UbD: Algebra 1 - Quadratic Equations

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<tr><td>Time Frame: 24 Lessons</td><td>Unit 7: Introduction to Quadratic Functions</td><td>Course Name: Algebra 1</td></tr>
<tr><td colspan="3">Stage 1: Desired Results</td></tr>
<tr><td>Established Goal(s)</td><td colspan="2">Transferable Skills</td></tr>
<tr><td rowspan="4">Competencies Addressed:
Quadratic Equations

Standards:
HSA-REI.B.4 Solve quadratic equations in one variable.
HSA-REI.B.4.a Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x - p)2 = q that has the same solutions. Derive the quadratic formula from this form.
HSA-REI.B.4.b Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.
HSA-REI.C.7 Solve a simple system consisting of a linear equation and a quadratic</td><td colspan="2">Students will be able to independently use their learning to...

● students interpret, write, and solve quadratic equations.
● write and solve quadratic equations in a way to precisely describe and answer questions about quadratic functions.
● develop clear and effective communication.
● increase self-direction.
● develop creative and practical problem-solving.
● become responsible and involved citizens.
● develop informed and integrative thinking.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td><u>Understandings</u>
Students will understand that...

● quadratics for a parabolic graph.
● that they can find unknown inputs.
● there are multiple ways to solve a quadratic equation.
● completing the square is one way to solve a quadratic equation.
● the quadratic formula is another way to solve a quadratic equation
● the vertex form of the parabola can be used when graphing a quadratic equation
● with practice they will be able to identify the most efficient way to solve a quadratic equation</td><td><u>Essential Questions</u>

● How are quadratic functions used to model, analyze and interpret mathematical relationships?
● Why is it advantageous to know a variety of ways to solve and graph quadratic functions?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
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equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = -3x and the circle x2 + y2 = 3. **HSA-REI.D.10** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). **HSA-SSE.A.1** Interpret expressions that represent a quantity in terms of its context. **HSA-SSE.A.2** Use the structure of an expression to identify ways to rewrite it. For example, see x4 - y4 as (x2)2 - (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 - y2)(x2 + y2). **HSA-SSE.B.3.a** Factor a quadratic expression to reveal the zeros of the function it defines. **HSA-SSE.B.3.b** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. **HSF-IF.A.2** Use function notation, evaluate functions	*Students will know....* • that quadratic equations may have two solutions. • explain why dividing by a variable to solve a quadratic equation is not a good strategy. • that quadratic equations can have no solutions and can explain why there are none. • how the numbers in a quadratic expression in factored form relate to the numbers in an equivalent expression in standard form. • how to rewrite them in standard form given quadratic expressions in factored form. • that when given quadratic expressions in the form of ax^2+bx+c, they can rewrite them in factored form. • when given a quadratic expression given in standard form with a negative constant term, write an equivalent expression in factored form. • when given quadratic expressions in the form of , rewrite them in factored form. • how to rearrange a quadratic equation to be written as =0 and find the solutions. • how to recognize quadratic equations that have 0, 1, or 2 solutions when they are written in factored form. • how to use the factored form of a quadratic expression or a graph of a quadratic function to answer questions about a situation. • when given quadratic expressions of the form and is ax^2+bx+c and a is not 1, how to write equivalent expressions in factored form. • how to recognize perfect-square expressions written in different forms. • how to recognize quadratic equations that have a perfect-square expression and solve the equations. • how to explain what it means to "complete the square" and describe how to do it.	*Students will be able to....* • explain the meaning of a solution to an equation in terms of a situation. • write a quadratic equation that represents a situation. • recognize the factored form of a quadratic expression and know when it can be useful for solving problems. • use a graph to find the solutions to a quadratic equation but also know its limitations. • find solutions to quadratic equations by reasoning about the values that make the equation true. • explain the meaning of the "zero product property." • find solutions to quadratic equations when one side is a product of factors and the other side is zero. • explain how the numbers and signs in a quadratic expression in factored form relate to the numbers and signs in an equivalent expression in standard form. • explain why multiplying a sum and a difference, (x+m)(x-m) , results in a quadratic expression with no linear term. • explain the steps and complete some missing steps for deriving the quadratic formula. • explain why adding a rational number and an irrational number produces an irrational number.

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for inputs in their domains, and interpret statements that use function notation in terms of a context. **HSF-IF.B.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. **HSF-IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. **HSF-IF.C7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. **HSF-IF.C.7.a** Graph linear and quadratic functions and show intercepts, maxima, and minima. **HSF-IF.C.8.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. **HSF-IF.C.9** Compare	• how to solve quadratic equations by completing the square and finding square roots. • when given a quadratic equation in which the coefficient of the squared term is 1, they can solve it by completing the square. • how to complete the square for quadratic expressions of the form when is not 1 and explain the process. • how to solve quadratic equations in which the squared term coefficient is not 1 by completing the square. • why the plus-minus symbol is used when solving quadratic equations by finding square roots. • how to use the quadratic formula to solve quadratic equations. • some methods for solving quadratic equations can be more convenient than others. • how to use the quadratic formula to solve an equation and interpret the solutions in terms of a situation. • explain why multiplying a rational number (except 0) and an irrational number produces an irrational number. • explain why sums or products of two rational numbers are rational. • explain why adding a rational number and an irrational number produces an irrational number. • identify the vertex of the graph of a quadratic function when the expression that defines it is written in vertex form. • the meaning of the term "vertex form" and can recognize examples of quadratic expressions written in this form. • when given a quadratic expression in standard form, rewrite it in vertex form. • find the maximum or minimum of a function by writing the quadratic expression that defines it in vertex form. • when given a quadratic function in vertex form, explain why the vertex is a maximum or minimum.	• decide which form to use depending on the questions being asked in situations modeled by quadratic functions. • interpret information about a quadratic function given its equation or a graph. • explain why multiplying a rational number (except 0) and an irrational number produces an irrational number. • explain why sums or products of two rational numbers are rational. • know how the quadratic formula is related to the process of completing the square for a quadratic equation. • use the radical and "plus-minus" symbols to represent solutions to quadratic equations. • identify common errors when using the quadratic formula. • recognize several ways to tell if a number is a solution to a quadratic equation. Mathematical Practices: • make sense of problems and persevere in solving them. • reason abstractly and quantitatively. • construct viable arguments and critique the reasoning of others. • model with mathematics. • use appropriate tools strategically. • attend to precision. • look for and make use of structure. • look for and express regularity in repeated reasoning.

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properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). .	• rewrite quadratic functions in different but equivalent forms of my choosing and use that form to solve problems.	