



Cliffside Park Public Schools

COURSE OF STUDY UNIT PLANNING GUIDE FOR: Algebra 2 Unit 3

Grade Level:
11th

Cliffside Park School District
Cliffside Park, NJ 07010
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 Function and 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 3 Algebra 2

Unit Name: Rational Exponents, Rational Functions & Exponential Growth and Decay Functions

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

Duration: Approximately 12 weeks

WEEK 19

Essential Question: How can you use a rational exponent to represent a power involving a radical?
How can you use properties of exponents to simplify products and quotients of radicals?

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>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</p> <p>N.RN.A.2 - Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p>	<p>Lesson Vocabulary:</p> <p>Square root, cube root, exponent, nth root, index of a radical, simplest form of a radical, conjugate, like radicals</p> <p>Learning Goals:</p> <p>50. To use properties of exponents to simplify expressions.</p>	<ul style="list-style-type: none"> Find nth roots of numbers and solve equations using nth roots Evaluate expressions with rational exponents Use properties of rational exponents to simplify expression with rational exponents Use properties of radicals to simplify and write radical 	<ul style="list-style-type: none"> Explorations 1, 2 and 3 p 237 nth Roots and Rational Exponents Discuss vocabulary Core Concept p. 238, 239, 244, 245 Explorations 1, 2 and 3 p 243 Properties of Rational Exponents and Radicals Use word problems to illustrate real life examples of solving using nth roots 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Error Analysis, p 241 and 249 Thumbs up Think-pair -Share Monitoring Progress questions 5-12 p.239 Exit Slips Do Nows Leveled Homework p. 241 and p. 248 Mini assessments p. 242 and p. 250 Quizzes</p> <p>Summative:</p>



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<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</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>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>51. To simplify radical expressions.</p> <p>52. To add and subtract like radicals and roots.</p> <p>53. To write variable expressions in simplest form.</p> <p>54. To add and subtract variable expressions.</p>	<p>expressions in simplest form</p>		<p>Topic Tests Projects</p> <p>Benchmark Tests: Approximately every 5-6 weeks.</p> <p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com

Illustrative Mathematics [Extending the Definition of Exponents](#), [Kepler's Third Law of Motion](#)

Khan Academy [Radical Relations](#)

NJCTL Resources [Radical Functions and Rational Exponents](#)



WEEK 20

Essential Question: How can you identify the domain and range of a radical function?

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>F.IF.C.7b 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.BF.B.3 - Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</p>	<p>Lesson Vocabulary:</p> <p>Radical function, transformation, domain, range, end behavior, parabola, circle</p> <p>Learning Goals:</p> <p>55. To graph radical functions.</p> <p>56. To transform radical functions.</p> <p>57. To graph parabolas of the form.</p> <p>58. To Graph a circle.</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Graph radical functions • Write transformations of radical functions • Graph parabolas and circles 	<ul style="list-style-type: none"> • Exploration 1 and 2 on p. 251 • Discuss vocabulary • Core Concepts on p. 252 and p. 253 • Use graphing calculators to visual the different transformations and use them to write the transformations 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student discussion Error Analysis, p. 256 Think-pair -Share Monitoring Progress questions 1-6 p. 253 to p. 255 Exit Slips Do Nows Graphic Organizers Homework Quizzes Quiz p. 260 Leveled Homework p. 256 Mini assessments p. 258</p> <p>Summative:</p> <p>Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p> <p>Alternative:</p>



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<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>MP.8 Look for and express regularity in repeated reasoning.</p>				<p>Question students on transformations and actions compared to parent function</p> <p>Have students draw transformation from equation</p> <p>Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com

Khan Academy [Radical Relations](#)

NJCTL Resources [Radical Functions and Rational Exponents](#)

WEEK 21
Essential Question: How can you solve a radical 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
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<p>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.</p> <p>A.REI.A.2 - Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</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>Lesson Vocabulary:</p> <p>Radical equation, extraneous solution, rational exponents, radical expressions, solving quadratic equations.</p> <p>Learning Goals:</p> <p>59. To solve radical equations and equations with rational exponents.</p> <p>60. To solve radical inequalities.</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Solve equations containing radicals and rational exponents • Solve radical inequalities 	<ul style="list-style-type: none"> • Exploration 1 and 2: Solving Radical Equations and Inequalities on p. 261 • Core Concepts on p. 262 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student discussion Think- pair - Share Monitoring progress questions 1- 11 p. 262 to p. 265 Error Analysis, p. 266 Thumbs up, Thumbs down Exit Slips Do Nows Graphic Organizers, Homework Quizzes Leveled Homework p. 266 Mini Assessment p. 268</p> <p>Summative:</p> <p>Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p> <p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p>
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<p>MP.8 Look for and express regularity in repeated reasoning.</p>				<p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com

Mathematics Assessment Resource Service [Evaluating Radicals](#)

Illustrative Mathematics [Radical Equations](#) , [Who Wins the Race](#)

Khan Academy [Radical Relations](#)

NJCTL Resources [Radical Functions and Rational Exponents](#)

WEEK 22
Essential Question(s): How can you use the graphs of two functions to sketch the graph of an arithmetic combination of the two functions?
 How can you sketch the graph of the inverse of a function?

<p>NJSLS Standards</p>	<p>Concepts <i>What student will know.</i></p>	<p>Skills <i>What students will be able to do.</i></p>	<p>Activities</p>	<p>Assessments and Checks for Understanding</p>
<p>F.BF.A.1b - Write a function that describes a relationship between two quantities.</p> <p>A.CED.A.4 - Rearrange formulas to highlight a quantity of interest, using the</p>	<p>Lesson Vocabulary:</p> <p>Domain, range, input, output, function notation, inverse function, inverse operations, reflection,</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Add, subtract, multiply and divide functions 	<ul style="list-style-type: none"> • Exploration 1 p. 269: Performing Function Operations • Exploration 1 and 2 p. 275: Inverse of a Function • Discuss vocabulary 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student discussion Error Analysis, p. 273 and p. 282 Think-pair-Share Monitoring</p>



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<p>same reasoning as in solving equations.</p> <p>F.BF.B.4a - Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write the expression of the inverse. For example, $f(x) = 2x^3$ or $f(x) = \frac{x+1}{x-1}$ for $x \neq 1$</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</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>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>line of reflection, horizontal line test</p> <p>Lesson Concepts:</p> <p>61. To perform arithmetic operations on functions.</p> <p>62. Learn how to find the inverse of a function (linear, quadratic, cubic and radical).</p> <p>63. Verify functions are inverses.</p>	<ul style="list-style-type: none"> • Explore inverses of functions • Find and verify inverses of nonlinear functions • Solve real-life problems using inverse functions 	<ul style="list-style-type: none"> • Core Concepts p. 270 and p. 278 • Real World Applications p. 280 	<p>progress 1- 5 p. 271 to p. 272 and 1-12 p. 276 to p. 280</p> <p>Exit Slips Do Nows Homework Quizzes Mini assessment p. 274 Leveled homework</p> <p>Summative:</p> <p>Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p> <p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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Possible Additional Resources:

- www.desmos.com
- www.GeoGebra.com

Khan Academy [Rational Relations](#)

NJCTL Resources [Rational Functions](#)

WEEK 23

Essential Question: How can you determine the excluded values in a product or quotient of two rational expressions?

NJSLS 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>A.APR.D.6 - Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p> <p>A.APR.D.7 - Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.</p>	<p>Lesson Vocabulary:</p> <p>Rational expression, simplified form of a rational expression, fraction, reciprocal, equivalent expressions, polynomials</p> <p>Learning Goals:</p> <p>64. Use concepts of simplifying fractions to understand concepts of simplifying rational expressions.</p> <p>65. Use concepts of multiplying numerical</p>	<ul style="list-style-type: none"> Use and apply vocabulary terms in context. Simplify rational expressions Multiply and divide rational expressions 	<ul style="list-style-type: none"> Exploration 1 p. 375, Multiplying and Dividing Rational Expressions Exploration 2 p. 375, Writing a Product or Quotient Discuss vocabulary Core Concepts <ul style="list-style-type: none"> Simplifying Rational Expressions p. 376 Multiplying Rational Expressions p.377 Dividing Rational Expressions p. 378 Real World applications and Modeling with mathematics p. 379 and p. 381 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student discussion Error Analysis, p. 380 Think-pair-Share Monitoring progress 1- 9 p. 376 to p. 379 Exit Slips Do Nows Homework Quizzes Mini assessment p. 382 Leveled homework p. 380</p> <p>Summative:</p> <p>Dynamic Assessment Tool Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p>



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<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</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>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>fractions to multiply and divide rational functions, including listing restrictions</p>			<p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com

Khan Academy [Rational Relations](#)

NJCTL Resources [Rational Functions](#)

WEEK 24
Essential Question: How can you determine the domain of the sum or difference of two rational expressions?

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>A.APR.D.6 - Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p> <p>A.APR.D.7 - Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</p> <p>MP.4 Model with mathematics</p>	<p>Lesson Vocabulary:</p> <p>Complex fraction, rational numbers, reciprocal, Rational expression, simplified form of a rational expression, fraction, equivalent expressions, polynomials</p> <p>Learning Goals:</p> <p>66. Use the concepts of adding and subtracting fractions to understand addition and subtraction of rational expressions.</p> <p>67. Use concepts of adding fractions with unlike denominators and LCM to add and subtract rational expressions.</p> <p>68. To rewrite rational functions in order to create easier related functions for graphing.</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Add or subtract rational expressions • Rewrite rational expressions and graph the related function • Simplify complex fractions 	<ul style="list-style-type: none"> • Exploration 1 p. 383, Adding and Subtracting Rational Expressions • Exploration 2 p. 383, Writing a Sum or Difference • Core Concepts; <ul style="list-style-type: none"> ○ Adding or Subtracting with Like Denominators p. 384 ○ Adding or Subtracting with Unlike Denominators p. 384 ○ Simplifying Complex Fractions p. 387 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student Discussion Error Analysis p. 388 Think-pair-Share Monitoring progress 1- 12 p. 384 to p. 387 Exit Slips Do Nows Homework Quizzes Mini assessment p. 390 Leveled homework p. 388</p> <p>Summative:</p> <p>Dynamic Assessment Tool Topic Tests Projects</p> <p>Benchmark Assessments:</p> <p>Every 5-6 weeks.</p> <p>Alternative:</p> <p>Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response,</p>
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<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>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>69. To simplify complex fractions.</p>			<p>creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com

Mathematics Assessment Resource Service [Arithmetic with Polynomials and Rational Expressions](#)

Khan Academy [Rational Relations](#)

NJCTL Resources [Rational Functions](#)

WEEK 25
Essential Question: How can you solve a rational equation?

NJSLS 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>A.CED.A.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.</p>	<p>Lesson Vocabulary:</p> <p>Cross multiplying, proportion, extraneous solutions, inverse of a function</p>	<ul style="list-style-type: none"> Use and apply vocabulary terms in context. To solve rational equations by cross multiplication 	<ul style="list-style-type: none"> Exploration 1 and 2 p. 391, Solving Rational Equations Solving Real Life problems p. 395 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student Discussion Error Analysis p. 397 Think-pair-Share Monitoring</p>



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<p>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.</p> <p>A.REI.A.2 - Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</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>Learning Goals:</p> <p>70. Solving rational equations.</p> <p>71. Understanding extraneous solutions.</p> <p>72. Finding the inverse of a rational function.</p>	<ul style="list-style-type: none"> To solve rational equations by using the least common denominator Use inverse of functions 		<p>progress 1- 10 p. 392 to p. 395</p> <p>Exit Slips</p> <p>Do Nows</p> <p>Homework</p> <p>Quizzes</p> <p>Mini assessment p. 398</p> <p>Leveled homework p. 396</p> <p>Summative:</p> <p>Dynamic Assessment Tool</p> <p>Topic Tests</p> <p>Projects</p> <p>Benchmark Assessments:</p> <p>Every 5-6 weeks.</p> <p>Alternative:</p> <p>Use dynamic assessment and investigations on online platform.</p> <p>Questioning</p> <p>Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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<p>MP.8 Look for and express regularity in repeated reasoning.</p>				
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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com
 Illustrative Mathematics [An Extraneous Solution](#), [Canoe Trip](#)
 Khan Academy [Rational Relations](#)
 NJCTL Resources [Rational Functions](#)

<p>WEEK 26</p>				
<p>Essential Question(s): What are some characteristics of the graph of a rational function?</p>				
<p>NJSLS Standards</p>	<p>Concepts <i>What student will know.</i></p>	<p>Skills <i>What students will be able to do.</i></p>	<p>Activities</p>	<p>Assessments and Checks for Understanding</p>
<p>A.APR.D.6 - Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p>	<p>Lesson Vocabulary: Rational function, domain, range, asymptote, long division</p> <p>Learning Goals: 73. To graph a simple rational function by hand.</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Graph simple rational functions • Translate simple rational functions • Graph other rational functions 	<ul style="list-style-type: none"> • Exploration 1 p. 365, Identifying Graphs of Rational Functions • Core Concepts <ul style="list-style-type: none"> ○ Parent Function for Simple Rational Functions p. 366 ○ Graphing Translations of Simple Rational Functions p. 367 • Modeling with 	<p>Formative: Analyzing Student classwork Strategic Questioning Student Discussion Error Analysis p. 370 Think-pair-Share Monitoring progress 1- 9 p. 366 to p. 369 Exit Slips Do Nows Homework Quizzes</p>



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<p>F.BF.B.3 - Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</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>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>74. To graph translations of simple rational functions.</p> <p>75. To graph rational functions of the form: $y = \frac{ax + b}{cx + d}$</p>		<p>Mathematics, Real Life Applications p. 369</p>	<p>Mini assessment p. 372 Leveled homework p. 370</p> <p>Summative: Dynamic Assessment Tool Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p> <p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
<p>Possible Additional Resources:</p>				



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www.desmos.com
www.GeoGebra.com

Khan Academy [Rational Relations](#)

NJCTL Resources [Rational Functions](#)

WEEK 27

Essential Question: What are some of the characteristics of the graph of an exponential function?

NJSLS 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>A.SSE.B.3c - Use the properties of exponents to transform expressions for exponential functions.</p> <p>F.IF.C.7e - Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p> <p>F.IF.C.8b - Use the properties of exponents to interpret expressions for exponential functions.</p> <p>F.LE.A.2 - Construct linear and exponential functions, including arithmetic and geometric sequences, given</p>	<p>Lesson Vocabulary:</p> <p>Exponential function, exponential growth function, exponential factor, asymptote, exponential decay function, decay factor, properties of exponents</p> <p>Learning Goals:</p> <p>76. Graph exponential growth and decay functions.</p> <p>77. Use exponential growth and decay functions to solve real-life problems.</p> <p>78. Write an exponential model.</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Graph exponential growth and decay functions • Use exponential models to solve real-life problems 	<ul style="list-style-type: none"> • Exploration 1 p. 295, Identifying Graphs of Exponential Functions • Exploration 2 p. 295, Characteristics of Graphs of Exponential Functions • Core Concepts <ul style="list-style-type: none"> ○ Parent Function for Exponential Growth Function p. 296 ○ Parent Function for Exponential Decay Function p. 296 ○ Compound Interest p. 299 • Real Life Applications on p. 298 to p. 299 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student Discussion Error Analysis p. 301 Think-pair-Share Monitoring progress 1- 8 p. 297 to p. 299 Exit Slips Do Nows Homework Quizzes Mini assessment p. 302 Leveled homework p. 300</p> <p>Summative:</p> <p>Dynamic Assessment Tool Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p>



<p>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.3 Construct viable arguments & critique the reasoning of others.</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>MP.8 Look for and express regularity in repeated reasoning.</p>				<p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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Possible Additional Resources:

www.desmos.com
www.GeoGebra.com

Exponential Growth and Decay [Mathbits](#)

Graphing Calculator [TI-84 -Activity](#)

Mathematics Assessment Resource Service [Modeling Population Growth](#)

Khan Academy [Exponential Growth and Decay](#)

Khan Academy [Exponential and Logarithms](#)

NJCTL Resources [Exponential and Logarithmic Functions](#)

WEEK 28

Essential Question: What is the natural base e ?

What are some of the characteristics of the graph of a logarithmic function?

NJSLS 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>F.IF.C.7e - Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p> <p>F.LE.A.4 - Understand the inverse relationship between exponents and</p>	<p>Lesson Vocabulary:</p> <p>Natural base, irrational number, properties of exponents, logarithm of y with base, common logarithm, natural logarithm, inverse functions</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Define and use the natural base e • Graph natural base functions • Solve real-life problems 	<ul style="list-style-type: none"> • Exploration 1 and 2 p. 303, Approximating the Natural Base e • Exploration 3 p. 303, Graphing a Natural Base Function • Exploration 1 p. 309, Rewriting Exponential Equations • Exploration 2 and 3 p. 309, Graphing Exponential and 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student Discussion Error Analysis p. 307 and p. 315 Think-pair-Share Monitoring progress 1- 7 p. 304 to p.306 and 1 - 21 p. 310 to p. 313 Exit Slips Do Nows Homework Quizzes</p>



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<p>logarithms. For exponential models, express as a logarithm the solution to $ab^ct = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.</p> <p>F.LE.B.5 - Interpret the parameters in a linear or exponential function in terms of a context.</p> <p>F. BF.B.4a - Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</p> <p>MP.4 Model with mathematics</p>	<p>Learning Goals:</p> <p>79. Rewriting logarithmic and exponential equations</p> <p>80. Using inverse properties to find inverse functions of logarithmic and exponential functions</p> <p>81. Graph logarithmic functions</p> <p>82. Solve real-life problems compound interest problems</p>	<ul style="list-style-type: none"> • Define and evaluate logarithms • Use inverse properties of logarithmic and exponential functions • Graph logarithmic functions 	<p>Logarithmic Functions</p> <ul style="list-style-type: none"> • Core Concepts <ul style="list-style-type: none"> ○ The Natural Base e, p. 304 ○ Natural Base Functions, p. 305 ○ Continuously Compounded Interest, p. 306 ○ Definition of Logarithm with Base b, p. 310 ○ Parent Graphs for Logarithmic Functions, p. 313 • Real Life Applications on p. 306 	<p>Mini assessment p. 308 and p. 316 Leveled homework p. 307 and p. 314</p> <p>Summative: Dynamic Assessment Tool Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p> <p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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<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>MP.8 Look for and express regularity in repeated reasoning.</p>				
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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com
 Khan Academy [Exponential Growth and Decay](#)
 Khan Academy [Exponential and Logarithms](#)
 NJCTL Resources [Exponential and Logarithmic Functions](#)

Week 29:
Essential Question: How can you use properties of exponents to derive properties of logarithms?
 How can you solve exponential and logarithmic equations?

NJSLS 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>A.SSE.A.2 - Use the structure of an expression to identify ways to rewrite it</p>	<p>Lesson Vocabulary:</p>	<ul style="list-style-type: none"> Use and apply vocabulary terms in context. 	<ul style="list-style-type: none"> Exploration 1 p. 327, Product Property of Logarithms 	<p>Formative: Analyzing Student classwork Strategic Questioning</p>



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<p>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.</p> <p>F.LE.A.4 - Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^ct = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.</p> <p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</p> <p>MP.4 Model with mathematics</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>base , properties of exponents, exponential equations, logarithmic equations, extraneous solution, inequality</p> <p>Learning Goals:</p> <p>83. Using properties of logarithms to expand or condense logarithmic expressions</p> <p>84. Using properties of logarithms to solve real life problems</p> <p>85. To solve exponential and logarithmic equations and inequalities</p>	<ul style="list-style-type: none"> • Use the properties of logarithms to evaluate logarithms • Use the properties of logarithms to expand or condense logarithmic expressions • Use the change of base formula to evaluate logarithms • Solve exponential equations • Solve logarithmic equations • Solve exponential and logarithmic inequalities 	<ul style="list-style-type: none"> • Exploration 2 p. 327, Quotient Property of Logarithms • Exploration 3 p. 327, Power Property of Logarithms • Explorations 1 and 2 p. 333, Solving Exponential and Logarithmic Equations • Core Concepts <ul style="list-style-type: none"> ○ Properties of Logarithms p. 328 ○ Change-of-Base Formula p. 329 ○ Property of Equality for Exponential Functions, p. 334 ○ Property of Equality for Logarithmic Equations , p. 335 • Solve Real Life Applications p. 330 	<p>Student Discussion Error Analysis p. 331 and p.339 Think-pair-Share Monitoring progress 1- 13 p. 328 to p. 330 and 1 - 12 p. 335 to p. 337 Exit Slips Do Nows Homework Quizzes Mini assessment p. 332 and p. 340 Leveled homework p. 331 and p. 338</p> <p>Summative: Dynamic Assessment Tool Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p> <p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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<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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Possible Additional Resources:
www.desmos.com
www.GeoGebra.com
 Khan Academy [Exponential Growth and Decay](#)
 Khan Academy [Exponential and Logarithms](#)
 Mathbits Log Properties [Mathbits](#)
 NJCTL Resources [Exponential and Logarithmic Functions](#)

WEEK 30
Essential Question: How can you recognize polynomial, exponential, and logarithmic models?

NJSLS 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>A.CED.A.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p>	<p>Lesson Vocabulary:</p> <p>Finite differences, common ratio, point-slope form</p>	<ul style="list-style-type: none"> • Use and apply vocabulary terms in context. • Classify data sets • Write exponential functions 	<ul style="list-style-type: none"> • Exploration 1 p. 341, Recognizing Different Types of Models • Exploration 2 p. 341, Exploring Gaussian and Logistic Models • Use graphing calculators to determine 	<p>Formative:</p> <p>Analyzing Student classwork Strategic Questioning Student Discussion Error Analysis p. 346 Think-pair-Share Monitoring progress 1- 8 p. 342 to p. 345 Exit Slips</p>



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<p>F.BF.A.1a - Determine an explicit expression, a recursive process, or steps for calculation from a context.</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>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments & critique the reasoning of others.</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>Learning Goals:</p> <p>86. Classify data sets by determining which type of function is represented by a table.</p> <p>87. Write an exponential model using two points</p> <p>88. Use technology to find an exponential and logarithmic model to solve real life problems</p>	<ul style="list-style-type: none"> Use technology to find exponential and logarithmic models 	<p>the Exponential and Logarithmic regression to find the best fit model.</p>	<p>Do Nows Homework Quizzes Mini assessment p. 348 Leveled homework p. 346</p> <p>Summative: Dynamic Assessment Tool Topic Tests Projects</p> <p>Benchmark Assessments: Every 5-6 weeks.</p> <p>Alternative: Use dynamic assessment and investigations on online platform.</p> <p>Questioning Journal responses</p> <p>Illustrations, computer projects, oral response, creative presentations or demonstration, etc</p> <p>Performance Assessment Tasks</p>
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<p>MP.8 Look for and express regularity in repeated reasoning.</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:



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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.

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.



Possible Additional Resources:

www.desmos.com

www.GeoGebra.com

Khan Academy [Exponential Growth and Decay](#)

Khan Academy [Exponential and Logarithms](#)

[CK-12 Foundation](#)

Mathematics Assessment Resource Service [Table Tilting Task](#)

NJCTL Resources [Exponential and Logarithmic Functions](#)



Integrated Differentiation/Accommodations/Modifications for Algebra 2 Unit 3 (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 & T students can research professions related to the Algebra.</p> <p>Have the student teach the lesson - peer tutoring (research-based strategy) 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>See specific modifications in each lesson.</p> <p>Concept/Idea Map - teacher models note-taking on Rational exponents and radical functions, performing function operations, inverse functions, performing arithmetic operations on functions, solving rational equations, graphing rational equations, and exponential and log functions.</p> <p>Contextualize language See each lesson for specific vocabulary</p> <p>Visuals and illustrations to be used for performing operations on functions, inverse functions, graphing rational functions and other concrete terms.</p> <p>Word/picture bank available for students' reference in classroom, online and in their textbooks.</p> <p>Wait Time Two - 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>Native Language Supports (peer, online assistive technology, translation device, bilingual dictionary)</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 problems involving graphing.</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 graphing functions.</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 performing arithmetic operations on functions.</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 functions and graphs of functions.</p>



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	<p>Teach the text backward - frontload the concepts and vocabulary needed for learning the material and activating prior knowledge vocabulary, see specific lesson for vocabulary list.</p> <p>Use a word square 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>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>Utilize visual aids such as charts or graphs connected to solving rational equations, finding inverse functions, performing arithmetic operations on functions and graphing rational equations and provide explicit instruction in how to analyze or use the data or information.</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 presented information and questions relating to the 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.</p> <p>Students should be given copies 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>
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		<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>Review essential questions/big ideas of <enter text here> to 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 presented information and questions relating to the unit.</p> <p>Access to word/picture banks to develop an understanding and use content-specific vocabulary, such as those listed in each lesson.</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>
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		<p>Support comprehension of unknown vocabulary, by providing examples of Note-taking, highlighting, underlining, etc. Students should be allowed given copies of grade level material or text so they can highlight or underline pertinent information. Text to speech/Oral reading</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 the 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>Modify tests to address big ideas/essential questions of the unit.</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/>



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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>