Course: Algebra I **Unit # and Name:** Unit #4 Quadratics	**Year of Implementation:** 2019-2020

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
https://www.state.nj.us/education/cccs/2016/math/standards.pdf

Unit Standards:

Quantities N-Q: 1

- Reason quantitatively and use units to solve problems

Seeing Structure in Expressions A-SSE: 1a, 2, 3a, 3b

- Interpret the structure of expressions
- Write expressions in equivalent form to solve problems

Creating Equations A-CED: 2,4

- Create equations that describe numbers or relationships

Reasoning with Equations and Inequalities A-REI: 1,3

- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Represent and solve equations and inequalities graphically

Interpreting Functions F-IF: 1,2,7a, 8a, 9

- Understand the concept of a function and use function notation.
- Analyze functions using different representations.

Building Functions F-BF: 3

- Build new functions from existing functions.

Interpreting Categorical and Quantitative Data S-ID: 6a,6c,7,8

- Summarize, represent, and interpret data on two categorical and quantitative variables

21st Century Themes:

___Global Awareness
_x_Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
___Health Literacy
___Environmental Literacy

21st Century Skills:

Learning and Innovation Skills:
_x_Creativity and Innovation
_x_Critical Thinking and Problem Solving
_x_Communication and Collaboration

Information, Media and Technology Skills:
_x_Information Literacy
_x_Media Literacy
_x_ICT (Information, Communications and Technology) Literacy

Life and Career Skills:

_x_Flexibility and Adaptability
_x_Initiative and Self-Direction
___Social and Cross-Cultural Skills
_x_Productivity and Accountability
_x_Leadership and Responsibility

Transfer Goal(s): Students will be able to independently use their learning to...compare different models and effectively communicate their reasoning.

Enduring Understandings	*Essential Questions*
Students will understand that... EU1 real world situations can be represented symbolically and graphically. EU2 in mathematical relationships, the value for one quantity depends on the value of another quantity.	EU1 How do I use algebraic expressions to analyze and solve problems? EU2 How does the value of one variable affect the value of another variable?
Knowledge Students will know... EU1 ● quadratic functions are used to model real-world situations that are non-linear. ● quadratic functions are used to analyze data. EU2 ● output values are dependent on input values.	*Skills* Students will be able to... EU1 ● graph a quadratic equation by hand and on the calculator. ● find the vertex (min/max), zeros, and y-intercept. ● describe how changing the key characteristics of the function transform the parent function. ● solve quadratic applications that model real-world phenomena.

	● analyze and compare the graphs of quadratic functions using algebraic and calculator techniques. EU2 ● predict future outcomes using quadratic models.

Stage Two - Assessment

Other Evidence:

Tests/Quizzes on graphing quadratics with and without the TI-Nspire, identifying the vertex as a maximum/minimum, identifying the zeros, solving equations by factoring, applying quadratic equations to real world problems.

Rubrics to assess tasks

Assessed Elements from Recommended Performance Tasks

Other Teacher-Graded Evaluations

Presentations of Student Research

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A=Acquiring basic knowledge and skills, M=Making meaning and/or a T=Transfer.**

Activities:

- **Desmos** - Will it hit the hoop? Introduction to why we need quadratic relationships in the real-world. *Revisit at the end of the unit. **(M/T)** https://teacher.desmos.com/quadratic
- **Transformations TI-Nspire** - Students will investigate various quadratic functions using their TI-Nspire calculators They will analyze the graphs and discover the transformations associated with a quadratic function. **(M)**
- **Characteristics of a Quadratic Function** – Matching Cards Activity **(A)**
- **Understanding the Three Forms of Quadratics** (Standard, Vertex, & Intercept Form) / Matching Domino Activity **(M)**

- **Linear, Quadratic, or Exponential Tables** / Have students explore different types of functions by examining the data shown in different types of tables. **(M)**
- **Quadratic Word Problems Task Cards Activity** (Collaborative Learning/Walk Around the Room) **(A)**

  *Quadratic Keywords Flowchart to be used as a reference for students who are struggling.

Critical Vocabulary: *The following terms should be utilized...*

-axis of symmetry	-coefficient	-minimum	-reflection
-vertex	-standard form	-zeros	
-parabola	-parent quadratic function	-roots	
-quadratic equation/function	-intercept form	-mirror point	
-y intercept	-vertex form	-vertical shift	
-x intercept	-maximum	-horizontal shift	

The following is the suggested sequence of learning activities for the Algebra I ACC class. Adjustments should be made accordingly for other levels.

- Identify characteristics of quadratics by looking at a graph with and without a calculator. Identify the vertex and determine whether it is a maximum/minimum, y-intercept, x-intercepts and state the domain/range.
- Find the vertex using $x = \frac{-b}{2a}$ and determine the minimum or maximum value.
- Graph quadratics in standard form by making a table and using the reflected(mirrored) points.
- Graph quadratics in vertex form by hand.
- Transformations of Quadratics – Comparing to the parent function $y = x^2$ by using the TI-Nspire calculator.
- Analyze and compare the graphs of quadratic functions using algebraic and calculator techniques.
- Determine which model – linear or quadratic – best fits a set of data.
- Use quadratic functions to model real-world phenomena and solve problems that involve varying quantities (projectile motion problems).