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 3

Number and Quantity				
Current Standard Abbreviation	**Current Standard**	**Proposed Standard Abbreviation**	**First Draft Proposed Standard**	**Second Draft Proposed Standards**
The Real Number System ***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.		*Integrated into another standard or moved into another course.*	*Moved to NC.M2.N-RN.3.*
Quantities ***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.		*Included in a 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.		*Included in a mathematical practice.*	*Included in Standards for Mathematical Practices 1, 4 and 6.*

Number and Quantity				
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N-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.		*Included in a mathematical practice.*	*Included in Standards for Mathematical Practices 1 and 6.*
The Complex Number System ***Perform arithmetic operations with 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.		*Integrated into another standard or moved into another course.*	*Moved to NC.M2.N-CN.1.*
N-CN.2	Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.		*Integrated into another standard or moved into another course.*	*Included in a fourth level math.*
The Complex Number System ***Use complex numbers in polynomial identities and equations.***				
N-CN.7	Solve quadratic equations with real coefficients that have complex solutions.	~~NC.M3.N-CN.7~~	Solve cubic equations with real coefficients that have complex solutions.	*After the 1st draft, this standard was fully integrated into NC.M2.A-REI.4, for quadratics.*
N-CN.9	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	NC.M3.N-CN.9	Use the Fundamental Theorem of Algebra to determine the number and potential types of solutions for polynomials equations.	Use the Fundamental Theorem of Algebra to determine the number and potential types of solutions for polynomial functions.

Algebra				
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Seeing Structure in Expressions ***Interpret the structure of expressions.***				
A-SSE.1 A-SSE.1a A-SSE.1b	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. 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.*	NC.M3.A-SSE.1 NC.M3.A-SSE.1a NC.M3.A-SSE.1b	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, coefficients, radicands, bases (exponentials and logarithms), constant of variation, and exponents in context. b. View a rational, logarithmic, exponential, or cubic expression made of multiple parts as a combination of single entities to give meaning to an expression in context.	Interpret expressions that represent a quantity in terms of its context. a. Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents. b. Interpret expressions composed of multiple parts by viewing one or more of their parts as a single entity 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.M3.A-SSE.2	Write equivalent forms of rational (common denominators are limited to linear expressions), logarithmic, exponential, or cubic expression based on their structure.	Use the structure of an expression to identify ways to write equivalent expressions.
Seeing Structure in Expressions ***Write expressions in equivalent forms to solve problems.***				
A-SSE.3 A-SSE.3b	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	~~NC.M3.A-SSE.3~~	Write an expression in equivalent forms to solve problems. Write equivalent forms of exponential expressions to reveal the rate of growth or decay and the compound nature of an exponential expression.	*Moved to* *NC.M3.A-SSE.3c* *NC.M2.A-SSE.3* *NC.M1.F-IF.8b*
A-SSE.3c	c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* Moved from Math II.	NC.M3.A-SSE.3c		Write an equivalent form of an exponential expression by using the property of exponents to transform expressions to reveal rates based on different intervals of the domain.

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A-SSE.4	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*		*Integrated into another standard or moved into another course.*	*Included in a fourth level math.*
Arithmetic with Polynomial and Rational Expressions ***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.	~~NC.M3.A-APR.1~~	Add, subtract, and multiply polynomials. Understand that the sum or difference of two polynomials can only result in a polynomial that is equal or less in degree. Understand that the product of two or more linear expressions can only result in a polynomial that is greater in degree.	*After the 1st draft, edits were made so that the full depth of this standard was achieved in NC Math 2.*
Arithmetic with Polynomial and Rational Expressions ***Understand the relationship between zeros and factors of polynomials.***				
A-APR.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x – a$ is $p(a)$, so $p(a) = 0$ if and only if $(x – a)$ is a factor of $p(x)$.	NC.M3.A-APR.2	Understand and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x – a$ is $p(a)$, so $p(a) = 0$ if and only if $(x – a)$ is a factor of $p(x)$.	Understand and apply the Remainder Theorem.
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.	NC.M3.A-APR.3	Understand the relationship between zeros and factors of cubic polynomials.	Understand the relationship among factors of a polynomial expression, the solutions of a polynomial equation and the zeros of a polynomial function.
Arithmetic with Polynomial and Rational Expressions ***Use polynomial identities to solve problems.***				
A-APR.4	Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.*		*Integrated into another standard or moved into another course.*	*Included in fourth level math.*

Algebra				
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Arithmetic with Polynomial and Rational Expressions ***Rewrite rational expressions.***				
A-APR.6	Rewrite simple rational expressions in different forms; write ${}^{a(x)}/_{b(x)}$ in the form $q(x) + {}^{r(x)}/_{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.	NC.M3.A-APR.6	Use long division to rewrite rational expressions expressed as ${}^{a(x)}/_{b(x)}$ in the form $q(x) + {}^{r(x)}/_{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$. Limit $b(x)$ to a linear expression.	Rewrite simple rational expressions in different forms; write $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$, where $a(x), b(x), q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$.
A-APR.7	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	NC.M3.A-APR.7	Understand the similarities between arithmetic with rational expressions and arithmetic with rational numbers. Add, subtract, multiply and divide rational expressions. Limit the rational expressions to those that have a common denominator that is a linear expression.	Understand the similarities between arithmetic with rational expressions and arithmetic with rational numbers. a. Add and subtract two rational expressions, $a(x)$ and $b(x)$, where the denominators of both $a(x)$ and $b(x)$ are linear expressions. b. Multiply and divide two rational expressions.
Creating Equations ***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.	NC.M3.A-CED.1	Create rational, logarithmic, or exponential equations in one variable and use them to solve problems in context.	Create equations and inequalities in one variable that represent absolute value, polynomial, exponential, and rational relationships and use them to solve problems algebraically and graphically.
A-CED.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	NC.M3.A-CED.2	Create rational, logarithmic, or exponential equations in two variables to represent relationships between quantities.	Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities.
A-CED.3	Represent constraints by equations or inequalities, and by systems	NC.M3.A-CED.3	Create a system of two equations in two variables,	Create systems of equations and/or inequalities to model

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	of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*		recognizing the limitation on the domain and range imposed by the context, that consist of a: ● Cubic equation and a constant, linear, quadratic, or another cubic equation. ● Rational equation (limited to a linear denominator) and a constant equation or a linear equation. ● Exponential equation and a constant equation or another exponential equation. ● Logarithmic equation and a constant equation or linear equation.	situations in context.
A-CED.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	~~NC.M3.A-CED.4~~	Solve formulas that come from modeling problems involving rational or exponential functions for a quantity of interest, using the same reasoning as in solving equations.	*Move to NC.M1.A-CED.4.*
Reasoning with Equations and Inequalities ***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.	NC.M3.A-REI.1	For exponential, logarithmic, rational, and cubic equations, justify a solution method and each step of the solution method using mathematical reasoning.	Justify a solution method for equations and explain each step of the solving process using mathematical reasoning.
A-REI.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise	NC.M3.A-REI.2	Solve rational equations in one variable and explain how extraneous solutions arise from the solving process. Rational equations will consist of rational expressions in which the common denominator will be a linear expression.	Solve and interpret one variable rational equations arising from a context, and explain how extraneous solutions may be produced.
Reasoning with Equations and Inequalities				

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Solve equations and inequalities in one variable.				
A-REI.4 A-REI.4a	Solve equations and inequalities in one variable. 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.		*Integrated into another standard or moved into another course.*	*Moved to NC.M2.A-REI.4a.*
A-REI.4b	Solve equations and inequalities in one variable. 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.		*Integrated into another standard or moved into another course.*	*Moved to NC.M2.A-REI.4b.*
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).	~~NC.M3.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.	*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 $y = g(x)$ 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.	NC.M3.A-REI.11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ 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.	Extend an understanding that the x-coordinates of the points where the graphs of two equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ and approximate solutions using a graphing technology or successive approximations with a table of values.

Functions				
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Interpreting Functions ***Understand the concept of a function and use function notation.***				
	None	NC.M3.F-IF.1		Extend the concept of a function by recognizing that trigonometric ratios are functions of angle measure.
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.	NC.M3.F-IF.2	Use function notation to evaluate polynomial, rational, and piecewise functions for inputs in their domains and interpret statements that use function notation in terms of a context.	Use function notation to evaluate piecewise defined functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
Interpreting Functions ***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, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.	NC.M3.F-IF.4	Interpret key features in context of graphs, tables, and verbal descriptions to describe functions that arise in applications relating two quantities. 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; end behavior; and periodicity.	Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities to include periodicity and discontinuities.
F-IF.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *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.*		*Integrated into another standard or moved into another course.*	*Incorporated into NC.M3.F-IF.4 and NC.M3.F-IF.7.*

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Interpreting Functions ***Analyze functions using different representations.***				
F-IF.7 F-IF.7c 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. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	NC.M3.F-IF.7	Analyze polynomials, rational, piecewise functions, and trigonometric functions (sine and cosine) using different representations to show key features of the graph, by hand in simple cases and using technology for more complicated cases. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; rate of change; relative maximums and minimums; symmetries; end behavior; period; and discontinuities.	Analyze piecewise, absolute value, polynomials, exponential, rational, and trigonometric functions (sine and cosine) using different representations to show key features of the graph, by hand in simple cases and using technology for more complicated cases, including: domain and range; intercepts; intervals where the function is increasing, decreasing, positive, or negative; rate of change; relative maximums and minimums; symmetries; end behavior; period; and discontinuities.
F-IF.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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.		*Integrated into another standard or moved into another course.*	*Moved to NC.M2.F-IF.8a.*
F-IF.8 F-IF.8b	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{\frac{t}{10}}$, *and classify them as representing exponential growth or decay* Moved from Math I.	~~NC.M3.F.IF.8~~ ~~NC.M3.F.IF.8b~~	Rewrite an expression into equivalent forms to reveal and explain different properties of the function. b. Use an equivalent expression to write an exponential function that reveals a different growth rate in a different interval of time.	*After the 1st draft, this standard was moved to NC Math 1 to match the expectations for exponential functions.*

Functions				
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F-IF.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	NC.M3.F-IF.9	Analyze functions using different representations by comparing properties of two different functions each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions)	Compare key features of two functions using different representations by comparing properties of two different functions, each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions).
Building Functions ***Build a function that models a relationship between two quantities.***				
F-BF.1 F-BF.1a F-BF.1b	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. *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.*	NC.M3.F-BF.1 NC.M3.F-BF.1a NC.M3.F-BF.1b	*Integrated into another standard or moved into another course.*	Write a function that describes a relationship between two quantities. a. Build polynomial and exponential functions with real solution(s) given a graph, a description of a relationship, or ordered pairs (include reading these from a table). b. Build a new function, in terms of a context, by combining standard function types using arithmetic operations.
F-BF.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.		*Integrated into another standard or moved into another course.*	*Moved to NC.M1.F-BF.2.*

Functions				
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Building Functions ***Build new functions from existing functions.***				
F-BF.3	Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k 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.	NC.M3.F-BF.3	Identify the effect on the graphical and numerical representations of functions when replacing $f(x)$ with $k \cdot f(x)$, $f(x) + k$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative) by experimenting with cases and illustrate an explanation of the effects on the graph using technology.	Extend an understanding of the effects on the graphical and tabular representations of a function when replacing $f(x)$ with $k \cdot f(x)$, $f(x) + k$, $f(x + k)$ to include $f(k \cdot x)$ for specific values of k (both positive and negative).
F-BF.4 F-BF.4a	Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example,* $f(x) = 2x^3$ *for* $x > 0$ *or* $f(x) = \frac{x+1}{x-1}$ *for x not equal to 1.*	NC.M3.F-BF.4 NC.M3.F-BF.4a NC.M3.F-BF.4b NC.M3.F-BF.4c	Build an inverse function. a. Determine if an inverse function exists by analyzing tables, graphs, and equations. b. Solve an equation of the form $f(x) = c$ for a linear, quadratic, and exponential function *f* that has an inverse and write an expression for the inverse.	~~Build an inverse function to:~~ ~~a. Determine if an inverse function exists by analyzing tables, graphs, and equations.~~ b. ~~Solve an equation of the form $f(x) = c$ for a linear, quadratic, and exponential function f that has an inverse and write an expression for the inverse.~~ Find an inverse function. a. Understand the inverse relationship between exponential and logarithmic, quadratic and square root, and linear to linear functions and use this relationship to solve problems using tables, graphs, and equations. b. Determine if an inverse function exists by analyzing tables, graphs, and equations. c. If an inverse function exists for a linear, quadratic and/or exponential function, *f*, represent the inverse function, f^{-1}, with a table, graph, or

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				equation and use it to solve problems in terms of a context.
	None	~~NC.M3.F-BF.5~~		~~Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving exponential equations.~~ *Incorporated into NC.M3.F-BF.4*
Linear, Quadratic, and Exponential Models ***Construct and compare linear and exponential models and solve problems.***				
F-LE.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	NC.M3.F-LE.3	Compare the end behaviors of two functions using their rates of change.	Compare the end behavior of functions using their rates of change over intervals of the same length to show that a quantity increasing exponentially eventually exceeds a quantity increasing as a polynomial function.
F-LE.4	For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a, c,$ and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology	NC.M3.F-LE.4	Use logarithms to express the solution to $ab^{ct} = d$ where $a, c,$ and d are numbers and the base b is 10 or e, and evaluate the logarithm using technology	Use logarithms to express the solution to $ab^{ct} = d$ where a, c, and d are numbers and evaluate the logarithm using technology.
Trigonometric Functions ***Extend the domain of trigonometric functions using the unit circle.***				
F-TF.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	NC.M3.F-TF.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	Understand radian measure of an angle as: • The ratio of the length of an arc on a circle subtended by the angle to its radius. • A dimensionless measure of length defined by the quotient of arc length and radius that is a real number. • The domain for trigonometric functions.

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F-TF.2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle	NC.M3.F-TF.2	Use tables, graphs and technology to understand the cosine and sine functions as relationships between the radian measure of an angle formed by the horizontal axis and a terminal ray on the unit circle and its *x* and *y* coordinates.	Build an understanding of trigonometric functions by using tables, graphs and technology to represent the cosine and sine functions. a. Interpret the sine function as the relationship between the radian measure of an angle formed by the horizontal axis and a terminal ray on the unit circle and its *y* coordinate. b. Interpret the cosine function as the relationship between the radian measure of an angle formed by the horizontal axis and a terminal ray on the unit circle and its *x* coordinate.
Trigonometric Functions ***Model periodic phenomena with trigonometric functions.***				
F-TF.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	NC.M3.F-TF.5	Use technology to model periodic phenomena represented by sine and cosine functions and interpret key features in context.	Use technology to investigate the parameters, a, b, and h of a sine function, $f(x) = a \cdot sin(b \cdot x) + h$, to represent periodic phenomena and interpret key features in terms of a context.
Trigonometric Functions ***Prove and apply trigonometric identities.***				
F-TF.8	Prove the Pythagorean identity $sin^2(\theta) + cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.		*Integrated into another standard or moved into another course.*	*Included in a fourth level math.*

Geometry				
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Congruence ***Experiment with transformations in the plane.***				
G-CO.1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.		*Integrated into another standard or moved into another course*.	*Removed as a standard and it will be addressed in curricular resources.*
Congruence ***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 equidistant from the segment's endpoints.	~~NC.M3.G-CO.9~~	*Integrated into another standard or moved into another course.*	*Moved to NC.M2.G-CO.9.*
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.	NC.M3.G-CO.10	Verify experimentally properties of the centers of triangles: ● The distance on a median from the centroid to the vertex is twice the distance from the centroid to the side. ● The centroid serves as the balance point of a triangle. ● The centroid divides the triangle into 6 triangles of equal area. ● The circumcenter is equidistant from all three vertices of a triangle; therefore, it is the center of a circle that passes through the vertices of the triangle. ● The incenter is equidistant from all three sides of a triangle; therefore it is the center of a circle that is inscribed in the triangle.	Verify experimentally properties of the centers of triangles (centroid, incenter, and circumcenter).
G-CO.11	Prove theorems about parallelograms. Theorems include: opposite	NC.M3.G-CO.11	Prove theorems about parallelograms.	Prove theorems about parallelograms.

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	sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.		• Opposite sides of a parallelogram are congruent. • Opposite angles of a parallelogram are congruent. • Diagonals of a parallelogram bisect each other. • If the diagonals of a parallelogram are congruent, then the parallelogram is a rectangle.	• Opposite sides of a parallelogram are congruent. • Opposite angles of a parallelogram are congruent. • Diagonals of a parallelogram bisect each other. • If the diagonals of a parallelogram are congruent, then the parallelogram is a rectangle.
Congruence ***Make geometric constructions.***				
G-CO.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.		*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.*
	N/A	NC.M3.G-CO.14	Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.	Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.
Similarity, Right Triangles, and Trigonometry ***Understand similarity in terms of similarity transformations.***				
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.		*Integrated into another standard or moved into another course*	*Moved to NC.M2.G-SRT.2.*
G-SRT.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.		*Integrated into another standard or moved into another course*	*Moved to NC.M2.G-SRT.3.*
Similarity, Right Triangles, and Trigonometry				

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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		*Integrated into another standard or moved into another course*	*Moved to NC.M2.G-SRT.4.*
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*	*Moved to NC.M2.G-SRT.5.*
Circles ***Understand and apply theorems about circles.***				
G-C.1	Prove that all circles are similar.		*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.*
G-C.2	Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	NC.M3.G-C.2	Understand and apply theorems about circles. a) Understand and apply theorems about relationships with angles and circles. ● The measure of an inscribed angle is equal to half the central angle that subtends the same arc. ● If a quadrilateral is inscribed in a circle, the sum of the opposite angles is 180°. ● An angle inscribed in a semicircle is a right angle. b) Understand and apply theorems about relationships with line segments and circles. ● When two chords intersect at a point interior to a circle, the chords are divided proportionally. ● When two secants intersect at a point exterior to a circle, the lengths of the secants and the external parts are proportional. ● When a tangent and a secant intersect at a point exterior to a circle, the tangent is the geometric mean between the lengths of the secant and its external part.	Understand and apply theorems about circles. ● Understand and apply theorems about relationships with angles and circles, including central, inscribed and circumscribed angles. ● Understand and apply theorems about relationships with line segments and circles including, radii, diameter, secants, tangents and chords.

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			• The radius of a circle is perpendicular to the tangent at the point where the radius intersects the circle. • Tangents drawn from a point outside a circle are equal in length.	
G-C.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral 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.*
G-C.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	NC.M3.G-C.5	Using similarity, demonstrate that the length of an arc (*s*) for a given central angle is proportional to the radius (*r*) of the circle. Define radian measure of the central angle as the ratio of the length of the arc to the radius of the circle (*s*/*r*). Find arc lengths and areas of sectors of circles.	Using similarity, demonstrate that the length of an arc, *s*, for a given central angle is proportional to the radius, *r*, of the circle. Define radian measure of the central angle as the ratio of the length of the arc to the radius of the circle, *s/r*. Find arc lengths and areas of sectors of circles.
Expressing Geometric Properties with Equations ***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.	NC.M3.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.	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.
G-GPE.2	Derive the equation of a parabola given a focus and a directrix.		*Integrated into another standard or moved into another course*	*Included in a fourth level math.*
Expressing Geometric Properties with Equations ***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. Moved from Math I.		*Integrated into another standard or moved into another course*	*Included in a fourth level math.*
Geometric Measurement & Dimension ***Explain volume formulas and use them to solve problems.***				

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G-GMD.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *Note: At this level, formulas for pyramids, cones and spheres will be given.* Moved from Math I.	NC.M3.G-GMD.3	Use the volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	Use the volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems.
Geometric Measurement & Dimension ***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 Moved from Math II.	NC.M3.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.	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
Modeling with Geometry ***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).* Moved from Math II.	NC.M3.G-MG.1	● Use geometric and algebraic concepts to solve problems in modeling situations: ● Use geometric shapes, their measures, and their properties, to model real-life objects. ● Use geometric formulas and algebraic functions to model relationships. ● Apply concepts of density based on area and volume. ● Apply geometric concepts to solve design and optimization problems.	Apply geometric concepts in modeling situations ● Use geometric and algebraic concepts to solve problems in modeling situations: ● Use geometric shapes, their measures, and their properties, to model real-life objects. ● Use geometric formulas and algebraic functions to model relationships. ● Apply concepts of density based on area and volume. ● Apply geometric concepts to solve design and optimization problems.
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*	*Moved from NC Math 2 and combined into NC.M3.G-MG.1.*

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	Moved from Math II.			
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*	*Moved from NC Math 2 and combined into NC.M3.G-MG.1.*

Statistics and Probability				
Current Standard Abbreviation	**Current Standard**	**Proposed Standard Abbreviation**	**First Draft Proposed Standard**	**Second Draft Proposed Standard**
Making Inference and Justifying Conclusions ***Understand and evaluate random processes underlying statistical experiments.***				
S-IC.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	NC.M3.S-IC1	Understand the process of making inferences about a population based on a random sample from that population.	Understand the process of making inferences about a population based on a random sample from that population.
Making Inference and Justifying Conclusions ***Make inferences and justify conclusions from sample surveys, experiments, and observational studies.***				
S-IC.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	NC.M3.S-IC.3	Recognize the purposes of and differences between sample surveys, experiments, and observational studies and understand how randomization should be used in each.	Recognize the purposes of and differences between sample surveys, experiments, and observational studies and understand how randomization should be used in each.
S-IC.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	NC.M3.S-IC.4	Use simulation to understand how samples can be used to estimate a population mean or proportion and how to determine a margin of error for the estimate.	Use simulation to understand how samples can be used to estimate a population mean or proportion and how to determine a margin of error for the estimate.
S-IC.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	NC.M3.S-IC.5	Use simulation to determine whether observed differences between samples from two distinct populations indicate that the two populations are actually different in terms of a parameter of interest.	Use simulation to determine whether observed differences between samples from two distinct populations indicate that the two populations are actually different in terms of a parameter of interest.
S-IC.6	Evaluate reports based on data.	NC.M3.S-IC.6	Evaluate articles and websites that report data by identifying the source of the data, the design of the study, and the way the data are graphically displayed.	Evaluate articles and websites that report data by identifying the source of the data, the design of the study, and the way the data are graphically displayed.
Interpreting Categorical and Quantitative Data ***Summarize, represent, and interpret data on a single count or measurement variable.***				
S-ID.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.		*Integrated into another standard or moved to another course.*	*Included in a fourth level math.*

Statistics and Probability				
Current Standard Abbreviation	**Current Standard**	**Proposed Standard Abbreviation**	**First Draft Proposed Standard**	**Second Draft Proposed Standard**
Using Probability to Make Decisions ***Use probability to evaluate outcomes of decisions.***				
S-MD.6	(+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).		*Integrated into another standard or moved to another course.*	*Included in a fourth level math.*
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).		*Integrated into another standard or moved to another course.*	*Moved to NC.M2.S-MD.7.*