

**Curricular Framework Mathematics-Algebra 2**

Overview	Standards for Mathematical Content		Unit Focus	Standards for Mathematical Practice
<p><b>Unit 1</b></p> <p><b>Complex Solutions and Modeling with Rational Exponents</b></p>	<ul style="list-style-type: none"> <li>⦿ N.CN.A.1</li> <li>⦿ N.CN.A.2</li> <li>⦿ N.CN.C.7</li> <li>■ A.REI.B.4</li> <li>⦿ A.REI.C.7</li> <li>⦿ A.REI.C.6</li> <li>■ F.BF.A.2</li> <li>■ F.LE.A.2</li> </ul>	<ul style="list-style-type: none"> <li>⦿ F.LE.B.5</li> <li>■ A.SSE.B.4</li> <li>■ N.RN.A.1</li> <li>■ N.RN.A.2</li> <li>■ A.SSE.B.3</li> <li>■ F.IF.C.8</li> <li>■ F.LE.A.4</li> </ul>	<ul style="list-style-type: none"> <li>● Perform arithmetic operations with complex numbers</li> <li>● Use complex numbers in polynomial identities and equations</li> <li>● Build a function that models a relationship between two quantities</li> <li>● Construct &amp; compare linear, quadratic, &amp; exponential models</li> <li>● Write expressions in equivalent forms to solve problems</li> <li>● Extend the properties of exponents to rational exponents</li> <li>● Analyze functions using different representations</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p>
<p><i>Unit 1:</i></p> <p><i>Suggested Open Educational Resources</i></p>	<p><a href="#">N.CN.A.1 Complex number patterns</a></p> <p><a href="#">N.CN.A.2 Powers of a complex number</a></p> <p><a href="#">N.CN.C.7, A.REI.B.4b Completing the square</a></p> <p><a href="#">A.REI.C.7 Linear and Quadratic System</a></p> <p><a href="#">A.REI.C.6 Pairs of Whole Numbers</a></p> <p><a href="#">F.BF.A.2 Snake on a Plane</a></p> <p><a href="#">F.LE.A.2 Rumors</a></p>		<p><a href="#">F.LE.B.5, F.LE.A.2 Exponential Parameters</a></p> <p><a href="#">A.SSE.B.4 Course of Antibiotics</a></p> <p><a href="#">N.RN.A.1 Evaluating Exponential Expressions</a></p> <p><a href="#">N.RN.A.2 Rational or Irrational?</a></p> <p><a href="#">A.SSE.B.3c Forms of exponential expressions</a></p> <p><a href="#">F.IF.C.8b Carbon 14 dating in practice I</a></p> <p><a href="#">F.LE.A.4 Carbon 14 dating</a></p>	<p>MP.3 Construct viable arguments &amp; critique the reasoning of others.</p>
<p><b>Unit 2</b></p> <p><b>Polynomials and Analysis of Nonlinear Functions</b></p>	<ul style="list-style-type: none"> <li>■ A.APR.B.2</li> <li>■ A.SSE.A.2</li> <li>■ A.APR.B.3</li> <li>■ F.IF.C.7</li> <li>⦿ A.APR.C.4</li> <li>■ A.APR.D.6</li> <li>■ A.REI.A.1</li> </ul>	<ul style="list-style-type: none"> <li>■ A.REI.A.2</li> <li>■ A.CED.A.1</li> <li>■ F.IF.B.4</li> <li>■ F.IF.B.6</li> <li>● G.GPE.A.2</li> <li>■ F.IF.C.7</li> <li>■ A.REI.D.11</li> </ul>	<ul style="list-style-type: none"> <li>● Understand the relationship between zeros and factors of polynomials</li> <li>● Interpret the structure of expressions</li> <li>● Use polynomial identities to solve problems</li> <li>● Analyze functions using different representations</li> <li>● Rewrite rational expressions</li> <li>● Understand solving equations as a process of reasoning and explain the reasoning</li> <li>● Interpret functions in terms of the context</li> <li>● Translate between the geometric description and the equation for a conic section</li> <li>● Represent and solve equations and inequalities graphically</li> </ul>	<p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p>

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<p><b>Unit 2:</b> <i>Suggested Open Educational Resources</i></p>	<p><a href="#">A.APR.B.2 The Missing Coefficient</a>  <a href="#">A.SSE.A.2 A Cubic Identity</a>  <a href="#">A.APR.B.3 Graphing from Factors III</a>  <a href="#">F.IF.C.7c Graphs of Power Functions</a>  <a href="#">A.APR.C.4 Trina’s Triangles</a>  <a href="#">A.APR.D.6 Combined Fuel Efficiency</a>  <a href="#">A.REI.A.1 Products and Reciprocals</a></p>		<p><a href="#">A.REI.A.2 Radical Equations</a>  <a href="#">A.REI.A.2, A.CED.A.1 An Extraneous Solution</a>  <a href="#">G.GPE.A.2 Defining Parabolas Geometrically</a>  <a href="#">F.IF.C.7e Logistic Growth Model</a>  <a href="#">A.REI.D.11 Ideal Gas Law</a></p>	<p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>
<p><b>Unit 3</b>  <b>Periodic Models and the Unit Circle</b></p>	<p>☉ F.TF.A.1          ☉ F.TF.A.2          F.IF.C.7          ■ F.IF.B.4          ☉ F.TF.B.5          ☉ F.TF.C.8</p>	<p>S.ID.B.6          F.IF.C.9          ■ F.BF.A.1          N.Q.A.2          ☉ F.BF.B.3          ☉ F.BF.B.4</p>	<ul style="list-style-type: none"> <li>● Extend the domain of trigonometric functions using the unit circle</li> <li>● Analyze functions using different representations</li> <li>● Interpret functions that arise in applications in terms of the context</li> <li>● Model periodic phenomena with trigonometric functions</li> <li>● Prove and apply trigonometric identities</li> <li>● Summarize, represent, and interpret data on two categorical and quantitative variables</li> <li>● Build a function that models a relationship between two quantities</li> <li>● Build new functions from existing functions</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p>
<p><b>Unit 3:</b> <i>Suggested Open Educational Resources</i></p>	<p><a href="#">F.TF.A.1 Bicycle Wheel</a>  <a href="#">F.TF.A.2 What exactly is a radian?</a>  <a href="#">F.TF.A.2 Trigonometric functions for arbitrary angles (radians)</a>  <a href="#">F.TF.A.2 Trig Functions and the Unit Circle</a>  <a href="#">F.IF.B.4, F.IF.C.7e Model air plane acrobatics</a>  <a href="#">F.TF.B.5 As the Wheel Turns</a></p> <p><a href="#">F.TF.C.8 Trigonometric Ratios and the Pythagorean Theorem</a></p>		<p><a href="#">F.IF.C.9 Throwing Baseballs</a>  <a href="#">F.BF.A.1b A Sum of Functions</a>  <a href="#">F.BF.B.3 Exploring Sinusoidal Functions</a>  <a href="#">F.BF.B.3 Transforming the graph of a function</a>  <a href="#">F.BF.B.4a Temperatures in degrees Fahrenheit and Celsius</a></p>	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments &amp; critique the reasoning of others.</p>

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<p><b>Unit 4</b></p> <p><b>Making Inference, Justifying Conclusion and Conditional Probability</b></p>	<ul style="list-style-type: none"> <li>● S.ID.A.4</li> <li>■ S.IC.A.1</li> <li>■ S.IC.A.2</li> <li>■ S.IC.B.3</li> <li>■ S.IC.B.4</li> <li>■ S.IC.B.5</li> <li>■ S.IC.B.6</li> </ul>	<ul style="list-style-type: none"> <li>● S.CP.A.1</li> <li>● S.CP.A.2</li> <li>● S.CP.A.3</li> <li>● S.CP.A.4</li> <li>● S.CP.A.5</li> <li>● S.CP.B.6</li> <li>● S.CP.B.7</li> </ul>	<ul style="list-style-type: none"> <li>● Summarize, represent, and interpret data on a single count or measurement variable</li> <li>● Understand and evaluate random processes underlying statistical experiments</li> <li>● Make inferences and justify conclusions from sample surveys, experiments and observational studies</li> <li>● Understand the independence and conditional probability and use them to interpret data</li> <li>● Use the rules of probability to compute probabilities of compound events in a uniform probability model</li> </ul>	<p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p>
<p><i>Unit 4:</i></p> <p><i>Suggested Open Educational Resources</i></p>	<p><a href="#">S.ID.A.4 Do You Fit in This Car?</a></p> <p><a href="#">S.IC.A.1 School Advisory Panel</a></p> <p><a href="#">S.IC.A.2 Sarah, the chimpanzee</a></p> <p><a href="#">S.IC.B.3 Strict Parents</a></p> <p><a href="#">S.IC.B.4 Margin of Error for Estimating a Population Mean</a></p>		<p><a href="#">S.CP.A.1 Describing Events</a></p> <p><a href="#">S.CP.A.2 Cards and Independence</a></p> <p><a href="#">S.CP.A.3 Lucky Envelopes</a></p> <p><a href="#">S.CP.A.4 Two-Way Tables and Probability</a></p> <p><a href="#">S.CP.A.5 Breakfast Before School</a></p> <p><a href="#">S.CP.B.6 The Titanic I</a></p> <p><a href="#">S.CP.B.7 The Addition Rule</a></p> <p><a href="#">S.CP.B.7 Rain and Lightning</a></p>	<p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>

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Unit 1 Algebra 2		
Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none"> <li>⦿ N.CN.A.1. 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.</li> <li>⦿ N.CN.A.2. Use the relation <math>i^2 = -1</math> and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers</li> </ul>	<p>MP.6 Attend to precision. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Complex number <math>i</math> is defined such that <math>i^2 = -1</math>.</li> <li>● Every complex number has the form <math>a + bi</math> with <math>a</math> and <math>b</math> real.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● <math>i^2 = -1</math> and the commutative, associative properties to add and subtract complex numbers are to be used.</li> <li>● determine that <math>i^2 = -1</math> and the commutative, associative, and distributive properties to multiply complex numbers.</li> </ul> <p>Learning Goal 1: Add, subtract, and multiply complex numbers using the commutative, associative and distributive properties.</p>
<ul style="list-style-type: none"> <li>⦿ N.CN.C.7. Solve quadratic equations with real coefficients that have complex solutions.</li> </ul> <p>A.REI.B.4. Solve quadratic equations in one variable.</p> <p>A.REI.B.4b. 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>MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● As with real solutions, complex solutions to quadratic equations may be determined by taking square roots, factoring, and completing the square.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● solve quadratic equations in one variable that have complex solutions by taking square roots.</li> <li>● solve a quadratic equations in one variable that have complex solutions by completing the square.</li> <li>● solve a quadratic equations in one variable that have complex solutions by factoring.</li> <li>● write complex solutions in <math>a \pm bi</math> form.</li> </ul> <p>Learning Goal 2: Solve quadratic equations with real coefficients that have complex solutions by taking square roots, completing the square and factoring.</p>

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<p>☉ A.REI.C.7. 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>MP.1 Make sense of problems and persevere in solving them.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>• Solutions of linear systems contain different function types.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• solve a system containing one linear equation and one quadratic equation algebraically.</li> <li>• graph a system containing one linear equation and one quadratic equation to determine a solution.</li> </ul> <p>Learning Goal 3: Solve simple systems consisting of a linear and quadratic equation in two variables algebraically and graphically.</p>
<p>☉ A.REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>• Solving a system of linear equations containing <math>n</math> variables requires <math>n</math> equations.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• use the substitution method and/or elimination method to find the solution of a system containing three linear equations.</li> </ul> <p>Learning Goal 4: Solve algebraically a system of three linear equations.</p>
<p>■ F.BF.A.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p> <p>F.LE.A.2 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>☉ F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP 4. Model with mathematics</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>• Recursion</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• distinguish between recursive and explicit formulas.</li> <li>• represent geometric and arithmetic sequences recursively.</li> <li>• represent geometric and arithmetic sequences with explicit formulas.</li> <li>• translate between recursive form and explicit form of geometric and arithmetic sequences.</li> <li>• recognize explicit formula for geometric sequences as exponential functions containing a domain in the integers only.</li> <li>• interpret the parameters of an exponential function representing a geometric sequence.</li> </ul>

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		<ul style="list-style-type: none"> <li>interpret the parameters of a linear function representing an arithmetic sequence.</li> </ul> <p>Learning Goal 5: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p>
<ul style="list-style-type: none"> <li>A.SSE.B.4. Derive <b>and/or explain the derivation of</b> the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i></li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Series as a sum of a sequence</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>derive or explain the derivation of the formula for the sum of a finite geometric series.</li> <li>use the formula for the sum of a finite geometric series to solve problems.</li> </ul> <p>Learning Goal 6: Use the formula for the sum of a finite geometric series to solve problems [<i>for example, calculate mortgage payments; derive the formula for the sum of a finite geometric series (when the common ratio is not 1)</i>].</p>
<ul style="list-style-type: none"> <li>N.RN.A.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3) \cdot 3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i></li> <li>N.RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.</li> </ul>	<p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Properties of integer exponents extends to rational exponents (<i>for example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3) \cdot 3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5</i>)</li> <li>Radical notation is a representation of rational exponents.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>rewrite expressions containing rational exponents into radical form.</li> <li>rewrite expressions containing radical notation into exponential expressions containing rational exponents.</li> </ul> <p>Learning Goal 7: Use properties of integer exponents to explain and convert between expressions involving radicals and rational exponents.</p>

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<p>■ A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression  A.SSE.B.3c: Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></p> <p>F.IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function  F.IF.C.8b: Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{12t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i></p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>• Alternate, equivalent forms of an exponential expression containing rational exponents may reveal specific attributes of the function that it defines.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• use properties of exponent transform/rewrite an exponential expression for an exponential function.</li> <li>• explain the properties of the quantity or the function.</li> </ul> <p>Learning Goal 8: Use the properties of exponents to transform expressions for exponential functions, explain properties of the quantity revealed in the transformed expression or different properties of the function.</p>
<p>F.LE.A.4. <b>Understand the inverse relationship between exponents and logarithms.</b> For exponential models, express as a logarithm the solution to <math>ab^{ct} = d</math> where <math>a</math>, <math>c</math>, and <math>d</math> are numbers and the base <math>b</math> is 2, 10, or <math>e</math>; evaluate the logarithm using technology.</p>	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>• Exponents and logarithms have an inverse relationship.</li> <li>• Solutions to an exponential equation in one variable can be written as a logarithm.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• transform an exponential model represented by <math>ab^{ct} = d</math> where <math>a</math>, <math>c</math>, and <math>d</math> are numbers and the base <math>b</math> is 2, 10, or <math>e</math>.</li> </ul>

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		<ul style="list-style-type: none"> <li>write the solution to <math>ab^{ct} = d</math> as a logarithm.</li> <li>use technology to evaluate logarithms having base 2, 10, or e.</li> </ul> <p style="text-align: center;">Learning Goal 9: Express as a logarithm the solution to <math>ab^{ct} = d</math> where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.</p>
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### Unit 1 Algebra 2 What This May Look Like

District/School Formative Assessment Plan	District/School Summative Assessment Plan
<p>Topic 1 - Linear Functions and Systems</p> <ul style="list-style-type: none"> <li>Readiness Assessment</li> <li>Assessment                             <ul style="list-style-type: none"> <li>Quiz 1 - 1.1, 1.2</li> <li>Test 1 - 1.1-1.4</li> <li>Quiz 2 - 1.5, 1.6</li> <li>Test 2 - 1.5-1.7</li> </ul> </li> <li>Optional: Topic 1 Performance Task</li> </ul> <p>Topic 2 - Quadratic Functions and Equations</p> <ul style="list-style-type: none"> <li>Readiness Assessment</li> <li>Assessment                             <ul style="list-style-type: none"> <li>Quiz 1 - 2.1, 2.2</li> <li>Test 1 - 2.1-2.4</li> <li>Quiz 2 - 2.5, 2.6</li> <li>Test 2 - 2.5-2.7</li> </ul> </li> <li>Optional: Topic 2 Performance Task</li> </ul>	<p>**All assessments on Savvas Realize</p> <p><a href="#">Beginning of the Year Assessment</a></p> <p><a href="#">Topic 1 Assessment</a></p> <p><a href="#">Topic 2 Assessment</a></p> <p><a href="#">Benchmark Assessment 1</a> (on Google drive)</p>

### Focus Mathematical Concepts

<p>Prerequisite skills:</p> <ul style="list-style-type: none"> <li>Integer exponents (both positive and negative) and radicals.</li> <li>Students expand the concept of exponent to include fractional exponents and make a connection to radicals. s, rational exponents will be extended to irrational exponents by means of exponential and logarithmic functions.</li> <li>The domain of this class of functions (the x values) is all real numbers (rational and irrational) and the range is the set of all positive real numbers.)</li> </ul>
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## Curricular Framework Mathematics-Algebra 2

### Common Misconceptions:

- Some students may believe that both terminating and repeating decimals are rational numbers, without considering nonrepeating and nonterminating decimals as irrational numbers.
- Students may also confuse irrational numbers and complex numbers, and therefore mix their properties.
- By using false extensions of properties of rational numbers, some students may assume that the sum of any two irrational numbers is also irrational. This statement is not always true (e.g.,  $2 + \sqrt{3} + 2 - \sqrt{3} = 4$ , a rational number), and therefore, cannot be considered as a property.

### District/School Tasks

Enrichment activities for each section from Savvas Realize.

[Achieve the Core Coherence Map](#)

### District/School Primary and Supplementary Resources

[Savvas enVision Algebra 2](#)

[IXL](#)

[BrainPop](#)

[Illustrative Mathematics](#)

[Desmos](#)

[Khan Academy](#)

[NJCTL](#)

[Achieve the Core](#)

### Instructional Best Practices and Exemplars

[Number/Pattern talks](#)

[Which One Doesn't Belong](#)

[Performance Tasks](#)

[3-ACT tasks](#)

[3-Reads](#)

### Career and Technical Education

9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

### 21st Century Skills

CRP2. Apply appropriate academic and technical skills.

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

CRP11. Use technology to enhance productivity.

### Interdisciplinary Connections

#### NJSLS ELA

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

#### NJSLS Science

HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

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HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects

Unit 2 Algebra 2		
Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none"> <li>■ A.APR.B.2. Know and apply the Remainder Theorem: For a polynomial <math>p(x)</math> and a number <math>a</math>, the remainder on division by <math>x - a</math> is <math>p(a)</math>, so <math>p(a) = 0</math> if and only if <math>(x - a)</math> is a factor of <math>p(x)</math>.</li> </ul>	MP.6 Attend to precision.	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Polynomial division: For a polynomial <math>p(x)</math> and a number <math>a</math>:               <ul style="list-style-type: none"> <li>- <math>p(a) = 0</math> if and only if <math>(x - a)</math> is a factor of <math>p(x)</math></li> <li>- <math>(x - a)</math> is a factor of <math>p(x)</math> if and only if <math>p(a) = 0</math></li> </ul> </li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● use the Remainder Theorem to determine factors of a polynomial.</li> </ul> <p>Learning Goal 1: Apply the Remainder Theorem in order to determine the factors of a polynomial.</p>
<ul style="list-style-type: none"> <li>■ A.SSE.A.2. 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 recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></li> <li>■ A.APR.B.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.</li> </ul>	MP.7 Look for and make use of structure.	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Factors of polynomials can be used to identify zeros to be used to develop a rough graph of the polynomial function.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● factor polynomials.</li> <li>● analyze a table of values to determine where the polynomial is increasing and decreasing.</li> <li>● use the zeros of the polynomial to create rough graph.</li> </ul> <p>Learning Goal 2: Use an appropriate factoring technique to factor polynomials. Explain the relationship between zeros and factors of polynomials, and use the zeros to construct a rough graph of the function defined by the polynomial.</p>

Key: ■ Major | □ Supporting | ● Additional | \* Benchmarked Standard

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<p>F.IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p> <p>F.IF.C.7c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Factors of polynomials can be used to identify zeros to be used to develop a rough graph of the polynomial function.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>graph a polynomial function given its equation.</li> <li>identify zeros from the graph and using an appropriate factoring technique.</li> <li>show key features of the graph, including end behavior.</li> <li>use technology to graph and describe key features of the graph for complicated cases.</li> </ul> <p>Learning Goal 3: Graph polynomial functions from equations; identify zeros when suitable factorizations are available; show key features and end behavior.</p>
<p>⊙ A.APR.C.4. Prove polynomial identities and use them to describe numerical relationships. <i>For example, the difference of two squares; the sum and difference of two cubes; the polynomial identity <math>(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</i></p>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Polynomial identities can be used to describe numerical relationships.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>show that the polynomial identity <math>(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</li> <li>prove polynomial identities.</li> </ul> <p>Learning Goal 4: Use polynomial identities to describe numerical relationships and prove polynomial identities.</p>
<p>A.APR.D.6. Rewrite simple rational expressions in different forms; write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>, where <math>a(x)</math>, <math>b(x)</math>, <math>q(x)</math>, and <math>r(x)</math> are polynomials with the degree of <math>r(x)</math> less than the degree of <math>b(x)</math>, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Rational expressions can be written in different forms.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>, where <math>a(x)</math>, <math>b(x)</math>, <math>q(x)</math>, and <math>r(x)</math> are polynomials with the degree of <math>r(x)</math> less than the degree of <math>b(x)</math>.</li> <li>use inspection, factoring and long division to rewrite rational expressions.</li> <li>use technology to rewrite rational expressions for more complicated cases.</li> </ul>

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		<p>Learning Goal 5: Rewrite simple rational expressions in different forms using inspection, long division, or, for the more complicated examples, a computer algebra system.</p>
<ul style="list-style-type: none"> <li>■ A.REI.A.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</li> <li>■ A.REI.A.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</li> </ul> <p>A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p>	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.4 Model with mathematics.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Inverse relationships exist between roots and powers.</li> <li>● Extraneous solutions do not result in true statements.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● use the inverse relationship between roots and powers when solving radical equations.</li> <li>● identify any extraneous solutions.</li> <li>● solve simple rational equations in one variable (degree of numerators and denominator is not greater than 2).</li> <li>● write simple rational equations in one variable and use the rational equation to solve problems.</li> </ul> <p>Learning Goal 6: Solve simple rational and radical equations in one variable, use them to solve problems and show how extraneous solutions may arise. Create simple rational equations in one variable and use them to solve problems.</p>
<ul style="list-style-type: none"> <li>■ F.IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></li> <li>■ F.IF.B.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table)</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.4. Model with mathematics</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● A radical function is any function that contains a variable inside a root.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● interpret key features of radical functions from graphs and tables in the context of the problem.</li> <li>● sketch graphs of radical functions given a verbal description of the relationship between the quantities.</li> <li>● identify intercepts and intervals where function is increasing/decreasing.</li> <li>● determine the practical domain of a radical function.</li> <li>● determine key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maxima and minima; symmetries; end behavior.</li> </ul>

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<p>over a specified interval. Estimate the rate of change from a graph.</p>		<p>Learning Goal 7: For radical functions, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.</p>
<p>☉ G.GPE.A.2. Derive the equation of a parabola given a focus and directrix</p>		<p>Concepts:</p> <ul style="list-style-type: none"> <li>Any point on a parabola is equidistant between the focus and the directrix.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>use the distance formula to write an equation of a parabola when the focus and directrix are given.</li> </ul> <p>Learning Goal 8: Derive the equation of a parabola given a focus and directrix</p>
<p>F.IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. F.IF.C.7e. Graph exponential and logarithmic functions, showing intercepts and end behavior and trigonometric functions, showing period, midline, and amplitude.</p>		<p>Concepts:</p> <ul style="list-style-type: none"> <li>Logarithmic functions</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>graph logarithmic functions having base 2, 10 or e, using technology for more complicated cases.</li> <li>show intercepts and end behavior of logarithmic functions.</li> </ul> <p>Learning Goal 9: Graph logarithmic functions expressed symbolically and show key features of the graph (including intercepts and end behavior).</p>
<p>■ A.REI.D.11. 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>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.5 Use appropriate tools strategically.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Solutions to complex systems of nonlinear functions can be approximated graphically</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>find the solution to <math>f(x)=g(x)</math> approximately, e.g., using technology to graph the functions; include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</li> <li>find the solution to <math>f(x)=g(x)</math> approximately, e.g., using technology to make tables of values, or find successive approximations; include cases where <math>f(x)</math> and/or <math>g(x)</math></li> </ul>

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value, exponential, and logarithmic functions.*		<p>are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p> <p>Learning Goal 10: Find approximate solutions for <math>f(x)=g(x)</math>, using technology to graph, 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 value, logarithmic and exponential functions.</p>
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### Unit 2 Algebra 2 What This May Look Like

District/School Formative Assessment Plan	District/School Summative Assessment Plan
<p>Topic 3 - Polynomial Functions</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Quiz 1 - 3.1, 3.2</li> <li>○ Test 1 - 3.1-3.3</li> <li>○ Quiz 2 - 3.4, 3.5</li> <li>○ Test 2 - 3.4-3.7</li> </ul> </li> </ul> <p>Optional: Topic 3 Performance Task</p> <p>Topic 4 - Rational Functions</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Quiz 1 - 4.1, 4.2</li> <li>○ Test 1 - 4.1-4.3</li> <li>○ Quiz 2 - 4.4, 4.5</li> </ul> </li> <li>● Optional: Topic 4 Performance Task</li> </ul>	<p>**All assessments on Savvas Realize</p> <p><a href="#">Topic 3 Assessment</a></p> <p><a href="#">Topic 4 Assessment</a></p> <p><a href="#">Benchmark Assessment 2</a> (on Google drive)</p>

### Focus Mathematical Concepts

<p>Prerequisite skills:</p> <ul style="list-style-type: none"> <li>● Graph quadratic functions</li> <li>● Write equations of parabolas</li> <li>● Solve quadratic equations by graphing</li> <li>● Solve quadratic equations by factoring</li> <li>● Find the number and type of solutions</li> </ul> <p>Common Misconceptions:</p> <ul style="list-style-type: none"> <li>● Students may have difficulty sketching graphs with an appropriate level of accuracy.</li> </ul>
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- Students may find it difficult to determine which model should be used to represent a given situation.
- Students may struggle with accuracy while performing arithmetic operations on polynomials (ie:  $(a+b)^2$  does not equal  $a^2 + b^2$ ) or with factoring.
- Students may have difficulty analyzing graphical models that do not fit in the grapher's standard

District/School Tasks	District/School Primary and Supplementary Resources
Enrichment activities for each section from Savvas Realize.  <a href="#">Achieve the Core Coherence Map</a>	<a href="#">Savvas enVision Algebra 2</a> <a href="#">IXL</a> <a href="#">BrainPop</a> <a href="#">Illustrative Mathematics</a> <a href="#">Desmos</a> <a href="#">Khan Academy</a> <a href="#">NJCTL</a> <a href="#">Achieve the Core</a>

### Instructional Best Practices and Exemplars

<a href="#">Number/Pattern talks</a> <a href="#">Which One Doesn't Belong</a> <a href="#">Performance Tasks</a> <a href="#">3-ACT tasks</a> <a href="#">3-Reads</a>
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Career and Technical Education	21st Century Skills
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.  9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.	CRP2. Apply appropriate academic and technical skills.  CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.  CRP11. Use technology to enhance productivity.

### Interdisciplinary Connections

<p><b>NJSLS ELA</b>                      NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.</p> <p><b>NJSLS Science</b>                      HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.</p> <p>HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects</p>
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Unit 3 Algebra 2		
Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none"> <li>☉ F.TF.A.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.</li> <li>☉ F.TF.A.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.</li> </ul>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Radian measure of an angle as the length of the arc on the unit circle that is subtended by the angle</li> <li>● Relationship between degrees and radians</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● find the measure of the angle given the length of the arc.</li> <li>● find the length of an arc given the measure of the central angle.</li> <li>● convert between radians and degrees.</li> <li>● use the unit circle to evaluate sine, cosine and tangent of standard reference angles.</li> </ul> <p>Learning Goal 1: Use the radian measure of an angle to find the length of the arc in the unit circle subtended by the angle and find the measure of the angle given the length of the arc.</p> <p>Learning Goal 2: Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.</p>
<p>F.IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p> <p style="padding-left: 20px;">F.IF.C.7e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p> <ul style="list-style-type: none"> <li>● F.IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Relationship between the unit circle in the coordinate plane and graph of trigonometric functions.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● graph trigonometric functions, showing period, midline, and amplitude.</li> </ul> <p>Learning Goal 3: Graph trigonometric functions expressed symbolically, showing key features of the graph, by hand in simple cases and using technology for more complicated cases.</p>

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<p>quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p>		
<p>☉ F.TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.</p>	<p>MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>• Periodic functions may model real-world scenarios.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• use characteristics of real world phenomena to select a trigonometric model.</li> <li>• identify amplitude, frequency and midline appropriate for the model.</li> </ul> <p>Learning Goal 4: Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.</p>
<p>☉ F.TF.C.8. Prove the Pythagorean identity <math>\sin^2(\theta) + \cos^2(\theta) = 1</math> and use it to find <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> given <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> and the quadrant of the angle.</p>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts: No new concept(s) introduced</p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• prove the Pythagorean identity: <math>\sin^2(\theta) + \cos^2(\theta) = 1</math>.</li> <li>• use the Pythagorean identity to find <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> when given <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> and the quadrant of the angle.</li> </ul> <p>Learning Goal 5: Use the Pythagorean identity <math>(\sin \theta)^2 + (\cos \theta)^2 = 1</math> to find <math>\sin \theta</math>, <math>\cos \theta</math>, or <math>\tan \theta</math>, given <math>\sin \theta</math>, <math>\cos \theta</math>, or <math>\tan \theta</math>, and the quadrant of the angle.</p>
<p>S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related 6a. Fit a function to the data (including with the use of technology); use functions</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p>	<p>Concepts: No new concept(s) introduced</p> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>• fit exponential and trigonometric functions to data using technology.</li> <li>• solve problems using functions fitted to data (prediction equations).</li> <li>• interpret the intercepts of models in context.</li> <li>• Plot residuals of non-linear functions.</li> </ul>

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**Curricular Framework Mathematics-Algebra 2**

<p>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, quadratic, and exponential models.</p>	<p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<ul style="list-style-type: none"> <li>Analyze residuals in order to informally evaluate the fit of exponential and trigonometric functions.</li> </ul> <p>Learning Goal 6: Represent nonlinear (exponential and trigonometric) data for two variables on a scatter plot, fit a function to the data, analyze residuals (in order to informally assess fit), and use the function to solve problems. Use given functions or choose a function suggested by the context; emphasize exponential and trigonometric models.</p>
<p>F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i></p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts: No new concept(s) introduced Students are able to:</p> <ul style="list-style-type: none"> <li>compare key attributes of functions each represented in a different way (i.e zeros, end behavior, periodicity, asymptotes).</li> </ul> <p>Learning Goal 7: Analyze and compare properties of two functions when each is represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).</p>
<p>■ F.BF.A.1. Write a function that describes a relationship between two quantities. F.BF.A.1b. Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></p> <p>N.Q.A.2. Define appropriate quantities for the purpose of descriptive modeling.</p>	<p>MP.4 Model with mathematics.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Functions of various types can be combined to model real world situations.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>use arithmetic operations to combine functions of varying types in order to model relationships between quantities.</li> </ul> <p>Learning Goal 8: Construct a function that combines, using arithmetic operations, standard function types to model a relationship between two quantities.</p>

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Curricular Framework Mathematics-Algebra 2

<p>☉ F.BF.B.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. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Function notation representation of transformations</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>perform transformations on graphs of polynomial, exponential, logarithmic, or trigonometric functions.</li> <li>identify the effect on the graph of replacing <math>f(x)</math> by             <ul style="list-style-type: none"> <li><math>f(x) + k</math>;</li> <li><math>k f(x)</math>;</li> <li><math>f(kx)</math>;</li> <li>and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative).</li> </ul> </li> <li>identify the effect on the graph of combinations of transformations.</li> <li>given the graph, find the value of <math>k</math>.</li> <li>illustrate an explanation of the effects on polynomial, exponential, logarithmic, or trigonometric graphs using technology.</li> </ul> <p>Learning Goal 9: Identify the effect on the graph of a polynomial, exponential, logarithmic, or trigonometric function 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 and identify even and odd functions from graphs and equations.</p>
<p>☉ F.BF.B.4. Find inverse functions.</p> <p>F.BF.B.4a. Solve an equation of the form <math>f(x) = c</math> for a simple function <math>f</math> that has an inverse and write an expression for the inverse. <i>For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</i></p> <p><i>[*note: composition of functions is not introduced here]</i></p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.6 Attend to precision.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>For a function <math>f(x)</math> that has an inverse, the domain/input for <math>f(x)</math> is the inverse function's range/output and that the range/output for <math>f(x)</math> is the inverse function's domain/input.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>use function notation to represent the inverse of a function – <math>f^{-1}(x)</math>.</li> <li>transform an equation in order to isolate the independent variable, recognizing that the domain/input for <math>f(x)</math> is the inverse function's range/output and that the range/output for <math>f(x)</math> is the inverse function's domain/input.</li> </ul> <p>Learning Goal 10: Determine the inverse function for a simple function.</p>

Key: ■ Major | □ Supporting | ● Additional | \* Benchmarked Standard

Unit 3 Algebra 2 What This May Look Like

District/School Formative Assessment Plan	District/School Summative Assessment Plan
<p>Topic 5 - Rational Exponents and Radical Functions</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Quiz 1 - 5.1, 5.2</li> <li>○ Test 1 - 5.1-5.3</li> <li>○ Quiz 2 - 5.4, 5.5</li> <li>○ Test 1 - 5.4-5.6</li> </ul> </li> <li>● Optional: Topic 5 Performance Task</li> </ul> <p>Topic 6 - Exponential and Logarithmic Functions</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>■ Quiz 1 - 6.1, 6.2</li> <li>■ Test 1 - 6.1-6.3</li> <li>■ Quiz 2 - 6.4-6.5</li> <li>■ Test 2 - 6.4-6.7</li> </ul> </li> <li>● Optional: Topic 6 Performance Task</li> </ul> <p>Topic 7 - Trigonometric Functions</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Quiz 1 - 7.1, 7.2</li> <li>○ Test 1 - 7.1-7.3</li> <li>○ Quiz 2 - 7.4, 7.5</li> <li>○ Test 2 - 7.4-7.6</li> </ul> </li> <li>● Optional: Topic 7 Performance Task</li> </ul> <p>Topic 8 - Trigonometric Equations and Identities</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Test 1 - 8.1-8.3</li> <li>○ Test 2 - 8.4-8.5</li> </ul> </li> <li>● Optional: Topic 8 Performance Task</li> </ul>	<p><a href="#">Topic 5 Assessment</a></p> <p><a href="#">Topic 6 Assessment</a></p> <p><a href="#">Mid Year Assessment</a></p> <p><a href="#">Topic 7 Assessment</a></p> <p><a href="#">Topic 8 Assessment</a></p> <p><a href="#">Benchmark Assessment 3</a> (on Google drive)</p>

Focus Mathematical Concepts

Prerequisite skills:

Key: ■ Major | □ Supporting | ● Additional | \* Benchmarked Standard

## Curricular Framework Mathematics-Algebra 2

- Right triangle trigonometry, with advanced students working with laws of sines and cosines. connect the idea of functions with trigonometry and see sine, cosine and tangent values as functions of angle values input in radians. Connections are made such as the cosine of an angle equaling the sine of its complement as well as to the Geometry Standards involving radian measures.
- Relationship between the sine and cosine values for a particular angle. The fact that the sum of the squares of these values always equals 1 provides a unique way to view trigonometry through the lens of geometry.

### Common Misconceptions:

- Students may believe that there is no need for radians if one already knows how to use degrees. Students need to be shown a rationale for how radians are unique in terms of finding function values in trigonometry since the radius of the unit circle is 1.
- Students may also believe that all angles having the same reference values have identical sine, cosine and tangent values. They will need to explore in which quadrants these values are positive and negative.
- Students may believe that there is no connection between the Pythagorean Theorem and the study of trigonometry.

District/School Tasks	District/School Primary and Supplementary Resources
Enrichment activities for each section from Savvas Realize.  <a href="#">Achieve the Core Coherence Map</a>	<a href="#">Savvas enVision Algebra 2</a> <a href="#">IXL</a> <a href="#">BrainPop</a> <a href="#">Illustrative Mathematics</a> <a href="#">Desmos</a> <a href="#">Khan Academy</a> <a href="#">NJCTL</a> <a href="#">Achieve the Core</a>
Instructional Best Practices and Exemplars	
<a href="#">Number/Pattern talks</a> <a href="#">Which One Doesn't Belong</a> <a href="#">Performance Tasks</a> <a href="#">3-ACT tasks</a> <a href="#">3-Reads</a>	
Career and Technical Education	21st Century Skills
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.  9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.	CRP2. Apply appropriate academic and technical skills.  CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.  CRP11. Use technology to enhance productivity.
Interdisciplinary Connections	

Key: ■ Major | □ Supporting | ● Additional | \* Benchmarked Standard

**Curricular Framework Mathematics-Algebra 2**

**NJSLS ELA**

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

**NJSLS Science**

HS-PS2-1. Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

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

Unit 4 Algebra 2		
Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>☉ S.ID.A.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</p>	<p>MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Mean and standard deviation are used to fit in a normal distribution</li> <li>● Population percentages may be estimated when the data are approximately normally distributed.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● identify data sets as approximately normally distributed or not.</li> <li>● explain the 68-95-99.7 rule for normal distributions (approximately 68% of the area under a normal distribution curve is within one standard deviation, approximately 95% of the area under a normal distribution curve is within two standard deviations, etc).</li> <li>● use the mean and standard deviation of a normal distribution to estimate population percentages.</li> <li>● use calculators, spreadsheets, and tables to estimate areas under the normal curve and interpret in context.</li> </ul> <p>Learning Goal 1: Use the mean and standard deviation of a data set to fit it to a normal distribution, estimate population percentages, and recognize that there are data sets for which such a procedure is not appropriate (use calculators,</p>

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**Curricular Framework Mathematics-Algebra 2**

		spreadsheets, and tables to estimate areas under the normal curve).
S.IC.A.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Statistics is a process for making inferences about a population based on analysis of a random sample from the population.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>identify and evaluate random sampling methods.</li> <li>explain the importance of randomness to sampling and inference making.</li> <li>explain the difference between values that describe a population and a sample, in context.</li> </ul> <p>Learning Goal 2: Identify and evaluate random sampling methods.</p>
S.IC.A.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Random processes can be described mathematically by using a model: a list or description of possible outcomes.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>determine whether a given model is consistent with results from an experiment.</li> <li>know the difference between experimental and theoretical modeling.</li> <li>know how far predictions can be projected based on sample size.</li> <li>design simulations of random sampling.</li> </ul> <p>Learning Goal 3: Determine if the outcomes and properties of a specified model are consistent with results from a given data-generating process (e.g. using simulation).</p>
■ S.IC.B.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	MP.4 Model with mathematics.	<p>Concepts:</p> <ul style="list-style-type: none"> <li>Collecting data from a random sample of a population makes it possible to draw conclusions about the whole population.</li> <li>Randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments.</li> <li>Sample surveys, experiments, and observational studies serve different statistical purposes allowing for different statistical analyses.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>distinguish between sample surveys, experiments, and observational studies.</li> </ul>

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**Curricular Framework Mathematics-Algebra 2**

		<ul style="list-style-type: none"> <li>● explain the importance of randomization in each of these processes.</li> <li>● identify voluntary response samples and convenience samples.</li> <li>● describe simple random samples, stratified random samples, and cluster samples.</li> <li>● explain how under coverage, nonresponse, and question wording can lead to bias in a sample survey.</li> </ul> <p>Learning Goal 4: Identify the differences among and purposes of sample surveys, experiments, and observational studies, explaining how randomization relates to each.</p>
<ul style="list-style-type: none"> <li>■ S.IC.B.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Appropriately drawn samples of a population may be used to estimate a population mean or population proportion.</li> <li>● Relationship between margin of error, variation with a data set, and variability in the population</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● conduct simulations of random sampling to gather samples.</li> <li>● estimate population means with sample means.</li> <li>● estimate population proportions with sample proportions.</li> <li>● calculate margins of error for the estimates.</li> <li>● explain how the results relate to variability in the population.</li> </ul> <p>Learning Goal 5: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.</p>
<ul style="list-style-type: none"> <li>■ S.IC.B.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant</li> <li>■ S.IC.B.6. Evaluate reports based on data.</li> </ul>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● A statistically significant outcome is one that is unlikely to be due to chance alone.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● conduct a t-test to evaluate the effectiveness and differences in two treatments.</li> <li>● use simulations to generate data simulating applying two treatments.</li> <li>● use the results of simulations to determine if the differences are significant.</li> </ul>

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**Curricular Framework Mathematics-Algebra 2**

		<ul style="list-style-type: none"> <li>● read and explain, in the context of the situation, data from outside reports – discussing experimental study design, drawing conclusions from graphical and numerical summaries, and identifying characteristics of the experimental design.</li> </ul> <p>Learning Goal 6: Use data from a randomized experiment to compare two treatments and use simulations to decide if differences between parameters are significant; evaluate reports based on data.</p>
<p>⦿ S.CP.A.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Events are described as subsets of a sample space.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● identify a sample space, recognizing it as the set of all possible outcomes.</li> <li>● identify and describe subsets of a sample space as events.</li> <li>● describe unions, intersections and complements of events.</li> <li>● visualize unions, intersections and complements of events with Venn diagrams.</li> </ul> <p>Learning Goal 7: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” ”not”).</p>
<p>⦿ S.CP.A.2. Understand that two events <math>A</math> and <math>B</math> are independent if the probability of <math>A</math> and <math>B</math> occurring together is the product of their probabilities, and use this characterization to determine if they are independent.</p> <p>⦿ S.CP.A.3. Understand the conditional probability of <math>A</math> given <math>B</math> as <math>P(A \text{ and } B)/P(B)</math>, and interpret independence of <math>A</math> and <math>B</math> as saying that the conditional probability of <math>A</math> given <math>B</math> is the same as the probability of <math>A</math>, and the conditional probability of <math>B</math> given <math>A</math> is the same as the probability of <math>B</math>.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Two events <math>A</math> and <math>B</math> are independent if the probability of <math>A</math> and <math>B</math> occurring together is the product of their probabilities.</li> <li>● Independence of event <math>A</math> and event <math>B</math> means that the conditional probability of <math>A</math> given <math>B</math> is the same as the probability of <math>A</math>, and the conditional probability of <math>B</math> given <math>A</math> is the same as the probability of <math>B</math>.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● identify events as independent or dependent.</li> <li>● interpret the conditional probability of <math>A</math> given <math>B</math> as answering the question ‘now that <math>B</math> has occurred, what is the probability that event <math>A</math> will occur?’.</li> <li>● determine the conditional probability of <math>A</math> given <math>B</math> using <math>P(A \text{ and } B)/P(B)</math>.</li> <li>● represent conditional probability of <math>A</math> given <math>B</math> as <math>P(A B)</math>.</li> <li>● calculate conditional probabilities.</li> </ul>

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Curricular Framework Mathematics-Algebra 2

<p>☉ S.CP.A.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i></p> <p>☉ S.CP.A.5. Recognize and explain the NEW Concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i></p>		<ul style="list-style-type: none"> <li>● construct two-way frequency tables for two categorical variables.</li> <li>● calculate probabilities from the two-way frequency table.</li> <li>● use the probabilities to assess independence of two variables.</li> </ul> <p>Learning Goal 8: Use two-way frequency tables to determine if events are independent and to calculate conditional probability. Use everyday language to explain independence and conditional probability in real-world situations.</p>
<p>☉ S.CP.B.6. Find the conditional probability of <math>A</math> given <math>B</math> as the fraction of <math>B</math>'s outcomes that also belong to <math>A</math>, and interpret the answer in terms of the model.</p> <p>☉ S.CP.B.7. Apply the Addition Rule, <math>P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)</math>, and interpret the answer in terms of the model.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> <li>● Mutually exclusive events exist.</li> </ul> <p>Students are able to:</p> <ul style="list-style-type: none"> <li>● analyze event <math>B</math>'s outcomes to determine the proportion of <math>B</math>'s outcomes that also belong to event <math>A</math>.</li> <li>● interpret this proportion as conditional probability of <math>A</math> given <math>B</math>.</li> <li>● identify two events as mutually exclusive (disjoint).</li> <li>● calculate probabilities using the Addition rule <math>P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)</math>.</li> </ul>

Key: ■ Major | ■ Supporting | ☉ Additional | \* Benchmarked Standard

## Curricular Framework Mathematics-Algebra 2

		<p>Learning Goal 9: Find the conditional probability of <math>A</math> given <math>B</math> as the fraction of <math>B</math>'s outcomes that also belong to <math>A</math> and apply the Addition Rule [<math>P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)</math>].</p>
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Unit 4 Algebra 2 What This May Look Like	
District/School Formative Assessment Plan	District/School Summative Assessment Plan
<p>Topic 9 - Conic Sections</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Quiz 1 - 9.1, 9.2</li> <li>○ Test 1 - 9.1-9.4</li> </ul> </li> <li>● Optional: Topic 9 Performance Task</li> </ul> <p>Topic 10 - Matrices</p> <ul style="list-style-type: none"> <li>○ Readiness Assessment</li> <li>○ Assessment                             <ul style="list-style-type: none"> <li>■ Test 1 - 10.1, 10.2</li> <li>■ Test 2 - 10.3-10.5</li> </ul> </li> <li>■ Optional: Topic 10 Performance Task</li> </ul> <p>Topic 11 - Data Analysis and Statistics</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Quiz 1 - 11.1, 11.2</li> <li>○ Test 1 - 11.1-11.3</li> <li>○ Test 2 - 11.4-11.6</li> </ul> </li> <li>● Optional: Topic 11 Performance Task</li> </ul> <p>Topic 12 - Probability</p> <ul style="list-style-type: none"> <li>● Readiness Assessment</li> <li>● Assessment                             <ul style="list-style-type: none"> <li>○ Quiz 1 - 12.1, 12.2</li> <li>○ Test 1 - 12.1-12.3</li> <li>○ Test 2 - 12.4-12.6</li> </ul> </li> <li>● Optional: Topic 12 Performance Task</li> </ul>	<p>All on Savvas Realize</p> <p><a href="#">Topic 9 Assessment</a></p> <p><a href="#">Topic 10 Assessment</a></p> <p><a href="#">Benchmark Assessment 4</a></p> <p><a href="#">Topic 11 Assessment</a></p> <p><a href="#">Topic 12 Assessment</a></p> <p><a href="#">End of the Year Assessment</a> (on Google drive)</p>
Focus Mathematical Concepts	
Prerequisite skills:	

Key: ■ Major | □ Supporting | ● Additional | \* Benchmarked Standard

## Curricular Framework Mathematics-Algebra 2

- Beginning work with categorical variables and two-way tables.
- The four-step statistical process.
- Using simulation to estimate probabilities.
- Developing a measure of relationship between two quantitative variables.

### Common Misconceptions:

- That population parameters and sample statistics are one in the same, e.g., that there is no difference between the population mean which is a constant and the sample mean which is a variable.
- Making decisions is simply comparing the value of one observation of a sample statistic to the value of a population parameter, not realizing that a distribution of the sample statistic needs to be created.
- That collecting data is easy; asking friends for their opinions is fine in determining what everyone thinks. That causal effect can be drawn in surveys and observational studies, instead of understanding that causality is in fact a property of experiments.
- That inference from sample to population can be done only in experiments. They should see that inference can be done in sampling and observational studies if data are collected through a random process.
- That multiplying across branches of a tree diagram has nothing to do with conditional probability.
- That independence of events and mutually exclusive events are the same thing.

District/School Tasks	District/School Primary and Supplementary Resources
Enrichment activities for each section from Savvas Realize.  <a href="#">Achieve the Core Coherence Map</a>	<a href="#">Savvas enVision Algebra 2</a> <a href="#">IXL</a> <a href="#">BrainPop</a> <a href="#">Illustrative Mathematics</a> <a href="#">Desmos</a> <a href="#">Khan Academy</a> <a href="#">NJCTL</a> <a href="#">Achieve the Core</a>
Instructional Best Practices and Exemplars	
<a href="#">Number/Pattern talks</a> <a href="#">Which One Doesn't Belong</a> <a href="#">Performance Tasks</a> <a href="#">3-ACT tasks</a> <a href="#">3-Reads</a>	
Career and Technical Education	21st Century Skills
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.	CRP2. Apply appropriate academic and technical skills.  CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.  CRP11. Use technology to enhance productivity.

Key: ■ Major | □ Supporting | ● Additional | \* Benchmarked Standard

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

**Interdisciplinary Connections**

**NJSLS ELA**

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

**NJSLS Science**

HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects