WAKE COUNTY PUBLIC SCHOOL SYSTEM

High School Programs

Math III UNIT 1 OVERVIEW: Modeling with Functions & Their Inverses

Unit Outcomes At the end of this unit, your student should be able to:	**Key Vocabulary** Terms to deepen the student's understanding
✓ compare key features of two different functions each with unique representations such as symbols, graphs, tables, or with verbal descriptions. ✓ use function notation to evaluate piecewise-defined functions for inputs in their domains. ✓ build a new function, in a real life situation, by combining standard function "types" using arithmetic operations. ✓ make sense of a function by extending it graphically or in a table. ✓ understand the effects on a graph through transformations graphically. ✓ find the inverse of a function (symbolically, graphically, numerically and in tables, and by verbal description). ✓ recognize the inverse relationships between, quadratic and square root, and linear to linear functions. ✓ use inverse relationships in real world situations to interpret and solve. ✓ determine if an inverse function exists by analyzing a table, a graph, or an equation. ✓ use function notation to represent inverses. ✓ create equations and inequalities in one and two variables that represent absolute value and piecewise defined relationships. ✓ use absolute value equations and inequalities in one variable to solve problems algebraically and graphically. ✓ create systems of equations and/or inequalities to model situations in context. ✓ identify and interpret parts of piecewise-defined and absolute value expressions. ✓ use technology to solve equations through multiple representations (tables and graphs).	✓ Inverse ✓ Relation ✓ Function ✓ Function notation ✓ One-to-one ✓ Horizontal line test ✓ Vertical line test ✓ Absolute Value ✓ Piecewise function ✓ System of equations ✓ Domain ✓ Range ✓ Interval notation ✓ x-intercept ✓ y-intercept ✓ Increasing/decreasing intervals ✓ Evaluate ✓ End behavior

Key Standards Addressed Connections to Common Core/NC Essential Standards	**Where This Unit Fits** Connections to prior and future learning
NC.M3.F-IF.4	**Coming into this unit, students should have a strong foundation in:** ✓ Graphing linear equations and inequalities ✓ How to solve basic one to two step equations and inequalities

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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.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.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.1b
Write a function that describes a relationship between two quantities.
b. Build a new function, in terms of a context, by combining standard function types using arithmetic operations.

NC.M3.F-BF.3

- ✓ Solve systems of equations (graphically and elimination)
- ✓ Solve systems of inequalities
- ✓ The idea of a function and function notation
- ✓ Transformations of functions

This unit builds to the following future skills and concepts:

From Advanced Functions and Modeling Standards (4th level math)

2.02a
Use piecewise-defined functions to model and solve problems using tables, graphs, and algebraic properties.
2.02b
use piecewise-defined functions to model and solve problems. Interpret the constraints, coefficients, and bases in the context of the problem.

From Pre-Calculus Standards (4th level math)
1.01 Transform relations in two dimensions; describe the results algebraically and geometrically.
2.01 Use functions (polynomial, power, rational, exponential, logarithmic, logistic, piecewise-defined, and greatest integer) to model and solve problems; justify results.
a. Solve using graphs and algebraic properties.
b. Interpret the constants, coefficients, and bases in the context of the problem.
2.04 Use the composition and inverse of functions to model and solve problems.

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.4** 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 equation and use it to solve problems in terms of a context. **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. **NC.M3.A-CED.3** Create systems of equations and/or inequalities to model situations in context.	

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NC.M3.A-SSE.1 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. **NC.M3.A-REI.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.	
Additional Resources Materials to support understanding and enrichment	

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- ✓ MVP Module on Functions and Their Inverses
- ✓ Desmos
- ✓ Point Slope Form of a line
- ✓ Solving Inequalities
- ✓ Solving Absolute Equations
- ✓ Domain and Range
- ✓ Solving Systems of Equations by Graphing
- ✓ Solving Systems of Equations by Elimination
- ✓ Systems of Linear Inequalities
- ✓ Texas Gateway on Finding Inverses

Enrichment: Interval Notation with Inequalities
Enrichment: One-to-One Inverses

*** Please note**, the unit guides are a work in progress. If you have feedback or suggestions on improvement, please feel free to contact sdupree@wcpss.net.