NJDOE MODEL CURRICULUM PROJECT			
CONTENT AREA: Mathematics	**Course: Algebra 1**	**UNIT #: 4**	**UNIT NAME: Quadratic Functions and Modeling**

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING CCSS
1	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.	A.APR.3
2	Use properties of integer exponents to explain and convert between expressions involving radicals and rational exponents, using correct notation. *For example, we define* $5^{1/3}$ *to be the cube root of 5 because we want* $(5^{1/3})^3 = 5^{(1/3)3}$ *to hold, so* $(5^{1/3})^3$ *must equal 5.*	N.RN.1, N.RN.2
3	Use the properties of rational and irrational numbers to explain why the sum or product of two rational numbers is rational; the sum of a rational number and an irrational number is irrational; and the product of a nonzero rational number and an irrational number is irrational.	N.RN.3
4	Sketch the graph of a function that models a relationship between two quantities (expressed symbolically or from a verbal description) showing key features (including intercepts, minimums/maximums, domain, and rate of change) by hand in simple cases and using technology in more complicated cases and relate the domain of the function to its graph. ★	F.IF.4, F.IF.5 , F.1F.7
5	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.*	F.IF.9
6	Calculate (over a specified period if presented symbolically or as a table) or estimate (if presented graphically) and interpret the average rate of change of a function. ★	F.IF.6,
7	Write functions in different but equivalent forms by manipulating quadratic expressions using methods such as factoring and completing the square.	F.IF. 8
8	Write a function that describes a linear or quadratic relationship between two quantities given in context using an explicit expression, a recursive process, or steps for calculation and relate these functions to the model. ★	F.BF.1
9	Identify the effects of translations [*f(x) + k, k f(x), f(kx),* and *f(x + k)]* on a function, find the value of *k* given the graphs.	F.BF.3

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10	Compare (using graphs and tables) linear, quadratic, and exponential models to determine that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function, include interpretation of parameters in terms of a context.	F.LE.3 , F.LE.5

Major Content **Supporting Content** **Additional Content** *(Identified by PARCC Model Content Frameworks*).
Bold type indicates grade level fluency requirements. *(Identified by PARCC Model Content Frameworks).*

Selected Opportunities for Connection to Mathematical Practices

1. Make sense of problems and persevere in solving them. *
2. Reason abstractly and quantitatively.
SLO 4 Create a graph from a verbal description or a symbolic representation reasoning about the relationship between the two quantities.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics. *
5. Use appropriate tools strategically.
SLO 4 Use graphing technology when graphing complicated functions and to identify the key features of the graph.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.
SLO #6 Continually evaluate the results of calculating the rate of change between two quantities over a period of time.
*MP.1 and MP.4 are overarching practices relevant to Algebra 1. (PARCC Model Content Frameworks)
All of the content presented in this course has connections to the standards for mathematical practices.

Bold type identifies possible starting points for connections to the SLOs in this unit.

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Code #	Common Core State Standards
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.
N.RN.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*
N.RN.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
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 non-zero rational number and an irrational number is irrational.
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.*★
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.*★
F.IF.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★
F.IF.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. *Exponential, growth or decay.*
F.IF.8	F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

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	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.
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.*
F.BF.1	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.
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.*
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.
F.LE.5	Interpret the parameters in a linear or exponential function in terms of a context.

Major Content **Supporting Content** **Additional Content** *(Identified by PARCC Model Content Frameworks*).

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