

# Unit 6: Quadratic Functions and Equations

## Algebra 1

10 Class Meetings

Created July 2020; Revised May 2022

### Essential Questions

- What are the characteristics of quadratic functions?
- How can you solve a quadratic equation?
- How can you use functions to model real-world situations?

### Enduring Understandings with Unit Goals

- EU 1:** Quadratic equations can be solved by a variety of methods.
- Solve a quadratic equation through graphing estimating the solutions
  - Solve quadratic equations by graphing and finding square roots.
  - Solve quadratic equations by factoring.
  - Solve quadratic equations by using the quadratic formula.
- EU 2:** Functions can be used to model and solve real-world problems.
- Solve real-world problems using linear and quadratic equations.

### Standards

#### Common Core State Standards/College and Career Readiness Anchor Standards :

- **HS.A.SSE.B.3.A:** Factor a quadratic expression to reveal the zeros of the function it defines.
- **HS.A.REI.B.4:** Solve quadratic equations in one variable.
- **HS.A.REI.B.4.B:** Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, the quadratic formula, and factoring, as appropriate to the initial form of the equation.
- **HS.A.REI.C.7:** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
- **HS.F.IF.C.7.A:** Graph linear and quadratic functions and show intercepts, maxima, and minima.

### ISAAC Vision of the Graduate Competencies

- Competency 1:** Write effectively for a variety of purposes.
- Competency 2:** Speak to diverse audiences in an accountable manner.
- Competency 3:** Develop the behaviors needed to interact and contribute with others on a team.
- Competency 4:** Analyze and solve problems independently and collaboratively.
- Competency 5:** Be responsible, creative, and empathetic members of the community.

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### Unit Content Overview

#### 1. Quadratic Graphs and Their Properties

- Find the Standard Form of a Quadratic Function
- Identify a Vertex
- Graph  $y = ax^2$
- Graph  $y = ax^2 + c$
- Vocabulary: Ordered pair, point, coordinate plane, x-axis, y-axis, y-intercept, parabola, vertex, axes of symmetry, symmetry, quadratic, trinomial, function, standard form, exponent, coefficient, leading coefficient, term

#### 2. Quadratic Functions

- Graph of a Quadratic Function
- Graph  $ax^2 + bx + c$
- Vocabulary: Ordered pair, point, coordinate plane, x-axis, y-axis, y-intercept, parabola, vertex, axes of symmetry, symmetry, quadratic, trinomial, function, standard form, exponent, coefficient, leading coefficient, term

#### 3. Solving Quadratic Equations

- Standard Form of a Quadratic Equation
- Solve a Quadratic Equation by Graphing
- Solve a Quadratic Equation by Using Square Roots
- Vocabulary: quadratic, trinomial, function, standard form, exponent, coefficient, leading coefficient, term, radical, square root

#### 4. Factoring to Solve Quadratic Equations

- Solve a Quadratic Equation using the Zero-Product Property
- Vocabulary: quadratic, trinomial, function, standard form, exponent, coefficient, leading coefficient, term, radical, square root

#### 5. The Quadratic Formula and the Discriminant

- Use the Quadratic Formula to Solve a Quadratic Equation approximating its solution
- Find the Discriminant and use the discriminant to determine the properties of the roots
- Determine and apply the best method to solve a Quadratic Equation
- Vocabulary: quadratic, trinomial, function, standard form, exponent, coefficient, leading coefficient, term, radical, square root, discriminant

#### 6. Systems of Linear and Quadratic Equations

- Solve a system of linear and quadratic equations through Graphing
- Solve a system of linear and quadratic equations through Elimination
- Solve a system of linear and quadratic equations through Substitution
- Solve a system of linear and quadratic equations using a Graphing Calculator
- Vocabulary: quadratic, trinomial, function, standard form, exponent, coefficient, leading coefficient, multiplicative inverse, additive inverse, an intersection point

#### Interdisciplinary Connection:

- Language Arts- Accountable Talk, Word Problems

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#### Daily Learning Objectives with TWPS Activities

##### Students will be able to...

- Graph quadratic functions of the form  $y = ax^2$  and  $y = ax^2 + c$ 
  - *Do Now: Finding values for functions*
- Graph quadratic functions of the form  $y = ax^2 + bx + c$ 
  - *Do Now: Factoring a Trinomial (revisited)*
- Solve quadratic equations by graphing and using square roots
  - *Do Now: Finding the vertex and axis of symmetry*
- Solve quadratic equations by factoring
  - *Do Now: Solving an equation containing fractions & decimals*
- Solve quadratic equations by using Square Root Property and Completing the Square
  - *Do Now: Components of the Parabola*
- Find the number of solutions of a quadratic equation
- Solve quadratic equations by using the quadratic formula
  - *Do Now: The Discriminant*
- Solve systems of linear and quadratic equations
  - *Do Now: Solve a System of Linear Equations (revisited)*

#### Instructional Strategies/Differentiated Instruction

- Whole-group instruction
- Creating authentic connections for students
- Rephrasing and restatement of information and concepts
- Guided notes
- Student-led instruction
- Small group instruction
- Independent problem-solving
- Collaborative problem-solving
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Manipulatives
- Homework

##### EL DIFFERENTIATED INSTRUCTION:

- Word Walls with visuals
- TWPS (Think, Write, Pair, Share)
- Pre-reading strategies
- Culturally responsive teaching
- Explicit Modeling
- Key Vocabulary
- Graphic Organizers
- Non-verbal Assessments
- Strategic Grouping

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#### Assessments

##### **FORMATIVE ASSESSMENTS:**

- Accountable Talk Discussions
- Daily Think-Write-Pair Share (TWPS)
- Warm-Ups (SBAC prep)
- ABCD Cards
- Whiteboards
- Mid-class check-ins
- Exit Slips
- Student-led instruction
- Homework

##### **SUMMATIVE ASSESSMENTS:**

- Unit 6 Assessment (EU 1, EU 2) – Edulastic
- Performance Task - Smartphone Profit  
ISAAC Problem Solving Rubric

#### Unit Task

**Unit Task Name:** Smart Phone Profit

**Description:** Students will use information learned during this unit about the key features of the graphs of quadratic equations, how to solve quadratic equations using several different methods (EU 2), and how to use quadratics to model real-world situations (EU 3) compare and contrast profit functions for different companies selling smartphones. Students will be given information about each company in different forms (tables, graphs, etc.) and will be asked to write equations and sketch graphs for each of the profit functions. Students will use these equations and graphs to describe the long-term trend in profit for each of the companies. They will use their data to choose a company that they would invest in. Students will finally write a reflection on the assignment describing which company has the best future and which method of solving and graphing they like the best.

**Evaluation:** ISAAC Problem Solving Rubric

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#### Unit Resources

- Flipped Google Classroom Videos
- Worksheets
- Calculator
- Laptops
- SBAC Prep Online
- Kahn Academy
- Match Fishtank
- Map.Mathshell.org
- Online resources