

# UbD: Algebra 1 - Introduction to Quadratic Functions

Time Frame: 17 Lessons	Unit 6: Introduction to Quadratic Functions	Course Name: Algebra 1
Stage 1: Desired Results		
Established Goal(s)	Transferable Skills	
<b>Competencies Addressed:</b> Introduction to Quadratic Functions  <b>Standards:</b> <b>HSA-SSE.A.1</b> Interpret expressions that represent a quantity in terms of its context. <b>HSA-SSE.A.2</b> Use the structure of an expression to identify ways to rewrite it.. <b>HSA-SSE.B.3</b> Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. <b>HSF-BF.A.1</b> Write a function that describes a relationship between two quantities. <b>HSF-BF.A.1.a</b> Determine an explicit expression, a recursive process, or steps for calculation from a context. <b>HSF-BF.B.3</b> 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	<i>Students will be able to independently use their learning to...</i> <ul style="list-style-type: none"> <li>look at patterns which grow quadratically and contrast them with linear and exponential growth.</li> <li>examine other quadratic relationships via tables, graphs, and equations, gaining appreciation for some of the special features of quadratic functions and the situations they represent.</li> <li>develop clear and effective communication.</li> <li>increase self-direction.</li> <li>develop creative and practical problem-solving.</li> <li>develop informed and integrative thinking.</li> </ul>	
	Meaning	
	<u>Understandings</u> <i>Students will understand that...</i> <ul style="list-style-type: none"> <li>not all change is linear.</li> <li>expressing some relationships of change will require a quadratic function.</li> <li>quadratic relationships are evident in real life phenomena.</li> <li>quadratic expressions come in a variety of forms and the different forms lend themselves to different forms of the same solutions.</li> <li>they can identify features of graphs of quadratic functions.</li> </ul>	<u>Essential Questions</u> <ul style="list-style-type: none"> <li>How can I develop previous algebra skills so I can be successful in solving quadratic equations?</li> <li>How are quadratic functions used to model, analyze and interpret mathematical relationships?</li> <li>Why is it advantageous to know a variety of ways to solve and graph quadratic functions?</li> </ul>

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algebraic expressions for them.  
**HSF-IF.A.2** Use function notation, evaluate functions 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.C.7** 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** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

**HSF-IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal

## Acquisition

*Students will know...*

- how to create drawings, tables, and graphs that represent the area of a garden.
- choose a domain that makes sense in a revenue situation.
- model revenue with quadratic functions and graphs.
- relate the vertex of a graph and the zeros of a function to a revenue situation.
- rewrite quadratic expressions in different forms by using an area diagram or the distributive property.
- rewrite quadratic expressions given in factored form in standard form using either the distributive property or a diagram.
- the difference between "factored form" and "standard form."
- explain the meaning of the intercepts on a graph of a quadratic function in terms of the situation it represents.
- how the numbers in the factored form of a quadratic expression relate to the intercepts of its graph.
- graph a quadratic function given in factored form.
- how to find the vertex and -intercept of the graph of a quadratic function in factored form without graphing it first.
- explain how  $a$  and the  $c$  in  $y=ax^2+bx+c$  affect the graph of the equation.
- understand how graphs, tables, and equations that represent the same quadratic function are related.
- explain how the  $b$  in  $y=ax^2+bx+c$  affects the graph of the equation.
- match equations given in standard and

*Students will be able to...*

- recognize a situation represented by a graph that increases then decreases.
- describe how a pattern is growing.
- tell whether a pattern is growing linearly, exponentially, or quadratically.
- an expression with a squared term is called quadratic.
- recognize quadratic functions written in different ways.
- use information from a pattern of shapes to write a quadratic function.
- that, in a pattern of shapes, the step number is the input and the number of squares is the output.
- explain using graphs, tables, or calculations that exponential functions eventually grow faster than quadratic functions.
- explain the meaning of the terms in a quadratic expression that represents the height of a falling object.
- use tables, graphs and equations to represent the height of a falling object.
- create quadratic functions and graphs that represent a situation.
- relate the vertex of a graph and the zeros of a function to a situation.
- that the domain of a function can depend on the situation it represents.

Mathematical Practices:

- make sense of problems and persevere in solving them.
- reason abstractly and quantitatively.
- construct viable arguments and critique the reasoning of others.

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descriptions).

**HSF-LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

**HSF-LE.A.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.

- explain how a quadratic equation and its graph relate to a situation.
- recognize the "vertex form" of a quadratic equation.
- relate the numbers in the vertex form of a quadratic equation to its graph.
- graph a quadratic function given in vertex form, showing a maximum or minimum and the  $y$ -intercept.
- how to find a maximum or a minimum of a quadratic function given in vertex form without first graphing it.
- describe how changing a number in the vertex form of a quadratic function affects its graph.

- 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.