Unit Three Information

Georgia Milestones Domain & Weight:
Algebra and Functions (includes Number and Quantity) 60%

Curriculum Map: Modeling and Analyzing Quadratic Functions

Content Descriptors:
- Concept 1: Factoring Quadratics
- Concept 2: Solving Quadratics
- Concept 3: Graphing Quadratics
- Concept 4: Characteristics of Quadratics
- Concept 5: Applications of Quadratics

Content from Frameworks: Modeling & Analyzing Quadratic Functions

Unit Length: Approximately 40 days

Georgia Milestones Study Guide for Modeling & Analyzing Quadratic Functions
**TCSS – GSE Algebra I Unit 3**
**Curriculum Map**

**Unit Rational:**
Students will analyze quadratic functions only. Students will (1) investigate key features of graphs; (2) solve quadratic equations by taking square roots, factoring \((x^2 + bx + c)\) AND \(ax^2 + bx + c\), completing the square, and using the quadratic formula; (3) compare and contrast graphs in standard, vertex, and intercept forms. Students will only work with real number solutions.

**Prerequisites: As identified by the GSE Frameworks**
- Use Function Notation
- Graph data from tables
- Solve one variable linear equations
- Solve for any variable in a multi-variable equation
- Graph linear functions

*Put data into tables*
*Distinguish between linear and non-linear functions*
*Determine domain of a problem situation*
*Recognize slope of a linear function as a rate of change*
*Graph inequalities*

**Length of Unit**
40 Days

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<thead>
<tr>
<th>Concept 1 Factoring</th>
<th>Concept 2 Solving</th>
<th>Concept 3 Graphing</th>
<th>Concept 4 Characteristics</th>
<th>Concept 5 Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpret the structure of expressions.</td>
<td>Solve equations and inequalities in one variable.</td>
<td>Analyze functions using Different representations.</td>
<td>Identify and interpret key features of graphs and tables (quadratic functions).</td>
<td>Create equations that describe numbers or relationships.</td>
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<tr>
<td>Write expressions in equivalent forms to solve problems.</td>
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<td>Build new functions from existing functions.</td>
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<td>Interpret functions that arise in applications in terms of the context.</td>
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<tr>
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<td></td>
<td>Analyze functions using different representations.</td>
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<td>Build a function that models a relationship between two quantities.</td>
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<td>Understand the concept of a function and use function notation.</td>
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</table>

<table>
<thead>
<tr>
<th>Concept 1 GSE Standards</th>
<th>Concept 2 GSE Standards</th>
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<th>Concept 5 GSE Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>MGSE9-12.A.SSE.2 Use the structure of an expression to rewrite it in different equivalent forms. For example, see (x^4 - y^4) as ((x^2)^2 - (y^2)^2), thus recognizing it as a difference of</td>
<td>MGSE9-12.A.REI.4 Solve quadratic equations in one variable.</td>
<td>MGSE9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.</td>
<td>MGSE9-12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch graphs</td>
<td>MGSE9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational</td>
</tr>
<tr>
<td>MGSE9–12.A.SSE.3</td>
<td>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</td>
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<tr>
<td>MGSE9–12.A.SSE.3a</td>
<td>Factor any quadratic expression to reveal the zeros of the function defined by the expression.</td>
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<tr>
<td>MGSE9–12.A.SSE.3b</td>
<td>Complete the square in a quadratic expression to reveal the maximum and minimum value of the function defined by the expression.</td>
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<tr>
<td>MGSE9–12.A.SSE.3b</td>
<td>Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. Examples: Rearrange Ohm’s law $V = IR$ to highlight resistance $R$; Rearrange area of a circle formula $A = \pi r^2$ to highlight the radius.</td>
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<tr>
<td>MGSE9–12.A.REE.4b</td>
<td>Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation. (Limit to real number solutions).</td>
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<tr>
<td>MGSE9–12.A.REI.4b</td>
<td>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 $ax^2 + bx + c = 0$.</td>
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<tr>
<td>MGSE9–12.F.IF.7a</td>
<td>Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).</td>
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<tr>
<td>MGSE9–12.F.IF.7a</td>
<td>Showing key features including: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</td>
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<tr>
<td>MGSE9–12.F.IF.7a</td>
<td>Complete the square in a quadratic expression to reveal the maximum and minimum value of the function defined by the expression.</td>
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<tr>
<td>MGSE9–12.F.IF.7a</td>
<td>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. For example, compare and contrast quadratic functions in standard, vertex, and intercept forms.</td>
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</table>
| MGSE9–12.F.IF.7a | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.
## TCSS – GSE Algebra I Unit 3

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<tr>
<th>Concept 1 Lesson Essential Question</th>
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</tr>
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<tr>
<td>How is a relation determined to be quadratic?</td>
<td>How do you solve a quadratic equation?</td>
<td>What information can be gathered from the table of values and the graph of a relation?</td>
<td>Where is the maximum or minimum value of a quadratic equation located?</td>
<td>How do you create and solve quadratic equations and inequalities from context?</td>
</tr>
<tr>
<td>Are all quadratic expressions factorable?</td>
<td>How do you factor a quadratic expression?</td>
<td>How do you graph a quadratic function?</td>
<td>What does the domain of a function tell about the quantitative relationship of the given data?</td>
<td>How is the rate of change for a quadratic function different from the rate of change for a linear function?</td>
</tr>
<tr>
<td>How do you factor a quadratic expression?</td>
<td>What are two equivalent forms of a Quadratic expression?</td>
<td>How can the graph of ( f(x) = x^2 ) move left, right, up, down, stretch, or compress?</td>
<td>What are and how do you find the important parts of a quadratic function?</td>
<td>How do you evaluate functions interpret the solution in context?</td>
</tr>
</tbody>
</table>

### Concept 1 Vocabulary
- Quadratic Expression
- Quadratic Equation
- Quadratic Function
- Standard Form
- Vertex Form
- Standard Form
- Difference of squares
- Perfect Square
- Trinomial
- Factors
- Factorization
- Binomial

### Concept 2 Vocabulary
- Solution
- x-intercept
- roots
- zeros
- Square Root Method
- Quadratic Formula
- Discriminant

### Concept 3 Vocabulary
- Horizontal Shift
- Vertical Shift
- Stretch
- Shrink (compress)
- Reflection
- Parabola
- Axis of Symmetry
- Vertex

### Concept 4 Vocabulary
- Domain
- Range
- y-intercept
- Extrema
- Maximum
- Minimum
- End behaviors
- Increasing
- Decreasing
- Inequality

### Concept 5 Vocabulary
- Rate of Change
- Linear
- Function Notation
- Input
- Output

<p>| Concept 1 Sample Assessment Items | Concept 2 Sample Assessment Items | Concept 3 Sample Assessment Items | Concept 4 Sample Assessment Items | Concept 5 Sample Assessment Items |</p>
<table>
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<tr>
<th>Resources – Concept 1 Factoring</th>
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<tr>
<td>✓ Factoring Practice</td>
<td>✓ Graphic organizer – Quadratic Formula 1</td>
<td>✓ Graphic Organizer (graphing foldable)</td>
<td>✓ Graphic Organizer with practice – discovering transformations</td>
<td>✓ Quadratic Applications TicTacToe KEY</td>
</tr>
<tr>
<td>✓ Find Someone Who…</td>
<td>✓ Factoring Study Guide</td>
<td>✓ Graphing Organizer (AOS and vertex)</td>
<td>✓ Exploring quadratic function transformations</td>
<td>✓ Ticket Out the Door KEY</td>
</tr>
<tr>
<td>✓ Ticket out the door (A.SSE.2)</td>
<td>✓ Guided Quadratic Formula practice</td>
<td>✓ Graphing worksheet (AOS and vertex)</td>
<td>✓ Rate of Change Practice</td>
<td>✓ Quadratic applications graphs</td>
</tr>
<tr>
<td>✓ Graphic organizer – vertex to standard form</td>
<td>✓ Activator/Summarizer</td>
<td>✓ Practice worksheet</td>
<td>✓ These tasks were taken from the GSE Frameworks.</td>
<td></td>
</tr>
<tr>
<td>✓ Practice worksheet – standard to vertex form</td>
<td>✓ Solving &amp; Graphing Quadratic Functions (guided notes) with examples</td>
<td>✓ Exploring quadratic function transformations</td>
<td>➤ Sorting Functions (activator) – F.IF.7&amp;8</td>
<td>➤ Functions – A.CED.1</td>
</tr>
<tr>
<td>These tasks were taken from the GSE Frameworks.</td>
<td>✓ Graphic Organizer (graphing from std/vertex form)</td>
<td>✓ Rate of Change Practice</td>
<td>✓ Graphing Transformations – F.BF.3</td>
<td>➤ Quadratic Fanatic (culminating task)</td>
</tr>
<tr>
<td>➤ Sorting Equations &amp; Identities (FAL) – A.SSE.1-3</td>
<td>✓ Graphing with partners activity</td>
<td>✓ These tasks were taken from the GSE Frameworks.</td>
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## Concept 1
- Differentiated Activities
- Matching Factors Activity (A.SSE.3 & 3a)

## Concept 2
- Differentiated Activities
- Solving using QR codes

## Concept 3
- Differentiated Activities
- Domino FAL
- These tasks were taken from the GSE Frameworks.
- Forming Quadratics

## Concept 4
- Differentiated Activities

## Concept 5
- Differentiated Activities
- Graphing and Application task
- Building and Combining Functions

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<thead>
<tr>
<th>Concept 1 Resources recommended for Math Support</th>
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<tr>
<td>❖ Interactive Vocabulary Site (differentiate how vocabulary is presented)</td>
<td>❖ edHelper practice worksheets</td>
<td>❖ Step by step graphing</td>
<td>❖ Angry Birds Project</td>
<td>❖ Quadratic Drop Problems KEY</td>
</tr>
<tr>
<td>❖ Math Trick</td>
<td>❖ A.REI.4 DOE Notes</td>
<td>❖ Graphing Quadratics</td>
<td>❖ GADOE Notes</td>
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<td>❖ Riddles</td>
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<td>❖ Sudoku</td>
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<td>❖ McDougal Littell – Georgia Notetaking Guide pg (98-101)</td>
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### At the end of Unit 3 student’s should be able to say “I can…”

- focus on quadratic functions, equations, and applications
- explore variable rate of change
- learn to factor general quadratic expressions completely over the integers and to solve general quadratic equations by factoring by working with quadratic functions that model the behavior of objects that are thrown in the air and allowed to fall subject to the force of gravity
- learn to find the vertex of the graph of any polynomial function and to convert the formula for a quadratic function from standard to vertex form
- apply the vertex form of a quadratic function to find real solutions of quadratic equations that cannot be solved by factoring
- explore only real solutions to quadratic equations
- explain why the graph of every quadratic function is a translation of the graph of the basic function \( f(x) = x^2 \)
- apply the quadratic formula
- justify the quadratic formula