# Unit 02 Quadratic Functions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 1**
Length: **14 days**
Status: **Published**

## Brief Summary of Unit

The major work of this chapter is understanding characteristics of quadratic functions and writing equations of parabolas. Modeling with quadratic functions and graphing transformations of quadratic functions are also included in this chapter. The same transformations from the first chapter are reviewed with quadratic functions. The vertex of an absolute value function and the vertex of a quadratic function are key points that help students quickly identify the type(s) of transformation(s) represented by a graph. In the second section, students examine characteristics of quadratic functions and parabolas. Where is the function increasing or decreasing? Where is the axis of symmetry? What is the maximum or minimum value of the function? They will also use quadratic regression to find quadratic models. There are three common forms in which quadratic functions are written, and each gives information about the graph and the behavior of the function. Understanding the connection between the characteristics of a quadratic function and its equation can help students apply their knowledge when working with real-life applications.

**Revised Date:** July 2025

## Standards

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| ELA.K-12.1 | Developing Responsibility for Learning: Cultivating independence, self-reflection, and responsibility for one's own learning. |
| ELA.K-12.2 | Adapting Communication: Adapting communication in response to the varying demands of audience, task, purpose, and discipline. |
| ELA.K-12.3 | Valuing Evidence in Argumentation: Constructing viable claims and evaluating, defending, challenging, and qualifying the arguments of others. |
| ELA.K-12.4 | Building Knowledge: Building strong content knowledge and connecting ideas across disciplines using a variety of text resources and media. |
| MATH.9-12.S.ID.B.6.a | Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. |
| MATH.9-12.F.BF.B.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. |
| MATH.9-12.S.ID.C.8 | Compute (using technology) and interpret the correlation coefficient of a linear fit. |
| MATH.9-12.A.CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. |
| MATH.9-12.F.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 |

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| | a verbal description of the relationship. |
| MATH.9-12.F.IF.B.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. |
| MATH.9-12.F.IF.C.7.c | Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. |
| MATH.9-12.F.IF.C.9 | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). |
| TEC.K-12.8.1 | All students will use computer applications to gather and organize information and to solve problems. |
| TEC.K-12.8.2 | All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment. |
| WORK.K-12.9.1 | All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace. |
| WORK.K-12.9.2 | All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace. |

## Essential Questions

- How can a given function be identified as a quadratic function?
- What are the different forms of equations of parabolas?
- What characteristics of a graph depicts a quadratic function?

## Enduring Understandings

- Quadratic functions are graphed by a symmetric curve with a highest or lowest point (vertex) corresponding to an absolute maximum or minimum value.
- The family of quadratic functions models certain situations where the rate of change is NOT CONSTANT.

## Students Will Know

- Students will know how to identify characteristics of the graphs of quadratic functions.
- Students will know that they can model real-world situations with quadratic functions.
- Students will write different forms of equations of parabolas.

## Students Will Be Skilled At

- Students will be skilled at describing transformations of quadratic functions.
- Students will be skilled at graphing transformations of quadratic functions.
- Students will be skilled at identifying characteristics of quadratic functions and their graphs.
- Students will be skilled at using characteristics of quadratic functions to solve real life problems.

- Students will be skilled at using technology to find a quadratic model for a set of data.
- Students will be skilled at using three forms of quadratic equations (vertex, intercept, standard) to graph quadratic equations.
- Students will be skilled at writing equations of quadratic functions using vertices, points, and x-intercepts.
- Students will be skilled at writing functions that represent transformations of quadratic functions.
- Students will be skilled at writing quadratic equations to model data sets.

## Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

## Learning Plan

Unit 2 Graphing Quadratic Functions (3 weeks) (Big Ideas Chapter 2.1, 2.2, 2.4)

2.1 Transformations (2 days)

- Students will apply knowledge from previous chapter to quadratic functions, using x^2 as the new parent function
- Transformations will include: horizontal and vertical translations, reflections over both x and y axis, and vertical stretches.
- Students will graph a transformed equation

- Students will write equation, given a graph
- Given a description of transformations, students will name the equation and graph the equation.
- Students will name the vertex as a characteristic of the graph and identify the values for (h, k) in the equation.
- Students will recognize y=a(x-h)2 +k as the vertex form of a quadratic equation.

2.2 Graphing using 3 Forms of Quadratic Equations (3 days)

- Introduce the Axis of Symmetry focusing on its relationship with the vertex and how points on the parabola are reflected across the Axis of Symmetry
- Graph a quadratic given in vertex form, using Axis of Symmetry to quickly find additional points on the curve.
- Derive Standard Form by expanding Vertex Form.
- Recognize properties of the graph of a quadratic in Standard Form: whether it opens up or down, how to calculate the Axis of Symmetry and the Vertex, finding the y-intercept.
- Graph a Quadratic in Standard Form
- Identify characteristics of the Graph of a Quadratic curve: name the maximum or minimum value, name the increasing and decreasing interval, name the domain and range.
- Discuss Intercept Form, y=a(x-p)(x-q), including the vertex can be found by finding the midpoint between p and q and substituting the value for the x-coordinate of the vertex back into the equation to find the y-coordinate.
- Use quadratic models of real life problems to answer questions about the problem: max height, furthest distance, etc.

2.4 Finding Equations of Quadratic Equations (2 days)

- Given the vertex and a point on the parabola, find the equation of the parabola in vertex form (solve for a); be able to expand to standard form.
- Given the intercepts and a point on the parabola, find the equation of the parabola in intercept form; be able to expand to standard form.
- Find the average rate of change from the vertex to each intercept; interpret the results
- Use technology (graphing calculator, or desmos) to find a regression equation that fits the data. Interpret its correlation coefficient and use the equation to predict.

Frequent assessments, with next-day results, should be given throughout this chapter as there is a lot of new material that should be memorized.

Each section, in and of itself, could have it's own big assessment.

Real life examples could be used to review for a large chapter test.

## Materials

Core instructional materials:Core Book List including Big Ideas Math Algebra 2 2022

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook and ancillary materials.
- Online resources:  Delta Math, Edia, Ed Puzzle, Khan Academy
- Teacher created activiites
- Teacher created notes

## Suggested Strategies for Modifications

QSAC Accomodations for Algebra 2/Intro to Trig CP