



# Cliffside Park Public Schools

## COURSE OF STUDY UNIT PLANNING GUIDE FOR: Algebra 2 Unit 1

Grade Level:  
11th

Cliffside Park School District  
Cliffside Park, NJ 07010  
[www.cliffsidepark.edu](http://www.cliffsidepark.edu)



## Course Overview:

The Algebra 2 course explores families of functions which include linear, quadratic, exponential, logarithmic, radical and rational. The course examines these functions in various forms including algebraically and graphically. Students explore key concepts involving operations on these types of functions and different graphical representation using both technology and sketches by hand. Trigonometric functions are also explored and investigated using  $r$  models and the unit circle. Probability, data analysis, and statistics are also explored to create inferences and justify conclusions.

### Overview of Units:

1. Linear Functions, Quadratic Functions,
2. Polynomial Functions
3. Rational Exponents, Rational Functions & Exponential Growth and Decay Functions
4. Periodic Models, Making Inference, Justifying Conclusion and Conditional Probability



Mathematics: Algebra 2

Unit 1 Algebra 2

Unit Name: Linear Functions, Quadratic Functions, and Polynomial Functions

Career Ready Practices:

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity

Primary Resource: Big Ideas Algebra 2 Common Core Edition 2016 and Associated Online Resources;

Duration: Approximately 11 weeks

WEEK 1

Essential Question: How can you use a linear function to model and analyze a real-life solution?

NJSL Standards	Concepts <i>What student will know.</i>	Skills <i>What students will be able to do.</i>	Activities	Assessments and Checks for Understanding
<p><b>A.CED.A.2</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p><b>F.IF.C.9</b> Compare properties of two functions each represented in a different way (algebraically, graphically,</p>	<p><b>Lesson Vocabulary:</b></p> <p>Line of fit, line of best fit, correlation coefficient</p> <p><b>Learning Goals:</b></p>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>Use and apply vocabulary terms in context.</li> <li>write an equation of a line using points and slope</li> </ul>	<ul style="list-style-type: none"> <li>Use a TI-84 activity to have student practice using technology to find a <a href="#">line of best fit</a>.</li> <li>Use real-life data to create a model student height with student shoe size; find the correlations if they exist</li> <li>Exploration 1: Modeling</li> </ul>	<p><b>Formative:</b></p> <p>Analyzing Student classwork Strategic Questioning Error Analysis, p. 27 Think-Pair-Share Exit Slips Do Nows Graphic Organizers Homework</p>



<p>numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</p> <p><b>F.BF.A.1a</b> Write a function that describes a relationship between two quantities.★  a. Determine an explicit expression, a recursive process, or steps for calculation from a context.</p> <p><b>F.LE.A.2</b> Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).★</p> <p><b>S.ID.B.6a</b> Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.  a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.</p> <p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics</p>	<ol style="list-style-type: none"> <li>1. Write the equation of a line using characteristics of the line;</li> <li>2. Find the line of best fit using technology</li> <li>3. Justify findings using reasoning</li> </ol>	<ul style="list-style-type: none"> <li>• analyze data to find linear models from data</li> <li>• find the line of fit and best fit from data</li> <li>• communicate their answers and justify their reasoning</li> </ul>	<p>with Linear Functions, p. 21</p> <ul style="list-style-type: none"> <li>• Exploration 2: Modeling with Linear Functions, p. 21</li> <li>• Example 4: Using the calculator</li> </ul>	<p>Quizzes</p> <p><b>Summative:</b></p> <p>Topic Tests  Projects</p> <p><b>Benchmark Tests:</b></p> <p>Approximately every 6 weeks.</p> <p><b>Alternative:</b></p> <p>illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Verbally ask students to explain the procedure needed to find the line of best fit.</p> <p>Allow student to use a calculator to find the line of best fit.</p>
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<p><b>MP.5</b> Use appropriate tools strategically</p> <p><b>MP.7</b> Look for and make use of structure.</p>				
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**Possible Resources:**  
 Linear equation: [DESMOS](#), [www.ixl.com](http://www.ixl.com)

Modeling with Linear functions: [Khan Academy](#), [Line of Best Fit TI-84 F.LE.A.2 Rumors](#)

**WEEK 2**  
**Essential Question:** How can you determine the number of solutions of a linear system?

<b>NJSLS Standards</b>	<b>Concepts</b> <i>What student will know.</i>	<b>Skills</b> <i>What students will be able to do.</i>	<b>Activities</b>	<b>Assessments and Checks for Understanding</b>
<p><b>A.CED.A.3</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost</i></p>	<p><b>Lesson Vocabulary:</b></p> <p>Linear equations in three variables, system of three equations, solution to system of three equations, ordered triple</p> <p><b>Learning Goals:</b></p> <p>3. To solve and classify solutions to a three-variable system</p>	<ul style="list-style-type: none"> <li>visualize solutions of systems of linear equations in three variables</li> <li>solve systems of linear equations in three variables algebraically</li> <li>solve real-life problems</li> </ul>	<ul style="list-style-type: none"> <li>Exploration 1, Recognizing Graphs of Linear Systems</li> <li>Exploration 2, Solving Systems of Linear Equations p. 29</li> <li><a href="#">TI-84 Activities on Solving Linear Systems</a></li> <li>Use visualizations on p. 30</li> <li>Use real-life modeling/problem solving examples pp.</li> </ul>	<p><b>Formative:</b> <b>Formative:</b></p> <p>Analyzing Student classwork          Strategic Questioning          Error Analysis, p. 34          Think-Pair-Share          Exit Slips see closure p. 33          Do Nows          Graphic Organizers          Homework          Quizzes</p>



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<p><i>constraints on combinations of different foods.</i></p> <p><b>A.REI.C.6</b> Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p> <p><b>MP.1</b> Make sense of problems and persevere in solving them.</p> <p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.3</b> Construct viable arguments &amp; critique the reasoning of others.</p> <p><b>MP.4</b> Model with mathematics</p> <p><b>MP.5</b> Use appropriate tools strategically</p>	<p>4. To solve real-life problems using three-variable systems</p> <p>5. To understand and describe the solutions of a three-variable solution.</p>		<p>34-35</p> <ul style="list-style-type: none"> <li>Solve mathematical connection problems p. 35</li> </ul>	<p><b>Summative:</b></p> <p>Topic Tests Projects</p> <p><b>Benchmark Assessments:</b> Every 5-6 weeks.</p> <p><b>Alternative:</b></p> <p>illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Have students describe the solution set of a problem</p> <p>Have students use technology to create a visual and explain the solution of a problem.</p>
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**WEEK 3- Week 4**  
**Essential Question:** How do the graphs of  $y=f(x) + k$ ,  $y=f(x - h)$ , and  $y = -f(x)$  compare to the graph of the parent function  $f$  ?

<b>NJSLS Standards</b>	<b>Concepts</b> <i>What student will know.</i>	<b>Skills</b> <i>What students will be able to do.</i>	<b>Activities</b>	<b>Assessments and Checks for Understanding</b>
<p><b>F.BF.B.3b.</b> Build new functions from existing functions 3. Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) +</math></p>	<p><b>Lesson Vocabulary:</b></p> <p>No new vocabulary</p>	<ul style="list-style-type: none"> <li>Use and apply vocabulary terms in context.</li> </ul>	<ul style="list-style-type: none"> <li>Exploration 1, 2 and 3: Transformations of the Absolute Value Function</li> </ul>	<p><b>Formative:</b></p> <p>Analyzing Student classwork Strategic Questioning</p>



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<p><math>k</math>, <math>k f(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.</p> <p><b>MP.1</b> Make sense of problems and persevere in solving them.</p> <p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.3</b> Construct viable arguments &amp; critique the reasoning of other</p> <p><b>MP.4</b> Model with mathematics</p> <p><b>MP.5</b> Use appropriate tools strategically</p>	<p><b>Learning Goals:</b></p> <p>6. To write and understand transformations of linear functions.</p> <p>7. To write transformed functions when a combination of translations are used.</p>	<ul style="list-style-type: none"> <li>• write functions representing translations and reflections</li> <li>• write functions representing stretches and shrinks.</li> <li>• write functions representing combinations of transformations</li> </ul>	<ul style="list-style-type: none"> <li>• Use <a href="#">Polya's four step process for problem solving</a> when finding combination of transformations p. 15</li> </ul>	<p>Error Analysis, p. 17 Thumbs up, Thumbs down Exit Slips Do Nows Graphic Organizers, to diagram the Core concepts. Pp. 12,13, 14 Homework Quiz pp.19-20</p> <p><b>Summative:</b></p> <p>Topic Tests Projects</p> <p><b>Benchmark Assessments:</b> Every 5-6 weeks.</p> <p><b>Alternative:</b> Question students on transformations and actions compared to parent function</p> <p>Have students draw transformation from equation</p>
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**Possible Resources:**

Solving equations - [Khan Academy](#), <https://www.ixl.com/signin/cliffsidepark>

Real world problem - [Illustrative Math](#)

Solving nonlinear systems- [Khan Academy 1](#) [Khan Academy 2](#) [A.REI.C.7 Linear and Quadratic System](#)

Real world problem - [Illustrative Math](#)



Additional Resources:

[www.desmos.com](http://www.desmos.com)  
[www.GeoGebra.com](http://www.GeoGebra.com)

WEEK 5

**Essential Question(s):** How do the constants  $a$ ,  $h$  and  $k$  affect the graph of the quadratic function  $g(x) = a(x - h)^2 + k$ ?  
What type of symmetry does the graph of  $f(x) = a(x - h)^2 + k$  have on how can you describe this symmetry?

NJSL Standards	Concepts <i>What student will know.</i>	Skills <i>What students will be able to do.</i>	Activities	Assessments and Checks for Understanding
<p><b>F.IF.C.7c</b> Graph polynomial functions and show intercepts, maxima and minima.</p> <p><b>F.BF.B.3b</b> Build new functions from existing functions 3. Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>k f(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include</p>	<p><b>Lesson Vocabulary:</b></p> <p>Quadratic function, parabola, vertex of a parabola, vertex from, axis of symmetry standard form of a parabola, minimum value, maximum value, intercept form</p> <p><b>Lesson Concepts:</b></p>	<ul style="list-style-type: none"> <li>• Use and apply vocabulary terms in context.</li> <li>• Describe the transformation of a quadratic function</li> <li>• Write the transformations of quadratic functions</li> <li>• Explore properties of parabolas.</li> <li>• Find the maximum and minimum values</li> </ul>	<ul style="list-style-type: none"> <li>• Exploration 1: Identify the Graphs of quadratic functions p. 47</li> <li>• Working in pairs have one student use the parent function. <math>f(x) = x^2</math> to write a transformed function and the other to describe the transformation.</li> <li>• Review core concepts, pp. 48-49.</li> <li>• Use graphing tools to explore transformations</li> </ul>	<p><b>Formative:</b></p> <p>Analyzing Student classwork Strategic Questioning Error Analysis, p. 52 Think-pair-share Turn and Talk: Auditory exercise p. 57 TE Exit Slips Do Nows Mini assessment p. 64 TEQuiz</p> <p><b>Summative:</b></p>





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<p>recognizing even and odd functions from their graphs and algebraic expressions for them.</p> <p><b>MP.1</b> Make sense of problems and persevere in solving them.</p> <p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.3</b> Construct viable arguments &amp; critique the reasoning of other</p> <p><b>MP.4</b> Model with mathematics</p> <p><b>MP.5</b> Use appropriate tools strategically</p> <p><b>MP.7</b> Looking for and making use of structure.</p>	<p>8. To translate quadratic functions</p> <p>9.To write the equation of a transformed quadratic function</p> <p>10. To solve real-life problems using transformation of quadratic functions.</p>	<p>of quadratic functions.</p> <ul style="list-style-type: none"> <li>Graph quadratic functions using x-intercepts.</li> <li>Solve real-life problems.</li> </ul>	<ul style="list-style-type: none"> <li>Explorations 1,2 p 55</li> <li>Core concepts pp 57-59</li> <li><a href="#">TI-84 activities</a></li> </ul>	<p>Topic Tests Projects</p> <p><b>Benchmark Assessments:</b> Every 5-6 weeks.</p> <p><b>Alternative:</b> illustrations, computer projects, oral response, creative presentations or demonstration, etc Have students describe transformation and justify steps. p.53 . problems 41, 42</p> <p>Use dynamic assessment and investigations on online platform.</p>
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**Additional Resources:**

Solving equations - [Khan Academy](#), [www.ixl.com](http://www.ixl.com)

Real world problem - [Illustrative Math](#)

**WEEK 6- WEEK 7**

**Essential Question:** How can you use a quadratic function to model a real-life situation?

NJSL Standards	Concepts <i>What student will know.</i>	Skills <i>What students will be able to do.</i>	Activities	Assessments and Checks for Understanding
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<p><b>A.CED.A.2</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p><b>F.IF.B.6</b> Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★</p> <p><b>F.BF.A.1a</b> Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context.</p> <p><b>S.ID.B.6a</b> Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.</p> <p><b>MP.1</b> Make sense of problems and persevere in solving them.</p>	<p><b>Lesson Vocabulary:</b></p> <p>Average rate of change, systems of three linear equations</p> <p><b>Learning Goals:</b></p> <p>11. Write equations of quadratic functions given a vertex and a point</p> <p>12. Write equations of a quadratic function using a point and the x-intercept.</p> <p>13. To write a quadratic equation using 3 points.</p> <p>14. To use quadratic regression.</p>	<ul style="list-style-type: none"> <li>• Use and apply vocabulary terms in context.</li> <li>• Write equations of quadratic functions using vertices, points and x-intercepts</li> <li>• Explain when to use intercept form and when to use vertex form when writing an equation of a parabola.</li> <li>• Write a function that models real-life phenomena.</li> </ul>	<ul style="list-style-type: none"> <li>• Exploration 1 Modeling with a Quadratic Function p. 75</li> <li>• Exploration 2, Modeling with a Graphing Calculator p. 75</li> <li>• Core Concepts p. 76</li> <li>• Interpret meaning of real-life quadratic functions. P. 80: 17-20</li> <li>• Use technology to model data, using quadratic regression. P. 79</li> </ul>	<p><b>Formative:</b></p> <p>Analyzing Student classwork Strategic Questioning Error Analysis, p. 81 Calculator activities Dynamic Investigations Student discussion Exit Slips Do Nows Extra Examples pp. 76-78 TE</p> <p><b>Summative:</b></p> <p>Dynamic Assessment Tool Topic Tests Projects</p> <p><b>Benchmark Assessments:</b></p> <p>Every 5-6 weeks.</p> <p><b>Alternative:</b></p> <p>illustrations, computer projects, oral response, creative presentations or demonstration, etc Questioning Journal responses <a href="#">Basketball Project</a></p>
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<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.3</b> Construct viable arguments &amp; critique the reasoning of other</p> <p><b>MP.4</b> Model with mathematics</p> <p><b>MP.5</b> Use appropriate tools strategically</p> <p><b>MP.6</b> Attend to precision.</p> <p><b>MP.7</b> Look for and make use of structure.</p>				
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**BENCHMARK TEST**

**Additional Resources:**

Using Quadratic Regression - [Khan Academy](#), [Quadratic Regression Youtube](#)  
 Real world problem - [Quadratic Regressions and the Catapult Wars](#), [Basketball Project](#), [Angry Bird Regression Project](#)  
[Achieve the Core](#)

**WEEK 8 - WEEK 9**

**Essential Question:** How can you use the graph of a quadratic equation to determine the number of real solutions of the equation?

NJSL Standards	Concepts <i>What student will know.</i>	Skills <i>What students will be able to do.</i>	Activities	Assessments and Checks for Understanding
<p><b>A.SSE.A.2</b> Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus</i></p>	<p><b>Lesson Vocabulary:</b></p> <p>Quadratic equation in one variable, root of an</p>	<ul style="list-style-type: none"> <li>Use and apply vocabulary terms in context.</li> </ul>	<ul style="list-style-type: none"> <li>Exploration 1, Matching a quadratic function with its graph</li> </ul>	<p><b>Formative:</b></p> <p>Analyzing Student classwork Strategic Questioning</p>



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<p><i>recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></p> <p><b>A.REI.B.4b</b> Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</p> <p><b>F.IF.C.8a</b> Use the process of factoring and completing the square in a quadratic function to show zeros, extreme value, and symmetry of the graph, and interpret these in terms of a context.</p> <p><b>MP.1</b> Make sense of problems and persevere in solving them.</p> <p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.3</b> Construct viable arguments &amp; critique the reasoning of others.</p> <p><b>MP.4 Model with mathematics.</b></p> <p><b>MP.5</b> Use appropriate tools strategically.</p>	<p>equation, zero of a function, properties of square roots, factoring, rationalizing the denominator</p> <p><b>Learning Goals:</b></p> <p>15. To solve quadratic equations using various methods.</p> <p>16. To understand the meaning and find the zeros of a function.</p> <p>17: To model parabolic phenomena to solve real-life problems.</p>	<ul style="list-style-type: none"> <li>• Solve quadratic equations by graphing.</li> <li>• Solve quadratic equations algebraically.</li> <li>• Solve real-life problems using quadratic equations.</li> </ul>	<ul style="list-style-type: none"> <li>• Exploration 2. Solving quadratic equations</li> <li>• Solving quadratic equations by graphing p. 94</li> <li>• Solve quadratic equations algebraically pp. 95-96</li> <li>• Core Concepts; Zero-Product Property p. 96</li> </ul>	<p>Partner work Error Analysis p. 109 Calculator activities Dynamic Investigations Student discussion Mini Assessment, p. 102 TE Exit Slips Do Nows</p> <p><b>Summative:</b> Dynamic Assessment Tool Word Problems p. 102 Physics examples (Electricity) p. 108 Topic Tests Projects</p> <p><b>Benchmark Assessments:</b> Every 5-6 weeks.</p>
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<p><b>MP.6</b> Attend to precision.</p>				
<p><b>MP.7</b> Look for and make use of structure.</p>				
<p><b>MP.8</b> Look for and express regularity in repeated reasoning.</p>				

**Additional Resources:**

Factoring Quadratics - [Khan Academy: Solving Quadratic Equations by Factoring](#), [Khan Academy: Solving Quadratic Equation by Graphing](#)  
[www.ixl.com](http://www.ixl.com)

**WEEK 10**

**Essential Question:** What are the subsets of the set of complex numbers?

<p><b>NJSLS Standards</b></p>	<p><b>Concepts</b> <i>What student will know.</i></p>	<p><b>Skills</b> <i>What students will be able to do.</i></p>	<p><b>Activities</b></p>	<p><b>Assessments and Checks for Understanding</b></p>
<p><b>N.CN.A.1</b> Know there is a complex number <math>i</math> such that <math>i^2 = -1</math>, and every complex number has the form <math>a + bi</math> with <math>a</math> and <math>b</math> real.</p> <p><b>N.CN.A.2</b> Use the relation <math>i^2 = -1</math> and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.</p> <p><b>N.CN.C.7</b> Solve quadratic equations with real coefficients that have complex solutions.</p>	<p><b>Lesson Vocabulary:</b></p> <p>Imaginary unit <math>i</math>, complex number, imaginary number, pure imaginary number</p> <p><b>Learning Goals:</b></p> <p>18. To find square roots of negative numbers.</p> <p>19. To find the sums</p>	<ul style="list-style-type: none"> <li>• Use and apply vocabulary terms in context.</li> <li>• To define and use the imaginary unit <math>i</math>.</li> <li>• To add, subtract and multiply complex numbers</li> <li>• To find complex solutions and zeros</li> <li>• To solve Electricity problems</li> </ul>	<ul style="list-style-type: none"> <li>• Core Concept: The Square Root of a Negative Number</li> <li>• Complex Number Diagram p. 104</li> <li>• Core Concept: Sums and Differences of complex numbers</li> <li>• Solving Complex Number equalities</li> <li>• Operations with Complex Numbers</li> </ul>	<p><b>Formative:</b></p> <p>Analyzing Student classwork            Strategic Questioning            Error Analysis, p. 109            Modeling: Circuits, p. 108            Dynamic Investigations            Student discussion            Exit Slips            Do Nows            Classification, p. 109 ex 65</p> <p><b>Summative:</b></p>



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<p><b>A.REI.B.4b</b> Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</p> <p><b>MP.1</b> Make sense of problems and persevere in solving them.</p> <p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.3</b> Construct viable arguments &amp; critique the reasoning of others.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>MP.5</b> Use appropriate tools strategically.</p> <p><b>MP.6</b> Attend to precision.</p> <p><b>MP.7</b> Look for and make use of structure.</p> <p><b>MP.8</b> Look for and express regularity in repeated reasoning.</p>	<p>and difference of complex numbers.</p>	<ul style="list-style-type: none"> <li>To find complex solutions of quadratic equations</li> </ul>	<ul style="list-style-type: none"> <li>Solving Real Life Electricity problems, p. 106</li> </ul>	<p>Dynamic Assessment Tool Mini assessment: p. 118 Topic Tests Projects</p> <p><b>Benchmark Assessments:</b> Every 5-6 weeks.</p> <p><b>Alternative:</b></p> <p>illustrations, computer projects, oral response, creative presentations or demonstration, etc Have students create problems using circuits with complex solutions. Station activities see Achieve the Core</p>
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**Additional Resources:**



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Complex Numbers: Interactive Mathematics - [Definitions, Representation, AC Circuits N.CN.A.1 Complex number patterns](#)  
[N.CN.A.2 Powers of a complex number](#)

Exploring roots of an quadratic equations: [Achieve the Core: Factored form of Quadratic Equations](#)

**WEEK 11**

**Essential Question(s):** How can you complete the square for a quadratic expression?  
 How can you derive a general formula for solving a quadratic equation?

<b>NJSLS Standards</b>	<b>Concepts</b> <i>What student will know.</i>	<b>Skills</b> <i>What students will be able to do.</i>	<b>Activities</b>	<b>Assessments and Checks for Understanding</b>
<p><b>N.CN.C.7</b> Solve quadratic equations with real coefficients that have complex solutions.</p> <p><b>A.REI.B.4b</b> Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</p> <p><b>F.IF.C.8a</b> Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</p>	<p><b>Lesson Vocabulary:</b>                      completing the square, quadratic formula, discriminant</p> <p><b>Learning Goals:</b></p> <p>20. To solve quadratic equations using square roots and completing the square.</p> <p>21. To write quadratic function.</p> <p>22. To use the Quadratic Formulas to solve equations.</p>	<ul style="list-style-type: none"> <li>• Use and apply vocabulary terms in context.</li> <li>• solve equations using square roots</li> <li>• solve quadratic equations by completing the square</li> <li>• write quadratic functions in vertex form</li> <li>• solve quadratic equations using the quadratic formula</li> <li>• analyze the discriminant to determine the</li> </ul>	<ul style="list-style-type: none"> <li>• Exploration 1, Using Algebra Tiles to understand completing the square, p. 111</li> <li>• Exploration 2, Drawing conclusions, p. 111</li> <li>• Core concepts p. 112</li> <li>• Using technology and modeling with mathematics examples pp 114-115</li> <li>• Solve quadratic equations by using square roots</li> <li>• Solving quadratic equations by completing the square</li> <li>• Change a standard form of a quadratic equation into vertex form</li> <li>• Exploration 1, Exploration 2 p. 121</li> <li>• Core Concepts pp 122,</li> </ul>	<p><b>Formative:</b></p> <p>Analyzing Student classwork                      Strategic Questioning                      Error Analysis, p. 116, 128                      Using diagrams to complete the square, p. 116                      Analyzing Equations p. 127                      Modeling examples using quadratic equations pp. 128-129                      Dynamic Investigations                      Turn and Talk                      Review common misconceptions p. 115                      Exit Slips                      Mini Assessment pp. 118, 130</p>





BOE APPROVAL: August 2018

<p><b>MP.1</b> Make sense of problems and persevere in solving them.</p> <p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.3</b> Construct viable arguments &amp; critique the reasoning of others.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>MP.5</b> Use appropriate tools strategically.</p> <p><b>MP.6</b> Attend to precision</p> <p><b>MP.7</b> Look for and make use of structure.</p> <p><b>MP.8</b> Look for and express regularity in repeated reasoning.</p>	<p>23. To analyze the discriminant to predict the type of solution.</p> <p>24. To write an equation given constraints on the discriminant.</p>	<p>number and type of solutions</p> <ul style="list-style-type: none"> <li>• solve a system containing one linear equation and one quadratic equation algebraically.</li> </ul>	<p>124</p> <ul style="list-style-type: none"> <li>• Concept summary p. 125</li> </ul>	<p>Writing Prompt Do Nows Leveled Homework Assignments p. 116</p> <p><b>Summative:</b> Dynamic Assessment Tool Topic Tests Projects</p> <p><b>Benchmark Assessments:</b> Every 5-6 weeks. Every 5-6 weeks.</p> <p><b>Alternative:</b>  illustrations, computer projects, oral response, creative presentations or demonstration, etc Use word problems to see if students understand application as well as methods used to solve quadratic equations.</p>
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**Possible Resources:**

Completing the square - [Khan Academy](#) [N.CN.C.7, A.REI.B.4b Completing the square](#)

Examples of Real world problems - [Monterey Institute](#)





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WEEK 12

Essential Question: How can we solve a nonlinear system of equations?  
How can we solve a quadratic inequality?

NJSL Standards	Concepts	Skills	Activities	Assessments and Checks for Understanding
<p><b>A.CED.A.3</b> Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i></p> <p><b>A.REI.C.7</b> Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math></i></p> <p><b>A.REI.D.11</b> Explain why the x-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute</p>	<p><i>What student will know.</i></p> <p><b>Lesson Vocabulary:</b> System of nonlinear equations Quadratic inequality in two variables Quadratic inequality in one variable</p> <p><b>Learning Goals:</b></p> <p>25. To solve nonlinear systems by graphing.</p> <p>26. To solve a nonlinear system algebraically.</p> <p>27. To graph a system of quadratic inequalities in two variables.</p> <p>28. To solve quadratic inequalities in one variables algebraically and by graphing; including with the use of technology.</p>	<p><i>What students will be able to do.</i></p> <ul style="list-style-type: none"> <li>• Use and apply vocabulary terms in context.</li> <li>• solve systems of nonlinear equations</li> <li>• solve quadratic equations by graphing</li> <li>• graph quadratic inequalities in two variables</li> </ul>	<ul style="list-style-type: none"> <li>• Exploration 1, 2 p. 131</li> <li>• Core Concepts p. 135</li> <li>• Use diagrams to emphasize solutions visually p. 136</li> <li>• Solve systems by various methods.</li> <li>• Explorations 1,2 p. 139</li> <li>• use Visual Differentiated Instruction example p. 140</li> <li>• Use technology, p. 143 ex 6</li> <li>• solve quadratic inequalities in one variable p. 143 ex 4</li> </ul>	<p><b>Formatives:</b> Analyzing Student classwork Think-pair-share p. T-131 Turn-and Talk, T-139 Strategic Questioning Error Analysis, p. 137, 144 Using Technology Dynamic Investigations Turn and Talk Exit Slips Mini Assessment pp. 118, 130 Do Nows Leveled Homework Assignments p. 136, 144</p> <p><b>Summative:</b> Dynamic Assessment Tool Standards assessment Chapter 3 pp 152-153 Topic Tests Projects</p>



BOE APPROVAL: August 2018

<p>value, exponential, and logarithmic functions.★</p> <p><b>A.CED.A.1</b> Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</p> <p><b>MP.1</b> Make sense of problems and persevere in solving them.</p> <p><b>MP.3</b> Construct viable arguments and critique the reasoning of others.</p> <p><b>MP.5</b> Use appropriate tools strategically.</p> <p><b>MP.7</b> Look for and make use of structure.</p>				<p><b>Benchmark Assessment:</b> Every 5-6 weeks</p> <p><b>Alternative:</b></p> <p>illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Have students explain the solution sets for a problem and how they are obtained.</p> <p>Have students research a problem in an area of interest.</p>
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**Interdisciplinary Connections:**

**NJSLS-ELA**

**RST.11-12.3** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

**RST.11-12.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

**RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**RST.11-12.10** By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.



**W.11-12.1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

**W.11-12.2.D** Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

**NJSLS-S: Physics**

**HS-PS3-2** Energy Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects)

**HS-PS3-5.5** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction

**HS-PS2-4** : Forces and Motions Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects

**NGSS Practices:**

*Analyzing and Interpreting Data:* Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

*Developing and Using Models:* Develop or use a model based on evidence to illustrate the relationships between systems or between components of a system.

*Engaging in Argument from Evidence:* Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.

**NJSLS- Biology**

**HS-LS3** Heredity: Inheritance and Variation of Traits

**HS-LS3-2.** Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

**NJSLS-Technology:**

Students will use Desmos, GeoGebra or the TI-84 calculator to assist in graphing and analyzing these equations. They will discuss their findings with the instructor and their classmates. Students will participate in activities on Google Classroom and other online resources, Desmos, GeoGebra, IXL

**8.1.12.A.3** Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.

**8.1.12.A.4** Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all the worksheets to convey the results.



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**Career Ready Practices:**

**CRP2.** Apply appropriate academic and technical skills.

**CRP4.** Communicate clearly and effectively and with reason

**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.

**CRP11.** Use technology to enhance productivity

**21st Century Life and Career:**

**9.1.12.B.6** Design and utilize a simulated budget to monitor progress of financial needs.

**9.1.12.C.2** Compare and compute interest and compound interest and develop an amortization table using business tools.

**9.1.12.C.3** Compute and assess the accumulating effect of interest paid over time when using a variety of sources of credit.

Integrated Differentiation/Accommodations/Modifications for <b>Algebra 2 Unit 1</b> (Alternate Modes of Instruction and Support)		
Modifications to Support Gifted and Talented Students	Modifications to Support English Language Learners	Modifications to Support Our Learners (Students with IEPs/504s and At-Risk Learners)
<p>See specific modifications in each lesson.</p> <p>Integrate Higher Order Thinking Skills (HOTS) through questioning and extension projects specific to linear equations, inequalities and functions</p> <p>Provide menu of challenge activities for when the child finishes the lesson early (integrate technology when possible).</p> <p>College/Career Readiness skill enhancement - G &amp; T students can research professions related to the Algebra.</p> <p>Have the student teach the lesson - peer tutoring (research-based strategy)</p>	<p>See specific modifications in each lesson.</p> <p><b>Concept/Idea Map</b> - teacher models note-taking on linear functions, transformations of linear functions and quadratic functions, absolute value functions, characteristics of functions, modeling, quadratic equations solutions, complex numbers, solving quadratic functions, solving nonlinear systems of equations and graphing and sketching polynomial functions.</p> <p><b>Contextualize language</b> See each lesson for specific vocabulary</p>	<p>See specific modifications in each lesson.</p> <p>Review student individual educational plan and/or 504 plan for instructional, assessment, and environmental supports.</p> <p>Allow student to use calculator to solve quadratic equations.</p> <p>Teach students how to check the accuracy of the solution that was derived from use of the graphing calculator.</p> <p>Utilize manipulatives and/or visuals within instructional presentation of linear functions and quadratic functions, absolute value functions</p>



BOE APPROVAL: August 2018

<p>Accelerate pace for students who are advanced in concepts.</p> <p>Use inquiry-based, discovery learning approaches that emphasize open-ended problems with multiple solutions or multiple paths to solutions.</p> <p>Allow students to design their own ways to find the answers to complex questions.</p> <p>Have students create a Slides presentation on different methods of factoring.</p> <p>Have students create a review sheet or a pamphlet to be used by the class</p> <p>Big Ideas:</p> <p>Performance Tasks Thought Provoking Questions Enrichment and Extension Start the Next Section</p>	<p><b>Visuals and illustrations</b> to be used for linear functions, transformations of linear functions and quadratic functions, absolute value functions, characteristics of functions, modeling, quadratic equations solutions, complex numbers, solving quadratic functions, solving nonlinear systems of equations and graphing and sketching polynomial functions and other concrete terms.</p> <p><b>Word/picture bank</b> available for students' reference in classroom, online and in their textbooks.</p> <p><b>Wait Time Two</b> - extend basic "Wait Time" - after the 1st student responds to a question, the teacher waits an additional 5 - 7 seconds before calling on another student to ask a question about this unit.</p> <p><b>Native Language Supports</b> (peer, online assistive technology, translation device, bilingual dictionary)</p> <p>Teach the text backward - <b>frontload</b> the concepts and vocabulary needed for learning the material and activating prior knowledge vocabulary, see specific lesson for vocabulary list.</p> <p>Use a <b>word square</b> to teach target academic vocabulary for this unit.</p> <p>Support comprehension of unknown vocabulary, by providing examples of Note-taking, highlighting, underlining, etc.</p> <p>Students should be given copies of grade level material or text so they can highlight or underline pertinent information.</p>	<p>Teach students how to check the accuracy of the solution that was derived from use of the calculator or other method.</p> <p>Provide graph paper to aid in aligning systems of equations and graphing and sketching polynomials.</p> <p>Utilize graphic organizer or partially completed template for students to solve word problems and other complex problems in the unit.</p> <p>Provide study guides that are partially completed by teacher, allowing the student to fill in missing information during instruction in order to aid in obtaining information pertaining to modeling linear functions and solving linear systems.</p> <p>Utilize visual aids such as charts or graphs connected to graphing and transformations and provide explicit instruction in how to analyze this data.</p> <p>By utilizing individual student assessment results, the teacher will provide small group or remedial instruction to review essential questions/big ideas, key concepts and provide additional explanations, more examples, and to model procedures in finding the solutions to particular problems.</p> <p>Provide wait time to allow students to process orally unit.</p> <p>Access to word/picture banks to develop an understanding and use content-specific vocabulary.</p> <p>Allow for Student Choice: Students should be permitted to demonstrate understanding of content through illustrations, computer projects, oral response, creative presentations or demonstration, etc.</p> <p>Support comprehension of unknown vocabulary, by providing examples of Note-taking, highlighting, underlining, etc. Students should be allowed given copies</p>
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	<p>Provide students with a sample problem or list of steps or procedures for multi-step solutions to problems. Allow student to reference these procedures when solving independently.</p>	<p>of grade level material or text so they can highlight or underline pertinent information.</p> <p>Text to speech/Oral reading if necessary.</p> <p>Provide students with flexible seating options while working independently, depending on need or preference.</p> <p>Math-specific vocabulary and literary terms should be pre-taught before teaching relevant concepts.</p> <p>Allow extra time to complete in class written assignments.</p> <p>Provide students with a sample problem or list of steps or procedures for multi-step solutions to problems. Allow student to reference these procedures when solving independently.</p> <p>Reduce the number of assigned problems within a unit.</p> <p>Provide models or templates to teach the structure of how to solve problems systematically.</p> <p>If necessary, provide additional set of materials or online access so that students can utilize resources at school and home.</p> <p>Provide study guide for students to review before Unit quizzes or tests.</p> <p>Provide models or templates to teach the structure of how to solve problems systematically.</p> <p>If necessary, provide additional set of materials or online access so that students can utilize resources at school and home.</p> <p>Modify tests to address big ideas/essential questions of the unit.</p> <p>Review inequalities in one variable</p>
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		<p>Review common errors p. T-139</p> <p>Resources by Chapter:  Practice A and Practice B  Puzzle Time  Student Journal: Practice  Differentiating the Lesson:  Skills review Handbook</p> <p>Khan Academy in Spanish</p>
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**Sources:**  
New Jersey Student Learning Standards (2016)- Math <https://www.state.nj.us/education/cccs/2016/math/standards.pdf>  
New Jersey Student Learning Standards (2016) -ELA <https://www.state.nj.us/education/cccs/2016/ela/g1112.pdf>  
New Jersey Student Learning Standards (2016)- Science <https://www.state.nj.us/education/cccs/2016/science/>  
New Jersey Student Learning Standards: Technology (2014) <http://www.state.nj.us/education/cccs/2014/tech/8.pdf>  
Career Ready Practices (2014) <http://www.state.nj.us/education/cccs/2014/career/CareerReadyPractices.pdf>