

**C2.0 Algebra 1 Unit 4 – Quadratic Relationships**

Topic	Overview
<b>Topic 1: Quadratic Functions</b>	<p>In this unit, students extend their knowledge of linear and exponential functions to quadratic functions. They compare the key characteristics of quadratic functions to those of linear and exponential functions and select from among these functions to model phenomena. They will interpret quadratic functions and write quadratic functions given context.</p> <p><b><u>Concepts:</u></b></p> <ul style="list-style-type: none"> <li>• Analyze quadratic patterns numerically, graphically, and symbolically.</li> <li>• Recognize quadratic functions by analyzing the rates of change.</li> <li>• Describe the functional characteristics of a quadratic function.</li> <li>• Recognize the growth of a linear function and the growth of a quadratic function by looking at first and second differences, respectively.</li> <li>• Use equations, both recursive and explicit, graphs, and tables to model linear and quadratic relationships.</li> <li>• Determine a linear pattern from a model based on first differences and define recursive and explicit formulas to make predictions.</li> <li>• Determine a quadratic pattern from a model by recognizing that first differences are linear and define its recursive and explicit formulas to make predictions.</li> <li>• Calculate the maximum area of a rectangle with a fixed perimeter using graph paper, tables, and/or graphs.</li> <li>• Discover that the relationship between the length and area of a rectangle is quadratic by examining the graph of area, <math>A(L)</math>, versus length, <math>L</math> and its table.</li> <li>• Develop tables and write formulas to represent quadratic relationships between quantities in context.</li> <li>• Compare and contrast graphs of quadratic functions that open upward and downward.</li> <li>• Compare and contrast quadratic and exponential functions.</li> <li>• Calculate and compare average speed over an interval for quadratic and exponential functions.</li> <li>• Determine if a relation is a function.</li> <li>• Determine if a function is linear, quadratic, or exponential.</li> <li>• Describe the growth of linear, quadratic, and exponential functions.</li> <li>• Create alternate representations of a linear, quadratic, or exponential function.</li> </ul>

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<b>Topic 2: Structure of Quadratic Expressions</b>	<p>Students will graph quadratic equations and show and analyze key features of the function. Students will formalize and become fluent in strategies for factoring trinomials and finding zeroes.</p> <p><b><u>Concepts:</u></b></p> <ul style="list-style-type: none"> <li>• Investigate the effects of transformations on the equation <math>y = x^2</math>, more specifically <math>y = x^2 \pm k</math>, <math>y = ax^2</math>, and <math>y = (x \pm h)^2</math>.</li> <li>• Determine the value of <math>a</math>, <math>h</math>, and <math>k</math> given representations of <math>y = x^2 \pm k</math>, <math>y = ax^2</math>, and <math>y = (x \pm h)^2</math>.</li> <li>• Write perfect square trinomials in standard and factored form.</li> <li>• Complete the square to find an equivalent form of a quadratic equation.</li> <li>• Multiply two binomials and make the connection to determine new areas in a real world context.</li> <li>• Apply what they know about multiplying binomials to develop a strategy to factor trinomials.</li> <li>• Use what they know about area to factor quadratic trinomials symbolically.</li> <li>• Develop symbolic processes to factor “difference of squares” binomials and perfect square trinomials.</li> <li>• Multiply expressions to create quadratic expressions.</li> <li>• Add and subtract quadratic expressions.</li> <li>• Graph quadratic functions given a quadratic function in factored form.</li> <li>• Identify the intercepts, vertex, line of symmetry, and vertical stretch of a quadratic function.</li> <li>• Investigate the relationship between intercepts of two linear functions and the intercepts of the product of those linear functions.</li> <li>• Determine possible linear factors of a quadratic function given a graph.</li> <li>• Translate among standard, vertex, and factored forms of quadratic equations and their tables and graphs.</li> <li>• Identify functional characteristics of quadratic equations given an equation, table, or graph.</li> </ul>

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<b>Topic 3: Solving Quadratic Equations</b>	<p>Students will solve quadratic equations through various methods and will apply these methods strategically to solve problems most efficiently. They will derive the quadratic formula and will use apply their knowledge of quadratic functions to explain the Pythagorean Theorem.</p> <p><b><u>Concepts:</u></b></p> <ul style="list-style-type: none"> <li>• Solve quadratic equations using the zero product property.</li> <li>• Solve quadratic equations in vertex form by factoring, by square roots, and by graphing.</li> <li>• Derive the quadratic formula to find the <math>x</math>-intercepts of the graph of a quadratic function.</li> <li>• Solve quadratic equations by applying techniques for transforming quadratic equations.</li> <li>• Solve quadratic equations using different methods (tables, factoring, completing the square, quadratic formula, and graphing) and determine when one method would work better than another.</li> <li>• Solve systems of quadratic and linear equations symbolically or by graphing.</li> <li>• Derive the Pythagorean Theorem using algebraic manipulation.</li> <li>• Calculate lengths of sides and measures of angles in right triangles.</li> <li>• Apply the Pythagorean Theorem to calculate a missing length in a right triangle.</li> <li>• Apply the Pythagorean Theorem to determine a length in three dimensions.</li> <li>• Calculate the distance between two points on a coordinate plane.</li> <li>• Derive the distance formula.</li> </ul>