North Carolina Mathematics

Math III: Grades 9, 10, 11, 12

Adopted 2016

Number and Quantity

The Complex Number System

9. Use the Fundamental Theorem of Algebra to determine the number and potential types of solutions for polynomial functions. NC.M3.N-CN.9

Seeing Structure in Expressions

1. Interpret expressions that represent a quantity in terms of its context. NC.M3.A-SSE.1
    a. Identify and interpret parts of a piecewise, absolute value, polynomial, exponential and rational expressions including terms, factors, coefficients, and exponents. NC.M3.A-SSE.1.A
    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. NC.M3.A-SSE.1.B
2. Use the structure of an expression to identify ways to write equivalent expressions. NC.M3.A-SSE.2
3. 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.A-SSE.3

Arithmetic with Polynomial and Rational Expressions

2. Understand and apply the Remainder Theorem. NC.M3.A-APR.2
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.A-APR.3
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). NC.M3.A-APR.6
7. Understand the similarities between arithmetic with rational expressions and arithmetic with rational numbers. NC.M3.A-APR.7
    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. NC.M3.A-APR.7.A
    b. Multiply and divide two rational expressions. NC.M3.A-APR.7.B

Creating Equations

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.1
2. Create and graph equations in two variables to represent absolute value, polynomial, exponential and rational relationships between quantities. NC.M3.A-CED.2
3. Create systems of equations and/or inequalities to model situations in context. NC.M3.A-CED.3

Reasoning with Equations and Inequalities

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

11. 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. NC.M3.A-REI.11

Functions

Interpreting Functions

1. Extend the concept of a function by recognizing that trigonometric ratios are functions of angle measure. NC.M3.F-IF.1
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.2
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.4
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-IF.7
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.9

Building Functions

1. Write a function that describes a relationship between two quantities. NC.M3.F-BF.1
    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). NC.M3.F-BF.1.A
    b. Build a new function, in terms of a context, by combining standard function types using arithmetic operations. NC.M3.F-BF.1.B
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). NC.M3.F-BF.3
4. Find an inverse function. NC.M3.F-BF.4
    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. NC.M3.F-BF.4.A
    b. Determine if an inverse function exists by analyzing tables, graphs, and equations. NC.M3.F-BF.4.B
    c. If an inverse function exists for a linear, quadratic and/or exponential function, f, represent the inverse function, f¹, with a table, graph, or equation and use it to solve problems in terms of a contex- NC.M3.F-BF.4.C

Linear, Quadratic, and Exponential Models

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. NC.M3.F-LE.3
4. Use logarithms to express the solution to ab^{ct} = d where a, c, and d are numbers and evaluate the logarithm using technology. NC.M3.F-LE.4

Trigonometric Functions

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-TF.1
2. Build an understanding of trigonometric functions by using tables, graphs and technology to represent the cosine and sine functions. NC.M3.F-TF.2
    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. NC.M3.F-TF.2.A
    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. NC.M3.F-TF.2.B
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.5

Geometry

Congruence

10. Verify experimentally properties of the centers of triangles (centroid, incenter, and circumcenter). NC.M3.G-CO.10
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.11
14. Apply properties, definitions, and theorems of two-dimensional figures to prove geometric theorems and solve problems. NC.M3.G-CO.14

Circles

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. NC.M3.G-C.2
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-C.5

Expressing Geometric Properties with Equations

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

Geometric Measurement & Dimension

3. Use the volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems. NC.M3.G-GMD.3
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-GMD.4

Modeling with Geometry

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-MG.1

Statistics and Probability

Making Inference and Justifying Conclusions

1. Understand the process of making inferences about a population based on a random sample from that population. NC.M3.S-IC.1
3. Recognize the purposes of and differences between sample surveys, experiments, and observational studies and understand how randomization should be used in each. NC.M3.S-IC.3
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.4
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.5
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. NC.M3.S-IC.6