

Ratio and Proportional Relationships

5 TH GRADE	6 TH GRADE	7 TH GRADE	8 TH GRADE
	<p><i>Understand ratio concepts and use ratio reasoning to solve problems.</i> NC.6.RP.1 Understand the concept of a ratio and use ratio language.</p> <p>NC.6.RP.2 Understand that ratios can be expressed as equivalent unit ratios by finding and interpreting both unit ratios in context.</p> <p>NC.6.RP.3 Use ratio reasoning with equivalent whole-number ratios to solve real-world and mathematical problems by:</p> <ul style="list-style-type: none"> • Creating and using a table • Finding values in the tables. • Using a unit ratio. • Converting and manipulating measurements using given ratios. • Plotting on the coordinate plane. <p>NC.6.RP.4 Use ratio reasoning to solve real-world and mathematical problems with percents by:</p> <ul style="list-style-type: none"> • Understanding, finding a percent of a quantity as a ratio per 100. • Using equivalent ratios, such as benchmark percents (50%, 25%, 10%, 5%, 1%), to determine a part of any given quantity. • Finding the whole, given a part and the percent 	<p><i>Analyze proportional relationships and use them to solve real-world and mathematical problems.</i> NC.7.RP.1 Compute unit rates associated with ratios of fractions to solve real-world and mathematical problems.</p> <p>NC.7.RP.2 Recognize and represent proportional relationships between quantities.</p> <ul style="list-style-type: none"> • Understand that a proportion is a relationship of equality between ratios. • Identify the unit rate (constant of proportionality) within two quantities in a proportional relationship using tables, graphs, equations, and verbal descriptions. • Create equations and graphs to represent proportional relationships. • Use a graphical representation of a proportional relationship <p>NC.7.RP.3 Use scale factors and unit rates in proportional relationships to solve ratio and percent problems</p>	

Functions

5 TH GRADE	6 TH GRADE	7 TH GRADE	8 TH GRADE
			<p style="text-align: center;"><i>Define, evaluate, and compare functions.</i></p> <p>NC.8.F.1 Understand that a function is a rule that assigns to each input exactly one output.</p> <ul style="list-style-type: none">• Recognize functions when graphed as the set of ordered pairs consisting of an input and exactly one corresponding output.• Recognize functions given a table of values or a set of ordered pairs. <p>NC.8.F.2 Compare properties of two linear functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).</p> <p>NC.8.F.3 Identify linear functions from tables, equations, and graphs.</p> <p style="text-align: center;"><i>Use functions to model relationships between quantities.</i></p> <p>NC.8.F.4 Analyze functions that model linear relationships.</p> <ul style="list-style-type: none">• Understand that a linear relationship can be generalized by $y = mx + b$.• Write an equation in slope-intercept form to model a linear relationship by determining the rate of change and the initial value, given at least two (x, y) values or a graph.• Construct a graph of a linear relationship given an equation in slope-intercept form.• Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of the slope and y-intercept of its graph or a table of values. <p>NC.8.F.5 Qualitatively analyze the functional relationship between two quantities.</p> <ul style="list-style-type: none">• Analyze a graph determining where the function is increasing or decreasing; linear or non-linear.• Sketch a graph that exhibits the qualitative features of a real-world function

Expressions and Equations

5 TH GRADE	6 TH GRADE	7 TH GRADE	8 TH GRADE
<p>OPERATIONS AND ALGEBRAIC THINKING</p> <p><i>Write and interpret numerical expressions.</i></p> <p>NC.5.OA.2 Write, explain, and evaluate numerical expressions involving the four operations to solve up to two-step problems. Include expressions involving:</p> <ul style="list-style-type: none"> • Parentheses, using the order of operations. • Commutative, associative and distributive properties. <p><i>Analyze patterns and relationships.</i></p> <p>NC.5.OA.3 Generate two numerical patterns using two given rules.</p> <ul style="list-style-type: none"> • Identify apparent relationships between corresponding terms. • Form ordered pairs consisting of corresponding terms from the two patterns. • Graph the ordered pairs on a coordinate plane. 	<p><i>Apply and extend previous understandings of arithmetic to algebraic expressions.</i></p> <p>NC.6.EE.1 Write and evaluate numerical expressions, with & w/o grouping symbols, involving whole-number exponents.</p> <p>NC.6.EE.2 Write, read, and evaluate algebraic expressions.</p> <p>NC.6.EE.3 Apply the properties of operations to generate equivalent expressions without exponents.</p> <p>NC.6.EE.4 Identify when 2 expressions are equivalent and justify with mathematical reasoning.</p> <p><i>Reason about and solve one-variable equations.</i></p> <p>NC.6.EE.5 Use substitution to determine whether a given number in a specified set makes an equation true.</p> <p>NC.6.EE.6 Use variables to represent numbers and write expressions when solving a real-world problem.</p> <p>NC.6.EE.7 Solve real-world problems by writing and solving equations.</p> <p><i>Reason about one variable inequalities.</i></p> <p>NC.6.EE.8 Reason about inequalities by:</p> <ul style="list-style-type: none"> • Using substitution to determine whether a given number in a specified set makes an inequality true. • Writing an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world problem. • Recognizing that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions. • Representing solutions of inequalities on number lines. <p><i>Represent and analyze quantitative relationships between dependent and independent variables.</i></p> <p>NC.6.EE.9 Represent & analyze quantitative relationships:</p> <ul style="list-style-type: none"> • Use variables to represent 2 quantities in a real-world or context that change in relationship to one another. • Analyze the relationship between quantities in different representations (context, equations, tables, and graphs) 	<p><i>Use properties of operations to generate equivalent expressions.</i></p> <p>NC.7.EE.1 Apply properties of operations as strategies to:</p> <ul style="list-style-type: none"> • Add, subtract, and expand linear expressions with rational coefficients. • Factor linear expression with an integer GCF. <p>NC.7.EE.2 Understand that equivalent expressions can reveal real-world and mathematical relationships. Interpret the meaning of the parts of each expression in context.</p> <p><i>Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities.</i></p> <p>NC.7.EE.3 Solve multi-step real-world and mathematical probs posed with rational numbers in algebraic expressions.</p> <ul style="list-style-type: none"> • Apply properties of operations to calculate with positive and negative numbers in any form. • Convert between different forms of a number and equivalent forms of the expression as appropriate. <p>NC.7.EE.4 Use variables to represent quantities to solve real-world or mathematical problems.</p> <ul style="list-style-type: none"> • Construct equations to solve problems by reasoning about the quantities. <ul style="list-style-type: none"> – Solve multistep equations with the variable on one side, including those generated by word problems. – Compare an algebraic solution to an arithmetic solution, – Interpret the solution in context. • Construct inequalities to solve problems by reasoning about the quantities. <ul style="list-style-type: none"> – Solve multi-step inequalities with the variable on one side, including those generated by word problems. – Compare an algebraic solution process for equations and an algebraic solution process for inequalities. – Graph the solution set of the inequality and interpret in context. 	<p><i>Work with radicals and integer exponents.</i></p> <p>NC.8.EE.1 Develop and apply the properties of integer exponents to generate equivalent numerical expressions.</p> <p>NC.8.EE.2 Use square root and cube root symbols to:</p> <ul style="list-style-type: none"> • Represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. • Evaluate square roots of perfect squares and cube roots of perfect cubes for positive numbers less than or equal to 400. <p>NC.8.EE.3 Use numbers expressed in scientific notation to estimate very large or very small quantities and to express how many times as much one is than the other.</p> <p>NC.8.EE.4 Perform multiplication and division with numbers expressed in scientific notation to solve real-world problems, including problems where both decimal and scientific notation are used.</p> <p><i>Analyze and solve linear equations and inequalities.</i></p> <p>NC.8.EE.7 Solve real-world & mathematical problems by writing and solving equations & inequalities in 1 variable.</p> <ul style="list-style-type: none"> • Recognize linear equations in one variable as having one solution, infinitely many solutions, or no solutions. • Solve linear equations and inequalities including multi-step equations and inequalities with the same variable on both sides. <p><i>Analyze and solve pairs of simultaneous linear equations.</i></p> <p>NC.8.EE.8 Analyze and solve a system of two linear equations in two variables in slope-intercept form. • Understand that solutions to a system of two linear equations correspond to the points of intersection of their graphs because the point of intersection satisfies both equations simultaneously. • Solve real-world and mathematical problems leading to systems of linear equations by graphing the equations. Solve simple cases by inspection.</p>

The Number System

5 TH GRADE	6 TH GRADE	7 TH GRADE	8 TH GRADE
<p align="center">NUMBER AND OPERATIONS - IN BASE TEN/FRACTIONS <i>Understand the place value system.</i></p> <p>NC.5.NBT.1 Explain the patterns in the place value system from one million to the thousandths place.</p> <p>NC.5.NBT.3 Read, write, compare decimals to thousandths.</p> <p align="center"><i>Perform operations with multi-digit whole numbers.</i></p> <p>NC.5.NBT.5 Demonstrate standard algorithm fluency with multiplication of 2 whole numbers (max 3-digit by 2-digit)</p> <p>NC.5.NBT.6 Find quotients w/ remainders when dividing whole numbers (max 4-digit dividend & 2-digit divisor) using rectangular arrays, area models, repeated subtraction, partial quotients, and relationships between multiplication & division.</p> <p align="center"><i>Use models to make connections and develop the algorithm.</i></p> <p>NC.5.NBT.7 Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.</p> <ul style="list-style-type: none"> • Add and subtract decimals to thousandths • Multiply decimals with a product to thousandths • Divide whole number by decimal and decimal by whole number, using repeated subtraction or area models. (Hundredths place) • Use estimation to assess answer reasonableness. <p align="center"><i>Apply and extend previous understandings of multiplication and division to multiply and divide fractions.</i></p> <p>NC.5.NF.3 Use fractions to model & solve division problems. Solve 1-step word problems involving division of whole numbers leading to answers in fractions and mixed numbers, with denominators of 2, 3, 4, 5, 6, 8, 10, and 12, using area, length, and set models or equations.</p> <p>NC.5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction, including mixed numbers.</p> <ul style="list-style-type: none"> • Area and length models to multiply fractions (denominators 2, 3, 4) • Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number by a fraction less than 1 results in a product smaller than the given number. • Solve 1-step word problems involving multiplication of fractions <p>NC.5.NF.7 Solve 1-step word probs w/division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions using area and length models, and equations to represent the problem.</p>	<p align="center"><i>Apply and extend previous understandings of multiplication and division to divide fractions by fractions.</i></p> <p>NC.6.NS.1 Use visual models and common denominators to interpret and compute quotients of fractions & solve real-world problems involving division of fractions.</p> <p align="center"><i>Compute fluently w/ multi-digit numbers and find common factors & multiples.</i></p> <p>NC.6.NS.2 Fluently divide using long division with a minimum of a 4-digit dividend and interpret the quotient and remainder in context.</p> <p>NC.6.NS.3 Apply & extend understandings of decimals to develop & fluently use algorithms for addition, subtraction, multiplication and division of decimals.</p> <p>NC.6.NS.4 Understand, Use prime factorization & relationships between factors:</p> <ul style="list-style-type: none"> • Find the unique prime factorization for a whole number. • Find the GCF of two whole numbers less than or equal to 100. • Use GCF and the distributive property to rewrite the sum of two whole numbers, each less than or equal to 100. • Find the least common multiple of two whole numbers less than or equal to 12 to add and subtract fractions with unlike denominators. <p align="center"><i>Apply & extend understandings of numbers to the system of rational numbers.</i></p> <p>NC.6.NS.5 Understand and use rational numbers to:</p> <ul style="list-style-type: none"> • Describe quantities having opposite directions or values. • Represent quantities in contexts, explaining the meaning of 0. • Understand absolute value as a number's distance from 0 on the number line <p>NC.6.NS.6 Understand rational numbers as points on the number line and as ordered pairs on a coordinate plane.</p> <p>NC.6.NS.7 Understand ordering of rational numbers.</p> <p>NC.6.NS.8 Solve real-world problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. Apply and extend understandings of addition and subtraction.</p> <p>NC.6.NS.9 Understand additive inverses when adding and subtracting integers. • Describe situations in which opposite quantities combine to make 0.</p> <ul style="list-style-type: none"> • Show that a number and its additive inverse create a zero pair. • Show that the distance between two integers on the number line is the absolute value of their difference. • Use models to add and subtract integers from -20 to 20 and describe real-world contexts using sums and differences. 	<p align="center"><i>Apply and extend understanding of operations with fractions to add, subtract, multiply, & divide rational numbers.</i></p> <p>NC.7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers, using the properties of operations, and describing real world contexts using sums and differences.</p> <p>NC.7.NS.2 Apply and extend previous understandings of multiplication and division.</p> <ul style="list-style-type: none"> • Understand that a rational number is any number that can be written as a quotient of integers with a non-zero divisor. • Apply properties of operations as strategies, including the standard algorithms, to multiply and divide rational numbers and describe the product and quotient in real-world contexts. • Use division and previous understandings of fractions and decimals. (Convert a fraction to a decimal using long division. Understand decimal form of a rational number terminates or eventually repeats). <p>NC.7.NS.3 Solve real-world and mathematical problems involving numerical expressions with rational numbers using the 4 operations.</p>	<p align="center"><i>Know that there are numbers that are not rational and approximate them by rational numbers.</i></p> <p>NC.8.NS.1 Understand every number has a decimal expansion. Building upon the definition of a rational number, know that irrational number is defined as a non-repeating, non-terminating decimal.</p> <p>NC.8.NS.2 Use rational approximations of irrational numbers to compare size of irrational numbers and locate them approximately on a number line. Estimate value of expressions involving square and cube roots to tenths and π to hundredths.</p>

Geometry

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<p>Understand the coordinate plane. NC.5.G.1 Graph points in the first quadrant of a coordinate plane, and identify and interpret the x and y coordinates to solve problems.</p> <p>Classify quadrilaterals. NC.5.G.3 Classify quadrilaterals into categories based on their properties.</p> <ul style="list-style-type: none"> • Explain that attributes belonging to a category of quadrilaterals also belong to all subcategories of that category. • Classify quadrilaterals in a hierarchy based on properties 	<p>Solve real-world and mathematical problems involving area, surface area, and volume.</p> <p>NC.6.G.1 Create geometric models to solve real-world and mathematical problems to:</p> <ul style="list-style-type: none"> • Find the area of triangles by composing into rectangles and decomposing into right triangles. • Find the area of special quadrilaterals and polygons by decomposing into triangles or rectangles. <p>NC.6.G.2 Apply and extend previous understandings of the volume of a right rectangular prism to find the volume of right rectangular prisms with fractional edge lengths. Apply this understanding to the context of solving real-world and mathematical problems.</p> <p>NC.6.G.3 Use the coordinate plane to solve real-world and mathematical problems by:</p> <ul style="list-style-type: none"> • Drawing polygons in the coordinate plane given coordinates for the vertices. • Using coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. <p>NC.6.G.4 Represent right prisms and right pyramids using nets made of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems</p>	<p>Draw, construct, and describe geometrical figures and describe the relationships between them.</p> <p>NC.7.G.1 Solve problems involving scale drawings of geometric figures by:</p> <ul style="list-style-type: none"> • Building an understanding that angle measures remain the same and side lengths are proportional. • Using a scale factor to compute actual lengths and areas from a scale drawing. • Creating a scale drawing. <p>NC.7.G.2 Understand the characteristics of angles and side lengths that create a unique triangle, more than one triangle or no triangle. Build triangles from three measures of angles and/or sides.</p>	<p>Understand congruence and similarity using physical models, transparencies, or geometry software.</p> <p>NC.8.G.2 Use transformations to define congruence.</p> <ul style="list-style-type: none"> • Verify experimentally the properties of rotations, reflections, and translations that create congruent figures. • Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations. • Given two congruent figures, describe a sequence that exhibits the congruence between them. <p>NC.8.G.3 Describe the effect of dilations about the origin, translations, rotations about the origin in 90 degree increments, and reflections across the x-axis and y-axis on two-dimensional figures using coordinates.</p> <p>NC.8.G.4 Use transformations to define similarity.</p> <ul style="list-style-type: none"> • Verify experimentally the properties of dilations that create similar figures. • Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. • Given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. <p>Analyze angle relationships.</p> <p>NC.8.G.5 Use informal arguments to analyze angle relationships.</p> <ul style="list-style-type: none"> • Recognize relationships between interior and exterior angles of a triangle. • Recognize the relationships between the angles created when parallel lines are cut by a transversal. • Recognize the angle-angle criterion for similarity of triangles. • Solve real-world and mathematical problems involving angles. <p>Understand and apply the Pythagorean Theorem.</p> <p>NC.8.G.6 Explain the Pythagorean Theorem and its converse.</p> <p>NC.8.G.7 Apply the Pythagorean Theorem and its converse to solve real-world and mathematical problems.</p> <p>NC.8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.</p> <p>Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.</p> <p>NC.8.G.9 Understand how the formulas for the volumes of cones, cylinders, and spheres are related and use the relationship to solve real-world and mathematical problems</p>

Statistics and Probability

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<p>MEASUREMENT AND DATA <i>Convert like measurement units within a given measurement system.</i></p> <p>NC.5.MD.1 Use multiplicative reasoning to solve one-step conversion problems within a given measurement system.</p> <p>Represent and interpret data.</p> <p>NC.5.MD.2 Represent & interpret data.</p> <ul style="list-style-type: none"> • Ask a question that yields data that changes over time. • Make & interpret a representation of data using a line graph. • Determine whether a survey question will yield categorical or numerical data, or data that changes over time. <p>Understand concepts of volume.</p> <p>NC.5.MD.4 Recognize volume as an attribute of solid figures and measure volume by counting unit cubes, using cubic centimeters, cubic inches, cubic feet, and improvised units.</p> <p>NC.5.MD.5 Relate volume to multiplication and addition.</p> <ul style="list-style-type: none"> • Find volume of a rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as multiplying the edge lengths. • Build understanding of the volume formula for rectangular prisms with whole-number edge lengths in the context of solving problems. • Find volume of solids with 1-digit dimensions composed of 2 non-overlapping rectangular prisms. 	<p>Develop understanding of statistical variability.</p> <p>NC.6.SP.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.</p> <p>NC.6.SP.2 Understand a set of data collected from a statistical question has distribution which can be described by its center, spread, and shape.</p> <p>NC.6.SP.3 Understand that both a measure of center and a description of variability should be considered when describing a numerical data set.</p> <ul style="list-style-type: none"> • Determine the measure of center of a data set and understand that it is a single number that summarizes all the values of that data set. • Understand that describing the variability of a data set is needed to distinguish between data sets in the same scale, by comparing graphical representations of different data sets in the same scale that have similar measures of center, but different spreads. <p>Summarize and describe distributions.</p> <p>NC.6.SP.4 Display numerical data in plots on number line.</p> <ul style="list-style-type: none"> • Use dot & box plots, histograms, box plots to represent data. • Compare attributes of different representations of the same data. <p>NC.6.SP.5 Summarize numerical data sets in relation to their context. Describe the collected data by reporting number of observations in dot plots and histograms & communicating the nature of the attribute under investigation, how it was measured, and units of measurement. Analyze center and variability giving quantitative measures of center, describing variability, and any overall pattern, and noting any striking deviations, & justifying the appropriate choice of measures of center using the shape of the data distribution</p>	<p>Use random sampling to draw inferences about a population.</p> <p>NC.7.SP.1 Understand statistics can be used to gain information about a population:</p> <ul style="list-style-type: none"> • Recognize generalizations about a population from a sample are valid only if the sample is representative of that population. • Use random sampling to support valid inferences. <p>NC.7.SP.2 Generate multiple random samples (or simulated samples) of the same size to gauge the variation in estimates or predictions, and use this data to draw inferences about a population with an unknown characteristic of interest.</p> <p>Make informal inferences to compare two populations.</p> <p>NC.7.SP.3 Recognize the role of variability when comparing two populations.</p> <ul style="list-style-type: none"> • Calculate the measure of variability of a data set and understand that it describes how the values of the data set vary with a single number. <ul style="list-style-type: none"> – Understand the mean absolute deviation of a data set is a measure of variability that describes the average distance that points within a data set are from the mean of the data set. – Understand that the range describes the spread of the entire data set and IQR describes the spread of the middle 50% of the data. b. Informally assess the difference between two data sets by examining the overlap and separation between the graphical representations of two data sets. <p>NC.7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw comparative inferences about two populations.</p> <p>Investigate chance processes & develop, use, and evaluate probability models.</p> <p>NC.7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.</p> <p>NC.7.SP.6 Collect data to calculate the experimental probability of a chance event, observing its long-run relative frequency. Use this experimental probability to predict the approximate relative frequency.</p> <p>NC.7.SP.7 Develop a probability model and use it to find probabilities of simple events.</p> <ul style="list-style-type: none"> • Uniform model - assigned equal probability to all outcomes • Model that may not be uniform - repeatedly performing a chance process and observing frequencies in the data generated. • Compare theoretical and experimental probabilities from a model to observed frequencies; explain/understand possible sources of the discrepancy. <p>NC.7.SP.8 Determine probabilities of compound events using organized lists, tables, tree diagrams, and simulation.</p>	<p>Investigate patterns of association in bivariate data.</p> <p>NC.8.SP.1 Construct and interpret scatter plots for to investigate patterns of association between two quantities. Investigate and describe patterns such as clustering, outliers, positive or negative association, linear and nonlinear association.</p> <p>NC.8.SP.2 Model relationship between bivariate quant. Data:</p> <ul style="list-style-type: none"> • Informally fit a straight line for a scatter plot that suggests linear association. • Informally assess the model fit by judging the closeness of the data points to the line. <p>NC.8.SP.3 Use the equation of a linear model to solve problems in context.</p> <p>NC.8.SP.4 Understand patterns of association can also be seen in bivariate categorical data by displaying frequencies /relative frequencies in a two-way table.</p> <ul style="list-style-type: none"> • Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. • Use relative frequencies calculated for rows or columns to describe possible association between the two variables