Unit I:

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| Topic: Polynomials | Skills:  \* Create equations for the situation given  \* Solve multi-step linear equations (including distributive property)  \* Graphing linear equations for the equations given  \* Perform polynomial operation (addition, subtraction)  \* Perform polynomial operation (multiplication/multi-step)  \* Explain the relationship between zeros and factors of polynomials  \* Use zeros to construct a rough graph of the function defined by the  polynomial  \* Graphing linear and quadratic functions for the tables given  \* Using graphing calculators to analyze the features of a function  \* Factor trinomials  \* Factor special trinomials  \* Factor polynomial by grouping  \* Show that the Fundamental Theorem of Algebra is true for  quadratic polynomials.  \* Apply quadratic formula to solve equations  \* Identify complex numbers  \* Perform operations of complex numbers  \* Use commutative, associative, or distributive property to find the  power of complex numbers  \* Solve quadratic equations with solution as complex numbers  \* Interpret exponential equations in terms of the context | Projected # of days:  28 days |

Unit 2:

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| Topic: Expressions and Equations (1) | Skills:  \* Apply exponent properties to simply expressions  \* Write a number in a radical form  \* Write radical expression containing one or more variables  \* Multiply and divide radical expressions  \* Combine radical expressions  \* Rationalize the denominator  \* Simply expressions with rational exponents  \* Convert between exponential and radical forms  \* Solve square and other radical equation equations  \* Justify and identify extraneous solutions  \* Express an exponential pattern in algebraic terms  \* Interpret each term of an exponential (with positive integer as  exponent ) function in terms of context  \* Solve exponential functions  \* Simply rational expression  \* Multiply and divide rational expressions  \* Add and subtract rational expressions  \* Identify restrictions on the variable of rational expressions  \* Solve rational equations algebraically  \* Solve system of equation containing linear and non-linear equations  algebraically and graphically  \* Interpret key features of graphs and tables in terms of quantities  \* Sketch polynomial graphs showing key features given a verbal  description of the relationship (key feature include: intercepts;  intervals, maximum, minimum, symmetry behavior, and periodicity) | Projected # of days :  25 days |

Cycle 3:

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| Topic: Expressions and Equations (2) | Skills  \* Interpret each term of an exponential function (with fraction as  exponent) in terms of context  \* Find the decay factor of an exponential function  \* Find the decay rate of an exponential function  \* Classify polynomial functions  \* Describe key feature for polynomial function graphs (intercepts,  turning points, end behaviors)  \* Graph polynomial functions  \* Factor a polynomial  \* Find zero of a polynomial function  \* Use factor theorem to solve polynomial equations  \* Solve polynomial equations graphically and algebraically  \* Solve system of polynomial equations by using graph and table  \* Solve system of polynomial equations algebraically  \* Identify inverse relations and function  \* Write the inverse of a function  \* Write arithmetic sequence formula in explicit and recursive forms  \* Write geometric sequence formula in explicit and recursive forms  \* Identify cycles and periods of periodic function  \* Find amplitude of periodic function  \* Find angle measure in standard position and it conterminal angle  \* Find the value of sine and cosine of an angle  \* Find the radian measure for angles  \* Find the length of an arc of a circle  \* Identify and graph Sine function  \* Identify and graph Cosine function | Projected # of days  27 days |

Cycle 4:

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| Topic: Modeling with Functions | Skills  \* Calculate average rate of change presented graphically,  algebraically or in table (linear or non-linear)  \* Graph piecewise functions  \* Solve literal equations (linear and nonlinear equations)  \* Convert standard quadratic equation from to vertex form  \* Rewrite a function in different but equivalent forms  \* Identify direct variation and inverse variation  \* Create polynomial equations for the situation given  \* Identify and the graph after the transformation of a function  \* Write an equation for the graph after transformed from a parent  function  \* Identify even function and odd function  \* Graph translations of trigonometric functions  \* Write equations of trigonometric translation  \* Write the equation of a parabolas and graph parabolas  \* Write and evaluate logarithmic expression  \* Graph logarithmic functions  \* Solve exponential equations the solution in logarithmic expressions | Projected # of days  27 days |

Unit 5:

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| Topic:  Inference and Conclusion from Data | Skills  \* List the sample space for an event  \* List possible outcomes that combine two or more events  \* Identify independent and dependent events  \* Find the probability of an independent event  \* Create examples of two independent events in real life situation  \* Give explanation to justify an independent or dependent event  \* Identify mutual exclusive and non-mutual exclusive events  \* Apply Addition Rule of property to find the probability of a mutual  exclusive event of a non-mutual exclusive event  \* Determine a conditional probability  \* Interpret two-way frequency table  \* Use two-way frequency table to find the theoretical probability  \* Decide if an event is fair or not and give explanation  \* Use probability to analyze decisions  \* Apply simulation as a probability model to solve real life problem  \* Identify sampling methods  \* Recognize bias in samples and surveys  \* Design a survey without bias  \* Use standard deviation to analyze data  \* Use a normal distribution to solve real life problem | Projected # of days  28 days |

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| Unit 1 :Polynomial  Goal(s)(NJCCCS and CCSS):  N.CN.1 : Know there is a complex number i such that i2 = −1, and every complex number has the form a + bi with a and b real.  N.CN.2: Use the relation i2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.  N.CN.7: Solve quadratic equations with real coefficients that have complex solutions.  N.CN.9: (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.  A.REI.4: Solve quadratic equations in one variable.  b. Solve quadratic equations by inspection (e.g., for x2 = 49), 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 a ± bi for real numbers a and b.  A.SSE.1: Interpret expressions that represent a quantity in terms of its context.★  a. Interpret parts of an expression, such as terms, factors, and coefficients.  b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the  product of P and a factor not depending on P.  A.SSE.2: Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a  difference of squares that can be factored as (x2 – y2)(x2 + y2).  A.SSE.4: Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.  For example, calculate mortgage payments  A.APR.1: Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition,  subtraction, and multiplication; add, subtract, and multiply polynomials.  A.APR.2: Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0  if and only if (x – a) is a factor of p(x).  A.APR.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.  A.APR.4: Prove Polynomial identities and use them to describe numerical relationships. For example, the polynomial identity  (x2 + y2)2 = (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples. |
| Essential Questions:   1. How can we use algebraic representation to analyze patterns? 2. How are arithmetic operations related to functions? 3. How can numeric operations be extended to algebraic objects? 4. What makes an algebraic algorithm both effective and efficient? |
| Skills/Knowledge/Understandings:  Understanding:  \* what is imaginary numbers  \* what is complex numbers  \* fundamental theorem  \* what is zero property  Skill: SWBAT  \* use properties of operations to add, subtract, and multiply polynomial  \* solve quadratic equations  \* interpret each term of a polynomial in terms of context  \* operate complex numbers  \* solve quadratic equation with real coefficients that have complex solutions  \* use factoring skills to solve quadratic equations  \* use zero product property to solve polynomial equations  \* use zeros to sketch a polynomial function graph  \* solve quadratic equation with non-real number solutions |
| Objectives:  \* Given polynomial equations/functions, students will use the concept of Zeros and factoring skills to determine solutions and end behavior of  the polynomial with at least 85% accuracy.  \* Given real life situations, students will create formula and derive the formula for the sum of a finite geometric series, interpret each term of  the formula in terms of context, and use the formula to solve problems with at least 85% accuracy. |
| Assessments:  Formative: \* daily do now \* daily exit ticket \*class work \*class discussion \* homework \*bi-weekly department wide assessment \*Diagnostic  assessment  Summative:\* CCSS Model curriculum unit assessments  Authentic: The birthday polynomial project |
| Literacy Connections:  \*All students will write in clear, concise, organized language that varies in content and form for different audiences and purpose.  \*All students will pose questions in mathematics, sequence events in a situation given, and develop recording skills in class activities.  \*All students will interpret the numbers on each term of an equation into meaningful context in a real life situation. |
| Interdisciplinary Connections:  NJ World Class Standards: (21st-Century Life and Careers)  9.2 Personal Financial Literacy: All students will develop skills and strategies that promote personal and financial responsibility related to  financial planning, savings, investment, and charitable giving in the global economy.  9.2.12.A.6 Analyze and critique various sources of income and available resource.  NJCCCS (Language Art Literacy)  3.1.12.E.1: Assess, and apply reading strategies that are effective for a variety of texts (e.g., previewing, generating questions, visualizing,  monitoring, summarizing, evaluating).  3.1.12.E.3.: Analyze the ways in which a text’s organizational structure supports or confounds its meaning or purpose. |
| Technology Integration:   1. Smart Board, Smart Response 2. TI-84 plus calculator 3. PearsonSuccessNet Practice   <https://www.pearsonsuccessnet.com/snpapp/login/login.jsp?showLoginPage=true>   1. Study Island Practice   [www.studyisland.com/web/index/](http://www.studyisland.com/web/index/) |
| Key Vocabulary:  \* slope \*linear function \* x intercept \* y-intercept \* slope-intercept form \*zero of function \* zero-product property \* complex numbers, \* discriminant \* imaginary unit \*imaginary number \*complex solution, \*real coefficient, \*fundamental theorem, \*quadratic polynomial, \*leading coefficients, \*monomial, \*rational expression, finite geometric series, \*tuning point \*end behavior \* quadratic trinomial \* perfect square trinomial \* difference of square \* factor by grouping \* sum of cubes \* difference of cubes |
| Useful Sites:  PMI <https://njctl.org/what-is-psi-pmi/>  theisland [https://hs.studyisland.com/?1550Nav=I&NodeID=413](https://hs.studyisland.com/?1550Nav=I)  Yourteacher [www.mathhelp.com/algebra-1-tutoring.php](http://www.mathhelp.com/algebra-1-tutoring.php)  KHANACADEMY [https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#1](https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#)  Algebra-class.com [www.algebra-class.com/algebra-made-easy.html](http://www.algebra-class.com/algebra-made-easy.html)  IXL [www.ixl.com/math/algebra-1](http://www.ixl.com/math/algebra-1)  CCSS Math Resource ccssmath.ore  interact math [www.interactmath.com](http://www.interactmath.com) |
| Primary Documents: |
| Text Crosswalk: Algebra II Common Core (Pearson)  Lesson 2.3 - 2.4 (p 74 - 88) Lesson 5-1 - 5-3 (p 280- 306)  Lesson 3.1 (p 134 - 141) Lesson 7.1 (p 434 - 441)  Lesson 4.2 (p 202 - 208)  Lesson 4.5 (p 226 - 230)  Lesson 4.7 -4.8 (p 240 - 255) |

\*Differentiation: [www.marzanoresearch.com/free\_resources/itembank.aspx](http://www.marzanoresearch.com/free_resources/itembank.aspx)

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| Unit 2: Expressions and Equations (1)  Goal(s)(NJCCCS and CCSS):  N.RN.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. For example, we define 51/3 to be the cube root of 5  because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5.  N.RN.2: Rewrite expressions involving radicals and rational exponents using the properties of exponents.  A.APR.6: Rewrite rational expressions. 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.  A.REI.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.  A.REI.2: Understand solving equations as a process of reasoning and explain the reasoning. Solve simple rational and radical equations in one  variable, and give examples showing how extraneous solutions may arise.  A.REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  A.REI.7: Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For  example, find the points of intersection between the line y = –3x and the circle x2 + y2 = 3.  A.SSE.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the  expression.  c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be  rewritten as (1.151/12)12t ≈ 1.01212t  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.  F.IF.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. Key features include: intercepts; intervals where  the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and  periodicity |
| Essential Questions:   1. Why is it useful to represent real-life situations algebraically? 2. What are some ways to represent, describe, and analyze patterns that occur in our world? 3. How can we model situation using quadratics/exponents ? |
| Skills/Knowledge/Understandings:  Understanding:  \* radical expression  \* extraneous solutions  \* exponential pattern  Skills: SWBAT  \* perform operations for radical expressions  \* perform operations for rational expressions  \* solve rational and radical equations  \* Identify and justify extraneous solutions  \* use exponential function model to solve problems  \* solve system of equations (linear and non-linear equations)  \* sketch a polynomial graph and show key features of the graph |
| Objectives:  \* Given rational expressions, students will use properties of integer exponents to explain and convert between expressions involving radicals  and rational exponents in correct notation; and rewrite rational expressions in different forms with at least 85% accuracy.  \* Given rational or radical equations, students will solve equations and justify each step in the process and discuss how extraneous solutions  may arise with at least 85% accuracy.  \* Given system of equations, students will solve the systems graphically, algebraically, or use table; 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. |
| Assessments:  Formative: \* daily do now \* daily exit ticket \*class work \*class discussion \* homework \*bi-weekly department wide assessment \*Diagnostic  assessment  Summative:\* CCSS Model curriculum unit assessments  Authentic: Applications of exponential functions project |
| Literacy Connections:  \* All students will orally describe features of a quadratic graph in and interpret exponential function in terms of context.  \*All students will write in clear, concise, organized language that varies in content and form for different audiences and purpose.  \*All students will construct charts and graphs to illustrate or determine the impact of details in a real life problems.  \*All students will use comparing and contrasting skills to articulate the feature of different functions. |
| Interdisciplinary Connections:  NJCCCS (Language Arts Literacy)  3.1.12.A.1 Interpret and use common textual features (e.g., paragraphs, topic, sentence, index, glossary, table of contents) and graphic  features (e.g., charts, maps, diagrams) to comprehend information. |
| Technology Integration:   1. Smart Board, Smart Response 2. TI-84 plus calculator 3. PearsonSuccessNet Practice   <https://www.pearsonsuccessnet.com/snpapp/login/login.jsp?showLoginPage=true>   1. Study Island Practice   [www.studyisland.com/web/index/](http://www.studyisland.com/web/index/)   1. poweralgebra.com   [www.personschool.com/index.cfm?locator-PS13DK](http://www.personschool.com/index.cfm?locator-PS13DK) |
| Key Vocabulary:  \* nth root \* principal root \* radicand \* index \* simplest form of a radical \* rationalize the denominator \* like radicals \*rational exponents \* radical equation \* square root equation \*extraneous solutions \* exponential growth \* growth factor \* exponential decay \* decay facto \* asymptote \* rational equation |
| Useful Sites:  PMI <https://njctl.org/what-is-psi-pmi/>  theisland [https://hs.studyisland.com/?1550Nav=I&NodeID=413](https://hs.studyisland.com/?1550Nav=I)  Yourteacher [www.mathhelp.com/algebra-1-tutoring.php](http://www.mathhelp.com/algebra-1-tutoring.php)  KHANACADEMY [https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#1](https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#)  Algebra-class.com [www.algebra-class.com/algebra-made-easy.html](http://www.algebra-class.com/algebra-made-easy.html)  IXL [www.ixl.com/math/algebra-1](http://www.ixl.com/math/algebra-1)  CCSS Math Resource ccssmath.ore |
| Primary Documents: |
| Text Crosswalk: Algebra II Common Core (Pearson)  Lesson 6.1 - 6.5 (p 361 - 390)  Lesson 7.5 (p 469 - 470)  Lesson 8.4 - 9.5 (p 527 - 541)  Lesson 8.6 (p 542 - 543) |

\*Differentiation: [www.marzanoresearch.com/free\_resources/itembank.aspx](http://www.marzanoresearch.com/free_resources/itembank.aspx)

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| Unit 3: Expressions and Equations (2)  Goal(s)(NJCCCS and CCSS):  A.REI.11: Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the  equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find  successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and  logarithmic functions.  F.BF.2: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate  between the two forms.  F.BF.4a: Find inverse functions.  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) =2 x3 or f(x) = (x+1)/(x–1) for x ≠≠ 1  F.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more  complicated cases.  e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions,  showing period, midline, and amplitude,  F.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.  F.TF.1: Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.  F.TF.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.  F.TF.5: Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.  F.TF.8: Prove the Pythagorean identity sin 2 (θ) + cos2(θ) = 1 and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the  quadrant of the angle. |
| Essential Questions:   1. How can spatial relationships be described by careful use of geometric language? 2. How do geometric relationships help to solve problems and/or make sense of phenomena? 3. How are function and their graph related?   4. How can we best represent and verify geometric and algebraic relationships? |
| Skills/Knowledge/Understandings:  Understanding:  \*exponential growth and decal model  \*concept of Zero on a polynomial equation  \* inverse of a function  \* periodic function  \* Trigonometric function  Skills: SWBAT  \* apply exponential decay function model to solve problem  \* identify decay factor and decay rate on an exponential function  \* sketch a polynomial function graph and describe key features of the graph  \* solve polynomial equations graphically and algebraically  \* write inverse of a function  \* interpret or graph periodic function  \* create arithmetic and geometric sequence formula in explicit and recursive forms  \* find the radian measure for angles and length of an arc of a circle  \* identify sine and cosine functions and graphs |
| Objectives:  \* Given number sequences, students will create arithmetic or geometric sequence formulas in both explicit and recursive forms with at least  85% accuracy.  \* Given a couple of system of polynomial equations, student will solve the systems graphically, algebraically, on in table with at least 85%  accuracy.  \* Given real life situations, students will apply periodic function and trigonometric function to model the problem graphically or symbolically at  Strong Command level or higher in PARCC PLDs rubric. |
| Assessments:  Formative: \* daily do now \* daily exit ticket \*class work \*class discussion \* homework \*bi-weekly department wide assessment \*Diagnostic  assessment  Summative:\* CCSS Model curriculum unit assessments  Authentic: Project: Job choice project (project dealing with arithmetic and geometric sequences) |
| Literacy Connections:  \*All students will write in clear, concise, organized language that varies in content and form for different audiences and purpose.  \*All students will construct charts and graphs to illustrate or determine the impact of details in a real life problems.  \*All students will use comparing and contrasting skills to articulate the feature of different functions.  \*All students will examine story for patterns and then predict or hypothesize the theme, climax and conclusion. |
| Interdisciplinary Connections:  NJ World Class Standards: (Science)  5.1.12.A.1 : Mathematical, physical, and computational tools are used to search for an explain core scientific concepts and principles.  5.1.12. A2: Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations.  5.1.12.A.3: Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/  evidence.  NJCCCS (Language Arts Literacy)  3.1.12.A.2: Identify interrelationships between and among ideas and concepts within a text, such as cause-and-effect relationships.  3.1.12.E.1: Assess, and apply reading strategies that are effective for a variety of texts (e.g., previewing, generating questions, visualizing,  monitoring, summarizing, evaluating). |
| Technology Integration:   1. Smart Board, Smart Response 2. TI-84 plus calculator 3. PearsonSuccessNet Practice   <https://www.pearsonsuccessnet.com/snpapp/login/login.jsp?showLoginPage=true>   1. Study Island Practice   [www.studyisland.com/web/index/](http://www.studyisland.com/web/index/) |
| Key Vocabulary:  \* turning point \*end behavior \* degree of polynomial \* standard form of polynomial function \* leading term \* quadratic trinomial \* perfect square trinomial \* difference of square \* factory by grouping \* sum of cubes \* difference of cubes \* inverse relation \* inverse function \* one-to-one function \* arithmetic sequence \* geometry sequence \* explicit formula \* recursive formula \* common difference \* arithmetic mean \* common ratio \* geometric mean \* periodic function \* cycle \* period \* amplitude \* standard position \* initial side \* terminal side \* conterminal angle \* unit circle \* sine of an angle \* cosine of an angle \* center angle \*intercepted arc \* radian \* sine function \* sine curve \* cosine function \* cosine curve |
| Useful Sites:  PMI <https://njctl.org/what-is-psi-pmi/>  theisland [https://hs.studyisland.com/?1550Nav=I&NodeID=413](https://hs.studyisland.com/?1550Nav=I)  Yourteacher [www.mathhelp.com/algebra-1-tutoring.php](http://www.mathhelp.com/algebra-1-tutoring.php)  KHANACADEMY [https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#1](https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#)  Algebra-class.com [www.algebra-class.com/algebra-made-easy.html](http://www.algebra-class.com/algebra-made-easy.html)  IXL [www.ixl.com/math/algebra-1](http://www.ixl.com/math/algebra-1)  CCSS Math Resource ccssmath.ore |
| Primary Documents: |
| Text Crosswalk: Algebra II Common Core (Pearson)  Lesson 5.1 - 5.3 (p 280 - 302)  Lesson 6.7 (p 405 - 412)  Lesson 9.1 - 9.3 (p 560 - 587)  Lesson 13.1 - 13.5 (p 828 - 987) |

\*Differentiation: [www.marzanoresearch.com/free\_resources/itembank.aspx](http://www.marzanoresearch.com/free_resources/itembank.aspx)

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| Unit 4:Modeling with Functions  Goal(s)(NJCCCS and CCSS):  N.Q.2: Define appropriate quantities for the purpose of descriptive modeling.  G.PE.2: Derive the equation of a parabola given a focus.  F.IF.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. Key features include: intercepts; intervals  where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior;  and periodicity.  F.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate  the rate of change from a graph.  F.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more  complicated cases.  b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.  e. Graph exponential and logarithmic functions, showing intercepts and end behavior,  F.IF.8: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.  F.IF.9: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal  descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger  maximum.  F.BF.1: Write a function that describes a relationship between two quantities.  b. Combine standard function types using arithmetic operations. 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.  F.BF.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.  Include recognizing even and odd functions from their graphs and algebraic expressions for them.  F.LE.4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e;  evaluate the logarithm using technology. |
| Essential Questions:   1. How can we best represent and verify geometric/algebraic relationships? 2. How do geometric relationships help to solve problems and/or make sense of phenomena? 3. What situations can be analyzed using transformations and symmetries? |
| Skills/Knowledge/Understandings:  Understandings:  \* piecewise functions  \* direction variation  \* inverse variation  \* even function and odd function  \* trigonometric function  \* definition of logarithm  Skills: SWBAT  \* compare average rate of change for functions in different representations  \* graph and interpret piecewise functions  \* rewrite a function in different but equivalent forms  \* identify the graph for a transforming function  \* write a transforming function for a graph based on the parent function  \* create equations and graph parabolas  \* evaluate logarithmic expressions and equations |
| Objectives:  \* Given functions in different representations, students will determine the average rate of change in a certain interval, analyze and compare  the rate of change and properties of the functions with at least 85% accuracy.  \* Given a rule of transformation, student will identify, create the graph of the transforming functions with the parent function including  polynomial functions and trigonometric functions with at least 85% accuracy.  \* Given exponential equations, students will solve the equation and express the solution in logarithm. |
| Assessments:  Formative: \* daily do now \* daily exit ticket \*class work \*class discussion \* homework \*bi-weekly department wide assessment \*Diagnostic  assessment  Summative:\* CCSS Model curriculum unit assessments  Authentic: Project: \* Trigonometric project |
| Literacy Connections:  \*All students will write in clear, concise, organized language that varies in content and form for different audiences and purpose.  \*All students will construct charts and graphs to illustrate or determine the impact of details in a real life problems.  \*All students will use comparing and contrasting skills to articulate the feature of different functions.  \*All students will examine story for patterns and then predict or hypothesize the theme, climax and conclusion. |
| Interdisciplinary Connections:  NJ World Class Standards: (Science)  5.2.12.E.1: The motion of an object can be described by its position and velocity as functions of time and by its average speed and average  acceleration during intervals of time.  5.2.12. E.2: Objects undergo different kinds of motion (translational, rotational, and vibrational).  5.2.12.E.4: The magnitude of acceleration of an object depends directly on the strength of the net force, and inversely on the mass of the  object. The relationship (a = Fnet/m) is independent of the nature of the force.  NJCCCS (Language Art Literacy)  3.1.12.E.1: Assess, and apply reading strategies that are effective for a variety of texts (e.g., previewing, generating questions, visualizing,  monitoring, summarizing, evaluating).  3.1.12.E.3.: Analyze the ways in which a text’s organizational structure supports or confounds its meaning or purpose. |
| Technology Integration:   1. Smart Board, Smart Response 2. TI-84 plus calculator 3. PearsonSuccessNet Practice   <https://www.pearsonsuccessnet.com/snpapp/login/login.jsp?showLoginPage=true>   1. Study Island Practice   [www.studyisland.com/web/index/](http://www.studyisland.com/web/index/) |
| Key Vocabulary:   * rate of change \* piecewise function \* direct variation \* inverse variation \* power function \* constant of proportionality \* odd function \*even function \* phase shift \* parabola \* focus of a parabola \* directrix \* focal length \* vertical parabola \* horizontal parabola \* logarithm \* logarithmic function \* common logarithm \* logarithmic scale |
| Useful Sites:  PMI <https://njctl.org/what-is-psi-pmi/>  theisland [https://hs.studyisland.com/?1550Nav=I&NodeID=413](https://hs.studyisland.com/?1550Nav=I)  Yourteacher [www.mathhelp.com/algebra-1-tutoring.php](http://www.mathhelp.com/algebra-1-tutoring.php)  KHANACADEMY [https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#1](https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#)  Algebra-class.com [www.algebra-class.com/algebra-made-easy.html](http://www.algebra-class.com/algebra-made-easy.html)  IXL [www.ixl.com/math/algebra-1](http://www.ixl.com/math/algebra-1)  CCSS Math Resource ccssmath.ore |
| Primary Documents: |
| Text Crosswalk: Algebra II Common Core (Pearson)  Lesson 5.9 (p 339 - 345 )  Lesson 7.3 (p451 - 458)  Lesson 8.1 (p 498 - 505)  Lesson 13.7 (875 - 882) |

\*Differentiation: [www.marzanoresearch.com/free\_resources/itembank.aspx](http://www.marzanoresearch.com/free_resources/itembank.aspx)

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| Unit 5: Inference and Conclusions from Data  Goal(s)(NJCCCS and CCSS):  S.CP.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”).  S.CP.2: Understand that two events A and B are independent if the probability of A and B occurring together is the product of their  probabilities, and use this characterization to determine if they are independent.  S.CP.3: Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the  conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the  probability of B.  S.CP.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. 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.  S.CP.5: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. 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.  S.CP.6: Find the conditional probability of A given B as the fraction of B’s outcomes that also belong to A, and interpret the answer in terms of  the model.  S.CP.7: Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.  S.IC.1: Understand statistics as a process for making inferences about population parameters based on a random sample from that population. |
| Essential Questions:   1. How can experimental and theoretical probabilities be used to make predictions or draw conclusions? 2. When does order matter? |
| Skills/Knowledge/Understandings:  Understanding:  \* independent and dependent events  \* mutually exclusive events  \* theoretical and experimental probability  \* conditional probability  \* two-way table  \* standard deviation  \* normal distribution  Skill: SWBAT  \* list sample space of an event  \* list possible outcomes for two or more events  \* determine probability of independent, dependent, and conditional events  \* apply Addition Rule of probability to determine the probability of a mutually or non mutually exclusive event  \* use two-way table to decide the probability of a conditional event  \* choose an appropriate sampling method  \* design a no bias survey  \* apply standard deviation and normal distribution to solve real life problem |
| Objectives:  \*. Given a two-way frequency table, students will determine if two events are dependent or independent, give an explanation to prove their  determination, and find the probability of the events with 85% accuracy.  \* Given a real life situation, students will choose an appropriate sampling method, design a survey, and use data from a sample survey to  estimate a population mean or proportion.  \* Given a real life situation, students will evaluate random processes underling statistical experiments, make inferences and justify conclusion  from sample surveys, experiments, and observational studies. |
| Assessments:  Formative: \* daily do now \* daily exit ticket \*class work \*class discussion \* homework \*bi-weekly department wide assessment \*Diagnostic  assessment  Summative:\* CCSS Model curriculum unit assessments, Final Examination, Post test  Authentic: Probability activity project  <http://www.cimt.plymouth.ac.uk/projects/mepres/allgcse/as5act1.pdf> |
| Literacy Connections:  \* Write paragraphs to explain why an even is independent or dependent.  \* Create two real life events to show they are independent/dependent.  \* Create survey questions which avoid biased words or phases. |
| Interdisciplinary Connections:  NJ World Class Standards: (Technology)  Marketing Career Cluster  9.4.12.N. (3).3 : Technology is used to access, manage, integrate, and disseminate information.  Career Education and Consumer, Family, and Life Skill  9.2.12. A. Critical Thinking  1. Apply communications and data analysis to the problem-solving and decision making processes in a variety of life situations.  2. Describe and apply constructive responses to criticism.  4. Recognize bias, vested interest, stereotyping, and the manipulation and misuse of information while formulating solutions to  problems that interfere with attaining goals.  NJCCCS (Language Art Literacy)  3.1.12.E.1: Assess, and apply reading strategies that are effective for a variety of texts (e.g., previewing, generating questions, visualizing,  monitoring, summarizing, evaluating). |
| Technology Integration:   1. Smart Board, Smart Response 2. TI-84 plus calculator 3. PearsonSuccessNet Practice   <https://www.pearsonsuccessnet.com/snpapp/login/login.jsp?showLoginPage=true>   1. Study Island Practice   [www.studyisland.com/web/index/](http://www.studyisland.com/web/index/) |
| Key Vocabulary:  \* probability \* theoretical probability \* experimental probability \* sample space, favorite outcome \* simulation \* equally likely outcomes \* dependent event \* independent event \* mutually exclusive event \* conditional probability \* two-way frequency table \* contingency table \* probability model \* fair decision \* random sample \* standard deviation \* population \* sample \* convenience sample \* self-selected sample \* systematic system \* bias \* observational study \* controlled experiment \* survey |
| Useful Sites:  PMI <https://njctl.org/what-is-psi-pmi/>  theisland [https://hs.studyisland.com/?1550Nav=I&NodeID=413](https://hs.studyisland.com/?1550Nav=I)  Yourteacher [www.mathhelp.com/algebra-1-tutoring.php](http://www.mathhelp.com/algebra-1-tutoring.php)  KHANACADEMY [https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#1](https://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/systems-word-problems/v/algebraic-word-problem#)  Algebra-class.com [www.algebra-class.com/algebra-made-easy.html](http://www.algebra-class.com/algebra-made-easy.html)  IXL [www.ixl.com/math/algebra-1](http://www.ixl.com/math/algebra-1)  CCSS Math Resource ccssmath.ore |
| Primary Documents: |
| Text Crosswalk: Algebra II Common Core (Pearson)  Lesson 11.2 - 11.5 ( p 681 - 709)  Lesson 11.7 - 11.8 (p 719 - 730)  Lesson 11.10 (p 739 - 745) |

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