Math I UNIT 5 OVERVIEW: Quadratic Functions

Unit Outcomes At the end of this unit, your student should be able to:	**Key Vocabulary** Terms to deepen the student's understanding
✓ Use function notation to evaluate a quadratic function given a value in the domain. ✓ Interpret the contextual meaning of a given point from a quadratic function in function notation. ✓ Interpret the meaning of the independent and dependent variables in context of a quadratic function. ✓ Interpret contextual significance of the domain and range of a quadratic function ✓ State the domain and range of a quadratic function from its graph. ✓ Interpret and analyze key features of a quadratic function in context including positive/negative, increasing/decreasing, intercepts, maximum/minimum and domain/range when given the function as a table, graph, and/or verbal description. ✓ Use mathematical reasoning to justify a chosen solution method for a quadratic equation. ✓ Use mathematical reasoning to justify each step of the solving process for a quadratic equation. ✓ Identify the terms, factors and coefficients of a quadratic expression. ✓ Interpret the terms, factors and coefficients of a quadratic expression in terms of the context. ✓ Create an equation in two variables to represent a quadratic relationship between two quantities. ✓ Graph a quadratic equation that represents a relationship between two quantities. ✓ Choose an appropriate domain and range for a quadratic function. ✓ Identify the maximum and minimum of quadratic functions. ✓ Identify where a quadratic function is increasing and decreasing. ✓ Compare two quadratic functions symbolically, graphically, verbally, and using tables. ✓ Compare linear and quadratic functions symbolically, graphically, verbally, and using tables. ✓ Build a quadratic function by multiplying linear equations and combining two quadratic equations with addition and subtraction.	✓ Acceleration due to Gravity ✓ Axis of Symmetry ✓ Binomial ✓ Constant ✓ Degree of a Monomial ✓ Degree of a Polynomial ✓ Difference of Squares ✓ Extreme Values ✓ Factoring ✓ Initial Height ✓ Initial Velocity ✓ Greatest Common Factor ✓ Intercepts ✓ Intervals Where Increasing, Decreasing, Positive or Negative ✓ Linear Expression ✓ Monomial ✓ Parabola ✓ Polynomial ✓ Relative Maximum or Minimum ✓ Roots ✓ Solutions ✓ Standard Form of a Polynomial ✓ Symmetry ✓ Trinomial ✓ Vertex ✓ x-intercepts of a Quadratic Function ✓ Zeros
Key Standards Addressed Connections to Common Core/NC Essential Standards	**Where This Unit Fits** Connections to prior and future learning

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NC.M1.A-SSE.1 Interpret expressions that represent a quantity in terms of its context.
a. Identify and interpret parts of a linear, exponential, or **quadratic** expression, including terms, factors, coefficients, and exponents.
b. Interpret a linear, exponential, or **quadratic** expression made of multiple parts as a combination of entities to give meaning to an expression.

NC.M1.A-SSE.3 Write an equivalent form of a quadratic expression, $ax^2 + bx + c$, where a is an integer, by factoring to reveal the solutions of the equation or the zeros of the function the expression defines.

NC.M1.A-APR.1 Build an understanding that operations with polynomials are comparable to operations with integers by adding and subtracting quadratic expressions and by adding, subtracting, and multiplying linear expressions.

NC.M1.A-APR.3 Understand the relationships among the factors of a quadratic expression, the solutions of a quadratic equation, and the zeros of a quadratic function.

NC.M1.A-CED.2 Create and graph equations in two variables to represent linear, exponential, and quadratic relationships between quantities.

NC.M1.A-REI.1 Justify a chosen solution method and each step of the solving process for linear and **quadratic** equations using mathematical reasoning.

NC.M1.A-REI.4 Solve for the real solutions of quadratic equations in one variable by taking square roots and factoring.

NC.M1.A-REI.11 Build an understanding of why the *x*-coordinates of the points where the graphs of two linear, exponential, and/or quadratic equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ and approximate solutions using graphing technology or successive approximations with a table of values.

NC.M1.F-IF.2 Use function notation to evaluate linear, **quadratic**, and exponential functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Coming into this unit, students should have a strong foundation in:

- ✓ Solving one variable equations
- ✓ Graphing linear functions
- ✓ Linear and exponential functions
- ✓ Finding the GCF of integers
- ✓ Combining like terms
- ✓ The Distributive Property
- ✓ Identifying key features of a function from a graph

This unit builds to the following future skills and concepts:

- ✓ Factoring quadratic equations with a leading coefficient other than one
- ✓ Graphing and analyzing more complex functions (including inverse, step, exponential, absolute value, trigonometric and logarithmic functions)

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NC.M1.F-IF.4 Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities, including: intercepts; intervals where the function is increasing, decreasing, positive, or negative; and maximums and minimums. **NC.M1.F-IF.5** Interpret a function in terms of the context by relating its domain and range to its graph and, where applicable, to the quantitative relationship it describes. **NC.M1.F-IF.6** Calculate and interpret the average rate of change over a specified interval for a function presented numerically, graphically, and/or symbolically. **NC.M1.F-IF.7** Analyze linear, exponential, and quadratic functions by generating different representations, by hand in simple cases and using technology for more complicated cases, to show key features, including: domain and range; rate of change; intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximums and minimums; and end behavior. **NC.M1.F-IF.8** Use equivalent expressions to reveal and explain different properties of a function. a. Rewrite a quadratic function to reveal and explain different key features of the function **NC.M1.F-IF.9** Compare key features of two functions (linear, quadratic, or exponential) each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions). **NC.M1.F.BF.1** Write a function that describes a relationship between two quantities. b. Build a function that models a relationship between two quantities by combining linear, exponential, or quadratic functions with addition and subtraction or two linear functions with multiplication. **NC.M1.F-LE.3** Compare the end behavior of linear, exponential, and quadratic functions using graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.	

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Additional Resources Materials to support understanding and enrichment	**"Learning Checks"** Questions Parents Can Use to Assess Understanding
✓ Quadratic equations overview (notes) ✓ Quadratic equation solver ✓ Factoring overview (video) ✓ Graphing quadratic equations (video) ✓ Factoring GCF (practice) ✓ Factor quadratics when a=1 (practice) ✓ Factor quadratics with a leading coefficient (practice) ✓ Factoring special cases (practice)	✓ How can projectile motion be modeled using a quadratic function? ✓ How does knowing the definition of a maximum or minimum help you visualize the graph of a quadratic function? ✓ How do you determine which solution to use for a quadratic equation? ✓ How is factoring connected to the distributive property? ✓ How can I compare operations with integers to operations with quadratic expressions? ✓ What types of information are contained in various forms of a quadratic function?

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