

Algebra I: Quadratic Functions

Stage 1 Desired Results		
ESTABLISHED GOALS: Competencies: - Students will demonstrate perseverance and strategic thinking by identifying the underlying meaning of a problem, planning a logical solution pathway, working through challenges, and verifying the reasonableness of their answers. - Students will demonstrate the ability to decontextualize (represent symbols) and contextualize (understand the meaning of quantities) by converting real-world situations into mathematical symbols for manipulation, and interpreting symbolic results back into practical contexts. - Students will demonstrate application skills by using mathematical concepts and symbols to represent, analyze, and solve problems arising in everyday life, society, and the workplace. - Students will demonstrate resourcefulness by evaluating and selecting the most effective tools to solve mathematical problems and deepen their understanding of concepts. - Students will demonstrate structural awareness by discerning patterns and functional relationships within complex mathematical concepts to simplify and solve problems. - Students will demonstrate the ability to notice repetitive calculations or patterns, evaluate the reasonableness of results, and formulate general methods, formulas, or shortcuts while maintaining oversight of the process. - Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials. - Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences. - Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style. Content Standards: - A.SSE.1 Interpret expressions that represent a quantity in terms of its context. - Interpret parts of an expression, such as terms, factors, and coefficients. - Interpret complicated expressions by viewing one or more of their parts as a single entity. - A.SSE.2 Use the structure of an expression to identify ways to rewrite it. - A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. - Factor a quadratic expression to reveal the zeros of the function it defines. - A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	Transfer	
	Students will be able to independently use their learning to solve problems that can be represented with a symmetric curve.	
	Meaning	
	ENDURING UNDERSTANDINGS Students will understand that... - equivalent expressions can be created by using multiple strategies and the guiding rules of mathematics. - the graph and equation of a function communicate information that can be used to answer questions about real world problems.	ESSENTIAL QUESTIONS When presented with multiple methods of representing information, how does one select the best method?
	Acquisition	
	Students will know... - that polynomials are closed under the operations of addition, subtraction, and multiplication. - that quadratic expressions can often be written as the product of two binomials. - that the zero-product property can be used to solve quadratic equations that can be factored. - that the quadratic formula can be used to solve any quadratic equation. - that the standard form and the graph of the quadratic parent function ($y=x^2$). - that a quantity increasing exponentially eventually exceeds a quantity increasing quadratically. - that the solution(s) of a quadratic equation are the zeros/roots of the related function. - that the discriminant reveals the nature and number of solutions to a quadratic equation. - that a system of linear and quadratic equations can have two solutions, one solution, or no solutions. vocabulary: monomial, binomial, trinomial, polynomial, degree, quadratic, leading coefficient,	Students will be skilled at... - adding and subtracting polynomial expressions. - naming polynomials by degree and number of terms. - multiplying polynomial expressions. - factoring the GCF from polynomials. - solving basic polynomial equations. - multiplying special cases, including sums and differences. - factoring special cases, including the difference of two squares and perfect square trinomials. - factoring quadratic expressions, including trinomials with the coefficient of the first term not equal to one. - applying symmetry to create and interpret graphs of quadratic functions. - determining the axis of symmetry. - determining the number and type of roots using the discriminant. - finding the roots of a quadratic equation by graphing, factoring, using technology, and using the quadratic formula. - simplifying radicals.

• A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. • A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. • A.REI.4 Solve quadratic equations in one variable. ◦ Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. • A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. • 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. *req. per appendix • 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. ◦ Graph linear and quadratic functions and show intercepts, maxima, and minima. • F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. ◦ 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). • F.BF.1 Write a function that describes a relationship between two quantities. ◦ Determine an explicit expression, a recursive process, or steps for calculation from a context. ◦ Combine standard function types using arithmetic operations. • F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly,	<i>constant term, parabola, axis of symmetry, vertex, minimum and maximum point, zeros, roots, discriminant</i>	• <i>performing operations with radicals, including adding and multiplying.</i> • <i>solving systems of linear and quadratic equations graphically.</i> • <i>solving systems of linear and quadratic equations algebraically, using elimination or substitution.</i>
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quadratically, or (more generally) as a polynomial function. • MP2 Reason abstractly and quantitatively. • MP4 Model with mathematics. • MP7 Look for and make use of structure. • MP8 Look for and express regularity in repeated reasoning.		
Content Area Literacy Standards		21st Century Skills
• RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. • RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. • RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to <i>grades 9-10 texts and topics</i>. • RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., <i>force, friction, reaction force, energy</i>). • RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.		• <i>reason effectively</i> • <i>use systems thinking</i> • <i>make judgments and decisions</i> • <i>solve problems</i> • <i>access and evaluate information</i> • <i>use and manage information</i>

Stage 2 - Evidence	
<i>Evaluative Criteria</i>	<i>Assessment Evidence</i>
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan		
Summary of Key Learning Events and Instruction		
Science Integration	College, Career, and Civic Life Integration	Technology Integration

<i>District Materials</i>	<i>Distance Learning/Field Trips</i>	<i>Technology Resources</i>

Students will know....

* The vertex form of a quadratic equation reveals the minimum or maximum of the function and the axis of symmetry

* *means for ACC classes or enrichment in CCP*

Students will be skilled at....

* transforming quadratic functions from standard to vertex form by completing the square

* factoring the sum and difference of cubes