

# Southern York County School District Instructional Plan

Name:

Dates: August/September

Course/Subject: Algebra 2

Chapter 1

## Stage 1 – Desired Results

**PA Core Standard(s)/Assessment Anchors Addressed:**

**CC.2.2.HS.D.10**

**Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.**

**CC.2.2.HS.C.3**

**Write functions or sequences that model relationships between two quantities.**

**CC.2.2.HS.C.1**

**Use the concept and notation of functions to interpret and apply them in terms of their context.**

**CC.2.2.HS.C.2**

**Graph and analyze functions and use their properties to make connections between the different representations.**

**CC.2.2.HS.C.3**

**Write functions or sequences that model relationships between two quantities.**

**CC.2.2.HS.C.6**

**Interpret functions in terms of the situation they model.**

**CC.2.2.HS.C.3**

**Write functions or sequences that model relationships between two quantities.**

**CC.2.2.HS.D.7**

**Create and graph equations or inequalities to describe numbers or relationships.**

**CC.2.2.HS.C.6**

**Interpret functions in terms of the situation they model.**

**Understanding(s):**

***Students will understand . . .***

1. Analyzing a function involves determining specific characteristics (shape, intercepts, domain, and range).
2. Breaking problems into subproblems is an effective strategy to use when working with complicated problems.
3. Models of data can be used to make predictions and inferences.
4. The shape of a graph of a two-variable equation is determined by the characteristics of the equation (degree, coefficients, constants).
5. The solution to a system of equations is a point on the graph where they intersect. This point can be verified algebraically.

**Essential Question(s):**

- In what ways can a linear graph be used to interpret data and find solutions?
- How do we create and solve linear systems to model real world situations?
- There are functions all around us everyday, what characteristics of a function should we analyze and why are those characteristics important and meaningful to us?
- What is the meaning and use of points on a graph (including graphs of data and of equations)?
- How do the numbers in a linear or quadratic equation determine its graph?

**Learning Objectives:**

***Students will know . . .***

- Characteristics of a linear and quadratic graph: slope, intercepts, shape.
- The vocabulary and notation associated with functions.
- How to interpret the solution to a system

***Students will be able to:***

- Model real-life and algebraic functions.
- Use the strategy of Sub-problems to solve a complicated word problem.
- (Review) Solve a quadratic equation using various methods.
- (Review) Graph linear equations without

<p>of equations associated with an application.</p>	<p>plotting points.</p> <ul style="list-style-type: none"> <li>▪ Work effectively in groups to generate rules and strategies for solving problems.</li> <li>▪ Through study groups students will develop mathematical approaches to problem solving and assessment strategies that identify the need to alter these approaches.</li> <li>▪ Develop an awareness of how they think about problem solving and explain this process in oral and in writing form.</li> <li>▪ Use appropriate problem-solving strategies to analyze and solve a variety of problems.</li> <li>▪ Verify that algebraic solutions are correct by using graphing strategies and vice versa.</li> </ul>
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<p><b>Name:</b></p>	<p><b>Dates: October</b></p>
<p><b>Course/Subject: Algebra 2</b></p>	<p><b>Chapter 2</b></p>

**Stage 1 – Desired Results**

<p><b>PA Standard(s)/Assessment Anchors Addressed:</b></p> <p><b>CC.2.2.HS.D.1</b> Interpret the structure of expressions to represent a quantity in terms of its context</p> <p><b>CC.2.2.HS.D.2</b> Write expressions in equivalent forms to solve problems</p> <p><b>CC.2.2.HS.D.3</b> Extend the knowledge of arithmetic operations and apply to polynomials</p> <p><b>CC.2.2.HS.D.3</b> Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs</p> <p><b>CC.2.2.HS.D.5</b> Use Polynomial identities to solve problems</p> <p><b>CC.2.2.HS.D.10</b> Use reasoning to solve equations and justify the solution method</p> <p><b>CC.2.2.HS.C.3</b> Write functions or sequences that model relationships between two quantities</p>	
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<p><b>Understanding(s):</b></p>	<p><b>Essential Question(s):</b></p>
<p><i>Students will understand . . .</i></p> <ol style="list-style-type: none"> <li>1. A function is a special mathematical relationship in which each element of the domain is assigned one and only one element from the range.</li> <li>2. The algebraic solution to a one-variable equation is graphically related to the intercepts of its related two-variable equation.</li> <li>3. Models of data can be used to make predictions and inferences.</li> <li>4. The shape of a graph of a two-variable equation is determined by the</li> </ol>	<ul style="list-style-type: none"> <li>▪ There are functions all around us everyday, can you identify them and their components (domain and range?) Why is a particular relationship a function? Why are some discrete and some continuous?</li> <li>▪ What is the meaning and use of points on a graph (including graphs of data and of equations)? How do we use this meaning to make sense of solutions to equations?</li> <li>▪ How do the numbers in a linear or quadratic equation determine its graph?</li> </ul>

<p>characteristics of the equation (degree, coefficients, constants).</p> <p>5. A family of functions has graphs that are similar.</p> <p>6. The solution to a system of equations can be determined in multiple methods and each method can be used to check the solution of another method.</p> <p>7. Sequences can be represented as a list, as a rule, as an equation, and graphically.</p> <p>8. The number 1 is used to simplify algebraic fractions.</p>	<ul style="list-style-type: none"> <li>▪ What does the solution to a system of equations mean?</li> <li>▪ How can a pattern be expressed as a sequence, an equation, a function, a graph?</li> <li>▪ How do we create and solve linear systems that model real world situations?</li> <li>▪ What can <math>1/1</math> stand for?</li> </ul>
<p><b>Learning Objectives:</b> <b><i>Students will know . . .</i></b></p> <ul style="list-style-type: none"> <li>▪ Characteristics of a linear and quadratic graph: slope, intercepts, and shape.</li> <li>▪ The vocabulary and notation associated with functions.</li> <li>▪ Various methods to solving a system of equations.</li> <li>▪ The vocabulary and notation associated with sequences.</li> <li>▪ How to interpret the solution to a system of equations associated with an application.</li> </ul>	<p><b><i>Students will be able to:</i></b></p> <ul style="list-style-type: none"> <li>▪ Model real-life and algebraic functions.</li> <li>▪ Recognize patterns and sequences.</li> <li>▪ Determine relationships between discrete functions (sequences) and continuous functions (linear.)</li> <li>▪ Solve a quadratic equation using various methods.</li> <li>▪ Graph linear equations without plotting points.</li> <li>▪ Work effectively in groups to generate rules and strategies for solving problems.</li> <li>▪ Through study groups students will develop mathematical approaches to problem solving and assessment strategies that identify the need to alter these approaches.</li> <li>▪ Become more aware of their own thinking about problems and describe their efforts both orally and in writing.</li> <li>▪ Use appropriate problem-solving strategies to analyze and solve a variety of problems.</li> <li>▪ Verify that algebraic solutions are correct by using graphing strategies and vice versa.</li> </ul>
<p><b>Name:</b></p>	<p><b>Dates: November</b></p>
<p><b>Course/Subject: Algebra 2</b></p>	<p><b>Chapter 3</b></p>

**Stage 1 – Desired Results**

**PA Core Standard(s)/Assessment Anchors Addressed:**

**CC.2.2.HS.C.5**

Construct and compare linear, quadratic, and exponential models to solve problems

**CC.2.2.HS.C.3**

Graph and analyze function and use their properties to make connections between the different representations

**CC.2.2.HS.D.9**

Use reasoning to solve equations and justify the solution method

**CC.2.2.HS.C.2**

Graph and analyze functions and use their properties to make connections between between the different representations

**CC.2.2.HS.C.5**

Construct and compare linear, quadratic, and exponential models to solve problems

**CC.2.2.HS.D.2**

Apply and extend the properties of exponents to solve problems with rational exponents

**Understanding(s):**

*Students will understand . . .*

1. A family of functions have graphs that are similar..
2. Sequences can be represented as a list, as a rule, as an equation, and graphically.
3. The algebraic solution to a one-variable equation is graphically related to the intercepts of its related two-variable equation.
4. Models of data can be used to make predictions and inferences.
5. The shape of a graph of a two-variable equation is determined by the characteristics of the equation (degree, coefficients, constants).
6. Exponential growth and decay functions exist all around us.

**Essential Question(s):**

- There are functions all around us everyday. Why is a particular relationship a function? How can an algebraic function model a real world situation? What aspects of the real world situation affect the domain, range and continuity, of the algebraic function.
- What is the meaning and use of points on a graph (including graphs of data and of equations)? How do we use this meaning to make sense of solutions to equations?
- How do the numbers in a linear or quadratic equation determine its graph?
- How can a pattern be expressed as a sequence, an equation, a function, a graph?
- What does it mean to increase or decrease exponentially?

**Learning Objectives:**

*Students will know . . .*

- Characteristics of a linear and quadratic graph: slope, intercepts, shape.
- The vocabulary and notation associated with functions.
- Various methods to solving a system of equations; including graphing, substitution, linear combination, and with matrices.
- The vocabulary and notation associated with sequences.
- How to interpret the solution to a system of equations associated with an application.
- The vocabulary and notation associated exponential functions.

**Students will be able to:**

- Model exponential functions algebraically and graphically and use those models to make predictions.
- Model real-life and algebraic functions.
- Recognize patterns and sequences.
- Determine relationships between discrete functions (sequences) and continuous functions (linear.)
- Solve a quadratic equation using various methods.
- Work effectively in groups to generate rules and strategies for solving problems.
- Through study groups students will develop mathematical approaches to

<ul style="list-style-type: none"> <li>▪ Recognize patterns and sequences.</li> <li>▪ The relationships between discrete functions (sequences) and continuous functions (linear.)</li> <li>▪ How to solve a quadratic equation using various methods.</li> </ul>	<p>problem solving and assessment strategies that identify the need to alter these approaches.</p> <ul style="list-style-type: none"> <li>▪ Model exponential functions algebraically and graphically and use those models to make predictions.</li> <li>▪ Become more aware of their own thinking about problems and describe their efforts both orally and in writing.</li> <li>▪ Model real-life and algebraic functions.</li> <li>▪ Use appropriate problem-solving strategies to analyze and solve a variety of problems.</li> <li>▪ Verify that algebraic solutions are correct by using graphing strategies and vice versa.</li> </ul>
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<b>Name:</b>	<b>Dates: December, January</b>
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<b>Course/Subject: Algebra 2</b>	<b>Chapter 4</b>
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**Stage 1 – Desired Results**

<p><b>PA Core Standard(s)/Assessment Anchors Addressed:</b></p> <p><b>CC.2.2.HS.D.7</b> Create and graph equations or inequalities to describe numbers or relationships</p> <p><b>CC.2.2.HS.C.4</b> Interpret the effects transformations have on functions and find the inverse of functions</p> <p><b>CC.2.2.HS.C.2</b> Graph and analyze functions and use their properties to make connections between different representations</p> <p><b>CC.2.2.HS.D.7</b> Create and graph equations or inequalities to describe numbers or relationships</p>	
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<p><b>Understanding(s):</b> <i>Students will understand . . .</i></p> <ol style="list-style-type: none"> <li>1. Families of functions have similar graphs.</li> <li>2. Knowing the basic graph of a particular function family, transformations of that graph can be interpreted from the equation, which eliminates plotting points.</li> <li>3. Asymptotes are directly related to the domain and range of a function.</li> <li>4. Models of data can be used to make predictions and inferences.</li> <li>5. The shape of a graph of a two-variable equation is determined by the characteristics of the equation (degree, coefficients, constants).</li> <li>6. Transformations of graphs consist of horizontal movement, vertical movement, orientation, and vertical stretch/compression.</li> </ol>	<p><b>Essential Question(s):</b></p> <ul style="list-style-type: none"> <li>▪ What is the meaning and use of points on a graph (including graphs of data and of equations)? How do we use this meaning to make sense of solutions to equations?</li> <li>▪ How do the numbers in a linear or quadratic equation determine its graph?</li> <li>▪ There are functions all around us everyday. Why is a particular relationship a function? How can an algebraic function model a real world situation? What aspects of the real world situation affect the domain, range, and continuity, of the algebraic function?</li> <li>▪ How are asymptotes and division by zero related?</li> <li>▪ How are transformations of graphs accounted for in their equation?</li> </ul>
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<b>Learning Objectives:</b>	
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**Students will know . . .**

- What numbers in an equation cause each transformation (reflections, shifts and stretches/shrinks) of a graph.
- Characteristics of the graphs of 6 function families: slope, intercepts, shape, asymptotes.
- The vocabulary and notation associated with functions.
- And continue to work towards mastery of:
- Various methods to solving a system of equations; including graphing, substitution, and linear combination.
- How to interpret the solution to a system of equations associated with an application.
- The vocabulary and notation associated exponential functions.
- combination.
- How to interpret the solution to a system of equations associated with an application.
- The vocabulary and notation associated exponential functions.

**Students will be able to:**

- Graph any function or equation in which they know the parent graph by reading and interpreting the transformations in the given equation.
- Use appropriate problem-solving strategies to analyze and solve a variety of problems.
- Verify that algebraic solutions are correct by using graphing strategies and vice-versa.
- And continue to work towards mastery in their ability to:
  - *Use the technique of completing the square to find the vertex of a parabola.*
  - *Understand and determine the graph from the equation of a circle.*
  - *Factor quadratic and some cubic and degree four equations*
  - *Model exponential functions algebraically and graphically and use those models to make predictions.*
  - *Model real-life and algebraic functions.*
  - *Recognize patterns and sequences.*
  - *Determine relationships between discrete functions (sequences) and continuous functions (linear.)*
  - *Solve a quadratic equation using various methods.*
  - *Work effectively in groups to generate rules and strategies for solving problems.*
  - *Use a study group as a means of towards creating and persevering in their own mathematical approaches to problems and to assess when an approach is not working and a new direction is needed.*
  - *Develop an awareness of how they think about problem solving and explain their process in oral and in writing form.*

**Name:**

**Dates: February**

**Course/Subject: Algebra 2**

**Chapter 5**

## Stage 1 – Desired Results

**PA Core Standard(s)/Assessment Anchors Addressed:**

**C.C.2.2.HS.D.10**

Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically

**C.C.2.2.HS.D.9**

Use reasoning to solve equations and justify the solution method

**C.C.2.2.HS.D.7**

Create and graph equations or inequalities to describe numbers or relationships

**Understanding(s):**

***Students will understand...***

1. Systems of equations can be written to model a situation with multiple parameters and variables.
2. The solution to a system of equations has multiple meanings. It can be the ordered pair that two or more equations have in common, it can be the set of ordered pairs that make all of the equations true, or it may be the ordered pair that optimizes such variables as profit.
3. There are families of functions and their related graphs.
4. Knowing the basic graph of a particular function family, transformations of that graph can be interpreted from the equation which eliminates plotting points.
5. Asymptotes are directly related to the domain and range of a function.
6. Models of data can be used to make predictions and inferences.
7. Why some mathematical relationships are classified as functions and some are classified more generally as relationships.
8. The algebraic solution to a one-variable equation is graphically related to the intercepts of its related two-variable equation.
9. The shape of a graph of a two-variable equation is determined by the characteristics of the equation (degree, coefficients, constants).
10. The solution to a system of equations can be determined by equal values method, substitution, and elimination.
11. Sequences can be represented as a list, as a rule, as an equation, and graphically.
12. Exponential growth and decay functions exist all around us.

**Essential Question(s):**

- How do decision makers in organizations make optimum financial decisions that involve a variety of parameters and variables?
- There are functions all around us everyday. Why is a particular relationship a function? How can an algebraic function model a real world situation? What aspects of the real world situation affect the domain, range and continuity, of the algebraic function.
- What is the meaning and use of points on a graph (including graphs of data and of equations)? How do we use this meaning to make sense of solutions to equations?
- How do the numbers in a linear or quadratic equation determine its graph?
- What does the solution to a system of equations mean?
- How can a pattern be expressed as a sequence, an equation, a function, a graph?
- What does it mean to increase or decrease exponentially?

**Learning Objectives:**

**Students will know . . .**

- How to graph a system of equations and inequalities and find the region or points that solve the system.
- What numbers in an equation cause each transformation (reflections, shifts and stretches/shrinks) of a graph.
- And continue to work towards mastery of:
  - *Characteristics of the graphs of 6 function families: slope, intercepts, shape, asymptotes.*
  - *The vocabulary and notation associated with functions.*
  - *Various methods to solving a system of equations, including graphing, substitution, and linear combination.*
  - *How to interpret the solution to a system of equations associated with an application.*
  - *The vocabulary and notation associated exponential functions.*

**Students will be able to...**

- Use appropriate problem-solving strategies to analyze and solve a variety of problems.
- Verify that algebraic solutions are correct by using graphing strategies and vice versa.
- Graph any function or equation in which they know the parent graph by reading and interpreting the transformations in the given equation.
- And continue to work towards mastery in their ability to:
  - *Use the technique of completing the square to find the vertex of a parabola.*
  - *Understand and determine the graph from the equation of a circle.*
  - *Factor quadratic and some cubic and degree four equations*
  - *Model exponential functions algebraically and graphically and use those models to make predictions.*
  - *Model real-life and algebraic functions.*
  - *Recognize patterns and sequences.*
  - *Determine relationships between discrete functions (sequences) and continuous functions (linear.)*
  - *How to solve a quadratic equation using various methods.*
  - *Work effectively in groups to generate rules and strategies for solving problems.*
  - *Use a study group as a means of towards creating and persevering in their own mathematical approaches to problems and to assess when an approach is not working and a new direction is needed.*
  - *Become more aware of their own thinking about problems and describe their efforts both orally and in writing.*

**Name:**

**Dates: March**

**Course/Subject: Algebra 2**

**Chapter 6**



## Stage 1 – Desired Results

### PA Core Standard(s)/Assessment Anchors Addressed:

#### **C.C.2.1.HS.F.1**

Apply and extend the properties of exponents to solve problems with rational exponents

#### **C.C.2.2.HS.D.8**

Apply inverse operations to solve equations or formulas for a given variable

#### **C.C.2.2.HS.C.5**

Construct and compare linear, quadratic and exponential models to solve problems

#### **C.C.2.2.HS.C.4**

Interpret the effects transformations have on functions and find the inverses of functions

### Understanding(s):

*Students will understand . . .*

1. Every operation in mathematics has an inverse and that the inverse is critical to solving an equation.
2. Every function has an inverse, but not necessarily an inverse function.
3. The graph of a function and its inverse is symmetrical about the line  $y = x$ .
4. Logarithms are the inverses of exponential operations.
5. Some natural processes can be represented with logarithmic functions.
6. Students will continue to broaden their understanding of previous topics:
  - a. Systems of equations can be written to model a situation with multiple parameters and variables.
  - b. *A system of equations can be solved algebraically, using matrices, or graphically.*
  - c. *The solution to a system of equations has multiple meanings. It can be the ordered pair that two or more equations have in common, it can be the set of ordered pairs that make all of the equations true, or it may be the ordered pair that optimizes such variables as profit.*
  - d. *There are families of functions and their related graphs.*
  - e. *Knowing the basic graph of a particular function family, transformations of that graph can be interpreted from the equation which eliminates plotting points.*
7. Asymptotes are directly related to the domain.

### Essential Question(s):

- Does every operation and function in mathematics have an inverse? How can you determine what it is?
- There are functions all around us everyday. Why is a particular relationship a function? How can an algebraic function model a real world situation? What aspects of the real world situation affect the domain, range and continuity, of the algebraic function.
- What is the meaning and use of points on a graph (including graphs of data and of equations)? How do we use this meaning to make sense of solutions to equations?
- How do decision makers in organizations make optimum financial decisions that involve a variety of parameters and variables?
- How do the numbers in a linear or quadratic equation determine its graph?
- What does the solution to a system of equations mean?
- How can a pattern be expressed as a sequence, an equation, a function, a graph?
- What does it mean to increase or decrease exponentially?

### Learning Objectives:

**Students will know . . .**

- What a mathematical inverse is and be able to identify the inverse operation of any given operation.
- How to write the inverse function of a given function.
- Properties of logarithms.
- *And continue to work towards mastery of:*
  - *How to graph a system of equations and inequalities and find the region or points that solve the system.*
  - *What numbers in an equation cause each transformation (reflections, shifts and stretches/shrinks) of a graph.*
  - *Characteristics of the graphs of 6 function families: slope, intercepts, shape, asymptotes.*
  - *The vocabulary and notation associated with functions.*
  - *Various methods to solving a system of equations, including graphing, substitution, and linear combination.*
  - *How to interpret the solution to a system of equations associated with an application.*
  - *The vocabulary and notation associated exponential functions.*

**Students will be able to:**

- To find the inverse graph of a given function by using its symmetrical property.
- To use logarithms to undo exponential expressions.
- To write equations using logarithmic and exponential functions for given real life applications.
- *And continue to work towards mastery in their ability to:*
  - *Use appropriate problem-solving strategies to analyze and solve a variety of problems.*
  - *Verify that algebraic solutions are correct by using graphing strategies and vice versa.*
  - *Graph any function or equation in which they know the parent graph by reading and interpreting the transformations in the given equation.*
  - *Use the technique of completing the square to find the vertex of a parabola.*
  - *Understand and determine the graph from the equation of a circle.*
  - *Factor quadratic and some cubic and degree four equations.*
  - *Model exponential functions algebraically and graphically and use those models to make predictions.*
  - *Model real-life and algebraic functions.*
  - *Recognize patterns and sequences.*
  - *Determine relationships between discrete functions (sequences) and continuous functions (linear.)*
  - *How to solve a quadratic equation using various methods.*
  - *Work effectively in groups to generate rules and strategies for solving problems.*
  - *Use a study group as a means of towards creating and persevering in their own mathematical approaches to problems and to assess when an approach is not working and a new direction is needed.*
  - *Become more aware of their own thinking about problems and describe their efforts both orally and in writing.*

<b>Name:</b>	<b>Dates: April</b>
<b>Course/Subject: Algebra 2</b>	<b>Chapter 7</b>
<b>Stage 1 – Desired Results</b>	
<b>PA Core Standard(s)/Assessment Anchors Addressed:</b>	
<b>C.C.2.1.HS.F.1</b> Apply and extend the properties of exponents to solve problems with rational exponents <b>C.C.2.2.HS.D.8</b> Apply inverse operations to solve equations or formulas for a given variable <b>C.C.2.2.HS.C.5</b> Construct and compare linear, quadratic, and exponential models to solve problems	
<b>Understanding(s):</b> <b>Students will understand . . .</b> 1. Every operation in mathematics has an inverse and that the inverse is critical to solving an equation. 2. Students will continue to broaden their understanding of previous topics: <ol style="list-style-type: none"> <li><i>Every function has an inverse, but not necessarily an inverse function.</i></li> <li><i>The graph of a function and its inverse is symmetrical about the line <math>y = x</math>.</i></li> <li><i>Logarithms are the inverses of exponential operations. Some natural processes can be represented with logarithmic functions.</i></li> </ol>	<b>Essential Question(s):</b> <ul style="list-style-type: none"> <li>▪ Does every operation and function in mathematics have an inverse? How can you determine what it is?</li> <li>▪ What does it mean to increase or decrease exponentially?</li> </ul>
<b>Learning Objectives:</b> <b>Students will know . . .</b> <ul style="list-style-type: none"> <li>▪ How to find the inverse of an exponential function.</li> <li>▪ How the properties of Logarithms are related</li> </ul>	<b>Students will be able to:</b> <ul style="list-style-type: none"> <li>▪ Find the inverse of an exponential function.</li> <li>▪ Explain the relationship between logarithms and exponentials</li> </ul>
<b>Name:</b>	<b>Dates: May</b>
<b>Course/Subject: Algebra 2</b>	<b>Chapter 9</b>
<b>Stage 1 – Desired Results</b>	
<b>PA Standard(s)/Assessment Anchors Addressed:</b>	
<b>C.C.2.1.HS.F.6</b> Extend the knowledge of arithmetic operations to apply to complex numbers <b>CC.2.2.HS.D.7</b> Create and graph equations or inequalities to describe numbers or relationships <b>CC.2.2.HS.C.4</b> Interpret the effects transformations have on functions and find the inverse of functions <b>CC.2.2.HS.C.2</b> Graph and analyze functions and use their properties to make connections between different representations	
<b>Understanding(s):</b>	<b>Essential Question(s):</b>

**Students will understand . . .**

1. Systems of equations can be written to model a situation with multiple parameters and variables. But not all systems can be solved algebraically.
  2. The family of polynomials has differences among the various groups of polynomial functions and these differences can be predicted by the numbers in the function definition.
  3. Every operation in mathematics has an inverse and that the inverse is critical to solving an equation.
  4. The complex numbers are useful when a real number solution to a problem is impossible.
  5. The many application type problems can be solved by making the connections between the graphic and algebraic meanings of the roots of a function.
  6. Students will continue to broaden their understanding of previous topics:
    - a. *Every function has an inverse, but not necessarily an inverse function.*
    - b. *The graph of a function and its inverse is symmetrical about the line  $y = x$ .*
    - c. *Logarithms are the inverses of exponential operations. Some natural processes can be represented with logarithmic functions.*
    - d. *A system of equations can be solved algebraically, using matrices, or graphically.*
    - e. *The solution to a system of equations has multiple meanings. It can be the ordered pair that two or more equations have in common, it can be the set of ordered pairs that make all the equations true, or it may be the ordered pair that optimizes such variables as profit.*
- When are algebraic methods insufficient for solving systems of equations? What are our other tools?
  - Why did mathematicians have to define the complex set of numbers?
  - There are functions all around us everyday. Why is a particular relationship a function? How can an algebraic function model a real world situation? What aspects of the real world situation affect the domain, range and continuity, of the algebraic function.
  - Does every operation and function in mathematics have an inverse? How can you determine what it is?
  - What is the meaning and use of points on a graph (including graphs of data and of equations)? How do we use this meaning to make sense of solutions to equations?
  - How do decision makers in organizations make optimum financial decisions that involve a variety of parameters and variables?
  - How do the numbers in a linear or quadratic equation determine its graph?
  - What does the solution to a system of equations mean?
  - How can a pattern be expressed as a sequence, an equation, a function, a graph?
  - What does it mean to increase or decrease exponentially?

**Learning Objectives:**

***Students will know . . .***

- How the degree of a polynomial determines its general shape, domain, and range.
- That the terms, roots, zeroes, and x-intercepts are interchangeable terms.
- That some solutions to equations are not in the set of Real numbers.
- That minimums and maximums of functions are where the functions change from increasing to decreasing intervals or vice versa.

***Students will be able to:***

- Find the roots of various polynomial functions algebraically and graphically.
- Solve systems graphically.
- Use their graphing calculators effectively to analyze graphs and solve problems.