

**Summit Public Schools**  
**Summit, New Jersey**  
**Grade Level: 9th and 10th / Content Area: Mathematics**  
**Length of course: Full Academic Year**  
**Algebra 1 - Sheltered**

**Overview:**

This course offers an exploration of Algebra 1 for ESL Students. It has been designed to offer a comprehensive foundation that addresses the newly expanded core content standards for Algebra 1, while also being accessible to students who are learning English for the first time. It will provide students the opportunity to truly master algebraic and mathematics skills that will lead to greater achievement in subsequent courses. Throughout this course students will represent linear functions numerically, algebraically, graphically and verbally and work with and interpret these representations. Students will deepen their understanding of relations and functions and expand their repertoire in working with them. Students will develop insight and understanding of the algebraic properties that govern the manipulation of symbols in expressions, equations, and inequalities. Linear, quadratic, and exponential functions will be used as mathematical modeling tools providing students with a versatile and powerful means for analyzing and solving complex, multi-step, real world problems. Among the goals of this course is to explore algebraic relationships while also sharpening students' skills in working with the English language.

**Submitted By:**  
**Alicia Lyle**  
**Caitlin Reilly**  
**August 2021**

# QUARTER 1

\* Each quarter consists of 42 days and about 36 class periods.

## Unit 1 - Chapters 3 - Graphing Linear Functions

| Section # | Section Title                                                                                                           | Classes |
|-----------|-------------------------------------------------------------------------------------------------------------------------|---------|
| N/A       | ** When applicable, spend a full day introducing students to the online textbook resources we use in the class.         | 1       |
| 3.1       | Functions (domain and range; independent and dependent variables)                                                       | 2       |
| 3.2       | Linear Functions (how to show from tables, discrete and continuous)                                                     | 2       |
| 3.3       | Functional Notation                                                                                                     | 2       |
|           | Review                                                                                                                  | 1       |
| 3.1-3.3   | Quick Quiz and Activity                                                                                                 | 1       |
| 3.5       | Graphing Linear Equations in Slope Intercept Form <ul style="list-style-type: none"><li>• <math>y=mx+b</math></li></ul> | 1       |
| 3.4       | Graphing Linear Equations in Standard Form <ul style="list-style-type: none"><li>• <math>Ax+By=C</math></li></ul>       | 1       |
|           | Review                                                                                                                  | 1       |
|           | Chapter 3 Test                                                                                                          | 1       |

Total Number of Classes : 13

### Unit 1 - Chapter 4 - Writing Linear Functions

| Section # | Section Title                                                                                     | Classes |
|-----------|---------------------------------------------------------------------------------------------------|---------|
| 4.1       | Writing Equations in Slope-Intercept Form<br>-given slope and y-intercept<br>-given standard form | 4       |
| 4.2       | Writing Equations in Point-Slope Form<br>-given two points<br>-applications                       | 3       |
| 4.3       | Writing Equations of Parallel and Perpendicular Lines                                             | 3       |
|           | Review                                                                                            | 1       |
|           | Test                                                                                              | 1       |

Total Number of Classes: 12

### Unit 1 - Chapter 5-Systems of Equations

| Section # | Section Title                                                                                                                                                                  | Classes |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 5.1       | Solving Systems of Linear Equations by Graphing (Integrate 5.4) <ul style="list-style-type: none"><li>- "Do Now" by hand</li><li>- Graphing Calculator Introductions</li></ul> | 3       |
| 5.2       | Solving Systems of Linear Equations by Substitution (Integrate 5.4) <ul style="list-style-type: none"><li>- With word problems</li></ul>                                       | 3       |
| 5.3       | Solving Systems of Linear Equations by Elimination (Integrate 5.4) <ul style="list-style-type: none"><li>- With word problems</li></ul>                                        | 3       |
|           | Review                                                                                                                                                                         | 1       |
|           | Quiz 5.1-5.3                                                                                                                                                                   | 1       |

Total Number of Classes: 11

# QUARTER 2

## Unit 1 - Chapter 5-Systems of Equations Word Problems

| Section # | Section Title | Classes |
|-----------|---------------|---------|
| 5.4       | Word Problems | 3       |
|           | Review        | 1       |
|           | Test 5.1-5.4  | 1       |

Total Number of Classes: 5

## Unit 2 - Chapter 6-Exponential Functions

| Section # | Section Title                                                                                                      | Classes |
|-----------|--------------------------------------------------------------------------------------------------------------------|---------|
| 6.1       | Properties of Exponents                                                                                            | 5       |
|           | Review                                                                                                             | 1       |
|           | Quiz                                                                                                               | 1       |
| 6.3       | Exponential Functions<br>- Day 1 - Introduce exponential functions<br>- Day 2-3 - Graph with basic transformations | 3       |
| 6.4       | Growth and Decay<br>-identify growth/decay, write equations                                                        | 4       |
|           | Review                                                                                                             | 1       |
|           | Chapter 6 Test                                                                                                     | 2       |

Total Number of Classes: 17

### Unit 3 - Chapter 7 Part 1 - Polynomial Equations

| Section # | Section Title                                                                                                                                                  | Classes |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 7.1       | Adding and Subtracting Polynomials <ul style="list-style-type: none"><li>● Introduction with combining like terms</li></ul>                                    | 3       |
| 7.2       | Multiplying Polynomials <ul style="list-style-type: none"><li>● Distributive property</li><li>● Double Distribute</li><li>● Polynomial by polynomial</li></ul> | 3       |
|           | Review                                                                                                                                                         | 1       |
|           | Quiz 7.1-7.2                                                                                                                                                   | 1       |

Total Number of Classes: 8

**Review and Midterms - 6 Days**

# QUARTER 3

## Unit 3 - Chapter 7 Part 2 - Factoring

| Section # | Section Title                                                                | Classes |
|-----------|------------------------------------------------------------------------------|---------|
| 7.4       | Factoring by GCF                                                             | 3       |
| 7.5       | Factoring Trinomials ( $a=1$ )                                               | 3       |
| 7.6       | Factoring Trinomials ( $a>1$ )                                               | 4       |
| 7.7       | Factoring Special Products - just difference of squares                      | 1       |
|           | Review 7.4-7.7                                                               | 2       |
|           | Quiz 7.5-7.7                                                                 | 1       |
| 7.8       | Factoring Completely<br>-gcf<br>-grouping<br>-Picking the appropriate method | 3       |
|           | Review                                                                       | 2       |
|           | Chapter 7 Test                                                               | 1       |

Total Number of Classes: 20

#### Unit 4 - Chapter 8- Graphing Quadratic Equations

| Section # | Section Title                      | Classes |
|-----------|------------------------------------|---------|
| 8.1       | Graphing $f(x)=ax^2$               | 2       |
| 8.2       | Graphing $f(x)=ax^2+c$<br>-by hand | 2       |
| 8.4       | Vertex Form                        | 2       |
| 8.3       | Graphing $f(x)=ax^2+bx+c$          | 3       |
|           | Review                             | 1       |
|           | Quiz 8.1 - 8.4                     | 1       |
| 8.5       | Intercept Form                     | 2       |
|           | Review                             | 1       |
|           | Chapter 8 Test                     | 1       |

Total Number of Classes: 15

# QUARTER 4

## Unit 4 - Chapter 9-Solving Quadratic Equations

| Section # | Section Title                                                                                 | Classes |
|-----------|-----------------------------------------------------------------------------------------------|---------|
| 9.2       | Solving Quadratic Equations by Graphing (x-intercepts only)                                   | 2       |
| 9.1       | Radicals<br>-only numerical radicand (will simplify with variables next chapter)              | 2       |
| 9.3       | Solving Quadratic Equations by Using Square Roots                                             | 2       |
| 7.4       | Solving Quadratic Equations by Factoring                                                      | 5       |
|           | Review                                                                                        | 1       |
|           | Quiz 9.1-9.3, 7.4                                                                             | 1       |
| 9.5       | Solving Quadratic Equation by the Quadratic Formula<br>- Discriminant and nature of solutions | 3       |
|           | Choosing the Best Method, review all methods                                                  | 3       |
|           | Test                                                                                          | 1       |

Total Number of Classes: 20

**Unit - 5 - Rational Expressions (Optional Final Review Unit)**

|  |                               |   |
|--|-------------------------------|---|
|  | Simplify Rational Expressions | 4 |
|  | Quest?                        | 1 |

Total Number of Classes: 5

**NJSLA review: 5 days**

**Finals and Review: 6 days**

## Unit 1: Linear Equations (Including Systems of Linear Equations)

### Big Ideas: *Course Objectives/ Content Statement(s)*

- Write equations in graph-appropriate forms
- Graph functions
- Solve systems of equations
- Graph systems of equations and inequalities
- Explain how to solve and graph equations, functions, systems of equations, and inequalities

### Essential Questions

*What provocative questions will foster inquiry, understanding, and transfer of learning?*

- What are the key characteristics of a linear equation?
- How do we write / graph linear equations?
- When is it best to use slope intercept, point slope, or standard form of a linear equation?
- How are linear functions graphed based on the form provided?
- How are systems of equations and inequalities graphed?
- How are systems of equations solved?

### Enduring Understandings

*What will students understand about the big ideas?*

#### Students will understand that:

- Functions are mathematical models that have one unique output for every input.
- The equation of a function can be written in multiple forms. Lines are usually graphed in the form  $f(x) = mx + b$  where  $m$  and  $b$  are the slope and  $y$ -intercept respectively.
- Systems of equations can be solved by graphing, by substitution, or by elimination.
- To graph a system of equations or inequalities, graph each function, equation, or inequality on the same coordinate plane. The solution to the system is the intersection of the graphs.

### Areas of Focus: Proficiencies (New Jersey Student Learning Standards)

#### Students will:

#### A-CED: Creating Equations

A. Create equations that describe numbers or relationships

#### A-REI: Reason with Equations and Inequalities

A. Understand solving equations as a process of reasoning and explain the reasoning

B. Solve equations and inequalities in one variable

C. Solve systems of equations

D. Represent and solve equations and inequalities graphically

### Lessons

- What is a function? (domain and range; independent and dependent variables)
- What is a linear function? (how to show from tables, discrete and continuous)
- Using Functional Notation
- Graphing Linear Equations in Slope Intercept Form ( $y=mx+b$ )
- Graphing Linear Equations in Standard Form ( $Ax+By=C$ )
- Writing Equations in Slope-Intercept Form
  - given slope and  $y$ -intercept

| <p><b>F-IF: Interpreting Functions</b></p> <p>A. Understand the concept of a function and use function notation</p> <p>B. Interpret functions that arise in applications in terms of the context</p> <p>C. Analyze functions using different representations</p> <p><b>F-BF: Building Functions</b></p> <p>A. Build a function that models a relationship between two quantities</p> <p>B. Build new functions from existing functions</p> <p><b>Career-Ready Practices</b></p> <p><b>CRP1:</b> Act as a responsible and contributing citizen and employee.</p> <p><b>CRP2:</b> Apply appropriate academic and technical skills.</p> <p><b>CRP3:</b> Attend to personal health and financial well-being.</p> <p><b>CRP4:</b> Communicate clearly and effectively and with reason.</p> <p><b>CRP5:</b> Consider the environmental, social and economic impacts of decisions.</p> <p><b>CRP6:</b> Demonstrate creativity and innovation.</p> <p><b>CRP7:</b> Employ valid and reliable research strategies.</p> <p><b>CRP8:</b> Utilize critical thinking to make sense of problems and persevere in solving them.</p> <p><b>CRP9:</b> Model integrity, ethical leadership and effective management.</p> <p><b>CRP10:</b> Plan education and career paths aligned to personal goals.</p> <p><b>CRP11:</b> Use technology to enhance productivity.</p> <p><b>CRP12:</b> Work productively in teams while using cultural global competence.</p> | <ul style="list-style-type: none"> <li>○ given standard form</li> <li>● Writing Equations in Point-Slope Form <ul style="list-style-type: none"> <li>○ given two points</li> </ul> </li> <li>● Writing Equations of Parallel and Perpendicular Lines</li> <li>● Solving Systems of Linear Equations by Graphing</li> <li>● Graphing Calculator Introductions (Desmos)</li> <li>● Solving Systems of Linear Equations by Substitution</li> <li>● Solving Systems of Linear Equations by Elimination</li> <li>● Solve systems - word problems</li> </ul> |
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| Differentiation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>Interdisciplinary Connections</b></p> <ul style="list-style-type: none"> <li>● Students can write equations or functions to model real-world systems, for example, <math>d=r*t</math> equations from physics.</li> </ul> <p><b>Technology Integration</b></p> <ul style="list-style-type: none"> <li>● Desmos graphing calculator</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><b>Formative Assessments:</b></p> <ul style="list-style-type: none"> <li>● Total Physical Response</li> <li>● Vocabulary Speaking Practice and Review</li> <li>● Verbal Presentations of Processes and Solutions</li> <li>● Station Activities</li> <li>● Integer Operation Review</li> <li>● Guided Notes</li> </ul>                                                                                                                                                                                                                               |

- IXL
- Delta Math

### Media Literacy Integration

- Students can analyze different views of graphs and explain their format.

### Global Perspectives

- Students can graph the population change of immigrants from their native countries living in the US by year. Students will then analyze the graph of the function they've created and try to identify the rate of change (growth).

### Supports for English Language Learners

| Sensory Supports                   | Graphic Supports   | Interactive Supports        |
|------------------------------------|--------------------|-----------------------------|
| Real-life objects                  | Charts             | In pairs or partners        |
| Manipulatives                      | Graphic Organizers | In triads or small groups   |
| Pictures                           | Tables             | In a whole group            |
| Illustrations, diagrams & drawings | Graphs             | Using cooperative group     |
| Magazines & Newspapers             | Timelines          | Structures                  |
| Physical activities                | Number lines       | Internet / Software support |
| Videos & Film                      |                    | In the home language        |
| Broadcasts                         |                    | With mentors                |
| Models & Figures                   |                    |                             |

### Intervention Strategies

| Accommodations | Interventions | Modifications |
|----------------|---------------|---------------|
|----------------|---------------|---------------|

### Summative Assessments, Projects, and Celebrations:

- Vocabulary Quizzes
- Concept Quizzes / Tests
- Unit Project

### Examples

Evaluate.

1.  $f(x)=2x-4$  a.  $f(-2)$  b.  $f(4)$  c.  $f(x)=3$ , find  $x$ .

2. Evaluate the function  $f(x)=3x+6$  over the given domain. D:  $\{-2, -1, 0, 1\}$

3. Write the equation in slope intercept. Then graph the line  $2x-3y=6$

4. Given the two cost equations, at what value for  $x$  will they have the same cost?

$$C=4x+7$$

$$C=2x+25$$

### Relevant Vocabulary:

- quadrants I-IV
- x-axis
- y-axis
- domain
- input
- range
- output
- slope
- independent variable
- dependent variable
- table
- function
- function notation
- linear
- discrete
- continuous
- ordered pair
- positive
- negative
- coordinates
- graph
- slope-intercept form

|                                                            |                                                                                                   |                                                       |                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Allow for verbal responses                                 | Multi-sensory techniques                                                                          | Modified tasks/expectations                           | <ul style="list-style-type: none"> <li>• standard form</li> <li>• point-slope formula</li> <li>• zeros</li> <li>• parallel lines</li> <li>• perpendicular lines</li> <li>• graphing</li> <li>• substitute</li> <li>• eliminate</li> <li>• solution</li> <li>• solve</li> </ul> |
| Repeat/confirm directions                                  | Increase task structure (e.g. directions, checks for understanding, feedback                      | Differentiated materials                              |                                                                                                                                                                                                                                                                                |
| Permit response provided via computer or electronic device | Increase opportunities to engage in active academic responding                                    | Individualized assessment tools based on student need |                                                                                                                                                                                                                                                                                |
| Audio Books                                                | Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping | Modified assessment grading                           |                                                                                                                                                                                                                                                                                |

- Recommended Texts to Support Unit:**
- Big Ideas Mathematics - Algebra 1 (2015)

## Unit 2: Exponents and Exponential Functions

### Big Ideas: *Course Objectives/ Content Statement(s)*

- Compare and contrast exponential functions
- Graph exponential growth functions
- Graph exponential decay functions
- Multiplying and Dividing Exponents
- Zero and Negative Exponents
- Simplifying expressions with exponents
- Explain exponents and exponential functions

### Essential Questions

*What provocative questions will foster inquiry, understanding, and transfer of learning?*

- What patterns exist in the table of exponential functions?
- What are the characteristics of exponential growth and decay graphs?
- What are some real life situations that can be modeled with exponential growth or decay?
- How do the exponents of variables interact in different situations (multiplication, division, addition, subtraction)?

### Enduring Understandings

*What will students understand about the big ideas?*

#### Students will understand that:

- An exponent tells you how many times a value is multiplied by itself.
- Exponential expressions can be simplified.
- In exponential functions, the y-values are found by multiplying the previous y-value by the base.
- Exponential functions are functions in which a quantity grows or decreases at a proportional rate.
- The difference between exponential growth and decay functions is
- Compound interest, bacteria and population are only a few of the many real-life situations that use exponential growth and decay.

### Areas of Focus: Proficiencies (New Jersey Student Learning Standards)

#### Students will:

#### F-LE: Linear and Exponential Models

A. Construct and compare linear and exponential models and solve problems

B. Interpret expressions for functions in terms of the situation they model

#### Career-Ready Practices

**CRP1:** Act as a responsible and contributing citizen and employee.

### Lessons

- Properties of Exponents
  - Multiplication
  - Division
  - 0 exponent
  - Negative Exponents
  - Power to a power
- Exponential Functions
  - Growth
  - Decay
- Graphing Exponential Functions
- Word Problems

| <p><b>CRP2:</b> Apply appropriate academic and technical skills.</p> <p><b>CRP3:</b> Attend to personal health and financial well-being.</p> <p><b>CRP4:</b> Communicate clearly and effectively and with reason.</p> <p><b>CRP5:</b> Consider the environmental, social and economic impacts of decisions.</p> <p><b>CRP6:</b> Demonstrate creativity and innovation.</p> <p><b>CRP7:</b> Employ valid and reliable research strategies.</p> <p><b>CRP8:</b> Utilize critical thinking to make sense of problems and persevere in solving them.</p> <p><b>CRP9:</b> Model integrity, ethical leadership and effective management.</p> <p><b>CRP10:</b> Plan education and career paths aligned to personal goals.</p> <p><b>CRP11:</b> Use technology to enhance productivity.</p> <p><b>CRP12:</b> Work productively in teams while using cultural global competence.</p>                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| Differentiation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p><b>Interdisciplinary Connections</b></p> <ul style="list-style-type: none"> <li>Exponential growth and decay models are used in many real-life situations involving science, history, finance, health care and sports.</li> <li>One of the most common examples of exponential growth deals with bacteria. Bacteria can multiply at an alarming rate when each bacteria splits into two new cells, thus doubling. For example, if we start with only one bacterium, which can double every hour, by the end of one day, we will have over 16 million bacteria.</li> </ul> <p><b>Technology Integration</b></p> <ul style="list-style-type: none"> <li>Desmos graphing calculator</li> <li>IXL</li> <li>Delta Math</li> </ul> <p><b>Media Literacy Integration</b></p> <ul style="list-style-type: none"> <li>Students can explore how math can be used to solve story (or word) problems to solve for missing values.</li> </ul> <p><b>Global Perspectives</b></p> | <p><b>Formative Assessments:</b></p> <ul style="list-style-type: none"> <li>Total Physical Response</li> <li>Vocabulary Speaking Practice and Review</li> <li>Verbal Presentations of solutions to problems</li> <li>Station Activities</li> <li>Integer Operation Review</li> <li>Guided Notes</li> </ul> <p><b>Summative Assessments, Projects, and Celebrations:</b></p> <ul style="list-style-type: none"> <li>Vocabulary Quiz</li> <li>Concept Quizzes / Tests</li> <li>Unit Project</li> </ul> <p><b>Examples</b></p> <p>1. Create a table and sketch a graph.</p> <p>a. In 1985, there were 285 cell phone subscribers in the small town of Centerville. The number of subscribers increased by 75% per year after 1985.</p> <p>b. Canoe Brook Country Club has a tennis tournament every year. The tournament starts with 128 participants. After each round, half of the players are removed. How many players are still playing in the tournament after 5 rounds?</p> |

- Students can graph the population changes over the last 10 years in their native countries. Students will then analyze the graph of the function they've created and try to identify the type of function.

### Supports for English Language Learners

| Sensory Supports                   | Graphic Supports   | Interactive Supports        |
|------------------------------------|--------------------|-----------------------------|
| Real-life objects                  | Charts             | In pairs or partners        |
| Manipulatives                      | Graphic Organizers | In triads or small groups   |
| Pictures                           | Tables             | In a whole group            |
| Illustrations, diagrams & drawings | Graphs             | Using cooperative group     |
| Magazines & Newspapers             | Timelines          | Structures                  |
| Physical activities                | Number lines       | Internet / Software support |
| Videos & Film                      |                    | In the home language        |
| Broadcasts                         |                    | With mentors                |
| Models & Figures                   |                    |                             |

### Intervention Strategies

| Accommodations               | Interventions                                                                 | Modifications                   |
|------------------------------|-------------------------------------------------------------------------------|---------------------------------|
| Allow for verbal responses   | Multi-sensory techniques                                                      | Modified tasks/expectations     |
| Repeat/confirm directions    | Increase task structure (e.g. directions, checks for understanding, feedback) | Differentiated materials        |
| Permit response provided via | Increase opportunities to                                                     | Individualized assessment tools |

2. Simplify

a.  $\left(\frac{4x^2y}{6xy^2}\right)^4$       b.  $\frac{a^{-2}b^3}{c^{-4}d^{-1}}$

3. Graph

a.  $f(x) = 3^x$       b.  $f(x) = 18\left(\frac{1}{3}\right)^x$

4. Evaluate

a.  $-(-3)^3$       b.  $-2^4$       c.  $36\left(\frac{1}{2}\right)^3$

### Relevant Vocabulary:

- exponents
- power
- ordinal numbers
- squared
- cubed
- rule
- base
- expanded form
- variables
- if...then
- distribute
- numerator
- denominator
- inside
- outside

|                               |                                                                                                   |                             |  |
|-------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------|--|
| computer or electronic device | engage in active academic responding                                                              | based on student need       |  |
| Audio Books                   | Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping | Modified assessment grading |  |

- Recommended Texts to Support Unit:**
- Big Ideas Math - Algebra 1 (2015)

### Unit 3: Polynomials and Factoring

#### Big Ideas: Course Objectives/ Content Statement(s)

- Students will interpret the structure of expressions.
- Students will write and recognize expressions in equivalent forms.
- Students will factor quadratic polynomials.
- Students will factor special polynomials.
- Students will explain how to interpret and recognize expressions and factor polynomials.

#### Essential Questions

*What provocative questions will foster inquiry, understanding, and transfer of learning?*

- How can polynomials be combined through different mathematical operations?
- How do properties of exponents relate to polynomials?
- How can a polynomial be expressed in different ways based on its structure?
- How can factors be used to solve a problem?
- How are factors related to polynomials in standard form?

#### Enduring Understandings

*What will students understand about the big ideas?*

#### Students will understand that:

- If two or more polynomials have common terms, the coefficients of common terms can be combined to simplify the expression.
- Non-prime polynomials can be factored based on the number of terms, common factors, and defining structures.
- Once a polynomial is factored, if this expression is equivalent to zero, each non-constant factor is also equivalent to zero. Solving each of these equations results in the solution(s) of the original equation. This is known as the Zero Product Property.
- The methods used to factor a quadratic completely are; gcf, difference of squares, factor/sum (grouping).

#### Areas of Focus: Proficiencies (New Jersey Student Learning Standards)

#### Students will:

#### A-SSE: Seeing Structure in Expressions

A. Interpret the structure of expressions

#### A-APR: Arithmetic with Polynomials and Rational Expressions

A. Perform arithmetic operations on polynomials

B. Understand the relationship between zeros and factors of polynomials

#### Lessons

- Polynomial Operations
  - Adding / Subtracting (combining like terms)
  - Multiplying
- Factoring
  - GCF
  - Grouping
  - Trinomials ( $a=1$ )
  - Trinomials ( $a>1$ )
  - Difference of two squares

| <p><b>Career-Ready Practices</b></p> <p><b>CRP1:</b> Act as a responsible and contributing citizen and employee.</p> <p><b>CRP2:</b> Apply appropriate academic and technical skills.</p> <p><b>CRP3:</b> Attend to personal health and financial well-being.</p> <p><b>CRP4:</b> Communicate clearly and effectively and with reason.</p> <p><b>CRP5:</b> Consider the environmental, social and economic impacts of decisions.</p> <p><b>CRP6:</b> Demonstrate creativity and innovation.</p> <p><b>CRP7:</b> Employ valid and reliable research strategies.</p> <p><b>CRP8:</b> Utilize critical thinking to make sense of problems and persevere in solving them.</p> <p><b>CRP9:</b> Model integrity, ethical leadership and effective management.</p> <p><b>CRP10:</b> Plan education and career paths aligned to personal goals.</p> <p><b>CRP11:</b> Use technology to enhance productivity.</p> <p><b>CRP12:</b> Work productively in teams while using cultural global competence.</p> | <ul style="list-style-type: none"> <li>○ Factoring Special Products</li> <li>● Factoring Completely (all methods combined)</li> <li>● Factoring Word Problems</li> </ul>                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Differentiation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Interdisciplinary Connections</b></p> <ul style="list-style-type: none"> <li>● Applications to physics include projectile motion and real world situations.</li> </ul> <p><b>Technology Integration</b></p> <ul style="list-style-type: none"> <li>● IXL</li> <li>● Delta Math</li> <li>● Desmos</li> </ul> <p><b>Media Literacy Integration</b></p> <ul style="list-style-type: none"> <li>● Websites (such as wolframalpha.com) can provide visual representation and alternate representations of factorable and non-factorable polynomials. This can provide students with an opportunity to analyze polynomials from different perspectives.</li> </ul> <p><b>Global Perspectives</b></p> <ul style="list-style-type: none"> <li>● Students will research a common crop grown by farmers in their native country, as well as the cost of fencing to keep animals out. They will create a</li> </ul>                                                                                   | <p><b>Formative Assessments:</b></p> <ul style="list-style-type: none"> <li>● Total Physical Response</li> <li>● Vocabulary Speaking Practice and Review</li> <li>● Verbal Presentations of solutions</li> <li>● Station Activities</li> <li>● Integer Operation Review</li> <li>● Guided Notes</li> </ul> <p><b>Summative Assessments, Projects, and Celebrations:</b></p> <ul style="list-style-type: none"> <li>● Vocabulary Quiz</li> <li>● Concept Quizzes / Tests</li> <li>● Unit Project</li> </ul> |

project where they use polynomial operations to maximize the area of their farm field given a certain amount of money to spend on fencing.

### Supports for English Language Learners

| Sensory Supports                   | Graphic Supports   | Interactive Supports        |
|------------------------------------|--------------------|-----------------------------|
| Real-life objects                  | Charts             | In pairs or partners        |
| Manipulatives                      | Graphic Organizers | In triads or small groups   |
| Pictures                           | Tables             | In a whole group            |
| Illustrations, diagrams & drawings | Graphs             | Using cooperative group     |
| Magazines & Newspapers             | Timelines          | Structures                  |
| Physical activities                | Number lines       | Internet / Software support |
| Videos & Film                      |                    | In the home language        |
| Broadcasts                         |                    | With mentors                |
| Models & Figures                   |                    |                             |

### Intervention Strategies

| Accommodations                                             | Interventions                                                                 | Modifications                                         |
|------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------|
| Allow for verbal responses                                 | Multi-sensory techniques                                                      | Modified tasks/expectations                           |
| Repeat/confirm directions                                  | Increase task structure (e.g. directions, checks for understanding, feedback) | Differentiated materials                              |
| Permit response provided via computer or electronic device | Increase opportunities to engage in active academic                           | Individualized assessment tools based on student need |

### Examples

1. Perform the operation and classify the polynomial.  
 $(2x^2 - 6x + 2) - (4x^2 - 6x - 9)$

2. Simplify.

a.  $(x-4)(2x+5)$

b.  $(x+1)^2$

c.  $-2x(x-3)(x-4)$

3. Factor completely.

a.  $4x^2 - 9$

b.  $x^2 - 5x - 6$

c.  $3x^2 - 10x + 3$

d.  $2x^3 + 4x^2 + 2x$

e.  $8x^4 - 4x^3 - 16x^2 + 24x$

### Relevant Vocabulary:

- polynomial
- standard form
- expression
- highest/lowest
- leading coefficient
- monomial
- binomial
- trinomial
- term
- degree
- combine like-terms
- simplify
- distribute
- double distribute
- factoring
- product
- sum
- factor pairs

|             |                                                                                                   |                             |  |
|-------------|---------------------------------------------------------------------------------------------------|-----------------------------|--|
|             | responding                                                                                        |                             |  |
| Audio Books | Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic mapping | Modified assessment grading |  |

**Recommended Texts to Support Unit:**

- Big Ideas Math - Algebra 1 (2015)

## Unit 4: Graphing and Solving Quadratic Functions

### Big Ideas: *Course Objectives/ Content Statement(s)*

- Students will analyze the graph of a quadratic equation
- Students will recognize solutions to a quadratic equation graphically and algebraically.
- Students will relate the graph of a quadratic equation to projectile motion.
- Students will explain their understanding of quadratic equations graphically and algebraically.

### Essential Questions

*What provocative questions will foster inquiry, understanding, and transfer of learning?*

- What are the characteristics of the graph of a quadratic equation?
- How can we use a graph to solve a quadratic equation?
- How does the graph of a quadratic equation mimic projectile motion?
- What does the factored form of a quadratic tell us about the graph and vice versa?

### Enduring Understandings

*What will students understand about the big ideas?*

#### Students will understand that:

- Not all quadratics can be factored.
- You need to utilize different solution methods for different quadratics.
- Roots are solutions to a quadratic equation that is equal to 0. They are also known as zeros, and they are visible where the quadratic meets the x-axis (when  $y=0$ ).
- A quadratic function can have 0, 1 or 2 real roots. If a function has zero real roots.
- All quadratic functions are a transformation of the parent function  $f(x) = x^2$
- Quadratic functions are used to maximize profit and minimize cost.
- Quadratic functions are used to visualize projectile motion.

### Areas of Focus: Proficiencies (New Jersey Student Learning Standards)

#### Students will:

#### A-SSE: Seeing Structure in Expressions

B. Write expressions in equivalent forms to solve problems

#### A-APR: Arithmetic with Polynomials and Rational Expressions

C. Use polynomial identities to solve problems

#### Career-Ready Practices

CRP1: Act as a responsible and contributing citizen and

### Lessons

- Graphing Quadratics
  - Characteristics of a quadratic
    - Maximum, minimum, vertex, x-intercepts
  - Parent Function (graph and table)
  - Transformations
    - Reflections in the x-axis
    - Vertical Stretch / Shrink
    - Vertical Shifts
    - Horizontal Shifts
  - Graph  $y=ax^2$

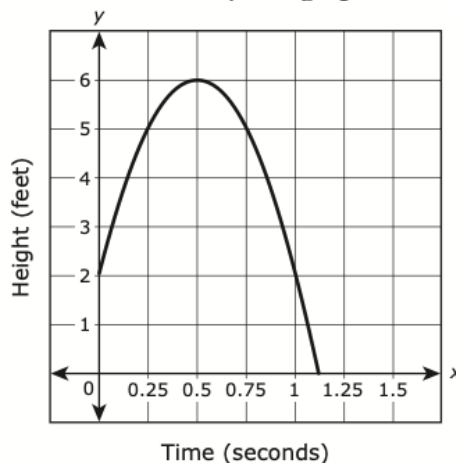
| <p>employee.</p> <p><b>CRP2:</b> Apply appropriate academic and technical skills.</p> <p><b>CRP3:</b> Attend to personal health and financial well-being.</p> <p><b>CRP4:</b> Communicate clearly and effectively and with reason.</p> <p><b>CRP5:</b> Consider the environmental, social and economic impacts of decisions.</p> <p><b>CRP6:</b> Demonstrate creativity and innovation.</p> <p><b>CRP7:</b> Employ valid and reliable research strategies.</p> <p><b>CRP8:</b> Utilize critical thinking to make sense of problems and persevere in solving them.</p> <p><b>CRP9:</b> Model integrity, ethical leadership and effective management.</p> <p><b>CRP10:</b> Plan education and career paths aligned to personal goals.</p> <p><b>CRP11:</b> Use technology to enhance productivity.</p> <p><b>CRP12:</b> Work productively in teams while using cultural global competence.</p>                                                                                                         | <ul style="list-style-type: none"> <li>○ Graph <math>y=ax^2+c</math></li> <li>○ Standard form <math>y=ax^2+bx+c</math> <ul style="list-style-type: none"> <li>■ Locate the vertex using <math>x=-b/2a</math> is the axis of symmetry, use it to create a table.</li> </ul> </li> <li>○ Vertex Form           <ul style="list-style-type: none"> <li>■ Locate the vertex, use it to create a table.</li> </ul> </li> <li>● Solve Quadratic Equations           <ul style="list-style-type: none"> <li>○ Square Roots</li> <li>○ Factoring and zero product property</li> <li>○ Quadratic Formula</li> </ul> </li> </ul> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Differentiation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Assessments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>Interdisciplinary Connections</b></p> <ul style="list-style-type: none"> <li>● Physics - introduce the idea of projectile motion and how it can be modeled</li> </ul> <p><b>Technology Integration</b></p> <ul style="list-style-type: none"> <li>● Use desmos to check solutions and visualize quadratic word problems.</li> </ul> <p><b>Media Literacy Integration</b></p> <ul style="list-style-type: none"> <li>● Create a word problem that can be represented by a parabola. Describe the situation verbally and visually through a graph.</li> </ul> <p><b>Global Perspectives</b></p> <ul style="list-style-type: none"> <li>● Projectile motion is modeled using quadratic equations. Students will research a soccer player from their favorite team and analyze the path the ball takes when they score a goal based on their kicking velocity and the angle of the kick.</li> </ul> <div> <p><b>Supports for English Language Learners</b></p> </div> | <p><b>Formative Assessments:</b></p> <ul style="list-style-type: none"> <li>● Total Physical Response</li> <li>● Vocabulary Speaking Practice and Review</li> <li>● Verbal Presentations of solutions</li> <li>● Station Activities</li> <li>● Integer Operation Review</li> <li>● Guided Notes</li> </ul> <p><b>Summative Assessments, Projects, and Celebrations:</b></p> <ul style="list-style-type: none"> <li>● Vocabulary Quiz</li> <li>● Concept Quizzes / Tests</li> <li>● Unit Project</li> </ul>                                                                                                             |

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| Intervention Strategies                                    |                                                                                           |                                                       |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Accommodations                                             | Interventions                                                                             | Modifications                                         |
| Allow for verbal responses                                 | Multi-sensory techniques                                                                  | Modified tasks/expectations                           |
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| Audio Books                                                | Utilize pre-reading strategies and activities previews, anticipatory guides, and semantic | Modified assessment grading                           |

### Examples

1. Analyze the graph to answer the questions below. A tennis ball was 2 feet off the ground when a tennis player hit it so that the ball traveled up in the air before coming back to the ground. The height of the tennis ball is described by the graph below.



- What is the maximum height of the ball?
- How long does it take the ball to reach the ground?

### 2. Graph.

- $y = x^2 + 4x + 3$
- $f(x) = -(x - 2)^2 + 3$
- $f(x) = 2x^2 + 4x + 2$

|  |         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--|---------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | mapping |  | <p><b>Examples (cont)</b></p> <p>1. Simplify.</p> <p>a. <math>\pm\sqrt{0.0009}</math></p> <p>b. <math>-\sqrt{0.25}</math></p> <p>c. <math>\sqrt{18}</math></p> <p>d. <math>3\sqrt{40}</math></p> <p>2. Solve.</p> <p>a. <math>x^2 - 12x = -11</math></p> <p>b. <math>2x^2 + 16x + 24 = 0</math></p> <p>c. <math>x^3 + 11x^2 - 12x = 0</math></p> <p>d. <math>3x^2 = 24</math></p> <p>e. <math>x^2 - 5x - 4 = 0</math></p> <p>f. The length of a rectangle is 3 meters longer than the width. If the area is <math>130\text{m}^2</math>, what are the dimensions of the rectangle?</p> <p>g. The hypotenuse of a right triangle measures 10in. If the side lengths are represented by <math>x</math> and <math>x + 2</math>, find the length and width of the triangle using the Pythagorean theorem.</p> <p><b>Relevant Vocabulary:</b></p> <ul style="list-style-type: none"> <li>• quadratic equation</li> <li>• projectile motion</li> <li>• vertex</li> <li>• intercept</li> <li>• radicals</li> <li>• square roots</li> <li>• factoring</li> <li>• discriminant</li> <li>• nature of solutions</li> <li>• simplifying</li> <li>• rational expressions</li> </ul> |
|--|---------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Recommended Texts to Support Unit:**

- Big Ideas Math - Algebra 1 (2015)