## Standards for Mathematical Practice

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

# North Carolina Math 2

| Number and Quantity | | | | |
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| **Current Standard Abbreviation** | **Current Standard** | **Proposed Standard Abbreviation** | **First Draft Proposed Standard** | **Second Draft Proposed Standard** |
| **The Real Number System**<br>***Extend the properties of exponents to rational exponents.*** | | | | |
| N-RN.1 | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.<br><br>*Moved from Math 1* | NC.M2.N-RN.1 | Understand that the properties of rational exponents are the same as properties of integer exponents. Explain how expressions with rational exponents can be rewritten as radical expressions. Convert between radical and rational exponent notation. | Explain how expressions with rational exponents can be rewritten as radical expressions. |
| N-RN.2 | Rewrite expressions involving radicals and rational exponents using the properties of exponents. | NC.M2.N-RN.2 | Rewrite algebraic, exponential and radical expressions with rational exponents using the properties of exponents. | Rewrite expressions with radicals and rational exponents into equivalent expressions using the properties of exponents. |

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| **The Real Number System**<br>***Use properties of rational and irrational numbers.*** | | | | |
| N-RN.3 | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.<br><br>*Moved from Math 3* | NC.M2.N-RN.3 | Use the properties of rational and irrational numbers to explain why:<br>● the sum or product of two rational numbers is rational<br>● the sum of a rational number and an irrational number is irrational<br>● the product of a nonzero rational number and an irrational number is irrational. | Use the properties of rational and irrational numbers to explain why:<br>● the sum or product of two rational numbers is rational;<br>● the sum of a rational number and an irrational number is irrational; and<br>● the product of a nonzero rational number and an irrational number is irrational. |
| **Quantities**<br>***Reason quantitatively and use units to solve problems.*** | | | | |
| N-Q.1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. | | *Integrated into the Standards for Mathematical Practice.* | *Included in Standards for Mathematical Practices 1, 4, 5 and 6.* |
| N-Q.2 | Define appropriate quantities for the purpose of descriptive modeling. | | *Integrated into the Standards for Mathematical Practice.* | *Included in Standards for Mathematical Practices 1, 4 and 6.* |
| N-Q.3 | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. | | *Integrated into the Standards for Mathematical Practice.* | *Included in Standards for Mathematical Practices Practice 1 and 6.* |
| **The Complex Number System**<br>***Defining complex numbers.*** | | | | |
| N-CN.1 | Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with $a$ and $b$ real.<br><br>*Moved from Math 3* | NC.M2.N-CN.1 | Know there is a complex number $i$ such that $i^2 = -1$, and every complex number has the form $a + bi$ with $a$ and $b$ real. | Know there is a complex number $i$ such that $i^2 = -1$, and every complex number has the form $a + bi$ where $a$ and $b$ are real numbers. |

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| **The Complex Number System**<br>***Use complex numbers in polynomial identities and equations.*** | | | | |
| N-CN.7 | Solve quadratic equations with real coefficients that have complex solutions.<br><br>*Moved from Math 3* | NC.M2.N-CN.7 | Solve quadratic equations with real coefficients that have complex solutions. | *After the 1st draft, this standard was fully integrated into NC.M2.A-REI.4.* |
| N-CN.9 | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials<br><br>*Moved from Math 3* | NC.M2.N-CN.9 | Know the Fundamental Theorem of Algebra and show that it is true for quadratic polynomials. | *After the 1st draft, this standard was rewritten into NC.M3.N-CN.9.* |

| Algebra | | | | |
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| **Seeing Structure in Expressions** ***Interpret the structure of expressions.*** | | | | |
| A-SSE.1<br><br>A-SSE.1a<br><br>A-SSE.1b | Interpret expressions that represent a quantity in terms of its context.<br><br>a. Interpret parts of an expression, such as terms, factors, and coefficients.<br><br>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*<br><br>***Note:*** *Limit to expression types covered in Math II.* | NC.M2.A-SSE.1<br><br>NC.M2.A-SSE.1a<br><br>NC.M2.A-SSE.1b | Interpret expressions that represents a quantity in terms of its context.<br><br>a. Interpret in context parts of an expression, such as terms, factors, coefficients, radicands, constant of variation/unit rate and exponents<br><br>b. View parts of an expression to give meaning in context.<br>● View a radical expression made of multiple parts as a combination of single entities to give meaning to an expression in context.<br>● View a trigonometric expression made of multiple parts as a combination of single entities to give meaning to an expression in context, extending from the reasoning of unit rates and proportions. | Interpret expressions that represent a quantity in terms of its context.<br><br>a. Identify and interpret parts of a quadratic, square root, inverse variation, or right triangle trigonometric expression, including terms, factors, coefficients, radicands, and exponents.<br><br>b. Interpret quadratic and square root expressions made of multiple parts as a combination of single entities to give meaning in terms of a context. |
| A-SSE.2 | Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.* | NC.M2.A-SSE.2 | Write equivalent forms of quadratic and radical expressions based on their structure. | *Moved to NC.M3.A-SSE.2 and Standard for Mathematical Practice 7.* |
| A-SSE.3<br><br>A-SSE.3b | Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.<br><br>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. | NC.M2.A-SSE.3 | Removed | Write an equivalent form of a quadratic expression by completing the square, where $a$ is an integer of a quadratic expression, $ax^2 + bx + c$, to reveal the maximum or minimum value of the function the expression defines. |

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| **Arithmetic with Polynomial and Rational Expressions**<br>***Perform arithmetic operations on polynomials*** | | | | |
| A-APR.1 | Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.<br>***Note:*** *At this level, add and subtract any polynomial and extend multiplication to as many as three linear expressions.* | NC.M2.A-APR.1 | Add and subtract polynomials. Multiply up to three linear expressions. | Extend the understanding that operations with polynomials are comparable to operations with integers by adding, subtracting, and multiplying polynomials. |
| **Arithmetic with Polynomial and Rational Expressions**<br>***Understand the relationship between zeros and factors of polynomials.*** | | | | |
| A-APR.3 | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.<br>***Note:*** *At this level, limit to quadratic expressions.* | | *Integrated into another standard or moved into another course.* | *Moved to NC.M1.A-APR.3 to address current coherence issue surrounding the relationship between finding zeros and factoring.* |
| **Creating Equations**<br>***Create equations that describe numbers or relationships.*** | | | | |
| A-CED.1 | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.<br>***Note:*** *Extend to quadratic, inverse variation* $\left(y = \frac{k}{x}\right)$, *and exponential equations.*<br>*(The use of logarithms to solve exponential equations is not expected at this level.)* | NC.M2.A-CED.1 | Create equations and inequalities in one variable that represent quadratic, radical, inverse variation, and trigonometric (derived from right triangles) relationships. | Create equations and inequalities in one variable that represent quadratic, square root, inverse variation, and right triangle trigonometric relationships and use them to solve problems. |
| A-CED.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.<br>***Note:*** *At this level extend to simple trigonometric equations that involve right triangle trigonometry.* | NC.M2.A-CED.2 | Create equations in two variables to represent quadratic, radical, inverse variation, and trigonometric (derived from right triangles) relationships between quantities; graph equations on coordinate axes with labels and scales. | Create and graph equations in two variables to represent quadratic, square root and inverse variation relationships between quantities. |

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| A-CED.3 | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.<br>*For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*<br><br>***Note:*** *Extend to linear-quadratic, and linear–inverse variation* $\left(y = \frac{k}{x}\right)$ *systems of equations.* | NC.M2.A-CED.3 | Create a system of two equations in two variables, recognizing the limitation on the domain and range imposed by the context, that consist of a:<br>● Linear equation and a constant, linear, quadratic, or rational equation.<br>● Quadratic equation and a constant, linear, or another quadratic equation.<br>● Radical equation and a constant or linear equation. | Create systems of linear, quadratic, square root, and inverse variation equations to model situations in context. |
| **Creating Equations**<br>***Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.*** | | | | |
| A-CED.4 | *For example, rearrange Ohm's law V = IR to highlight resistance R.*<br><br>***Note:*** *At this level, extend to compound variation relationships.* | NC.M2.A-CED.4 | Solve formulas to isolate a quantity of interest, using the same reasoning as in solving equations; extend to formulas involving quadratic, radical, and inverse variation. | *After the 1st draft, this standard moved to NC.M1.A-CED.4.* |
| **Reasoning with Equations and Inequalities**<br>***Understand solving equations as a process of reasoning and explain the reasoning.*** | | | | |
| A-REI.1 | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.<br><br>***Note:*** *Students should be able to justify the steps for any equation type solved in Math II.* | NC.M2.A-REI.1 | For quadratic, radical, and inverse variation equations, justify a solution method and each step of the solution method using mathematical reasoning. | Justify a chosen solution method and each step of the solving process for quadratic, square root and inverse variation equations using mathematical reasoning. |
| A-REI.2 | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.<br>***Note:*** *At this level, limit to inverse variation.* | NC.M2.A-REI.2 | Solve inverse variation and radical equations in one variable. Explain how extraneous solutions arise from the solution process. | Solve and interpret one variable inverse variation and square root equations arising from a context, and explain how extraneous solutions may be produced. |

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| | | **Reasoning with Equations and Inequalities** *Solve equations and inequalities in one variable.* | | |
| A-REI.4<br><br>A-REI.4a<br><br><br><br>A-REI.4b | Solve equations and inequalities in one variable.<br><br>a. Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.<br><br>b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$.<br><br>***Note:*** *Solve quadratic equations that have real solutions and recognize quadratic equations that do not have a real solution. (Writing complex solutions is not expected in Math II.)* | NC.M2.A-REI.4<br><br>NC.M2.A-REI.4a<br><br><br><br>NC.M2.A-REI.4b | Solve equations and inequalities in one variable.<br><br>a. Rewrite a quadratic equation in vertex form, using the method of completing the square. Show that the algebraic methods for solving quadratic equations, factoring, completing the square and the quadratic formula produce the same solutions. Explain why this is true using mathematical reasoning.<br><br>b. Solve quadratic equations in one variable by factoring, completing the square, and the quadratic formula. Explain when quadratic equations will have non-real solutions, through graphs and the discriminant. Express non-real solutions as complex numbers. | Solve for all solutions of quadratic equations in one variable.<br><br>a. Understand that the quadratic formula is the generalization of solving $ax^2 + bx + c$ by using the process of completing the square.<br><br>b. Explain when quadratic equations will have non-real solutions and express complex solutions as $a \pm bi$ for real numbers $a$ and $b$. |
| | | **Reasoning with Equations and Inequalities** *Solve systems of equations.* | | |
| A-REI.7 | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.<br>For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. | NC.M2.A-REI.7 | Find the solution to a system of two equations, graphically and algebraically, in two variables that consists of a(n):<br>● Linear equation and a constant, linear, quadratic, or radical equation.<br>● Quadratic equation and a constant, linear, or quadratic equation.<br>● Radical equation and a constant or linear equation.<br>● Inverse variation and a constant or linear equation. | Use tables, graphs, and algebraic methods to approximate or find exact solutions of systems of linear and quadratic equations, and interpret the solutions in terms of a context. |

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| **Reasoning with Equations and Inequalities** ***Represent and solve equations and inequalities graphically.*** | | | | |
| A-REI.10 | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).<br><br>***Note:*** *At this level, extend to quadratics.* | NC.M2.A-REI.10 | Understand that for equations with two variables, $x$ and $y$, all points, $(x , y)$, on the graph of equation are solutions to that equation. At this level, extend to radical and inverse variation equations. | *After the 1st draft, this standard was moved to NC.M1.A-REI.10.* |
| A-REI.11 | Explain why the $x$-coordinates of the points where the graphs of the equations $y = f(x)$ and<br>$y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.<br><br>***Note:*** *At this level, extend to quadratic functions.* | NC.M2.A-REI.11 | Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$<br>intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Limit to cases where $f(x)$ and/or $g(x)$ are quadratic, radical, inverse variations, or absolute value functions. | Extend the understanding that the $x$-coordinates of the points where the graphs of two square root and inverse variation equations $y = f(x)$ *and* $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ and approximate solutions using graphing technology or successive approximations with a table of values. |

| Functions | | | | |
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| **Interpreting Functions**<br>***Understand the concept of a function and use function notation.*** | | | | |
| | | NC.M2.F-IF.1 | Understand that a geometric transformation in the plane is a function.<br>• Recognize that the domain of a transformation function $f$ is the set of all points in the plane and that the range of $f$ is the set of all points in the plane.<br>Recognize that the image of a transformation is a function of its pre-image. | Extend the concept of a function to include geometric transformations in the plane by recognizing that:<br>• the domain and range of a transformation function $f$ are sets of points in the plane;<br>• the image of a transformation is a function of its pre-image. |
| F-IF.2 | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.<br><br>***Note:*** *Extend to quadratic, simple power* $(f(x) = a \cdot x^b)$*, and inverse variation functions* $(y = \frac{k}{x})$. | NC.M2.F-IF.2 | Use function notation to evaluate functions in terms of a context.<br>• Use function notation to evaluate quadratic and radical functions for inputs in their domains and interpret statements that use function notation in terms of a context.<br>• Use function notation to express the image of a geometric figure in the plane resulting from a translation, rotation by multiples of 90 degrees about the origin, reflection across an axis, or dilation as a function of its pre-image. | Extend the use of function notation to express the image of a geometric figure in the plane resulting from a translation, rotation by multiples of 90 degrees about the origin, reflection across an axis, or dilation as a function of its pre-image. |
| **Interpreting Functions**<br>***Interpret functions that arise in applications in terms of the context.*** | | | | |
| F-IF.4 | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, | NC.M2.F-IF.4 | Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. | Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities to include domain and range, rate of change, symmetries, and end behavior. |

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| | decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.<br><br>***Note:*** *At this level, limit to simple trigonometric functions (sine, cosine, and tangent in standard position) with angle measures of 180° ($\pi$ radians) or less. Periodicity not addressed.* | | | |
| F-IF.5 | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.<br>*For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*<br><br>***Note:*** *Extend to right triangle trigonometry and inverse variation functions.* | | *Integrated into another standard or moved into another course.* | *The concept of this standard was incorporated into NC.M2.F-IF.4 and NC.M2.F-IF.7.* |
| **Interpreting Functions**<br>***Analyze functions using different representations.*** | | | | |
| F-IF.7<br><br>F-IF.7b<br><br>F-IF.7e | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br>b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.<br>e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.<br>***Note:*** *At this level, extend to simple trigonometric functions (sine, cosine, and tangent in standard position)* | NC.M2.F-IF.7 | Analyze quadratic, absolute value, radical, and inverse variation functions using different representations by graphing to show key features of the graph, by hand in simple cases and using technology for more complicated cases. Key features include: domain and range; intercepts; intervals where the function is increasing, decreasing, positive, or negative; rate of change; relative maximums and minimums; symmetries; and end behavior. | Analyze quadratic, square root, and inverse variation functions by generating different representations, by hand in simple cases and using technology for more complicated cases, to show key features, including: domain and range; intercepts; intervals where the function is increasing, decreasing, positive, or negative; rate of change; maximums and minimums; symmetries; and end behavior. |

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<tr><th colspan="5">Functions</th></tr>
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<tr><td>F-IF.8<br><br>F-IF.8a</td><td>Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.<br>a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.<br><br>Note: At this level, completing the square is still not expected</td><td>NC.M2.F-IF.8<br><br>NC.M2.F-IF.8a</td><td>Rewrite an expression into equivalent forms to reveal and explain different properties of the function.<br><br>a. Develop and use the process of completing the square as an extension of writing equivalent expressions to identify the zeros, extreme values, and symmetry of the graph of a quadratic function, and interpret these in terms of a context.</td><td>Use equivalent expressions to reveal and explain different properties of a function by developing and using the process of completing the square as an extension of writing equivalent expressions to identify the zeros, extreme values, and symmetry in graphs and tables representing quadratic functions, and interpret these in terms of a context.</td></tr>
<tr><td>F-IF.9</td><td>Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).<br>For example, given a graph of one quadratic fun and an algebraic expression for another, say which has the larger maximum.<br><br>Note: Extend simple power($f(x) = a \cdot x^b$), and inverse variation functions $\left(y = \frac{k}{x}\right)$.</td><td>NC.M2.F-IF.9</td><td>Analyze functions using different representations by comparing properties of two different functions (quadratic, absolute value, radical, inverse variation) each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions).</td><td>Compare key features of two functions (linear, quadratic, square root, or inverse variation functions) each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions).</td></tr>
<tr><td colspan="5">Building Functions<br>Build a function that models a relationship between two quantities.</td></tr>
<tr><td>F-BF.1<br><br>F-BF.1a</td><td>Write a function that describes a relationship between two quantities.<br>a. Determine an explicit expression, a recursive process, or steps for calculation from a context.<br><br>Note: Continue to allow informal recursive notation through this level.</td><td></td><td>Integrated into another standard or moved to another course.</td><td>Write a function that describes a relationship between two quantities by building quadratic functions with real solution(s) and inverse variation functions given a graph, a description of a relationship, or ordered pairs (include reading these from a table).<br>(Standard included in NC Math 2 in second draft.)</td></tr>
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| F-BF.1b | Write a function that describes a relationship between two quantities.<br>b. Combine standard function types using arithmetic operations.<br>*For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* | | *Integrated into another standard or moved to another course.* | *This standard was removed in second draft.* |
| **Building Functions**<br>***Build new functions from existing functions.*** | | | | |
| F-BF.3 | Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $k \cdot f(x)$, $f(kx)$, and $f(x+k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.<br><br>***Note:*** *At this level, extend to quadratic functions and, k f(x).* | NC.M2.F-BF.3 | Identify the effects on the graphical and numerical representations of, quadratic, absolute value, radical, and inverse variation functions when replacing $f(x)$ with $k \cdot f(x)$, $f(x)+k$, and f(x + k) for specific values of $k$ (both positive and negative). Experiment with cases and use graphing technology to illustrate an explanation of the effects. | Understand the effects of the graphical and tabular representations of a linear, quadratic, square root, and inverse variation function $f$ with $k \cdot f(x)$, $f(x)+k$, $f(x+k)$ for specific values of $k$ (both positive and negative). |

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| **Geometry** | | | | |
| **Congruence** *Experiment with transformations in the plane.* | | | | |
| G-CO.2 | Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). | NC.M2.G-CO.2 | Experiment with transformations in the plane.<br>● Represent transformations in the plane.<br>● Describe transformations as functions that take points in the plane as inputs and give other points as outputs. Write a function rule for a given transformation.<br>● Compare rigid motions that preserve distance and angle measure (translations, reflections, rotations) to transformations that do not preserve both distance and angle measure (e.g. stretches, dilations).<br>● Understand that rigid motions produce congruent figures while dilations produce similar figures. | Experiment with transformations in the plane.<br>● Represent transformations in the plane.<br>● Compare rigid motions that preserve distance and angle measure (translations, reflections, rotations) to transformations that do not preserve both distance and angle measure (e.g. stretches, dilations).<br>● Understand that rigid motions produce congruent figures while dilations produce similar figures. |
| G-CO.3 | Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. | NC.M2.G-CO.3 | Given a triangle, rectangle, parallelogram, trapezoid, or regular polygon, describe any reflectional or rotational symmetry. Identify center and angle(s) of rotation for rotational symmetry. Identify line(s) of reflection for reflectional symmetry. | Given a triangle, quadrilateral, or regular polygon, describe any reflection or rotation symmetry i.e., actions that carry the figure onto itself. Identify center and angle(s) of rotation symmetry. Identify line(s) of reflection symmetry. |
| G-CO.4 | Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. | NC.M2.G-CO.4 | Verify experimentally properties of rotations, reflections, and translations.<br>● For a translation, connecting points on the pre-image to the corresponding points on the image produces line segments that are congruent and parallel.<br>● For a reflection, the line of reflection is the perpendicular bisector of any line segment joining a point on the pre-image to the corresponding point on the image. Therefore, corresponding points on the pre-image and the image are equidistant from the line of reflection.<br>● For a rotation, a point on the pre-image and its corresponding point on the image lie on a circle whose | Verify experimentally properties of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. |

| Geometry | | | | |
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| | | | center is the center of rotation. Therefore, line segments connecting corresponding points on the pre-image and the image to the center of rotation are congruent and form an angle equal to the angle of rotation. | |
| G-CO.5 | Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. | NC.M2.G-CO.5 | Given a geometric figure and a rigid motion, find the image of the figure. Given a geometric figure and its image, specify a rigid motion or sequence of rigid motions that will carry the pre-image to its image. | Given a geometric figure and a rigid motion, find the image of the figure. Given a geometric figure and its image, specify a rigid motion or sequence of rigid motions that will transform the pre-image to its image. |
| **Congruence**<br>***Understand congruence in terms of rigid motions.*** | | | | |
| G-CO.6 | Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent | NC.M2.G-CO.6 | Understand congruence in terms of rigid motions; i.e. determine whether two figures are congruent by specifying a rigid motion or sequence of rigid motions that will carry one figure onto the other. | Understand congruence in terms of rigid motions. Determine whether two figures are congruent by specifying a rigid motion or sequence of rigid motions that will transform one figure onto the other. |
| G-CO.7 | Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. | NC.M2.G-CO.7 | Use the properties of rigid motions (i.e. rigid motions preserve distance and angle measure) to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. | Use the properties of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. |
| G-CO.8 | Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. | NC.M2.G-CO.8 | Understand congruence in terms of rigid motion.<br>a. Use rigid motions to justify the ASA, SAS, and SSS criteria for triangle congruence.<br><br>b. Use criteria for triangle congruence (ASA, SAS, and SSS) to determine whether two triangles are congruent. | Use congruence in terms of rigid motion.<br>a. Justify the ASA, SAS, and SSS criteria for triangle congruence. Use criteria for triangle congruence (ASA, SAS, SSS, HL) to determine whether two triangles are congruent. |

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| | | **Congruence**<br>***Prove geometric theorems.*** | | |
| G-CO.9 | Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those the segment's endpoints. | NC.M2.G-CO.9 | Prove theorems about lines and angles and use them to prove relationships in geometric figures.<br>● Vertical angles are congruent.<br>● When a transversal crosses parallel lines, alternate interior angles are congruent.<br>● When a transversal crosses parallel lines, corresponding angles are congruent.<br>● Points are on a perpendicular bisector of a line segment if and only if they are equidistant from the endpoints of the segment.<br>● Use congruent triangles to justify why the bisector of an angle is equidistant from the sides of the angle. | Prove theorems about lines and angles and use them to prove relationships in geometric figures including:<br>● Vertical angles are congruent.<br>● When a transversal crosses parallel lines, alternate interior angles are congruent.<br>● When a transversal crosses parallel lines, corresponding angles are congruent.<br>● Points are on a perpendicular bisector of a line segment if and only if they are equidistant from the endpoints of the segment.<br>● Use congruent triangles to justify why the bisector of an angle is equidistant from the sides of the angle. |
| G-CO.10 | Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180º; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.<br><br>***Note:*** *At this level, include measures of interior angles of a triangle sum to 180° and the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length.* | NC.M2.G-CO.10 | Prove theorems about triangles and use them to prove relationships in geometric figures.<br>● The sum of the measures of the interior angles of a triangle is 180º.<br>● An exterior angle of a triangle is equal to the sum of its remote interior angles.<br>● The base angles of an isosceles triangle are congruent.<br>● The segment joining the midpoints of two sides of a triangle is parallel to the third side and half the length. | Prove theorems about triangles and use them to prove relationships in geometric figures including:<br>● The sum of the measures of the interior angles of a triangle is 180º.<br>● An exterior angle of a triangle is equal to the sum of its remote interior angles.<br>● The base angles of an isosceles triangle are congruent.<br>● The segment joining the midpoints of two sides of a triangle is parallel to the third side and half the length. |

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| **Congruence**<br>***Make geometric constructions.*** | | | | |
| G-CO.13 | Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. | | *Integrated into another standard or moved into another course.* | *Removed as a standard since it is an instructional tool and it will be used in curricular resources.* |
| **Similarity, Right Triangles, and Trigonometry**<br>***Understand similarity in terms of similarity transformations.*** | | | | |
| G-SRT.1<br><br>G-SRT.1a<br><br>G-SRT.1b | Verify experimentally the properties of dilations given by a center and a scale factor.<br><br>a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.<br><br>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor | NC.M2.G-SRT.1<br><br>NC.M2.G-SRT.1a<br><br>NC.M2.G-SRT.1b<br><br>NC.M2.G-SRT.1c<br><br>NC.M2.G-SRT.1d | Verify experimentally the properties of dilations with given center and scale factor:<br><br>a. When a line segment passes through the center of dilation, the line segment and its image lie on the same line. When a line segment does not pass through the center of dilation, the line segment and its image are parallel.<br><br>b. The length of the image of a line segment is equal to the length of the line segment multiplied by the scale factor.<br>c. The distance between the center of a dilation and any point on the image is equal to the scale factor multiplied by the distance between the dilation center and the corresponding point on the pre-image.<br>d. Dilations preserve angle measure. | Verify experimentally the properties of dilations with given center and scale factor:<br>a. When a line segment passes through the center of dilation, the line segment and its image lie on the same line. When a line segment does not pass through the center of dilation, the line segment and its image are parallel.<br>b. The length of the image of a line segment is equal to the length of the line segment multiplied by the scale factor.<br>c. The distance between the center of a dilation and any point on the image is equal to the scale factor multiplied by the distance between the dilation center and the corresponding point on the pre-image.<br>d. Dilations preserve angle measure. |

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| G-SRT.2 | Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. | NC.M2.G-SRT.2 | Understand similarity in terms of similarity transformations.<br><br>a. Determine whether two figures are similar by specifying a sequence of transformations (i.e. a dilation or sequence of rigid motions composed with a dilation) that will carry one figure onto the other.<br><br>b. Use the properties of dilations, (i.e. dilations preserve angle measure and produce corresponding segments that are proportional), to show that two triangles are similar if corresponding pairs of sides are proportional and corresponding pairs of angles are congruent. | Understand similarity in terms of transformations.<br><br>a. Determine whether two figures are similar by specifying a sequence of transformations that will transform one figure into the other.<br><br>b. Use the properties of dilations to show that two triangles are similar when all corresponding pairs of sides are proportional and all corresponding pairs of angles are congruent. |
| | Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. | NC.M2.G-SRT.3 | Use transformations (rigid motions and dilations) to justify the AA criterion for triangle similarity. | Use transformations (rigid motions and dilations) to justify the AA criterion for triangle similarity. |
| **Similarity, Right Triangles, and Trigonometry**<br>***Prove theorems involving similarity.*** | | | | |
| G-SRT.4 | Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity | NC.M2.G-SRT.4 | Use similarity to prove theorems about triangles and use them to prove relationships in geometric figures.<br>● A line parallel to one side of a triangle divides the other two sides proportionally and conversely.<br>● The Pythagorean Theorem<br>● Use similar triangles to justify that the altitude to the hypotenuse of a right triangle is the geometric mean between the two segments of the hypotenuse | Use similarity to prove theorems about triangles and use them to prove relationships in geometric figures.<br>● A line parallel to one side of a triangle divides the other two sides proportionally and its converse.<br>● The Pythagorean Theorem |
| G-SRT.5 | Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. | | *Integrated into another standard or moved into another course.* | *Integrated into NC.M2.G-SRT.4.* |

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| **Similarity, Right Triangles, and Trigonometry**<br>***Define trigonometric ratios and solve problems involving right triangles.*** | | | | |
| G-SRT.6 | Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. | NC.M2.G-SRT.6 | Verify experimentally that the side ratios in similar right triangles are properties of the angle measures in the triangle, due to the preservation of angle measure in similarity. Use this discovery to develop definitions of the trigonometric ratios for acute angles. | Verify experimentally that the side ratios in similar right triangles are properties of the angle measures in the triangle, due to the preservation of angle measure in similarity. Use this discovery to develop definitions of the trigonometric ratios for acute angles. |
| G-SRT.7 | **Similarity, Right Triangles, and Trigonometry**<br>***Define trigonometric ratios and solve problems involving right triangles.***<br>Explain and use the relationship between the sine and cosine of complementary angles. | | *Integrated into another standard or moved into another course.* | *Integrated into NC.M2.G-SRT.8.* |
| G-SRT.8 | **Similarity, Right Triangles, and Trigonometry**<br>***Define trigonometric ratios and solve problems involving right triangles.***<br>Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.* | NC.M2.G-SRT.8 | Define trigonometric ratios and solve problems involving right triangles. | Use trigonometric ratios and the Pythagorean Theorem to solve problems involving right triangles in terms of a context. |
| **Similarity, Right Triangles, and Trigonometry**<br>***Apply trigonometry to general triangles.*** | | | | |
| G-SRT.9 | (+) Derive the formula $A = ½ab \cdot sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. | | *Integrated into another standard or moved into another course.* | *Included in a fourth level math.* |
| G-SRT.11 | (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and nonright triangles (e.g., surveying problems, resultant forces). | | *Integrated into another standard or moved into another course.* | *Included in a fourth level math.* |
| | | NC.M2.G-SRT.12 | Develop properties of special right triangles (45-45-90 and 30-60-90) and use them to solve problems. | Develop properties of special right triangles (45-45-90 and 30-60-90) and use them to solve problems. |

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| **Expressing Geometric Properties with Equations**<br>***Translate between the geometric description and the equation for a conic section.*** | | | | |
| G-GPE.1 | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.<br><br>***Note:*** *At this level, derive the equation of the circle using the Pythagorean Theorem.* | | *Integrated into another standard or moved into another course.* | *Moved to NC.M3.G-GPE.1.* |
| **Expressing Geometric Properties with Equations**<br>***Use coordinates to prove simple geometric theorems algebraically.*** | | | | |
| G-GPE.6 | Find the point on a directed line segment between two given points that partitions the segment in a given ratio. | | *Integrated into another standard or moved into another course.* | *Moved to NC.M1.G-CPE.6.* |
| **Geometric Measurement & Dimension**<br>***Visualize relationships between two-dimensional and three-dimensional objects.*** | | | | |
| G-GMD.4 | Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects | | *Integrated into another standard or moved into another course.* | *Moved to NC.M3.G-GMD.4.* |
| **Modeling with Geometry**<br>***Apply geometric concepts in modeling situations*** | | | | |
| G-MG.1 | Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). | | *Integrated into another standard or moved into another course.* | *Moved to NC.M3.G-MG.1.* |
| G-MG.2 | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). | | *Integrated into another standard or moved into another course.* | *Integrated into NC.M3.G-MG.1.* |
| G-MG.3 | Apply geometric methods to solve design problems (e.g. designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). | | *Integrated into another standard or moved into another course.* | *Integrated into NC.M3.G-MG.1.* |

| Statistics and Probability | | | | |
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| **Making Inference and Justifying Conclusions** ***Understand and evaluate random processes underlying statistical experiments.*** | | | | |
| S-IC.2 | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?* | NC.M2.S-IC.2 | Use simulation to determine whether the experimental probability generated by sample data is consistent with the theoretical probability based on known information about the population. | Use simulation to determine whether the experimental probability generated by sample data is consistent with the theoretical probability based on known information about the population. |
| **Making Inference and Justifying Conclusions** ***Make inferences and justify conclusions from sample surveys, experiments, and observational studies*** | | | | |
| S-IC.6 | Evaluate reports based on data. | | *Integrated into another standard or moved into another course.* | *Moved to NC.M3.S-IC.6.* |
| **Conditional Probability and the Rules for Probability** ***Understand independence and conditional probability and use them to interpret data.*** | | | | |
| S-CP.1 | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). | NC.M2.S-CP.1 | Describe events as subsets of the outcomes in a sample space using characteristics of the outcomes or as unions, intersections and complements of other events. | Describe events as subsets of the outcomes in a sample space using characteristics of the outcomes or as unions, intersections and complements of other events. |
| S-CP.2 | Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. | | *Integrated into another standard or moved into another course.* | *Integrated into NC.M2.S-CP.3.* |

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| S-CP.3 | Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. | NC.M2.S-CP.3<br><br>NC.M2.S-CP.3a<br><br>NC.M2.S-CP.3b | Develop and understand independence and conditional probability.<br><br>b. Use a 2-way table to develop understanding of the conditional probability of A given B (written P(A\|B)) as the likelihood that A will occur given that B has occurred. That is, P(A\|B) is the fraction of event B's outcomes that also belong to event A.<br><br>c. Understand that event A is independent from event B if the probability of event A does not change in response to the occurrence of event B. That is P(A\|B)=P(A). | Develop and understand independence and conditional probability.<br><br>a. Use a 2-way table to develop understanding of the conditional probability of A given B (written P(A\|B)) as the likelihood that A will occur given that B has occurred. That is, P(A\|B) is the fraction of event B's outcomes that also belong to event A.<br><br>b. Understand that event A is independent from event B if the probability of event A does not change in response to the occurrence of event B. That is P(A\|B)=P(A). |
| S-CP.4 | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.<br>*For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* | NC.M2.S-CP.4 | Represent data on two categorical variables by constructing a two-way frequency table of data. Interpet the two-way table as a sample space to calculate conditional, joint and marginal probabilities. Use the table to decide if events are independent. | Represent data on two categorical variables by constructing a two-way frequency table of data. Interpet the two-way table as a sample space to calculate conditional, joint and marginal probabilities. Use the table to decide if events are independent. |
| S-CP.5 | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.<br>*For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* | NC.M2.S-CP.5 | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. |

| Statistics and Probability | | | | |
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| **Conditional Probability and the Rules for Probability** ***Use the rules of probability to compute probabilities of compound events in a uniform probability model.*** | | | | |
| S-CP.6 | Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. | NC.M2.S-CP.6 | Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in context. | Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in context. |
| S-CP.7 | Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. | NC.M2.S-CP.7 | Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in context. | Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in context. |
| S-CP.8 | (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B\|A) = P(B)P(A\|B), and interpret the answer in terms of the model. | NC.M2.S-CP.8 | Apply the general Multiplication Rule P(A and B) = P(A)P(B\|A) = P(B)P(A\|B), and interpret the answer in context. Include the case where A and B are independent: P(A and B) = P(A) P(B). | Apply the general Multiplication Rule P(A and B) = P(A)P(B\|A) = P(B)P(A\|B), and interpret the answer in context. Include the case where A and B are independent: P(A and B) = P(A) P(B). |
| S-CP.9 | (+) Use permutations and combinations to compute probabilities of compound events and solve problems. | NC.M2.S-CP.9 | *Integrated into another standard or moved into another course.* | *Included in a fourth level math.* |
| **Interpreting Categorical and Quantitative Data** ***Summarize, represent, and interpret data on two categorical and quantitative variables.*** | | | | |
| S-ID.5 | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. | | *Integrated into another standard or moved into another course.* | *Integrated into NC.M2.S-CP.4.* |
| **Using Probability to Make Decisions** ***Use probability to evaluate outcomes of decisions.*** | | | | |
| S-MD.7 | (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). *Moved from Math III.* | NC.M2.S-MD.7 | Analyze decisions and strategies using probability concepts. | Analyze decisions and strategies using probability concepts. |