North Carolina Tutorials are designed specifically for the Common Core State Standards for English language arts, the North Carolina Standard Course of Study for Math, and the North Carolina Essential Standards, to prepare students for the READY End-of-Course Assessments.

Math Tutorials offer targeted instruction, practice and review designed to develop computational fluency, deepen conceptual understanding, and apply mathematical practices. They automatically identify and address learning gaps down to elementary-level content, using adaptive remediation to bring students to grade-level no matter where they start. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing the ability to apply their knowledge in abstract and real world scenarios, students build the depth of knowledge and higher order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students through focused content, modeled logic and process, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

1. FUNCTIONS

- **FUNCTIONS AND RELATIONS**
  - **NC.M3.F-IF.2** *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.*
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.F-IF.7** *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.*

- **MULTIPLE REPRESENTATIONS OF FUNCTIONS**
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.F-IF.9** *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).*
  - **NC.M3.F-IF.7** *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.*
  - **NC.M3.F-BF.1a** *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).*

2. WORKING WITH FUNCTIONS

- **ARITHMETIC OPERATIONS ON FUNCTIONS**
  - **NC.M3.F-BF.1b** *Build a new function, in terms of a context, by combining standard function types using arithmetic operations.*

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- **INVERSE FUNCTIONS**
  - **NC.M3.F-BF.4b** *Determine if an inverse function exists by analyzing tables, graphs, and equations.*
  - **NC.M3.F-BF.4a** *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.*
  - **NC.M3.F-BF.4c** *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 equation and use it to solve problems in terms of a context.*

3. NONLINEAR FUNCTIONS

- **LINEAR VERSUS NONLINEAR FUNCTIONS**
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.F-BF.1a** *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).*
  - **NC.M3.F-LE.3** *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.*

- **ANALYZING GRAPHS OF SQUARE ROOT FUNCTIONS**
  - **NC.M3.F-BF.3** *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).*
  - **NC.M3.F-BF.4a** *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.*
  - **NC.M3.F-BF.4b** *Determine if an inverse function exists by analyzing tables, graphs, and equations.*
  - **NC.M3.F-BF.4c** *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 equation and use it to solve problems in terms of a context.*
  - **NC.M3.F-IF.4** *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.*

- **ABSOLUTE VALUE FUNCTIONS**
  - **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.F-IF.7** *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.*
  - **NC.M3.A-CED.2** *Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities.*

4. EXPONENTIAL AND LOGARITHMIC FUNCTIONS

- **EXPONENTIAL FUNCTIONS**
  - **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
  - **NC.M3.A-SSE.1b** *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.*
  - **NC.M3.F-IF.7** *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.*
  - **NC.M3.F-LE.3** *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.*

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- **NC.M3.F-BF.1a** *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).*
- **NC.M3.F-IF.4** *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.*
- **NC.M3.A-CED.1** *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.*
- **NC.M3.A-CED.2** *Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities.*

- **EXPONENTIAL GROWTH AND DECAY**
  - **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
  - **NC.M3.A-SSE.1b** *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.*
  - **NC.M3.F-BF.1a** *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).*
  - **NC.M3.A-SSE.3c** *Write an equivalent form of an exponential expression by using the properties of exponents to transform expressions to reveal rates based on different intervals of the domain.*
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.A-CED.2** *Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities.*
  - **NC.M3.A-SSE.2** *Use the structure of an expression to identify ways to write equivalent expressions.*
  - **NC.M3.F-IF.7** *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.*

- **LOGARITHMIC FUNCTIONS**
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.F-BF.4a** *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.*
  - **NC.M3.F-BF.4b** *Determine if an inverse function exists by analyzing tables, graphs, and equations.*
  - **NC.M3.F-BF.4c** *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 equation and use it to solve problems in terms of a context.*
  - **NC.M3.F-LE.4** *Use logarithms to express the solution to ab to the ct power $= d$ where a, c, and d are numbers and evaluate the logarithm using technology.*

5. SOLVING EXPONENTIAL AND LOGARITHMIC EQUATIONS

- **SOLVING EXPONENTIAL EQUATIONS**
  - **NC.M3.F-BF.4a** *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.*
  - **NC.M3.F-LE.4** *Use logarithms to express the solution to ab to the ct power $= d$ where a, c, and d are numbers and evaluate the logarithm using technology.*
  - **NC.M3.F-IF.7** *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.*
  - **NC.M3.F-BF.1a** *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).*

- **SOLVING LOGARITHMIC EQUATIONS**

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- **NC.M3.F-BF.4a** *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.*
- **NC.M3.F-IF.4** *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.*
- **NC.M3.F-LE.4** *Use logarithms to express the solution to ab to the ct power = d where a, c, and d are numbers and evaluate the logarithm using technology.*

6. TRANSFORMATIONS OF FUNCTIONS

- **TRANSFORMATIONS OF THE LINEAR AND EXPONENTIAL PARENT FUNCTIONS**
  - **NC.M3.F-BF.3** *Extend an understanding of the effects on the graphical and tabular representations of a function when replacing $f(x)$ with $k•f(x)$, $f(x)+k$, $f(x+k)$ to include $f(k•x)$ for specific values of k (both positive and negative).*

- **TRANSFORMATIONS OF THE QUADRATIC PARENT FUNCTION**
  - **NC.M3.F-BF.3** *Extend an understanding of the effects on the graphical and tabular representations of a function when replacing $f(x)$ with $k•f(x)$, $f(x)+k$, $f(x+k)$ to include $f(k•x)$ for specific values of k (both positive and negative).*

7. WORKING WITH POLYNOMIALS

- **DIVISION OF POLYNOMIALS**
  - **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
  - **NC.M3.A-SSE.1b** *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.*
  - **NC.M3.A-SSE.2** *Use the structure of an expression to identify ways to write equivalent expressions.*
  - **NC.M3.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 $b(x)$.*

- **FACTOR THEOREM AND REMAINDER THEOREM**
  - **NC.M3.A-APR.2** *Understand and apply the Remainder Theorem.*

8. POLYNOMIALS AND POLYNOMIAL FUNCTIONS

- **FACTORING HIGHER-ORDER POLYNOMIALS**
  - **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
  - **NC.M3.A-SSE.1b** *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.*
  - **NC.M3.A-APR.3** *Understand the relationship among factors of a polynomial expression, the solutions of a polynomial equation and the zeros of a polynomial function.*
  - **NC.M3.N-CN.9** *Use the Fundamental Theorem of Algebra to determine the number and potential types of solutions for polynomial functions.*
  - **NC.M3.A-SSE.2** *Use the structure of an expression to identify ways to write equivalent expressions.*

- **GRAPHS OF POLYNOMIAL FUNCTIONS**
  - **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
  - **NC.M3.A-SSE.1b** *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.*
  - **NC.M3.A-APR.3** *Understand the relationship among factors of a polynomial expression, the solutions of a polynomial equation and the zeros of a polynomial function.*
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.F-BF.1a** *Build polynomial and exponential functions with real solution(s) given a graph, a description of a relationship,*

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or ordered pairs (include reading these from a table).

- **NC.M3.N-CN.9** *Use the Fundamental Theorem of Algebra to determine the number and potential types of solutions for polynomial functions.*
- **NC.M3.A-CED.2** *Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities.*
- **NC.M3.F-IF.7** *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.*
- **NC.M3.F-LE.3** *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.*

9. RATIONAL EXPRESSIONS AND EQUATIONS

OPERATIONS WITH RATIONAL EXPRESSIONS

- **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
- **NC.M3.A-SSE.1b** *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.*
- **NC.M3.A-APR.7b** *Multiply and divide two rational expressions.*
- **NC.M3.A-APR.7a** *Add and subtract two rational expressions, $a(x)$ and $b(x)$, where the denominators of both $a(x)$ and (x) are linear expressions.*
- **NC.M3.A-SSE.2** *Use the structure of an expression to identify ways to write equivalent expressions.*
- **NC.M3.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 $b(x)$.*

SOLVING RATIONAL EQUATIONS

- **NC.M3.A-REI.1** *Justify a solution method for equations and explain each step of the solving process using mathematical reasoning.*
- **NC.M3.F-IF.4** *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.*
- **NC.M3.A-REI.2** *Solve and interpret one variable rational equations arising from a context, and explain how extraneous solutions may be produced.*

10. RATIONAL FUNCTIONS

ANALYZING GRAPHS OF RATIONAL FUNCTIONS

- **NC.M3.F-IF.4** *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.*
- **NC.M3.F-IF.7** *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.*
- **NC.M3.A-CED.2** *Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities.*

MODELING SITUATIONS WITH RATIONAL FUNCTIONS

- **NC.M3.A-SSE.1a** *Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents.*
- **NC.M3.A-SSE.1b** *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.*
- **NC.M3.A-CED.2** *Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities.*

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11. TRIANGLES AND PARALLELOGRAMS

- **TRIANGLE BISECTORS**
  - **NC.M3.G-CO.10** *Verify experimentally properties of the centers of triangles (centroid, incenter, and circumcenter).*
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
  - **NC.M3.G-MG.1** *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.*

- **MEDIANS AND ALTITUDES OF TRIANGLES**
  - **NC.M3.G-CO.10** *Verify experimentally properties of the centers of triangles (centroid, incenter, and circumcenter).*
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
  - **NC.M3.G-MG.1** *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.*

- **PARALLELOGRAMS AND RECTANGLES**
  - **NC.M3.G-MG.1** *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.*
  - **NC.M3.G-CO.11** *Prove theorems about parallelograms. 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.*
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*

12. TRIGONOMETRY AND TRIGONOMETRIC FUNCTIONS

- **RADIANS AND THE UNIT CIRCLE**
  - **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.*
  - **NC.M3.F-TF.1** *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.*
  - **NC.M3.F-IF.1** *Extend the concept of a function by recognizing that trigonometric ratios are functions of angle measure.*
  - **NC.M3.F-TF.2a** *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.*
  - **NC.M3.F-TF.2b** *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.*
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*

- **TRIGONOMETRIC FUNCTIONS**
  - **NC.M3.F-IF.1** *Extend the concept of a function by recognizing that trigonometric ratios are functions of angle measure.*
  - **NC.M3.F-IF.4** *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.*
  - **NC.M3.F-IF.7** *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*

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discontinuities.

- **NC.M3.F-TF.5** *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.*
- **NC.M3.F-TF.1** *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.*

13. CIRCLES 1

- **CIRCLE BASICS**
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
  - **NC.M3.G-C.2** *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.*

- **CENTRAL ANGLES, INSCRIBED ANGLES, AND CHORDS**
  - **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.*
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
  - **NC.M3.G-C.2** *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.*

14. CIRCLES 2

- **SECANTS, ANGLES, AND INTERCEPTED ARCS**
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
  - **NC.M3.G-C.2** *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.*

- **TANGENTS, ANGLES, AND INTERCEPTED ARCS**
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
  - **NC.M3.G-C.2** *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.*

15. CIRCLES AND PROPERTIES OF CIRCLES

- **CIRCUMFERENCE AND ARC LENGTH**
  - **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.*
  - **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
  - **NC.M3.G-MG.1** *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.*

- **AREA OF CIRCLES AND SECTORS**

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- **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.*
- **NC.M3.G-CO.14** *Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems.*
- **NC.M3.G-MG.1** *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.*

CIRCLES

- **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.*

16. THREE-DIMENSIONAL SOLIDS

RELATING TWO-DIMENSIONAL FIGURES TO THREE-DIMENSIONAL SOLIDS

- **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.*

SURFACE AREA AND VOLUME OF SPHERES

- **NC.M3.G-GMD.3** *Use the volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems.*
- **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.*
- **NC.M3.G-MG.1** *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.*

17. VOLUME

VOLUME OF PRISMS AND PYRAMIDS

- **NC.M3.G-GMD.3** *Use the volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems.*
- **NC.M3.G-MG.1** *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.*
- **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.*

VOLUME OF CYLINDERS AND CONES

- **NC.M3.G-GMD.3** *Use the volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems.*
- **NC.M3.G-MG.1** *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.*
- **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.*

18. STATISTICS

EXPERIMENTAL AND OBSERVATIONAL DESIGN

- **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.*

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- **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.*

- **ANALYZING STATISTICAL SAMPLES**
  - **NC.M3.S-IC.1** *Understand the process of making inferences about a population based on a random sample from that population.*
  - **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.*

- **CONCLUSIONS IN DATA**
  - **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.*
  - **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.*
  - **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.*

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