and quadratic models by analyzing residual plots and the coefficient of determination to select the most appropriate model. ● **NCM2.SDSR.5.4** Identify outliers in data from an identified relationship. ● **NCM2.SDSR.5.5** Describe how outliers affect the form, direction, and strength of the identified relationship in context. ● **NCM2.SDSR.5.6** Distinguish between correlation and causation, including identifying potential confounding variables. ● **NCM2.SDSR.5.7** Interpret the key features of linear, quadratic, and exponential regression models. ● **NCM2.SDSR.5.8** Make predictions using linear, exponential, and quadratic regression models by interpolating and extrapolating, and assess the validity of predicted values.

Standard	Objectives
NCM2.SDSR.6 Communicate the application of the statistical modeling process, conclusions, and limitations of a multivariate data investigation.	● **NCM2.SDSR.6.1** Evaluate the application of the statistical modeling process used to investigate multivariate data. ● **NCM2.SDSR.6.2** Communicate conclusions about multivariate data through narratives and presentations that describe the statistical modeling process conducted. ● **NCM2.SDSR.6.3** Critique claims in the media by analyzing the statistical modeling process used.

Draft 3 - Applied Logic and Reasoning

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Applied Logic and Reasoning

The purpose of this course is to introduce discrete structures that strengthen logical reasoning and problem-solving skills. Applied Logic & Reasoning explores mathematical structures that are countable or distinct, with topics such as logic, set theory, graph theory, voting methods, and mathematical reasoning. Students will learn how to apply these concepts to real-world decision-making, strategy, and analysis in everyday situations. The course builds critical thinking, attention to detail, and the ability to explain ideas clearly. It provides a strong foundation for advanced study in mathematics, including algebra, statistics, and discrete mathematics at the college level. Skills from this course also connect to a variety of career pathways, such as business, law, education, finance, technology, and other fields that require logical thinking and structured problem-solving.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Applied Logic and Reasoning.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Number and Quantity

Standard	Objectives
ALR.NQ.1 Apply operations with matrices and vectors.	• **ALR.NQ.1.1** Use appropriate tools strategically to implement procedures of addition, subtraction, multiplication, and scalar multiplication on matrices. • **ALR.NQ.1.2** Justify the conditions under which matrix addition, subtraction, multiplication, and scalar multiplication are defined using examples. • **ALR.NQ.1.3** Use appropriate tools strategically to implement procedures of addition, subtraction, scalar multiplication, and the dot product of vectors. • **ALR.NQ.1.4** Use appropriate tools strategically to implement procedures to find the inverse of invertible matrices.
Standard	**Objectives**
ALR.NQ.2 Understand matrices in context.	• **ALR.NQ.2.1** Decontextualize a real-world situation by representing it with matrices to solve problems. • **ALR.NQ.2.2** Use appropriate tools to solve a system of equations using an inverse matrix. • **ALR.NQ.2.3** Recontextualize the results of matrix operations. • **ALR.NQ.2.4** Assess the reasonableness of matrix-generated predictions in Leslie models and Markov chains by interpreting population distributions, growth trends, and state probabilities in the context of a given problem.
Standard	**Objectives**
ALR.NQ.3 Understand set theory to model and solve problems.	• **ALR.NQ.3.1** Identify a collection of numbers as sets, subsets, or proper subsets. • **ALR.NQ.3.2** Implement set operations to find unions, intersections, complements, and set differences with multiple sets. • **ALR.NQ.3.3** Represent properties and relationships among sets using Venn diagrams. • **ALR.NQ.3.4** Make use of the structure of Venn diagrams to solve problems.
Standard	**Objectives**
ALR.NQ.4 Understand statements related to number theory and set theory.	• **ALR.NQ.4.1** Find the greatest common factor (GCF) and least common multiple (LCM) of two integers using the Euclidean algorithm. • **ALR.NQ.4.2** Solve problems using the Fundamental Theorem of Arithmetic. • **ALR.NQ.4.3** Determine set equality using properties of set operations. • **ALR.NQ.4.4** Construct viable arguments about the greatest common factor, least

	common multiple, even and odd numbers, and prime and composite numbers using algebraic reasoning or visual models.

Domain: Graph Theory

Standard	Objectives
ALR.GT.1 Understand graph theory to model relationships and solve problems.	• **ALR.GT.1.1** Decontextualize real-world situations by representing them with a vertex-edge graph, adjacency matrix, and vertex-edge table. • **ALR.GT.1.2** Test graphs and digraphs for Euler paths, Euler circuits, Hamiltonian paths, or Hamiltonian circuits. • **ALR.GT.1.3** Interpret a complete digraph to determine vertex rank.
Standard	**Objectives**
ALR.GT.2 Apply graph theory to solve problems.	• **ALR.GT.2.1** Implement critical path analysis algorithms to determine the minimum project time. • **ALR.GT.2.2** Implement the brute-force method, the nearest-neighbor algorithm, and the cheapest-link algorithm to solve the Traveling Salesperson Problem. • **ALR.GT.2.3** Implement vertex-coloring techniques to solve problems. • **ALR.GT.2.4** Implement Kruskal's and Prim's algorithms to determine the weight of a minimum spanning tree of a connected graph.

Domain: Logic

Standard	Objectives
ALR.L.1 Evaluate mathematical logic to model and solve problems.	• **ALR.L.1.1** Construct truth tables that represent the truth values of two or more statements. • **ALR.L.1.2** Analyze logical arguments to determine their validity. • **ALR.L.1.3** Identify whether statements are tautologies, contradictions, or contingencies. • **ALR.L.1.4** Determine the truth value of Boolean logic circuits using 1s and 0s (true and false). • **ALR.L.1.5** Construct a viable argument about whether two statements are logically equivalent using truth tables.

Domain: Modeling Decision Making and Fairness

Standard	Objectives
ALR.MDMF.1 Apply and analyze voting methods.	• **ALR.MDMF.1.1** Determine election outcomes using voting methods: plurality, Borda count, pairwise comparisons, and plurality-with-elimination. • **ALR.MDMF.1.2** Construct a viable argument supporting the voting method used to determine an election outcome. • **ALR.MDMF.1.3** Analyze the fairness criteria of different voting methods. • **ALR.MDMF.1.4** Assess the implications of Arrow's Impossibility Theorem by analyzing how different voting systems can fail to satisfy fairness criteria in democratic decision-making.
Standard	**Objectives**
ALR.MDMF.2 Evaluate weighted voting systems.	• **ALR.MDMF.2.1** Analyze weighted voting systems using the Banzhaf and Shapley-Shubik power indices. • **ALR.MDMF.2.2** Analyze voting coalitions using subsets and permutations. • **ALR.MDMF.2.3** Critique the fairness and effectiveness of weighted voting systems in real-world contexts.
Standard	**Objectives**
ALR.MDMF.3 Analyze fair-division methods to solve problems.	• **ALR.MDMF.3.1** Determine equitable outcomes using fair-division strategies: divider-chooser, lone-divider, lone-chooser, sealed bids, and markers. • **ALR.MDMF.3.2** Assess the advantages, limitations, and fairness of various division methods, such as divider-chooser, lone-divider, lone-chooser, sealed bids, and markers, in context.
Standard	**Objectives**
ALR.MDMF.4 Evaluate apportionment methods.	• **ALR.MDMF.4.1** Analyze the distribution of seats among groups using the Hamilton, Jefferson, Adams, Webster, and Huntington-Hill apportionment methods. • **ALR.MDMF.4.2** Critique the fairness and effectiveness of apportionment methods in real-world contexts.

Draft 3 - Applied Statistics and Data Science

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Applied Statistics and Data Science

The primary focus of this course is on applied statistics and the practices of data science that extend the statistical and probabilistic reasoning students began in the middle grades. Students pose and refine statistical questions, collect and create data, visualize and communicate findings, build and critique models that describe and predict patterns, and draw conclusions that account for uncertainty and limitations. The course places questions of fairness and the responsible use of data at the center of these practices, and students use technology throughout to analyze both original and secondary data and build visualizations and data narratives for different audiences. Students who continue to postsecondary study will often take an entry-level statistics or data science course, whether or not they major in a STEM field. This course prepares students for that coursework and builds the data literacy they use to evaluate evidence and inform decisions in science, society, and everyday life.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Applied Statistics and Data Science.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Framing Statistical Problems

Standard	Objectives
ASDS.FSP.1 Formulate and refine statistical questions that can be addressed with data by connecting context, purpose, and variability.	• **ASDS.FSP.1.1** Distinguish between statistical and non-statistical questions. • **ASDS.FSP.1.2** Formulate investigable statistical questions that anticipate variability in data. • **ASDS.FSP.1.3** Refine questions iteratively to align with data availability, context, and intended audience. • **ASDS.FSP.1.4** Explain how the way a statistical question is framed influences the variables studied, the type of data collected, and the conclusions that can be drawn from the investigation.

Domain: Collecting and Creating Data

Standard	Objectives
ASDS.CCD.1 Design and carry out data collection plans that use randomization, limit bias, and support valid conclusions that address a statistical question.	• **ASDS.CCD.1.1** Design observational studies and surveys using random sampling to minimize bias. • **ASDS.CCD.1.2** Design experiments with random assignment to control for confounding variables and minimize bias. • **ASDS.CCD.1.3** Justify choices in study design by considering ethical principles, including informed consent, fair representation of groups, and the avoidance of unfair treatment. • **ASDS.CCD.1.4** Create data collection instruments (e.g., survey questions and observational tools) with neutral wording, structure, and visuals that minimize bias and support data validity. • **ASDS.CCD.1.5** Use technology to collect data efficiently.
Standard	**Objectives**
ASDS.CCD.2 Understand that different sampling methods affect how well a sample represents a population and contribute to	• **ASDS.CCD.2.1** Explain the difference between populations and samples. • **ASDS.CCD.2.2** Describe the purpose of sampling when drawing conclusions about the population. • **ASDS.CCD.2.3** Use random sampling to select a representative sample from a population.

a valid conclusion.	• **ASDS.CCD.2.4** Construct a viable argument for using a sampling method for a given situation. • **ASDS.CCD.2.5** Explain how randomization and sampling bias affect the validity of the results of a study.
Standard	**Objectives**
ASDS.CCD.3 Collect and process original and secondary data so they are ready for analysis and interpretation.	• **ASDS.CCD.3.1** Generate original data using designed surveys, observational tools, experiments, and simulations. • **ASDS.CCD.3.** Compile secondary data from pre-existing data sources. • **ASDS.CCD.3.3** Organize secondary data into appropriate structures. • **ASDS.CCD.3.4** Clean collected datasets (original and secondary) for analysis by addressing missing values, combining datasets, and creating new variables when appropriate. • **ASDS.CCD.3.5** Critique the assumptions and limitations of original and secondary data and note possible sources of error, bias, or misrepresentation.
Standard	**Objectives**
ASDS.CCD.4 Apply principles of fairness, consent, and representation when creating and collecting data.	• **ASDS.CCD.4.1** Explain the principles of informed consent, voluntary participation, and the right to withdraw. • **ASDS.CCD.4.2** Analyze risks of misrepresentation and bias introduced through collection practices. • **ASDS.CCD.4.3** Justify decisions about data creation and collection in light of ethical and civic responsibilities.

Domain: Data Visualizations

Standard	Objectives
ASDS.DV.1 Create visualizations of multivariate data to identify patterns, compare distributions, and support analysis.	• **ASDS.DV.1.1** Select appropriate visualizations based on data type, context, and audience. • **ASDS.DV.1.2** Construct visualizations of multivariate data using technology. • **ASDS.DV.1.3** Interpret the key features of data visualizations.
Standard	• **Objectives**

ASDS.DV.2 Critique and refine visualizations for accuracy, clarity, and appropriateness.	• **ASDS.DV.2.1** Analyze how design decisions affect the interpretation of data, including scales, axes, ordering, color, and aggregation. • **ASDS.DV.2.2** Explain how different data visualizations highlight varying aspects of a data narrative. • **ASDS.DV.2.3** Revise visualizations to improve clarity, transparency, and accessibility. • **ASDS.DV.2.4** Evaluate visualizations in the media and research for accuracy and fairness.

Domain: Analyzing and Modeling Data

Standard	Objectives
ASDS.AMD.1 Summarize, analyze, and compare multivariate distributions using descriptive statistics.	**ASDS.AMD.1.1** Summarize a data set with appropriate numerical measures that describe the distribution. **ASDS.AMD.1.2** Interpret measures of multivariate distributions in context. **ASDS.AMD.1.3** Compare measures of centrality, shape, and spread for two or more multivariate distributions in context. **ASDS.AMD.1.4** Interpret measures of relative standing.
Standard	**Objectives**
ASDS.AMD.2 Build mathematical and probabilistic models that describe data and interpret them in context.	**ASDS.AMD.2.1** Create linear, exponential, quadratic, and logistic models using technology. **ASDS.AMD.2.2** Interpret model parameters in context. **ASDS.AMD.2.3** Evaluate the goodness of fit of nonlinear models by analyzing residual plots. **ASDS.AMD.2.4** Justify model selection based on purpose and context. **ASDS.AMD.2.5** Determine when it is appropriate to model datasets with a binomial or normal distribution. **ASDS.AMD.2.6** Calculate probabilities of events modeled by a binomial distribution. **ASDS.AMD.2.7** Calculate probabilities of events modeled by a normal distribution using technology. **ASDS.AMD.2.8** Compare data points from normal distributions that have different means and standard deviations using z-scores.

Standard	Objectives
ASDS.AMD.3 Understand the role of randomness in data by applying probability and random processes as models of uncertainty.	**ASDS.AMD.3.1** Explain the role of probability in modeling randomness and uncertainty. **ASDS.AMD.3.2** Explain how simulation can be used to estimate a population mean or proportion and to determine a margin of error for the estimate. **ASDS.AMD.3.3** Determine, using simulation, whether observed differences between samples from two populations provide evidence that the populations differ with respect to a parameter of interest.

Domain: Drawing Conclusions and Communicating

Standard	Objectives
ASDS.DCC.1 Communicate insights using data visualizations through narratives and presentations tailored to varied audiences.	**ASDS.DCC.1.1** Develop data presentations that integrate visualizations with narrative explanations that include probabilistic and contextual language. **ASDS.DCC.1.2** Adapt communication to a specific audience by highlighting relevant context.
Standard	**Objectives**
ASDS.DCC.2 Draw and justify inferences from sample data about a population by using probabilistic reasoning.	**ASDS.DCC.2.1** Explain how limitations in sampling influence the extent to which results can be generalized. **ASDS.DCC.2.2** Make informal inferences, using randomization and simulation, about population parameters. **ASDS.DCC.2.3** Interpret margins of error as measures of uncertainty when making inferences about population parameters. **ASDS.DCC.2.4** Assess the validity of a predicted value.
Standard	**Objectives**
ASDS.DCC.3 Evaluate and critique claims based on data, recognizing the limitations of statistical inference.	**ASDS.DCC.3.1** Evaluate the strength and limitations of evidence from observational studies versus experiments. **ASDS.DCC.3.2** Critique claims in the media, research, and policy by analyzing data sources, study design, and reasoning.

Draft 3 - Mathematical and Statistical Modeling

North Carolina Standard Course Of Study - DRAFT

K-12 Mathematics - Mathematical and Statistical Modeling

Mathematical & Statistical Modeling is an advanced high school mathematics course that builds on students' experiences with algebra, functions, data, and probability. Throughout the course, students expand their understanding of exponential, polynomial, piecewise, and logarithmic models. The course is designed to help students become flexible mathematical and statistical thinkers who can explore messy, real-world situations, make informed modeling choices, and use technology strategically. By valuing reasoning, decision-making, communication, and critique alongside procedural skills, the course prepares students to interpret results in context, revise their thinking based on evidence, and explain their conclusions clearly to others.

Note: These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a local public-school unit (PSU) or school. The standards for this course have been developed to serve as the framework which will guide each PSU in developing the curriculum for Mathematical and Statistical Modeling.

North Carolina Mathematical and Statistical Practices

Students in North Carolina will engage with grade-level mathematics by:

1) Modeling and Using Tools and Representations
2) Explaining, Reasoning, and Proving
3) Seeing, Describing, and Generalizing Structure
4) Exhibiting the Habits of a Productive Mathematical and Statistical Thinker

Domain: Reasoning with Mathematical Modeling

Standard	Objectives
MSM.RMM.1 Find and defend solutions to real-world scenarios using the mathematical modeling process.	● **MSM.RMM.1.1** Identify a real-world scenario that requires analysis. ● **MSM.RMM.1.2** Describe the essential quantities, relationships, assumptions, constraints, and questions in a mathematical situation. ● **MSM.RMM.1.3** Decontextualize the mathematical situation to construct a model. ● **MSM.RMM.1.4** Use appropriate tools to analyze the model. ● **MSM.RMM.1.5** Make conjectures and explore their validity using mathematics. ● **MSM.RMM.1.6** Recontextualize the conclusion to determine appropriateness and to modify the model as needed. ● **MSM.RMM.1.7** Construct a viable argument that details the steps for creating and modifying the model and drawing conclusions. ● **MSM.RMM.1.8** Critique the reasoning used in another's modeling process and solution.
Standard	**Objectives**
MSM.RMM.2 Look for and make use of structure to analyze patterns of change across different function types.	● **MSM.RMM.2.1** Identify the appropriate function type to model in a context based on patterns of change. ● **MSM.RMM.2.2** Identify and define independent variables, dependent variables, and constant parameters within real-world scenarios. ● **MSM.RMM.2.3** Determine a reasonable domain and range for a function in context.
Standard	**Objectives**
MSM.RMM.3 Decontextualize a mathematical situation by representing it with a polynomial, exponential, reciprocal, piecewise, or logarithmic function as part of the mathematical modeling process.	● **MSM.RMM.3.1** Use appropriate tools to build a polynomial function that models the key features of a real-world scenario. ● **MSM.RMM.3.2** Build a piecewise function from a situation or graph. ● **MSM.RMM.3.3** Use technology to build polynomial and logarithmic regression models. ● **MSM.RMM.3.4** Use appropriate representations to highlight key features of and solutions to a mathematical situation. ● **MSM.RMM.3.5** Justify the model selected to represent a mathematical situation.

Standard	Objectives
MSM.RMM.4 Recontextualize the key features of and the solutions to equations and inequalities from a model as part of the mathematical modeling process.	● **MSM.RMM.4.1** Interpret the inputs and outputs of functions in context. ● **MSM.RMM.4.2** Solve equations from a function model using appropriate technology. ● **MSM.RMM.4.3** Solve inequalities from a model using appropriate technology. ● **MSM.RMM.4.4** Interpret the key features of polynomial, exponential, reciprocal, piecewise, and logarithmic functions. ● **MSM.RMM.4.5** Interpret solutions to equations and inequalities in context.

Domain: Reasoning with Statistical Modeling

Standard	Objectives
MSM.RSM.1 Formulate and investigate statistical questions about real-world issues to make inferences about data as part of the statistical modeling process.	● **MSM.RSM.1.1** Construct statistical questions to guide explorations of data in context. ● **MSM.RSM.1.2** Design surveys using sampling methods to collect data aligned with a statistical question. ● **MSM.RSM.1.3** Use informal or theoretical probability to anticipate possible outcomes and variability. ● **MSM.RSM.1.4** Implement plans to collect and curate original and/or existing data. ● **MSM.RSM.1.5** Explain the limitations and uncertainty associated with the collected data. ● **MSM.RSM.1.6** Evaluate statistical questions for potential sources of bias in data collection or response.
Standard	**Objectives**
MSM.RSM.2 Explore and evaluate collected data to investigate a statistical question as part of the statistical modeling process.	● **MSM.RSM.2.1** Create data visualizations using technology to represent quantitative and categorical data. ● **MSM.RSM.2.2** Interpret key features of graphical representations of data. ● **MSM.RSM.2.3** Calculate numerical summaries of quantitative and categorical data. ● **MSM.RSM.2.4** Interpret numerical summaries of quantitative and categorical data.

	• **MSM.RSM.2.5** Recognize when observed patterns align with or differ from expected probabilistic behavior.
Standard	**Objectives**
MSM.RSM.3 Apply probability distributions to make decisions under uncertainty as part of the statistical modeling process.	• **MSM.RSM.3.1** Create probability models using discrete, binomial, and normal distributions. • **MSM.RSM.3.2** Determine the likelihood of events occurring using discrete, binomial, and normal distributions. • **MSM.RSM.3.3** Make decisions using probability models. • **MSM.RSM.3.4** Construct a viable argument to support decisions using probabilistic reasoning.
Standard	**Objectives**
MSM.RSM.4 Analyze relationships in multivariate datasets using statistical measures as part of the statistical modeling process.	• **MSM.RSM.4.1** Construct polynomial, exponential, and logarithmic regression models for bivariate data using technology to model data and solve problems. • **MSM.RSM.4.2** Compare residuals, residual plots, the correlation coefficient, and the coefficient of determination for nonlinear models to assess model goodness of fit. • **MSM.RSM.4.3** Draw conclusions that answer the statistical question using evidence based on the analysis of the statistical model.
Standard	**Objectives**
MSM.RSM.5 Summarize findings from the statistical modeling process and communicate the workflow and conclusions.	• **MSM.RSM.5.1** Evaluate the appropriateness of the investigative questions, data collection plan, or analysis approach based on results. • **MSM.RSM.5.2** Communicate conclusions about data through narratives and presentations that describe the statistical modeling process used, including discussion of the limitations of the data, potential sources of bias, and additional questions that emerged. • **MSM.RSM.5.3** Evaluate the appropriateness of probability models used to represent the situation. • **MSM.RSM.5.4** Critique the workflow, conclusions, and potential sources of bias in data investigations by analyzing data sources, sampling design, and reasoning.