

Sayreville Public Schools
Algebra II Honors – 5 Credits

Algebra II Honors

Elective

Sayreville War Memorial High School

5 Credits

Full Year

Written by: Mary Kruh

Date Curriculum Approved/ Revised: October 18, 2016

Sayreville Public Schools
Algebra II Honors – 5 Credits

Table of Contents:

Statement of Purpose	3
Unit P: Linear Functions, Systems of Equations and Inequalities	4
Unit 1: Quadratic Functions and Factoring	10
Unit 2: Polynomials and Polynomial Functions	20
Unit 3: Rational Exponents and Radical Functions	28
Unit 4: Rational Functions	35
Unit 5: Exponential and Logarithmic Functions	41
Unit 6: Quadratic Relations and Conic Sections	51
Unit 7: Trigonometric Ratios	54
Unit 8: Trigonometric Graphs and Identities	62
Unit 9: Sequences and Series	67
Unit 10: Probability	73
Unit 11: Data Analysis and Statistics	79
Unit 12: Quadratic Relations and Conic Sections (continued)	86

Statement of Purpose

Summary of the Course:

This course is a fast-paced extension of Algebra 1, with a very limited review of Algebra 1 key concepts. After a brief review of linear functions and systems of linear equations, students will continue their study of quadratic functions, polynomials and polynomial functions, rational exponents and radical functions, and rational functions. Students will then be introduced to exponential and logarithmic functions, parabolas (from the conic section point of view), trigonometric ratios, trigonometric functions and their graphs, sequences and series, probability, and data analysis and statistics. As time permits, students will continue their study of conic sections and advanced topics in trigonometry. Applications of mathematics through a study of word problems are emphasized many times throughout the course. Assignments will include more challenging problems than in the non-honors course. The use of graphing calculators will be emphasized and mandatory.

In order to demonstrate a cohesive and complete implementation plan the following general suggestions are provided:

- The use of various formative assessments are encouraged in order to provide an ongoing method of determining the current level of understanding the students have of the material presented.
- Homework, when assigned should be relevant and reflective of the current teaching taking place in the classroom.
- Organizational strategies should be in place that allow the students the ability to take the information gained in the classroom and put in terms that are relevant to them.
- Instruction should be differentiated to allow students the best opportunity to learn.
- Assessments should be varied and assess topics of instruction delivered in class.
- Modifications to the curriculum should be included that address students with Individualized Educational Plans (IEP), English Language Learners (ELL), and those requiring other modifications (504 plans).

Unit P: Linear Functions, Systems of Equations and Inequalities

Summary of the Unit: In this unit, students will be able to analyze graphs of relations and functions, determine if relations are functions, use function notation, and write and graph linear equations. Students will be able to find and interpret the meaning of the slope of a line in order to solve real-world problems. Students will be able to identify and graph special functions, including constant, identity, absolute value, step and piece-wise functions. Students will be able to solve systems of linear equations graphically or algebraically, and interpret the meaning of the point of intersection. Students will extend their study to include the finding the point of intersection of three planes.

Enduring Understanding: Relations and functions can be represented numerically, graphically, algebraically, and/or verbally. Functions can be identified using a variety of techniques, including the Vertical Line Test. There are many forms of linear equations, and the most useful form depends on what you are trying to accomplish (i.e., graph, or find intercepts). The slope of a line indicate the rate of change of vertical units over horizontal units. The solution to a linear system of equations represents the point of intersection of the two lines, and has meaning based on the context of the original question.

Essential Questions: Why are relations and functions represented in different ways? How can you determine if a relation is a function? How do you write the equation of a line? What techniques can you use to solve a system of linear equations? What does the solution to a system of linear equations represent?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Glencoe Algebra 2 New Jersey Edition (©2005) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Relations and Functions	1 day	Analyze graphs of relations and functions. Determine if a relation is a function.	Present relations and functions in multiple representations, and use the definition of function or the Vertical Line Test to determine is a	Check student responses. Quick thumbs up/down whether a relation is a function.	HS A.CED.A.2 HS A.REI.D.10 HS F.IF.A.1 HS F.IF.A.2 HS F.IF.C.7a ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Find functional values. Write linear equations in standard form. Graph a linear function using intercepts.	relation is a function. Introduce function notation and how to use it. Indicate that $f(x)$ is not the only way to write function notation (i.e. $g(a)$, $C(d)$, $A(r)$) Model writing linear equations in standard form. Graph a linear equation using the intercepts method form the above form.	Assess understanding of functional notation via oral participation. Circulate to check student equations. Check student graphs. Classwork assigned. Homework assigned.	
Slope	1 day	Find and use the slope of a line. Graph parallel and perpendicular lines. Determine if two lines are parallel, perpendicular, or neither.	Provide slope formula, if students cannot recall it. Indicate that slope is a rate of change. Remind students of what makes lines parallel, perpendicular, or neither, if they cannot recall.	Assess student recall of these Algebra 1 topics, and review where needed. Check student responses. Classwork assigned. Homework assigned.	HS F.LE.A.1a HS F.LE.A.1b ELA- LITERACY.RST.9-10.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

Write Equations of Lines and Graph Linear Inequalities	1 day	Write equations of lines given a slope and y-intercept, a point and a slope, or two points. Graph linear inequalities (and determine whether the line is dashed or solid, and which half-plane to shade).	Provide students with examples of each type of problem, and tips on where to start. Include examples that are word problems. Remind students how to decide if a line is dashed or solid, and how to determine which half-plane to shade in a system of inequalities, if they cannot recall.	Assess student recall of these Algebra 1 topics, and review where needed. Check student responses. Check student graphs. Classwork assigned. Homework assigned.	HS A.CED.A.2 HS A.REI.D.12 HS F.LE.A.2 ELA-LITERACY.RST.9-10.5
Graphs of Special Functions	1.5 days	Identify and graph constant, identity, absolute value, step, and piece-wise defined functions.	Remind students of what a constant function is, if they cannot recall. Define identity function, and indicate that it is <u>the</u> function with slope=1 and y-intercept of 0 – it does not change. Provide directions on locating the vertex of an absolute value	Assess student recall of these Algebra 1 topics, and review where needed. Check student responses. Check student graphs. Check for correct use of graphing calculator.	HS A.REI.D.10 HS F.IF.C.7b HS F.BF.B.3 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			graph, and constructing a table of values centered about that vertex. Show how to graph a piece-wise defined function a variety of ways, based on student understanding (for example, using tables, graphing by hand and then erasing, what is not needed, or graphing calculator).	Classwork assigned. Homework assigned.	
Review and Test of Preliminary Topics	1.5 days	Review preliminary topics covered up until this point. Assess student understanding of preliminary topics.	Provide sample review questions, and provide time for individual work and group discussion, during ½-day review. Assessment to last all period.	Circulate during review to assess student understanding. Assessment to last all period.	HS A.CED.A.2 HS A.REI.D.10 HS A.REI.D.12 HS F.IF.C.7b HS F.BF.B.3 HS F.LE.A.2 ELA-LITERACY.RST.9-10.4
Systems of Two Linear Equations and Inequalities in Two Variables	2 days	Given a system of linear equations in two variables, approximate solutions graphically and confirm algebraically.	Review each technique and the importance of the “check”. Show how to use the graphing calculator the find	Assess student recall of this Algebra 1 topic, and review as needed. Check student responses.	HS A.CED.A.3 HS A.REI.C.5 HS A.REI.C.6 HS A.REI.D.11 HS A.REI.D.12 ELA-LITERACY.RST.9-10.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Solve systems by substitution or elimination. Graph a system of linear inequalities (determine whether the line is dashed or solid, and shade the correct half-planes lightly, and shade the solution set dark). Solve systems of two equations in two variables that involve word problems.	the solution to a system of equations. Review what “no solution” or “infinitely many” solutions looks like and means. Relate graphing a system of inequalities back to graphing just one linear inequality. Show how to use the graphing calculator to confirm the solutions to a system of inequalities. Provide multiple examples of word problems involving systems, such as number, money, geometry and age problems. Review common errors in translating word problems into algebra.	Check student graphs. Check for correct use of graphing calculator. Check translations of word problems into algebra. Classwork assigned. Homework assigned.	
--	--	---	--	---	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

Systems of Three Equations in Three Variables.	2 days	Given a system of three equations in three variables, solve by elimination, and check.	Show simple systems (such as triangular systems), and move up to move complicated systems.	Classwork assigned. Homework assigned. Students can craft their own word problem that needs a 3x3 system to solve, and can submit work for a quiz grade.	HS A.CED.A.3 ELA- LITERACY.RST.9-10.7
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 9.1 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 9.2 21st Century Life and Career Skills: 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. 9.3 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

Unit 1: Quadratic Functions and Factoring

Summary of the Unit: In this unit, students will learn how to graph quadratic functions written in standard form, vertex form, or intercept form, how to graph quadratic inequalities, and how to use the graph of a quadratic inequality to solve it. Students will learn how to factor binomials and trinomials and learn how to solve quadratic equations by factoring, finding square roots, completing the square, and using the quadratic formula. Students will learn how to use properties of radicals, how to simplify radicals, and how to calculate with the imaginary unit i and perform operations with complex numbers.

Enduring Understanding: Quadratic functions may be represented in a variety of forms (standard form, vertex form, or intercept form), and can be graphed in different ways based on the given form. Quadratic functions can be solved using a variety of techniques (factoring, finding square roots, completing the square, or using the quadratic formula), and the technique chosen comes after analyzing the function and thinking about the best course of action. Solving quadratic functions may produce complex solutions, and operations may be performed on complex numbers.

Essential Questions: How do you graph and write quadratic functions in several forms? What are the methods for solving quadratic functions? How do you perform operations with square roots and complex numbers?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Graph Quadratic Functions in Standard Form	2 days	Graph a quadratic in standard form correctly. Identify the axis of symmetry, vertex, and solutions, if possible. Find the minimum or maximum value	Graph $y = ax^2 + bx + c$, the “parent” quadratic function. Define the standard form of a quadratic function $y = ax^2 + bx + c$.	Check student responses. Check student graphs. Check for correct use of graphing calculator.	HS A.CED.1 HS A.REI.10 HS F.IF.4 HS F.IF.7a

Sayreville Public Schools
Algebra II Honors – 5 Credits

		of a quadratic function by hand or by using the graphing calculator. Create a quadratic function in order to solve a minimum/maximum word problem.	meaning of vertex, minimum/maximum, and axis of symmetry. Use the graphing calculator to explore what changes in a, b, or c do to the graph. Discuss what makes a parabola open up vs open down. Provide notes on the equation of the axis of symmetry, the y-intercept, and solutions (x-intercepts). Practice making graphs of quadratics using a hand-generated table of values, then use the graphing calculator. Model creating a quadratic function to solve a minimum/maximum word problem.	Check translations of word problems into algebra. Classwork assigned. Homework assigned.	
Graph Quadratic Functions in	2 days	Graph quadratic functions in vertex or intercept form.	Introduce vertex form $y = a(x - h)^2 + k$. Make	Check student responses.	HS A.SSE.3a HS F.IF.4 HS F.IF.7a

Sayreville Public Schools
Algebra II Honors – 5 Credits

Vertex or Intercept Form		Convert a quadratic function in vertex or intercept form to standard form using the distributive property.	changes in a, h, and k using the graphing calculator, and have students predict what will happen to the graph. Formalize discussion on how to find the vertex, and how to create a table of values that includes the vertex, in order to sketch the graph. Introduce intercept form $y = a(x - p)(x - q)$. The x-intercepts will be p and q, and the axis of symmetry will be $x = (p + q)/2$. Explore word problems such as finding the distance a football is kicked, and its maximum height, given an equations that models its path. Practice converting	Check student graphs. Check for correct use of graphing calculator. Check translations of word problems into algebra. Circulate to spot check converting to standard form. Classwork assigned. Homework assigned.	HS F.BF.3 ELA- LITERACY.RST.9-10.5
--------------------------	--	---	---	---	---

Sayreville Public Schools
Algebra II Honors – 5 Credits

Solve $x^2 + bx + c = 0$ by Factoring	1 day	Solve quadratic functions (where $a=1$) by factoring, then using the Zero Product Property.	Revisit the words: “zeros”, “roots”, “solutions” and “x-intercepts” (if real), all mean the same thing. Review the Zero Product Property. Model solving problems of this type, and show how to “check” by hand or with the graphing calculator. Model a word problem that can be solved using this technique.	Assess student recall of this Algebra 1 topic, and review as needed. Check student responses. Check for correct use of graphing calculator. Check translations of word problems into algebra. Classwork assigned. Homework assigned.	HS A.SSE.3a HS A.CED.1 HS F.IF.8
Solve $ax^2 + bx + c = 0$ by Factoring	2 days	Solve quadratic functions (where $a \neq 1$) by factoring, then using the Zero Product Property.	Review all factoring techniques (GCF, difference of squares, perfect square trinomials, trinomials of any type, grouping, etc.). Practice solving problems that can use the above techniques.	Assess student recall of this Algebra 1 topic, and review as needed. Check student responses. Check translations of word problems into algebra.	HS A.SSE.1 HS A.SSE.3a HS A.CED.1 HS F.IF.8

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Include word problems that can be solved using these techniques.	Classwork assigned. Homework assigned.	
Solve Quadratic Equations by Finding Square Roots	1 day	Review simplifying radicals. Solve quadratics by taking square roots.	Review vocabulary of radicals: square root, principal square root, radical, radical sign, radicand, index, “simplified radical”, rationalizing the denominator and conjugates. Identify when the square root technique will be able to be used. Remind students of the Fundamental Theorem of Algebra, and that in a quadratic, they must account for the two solutions (which may not be unique). Model word problems, including the height of a dropped object.	Assess student recall of this Algebra 1 topic, and review as needed. Check student responses. Check translations of word problems into algebra. Classwork assigned. Homework assigned.	HS A.REI.1 HS A.REI.4b HS A.REI.10 HS F.IF.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

Review and Assess Graphing and Solving Quadratics	3 days	Review all graphing techniques. Review all solving techniques explored up to this point. Assess student understanding of graphing and solving quadratics.	Provide review problems on graphing and solving quadratics. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS SSE.3a HS CED.A1 HS F.IF.4 HS F.IF.7a HS A.REI.1 HS A.REI.4b HS A.REI.10 ELA-LITERACY.RST.9-10.5
Perform Operations with Complex Numbers	3 days	Solve quadratic functions with imaginary solutions. Perform operations on complex numbers.	Discuss properties of imaginary numbers. Provide examples of quadratics that have imaginary solutions. Show how to perform operations on complex numbers, and relate this back to how operations with radical were performed. As time permits, explore graphing complex numbers in the complex plane.	Check student responses. Classwork assigned. Homework assigned. Quiz.	HS N.CN.1 HS N.CN.2 HS N.CN.3 HS N.CN.4 HS N.CN.7 ELA-LITERACY.RST.9-10.4
Complete the Square	2 days	Solve quadratic functions by completing the square.	Provide details in the process of completing the	Assess student understanding via oral participation.	HS N.CN.7 HS A.SSE.1a HS A.SSE.3b HS A.REI.4a

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Convert a quadratic function in standard form to vertex form using completing the square.	square (both when $a=1$ and when $a \neq 1$). Model practice problems of both types. Model practice problems of converting a quadratic function in standard form to vertex form using this process. Include word problems that can be solved using this technique.	Circulate to assist students as needed. Classwork assigned. Homework assigned.	HS A.REI.4b HS F.IF.8a
Use the Quadratic Formula and the Discriminant	1 day	Solve quadratics using the quadratic formula. Use the discriminant to determine the type of solutions there will be.	Derive the quadratic formula by completing the square. Model solving quadratics using the quadratic formula on 4 problems that give the 4 possible outcomes (2 complex solutions, 1 real rational double root, 2 real rational roots, and 2 real irrational roots).	Check student responses. Check for correct use of graphing calculator. Check translations of word problems into algebra. Classwork assigned. Homework assigned.	HS N.CN.7 HS A.REI.4a HS A.REI.4b HS F.IF.4 HS F.IF.5 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Leave these on the board. Discuss the discriminant and that its value can predict the types of solutions there will be. Use the problems above to direct the discussion. Include word problems that can be solved using the quadratic formula. Remind students that the graphing calculator can be used to do checks.		
Graph and Solve Quadratic Inequalities	2 days	Solve a quadratic inequality first by solving for the roots using any technique, then using a sign graph to help determine the solution set.	Review simple “and” and “or” inequalities and the rules of conjunction and disjunction. Show process of solving quadratic inequalities algebraically (sign graph) and/or graphically (using test points). Remind students that	Check student responses. Check student graphs. Check for correct use of graphing calculator. Classwork assigned.	HS A.SSE.3a HS A.CED.1 HS A.CED.3 HS A.REI.4b HS F.IF.4 HS F.IF.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

			boundary line acts the same ways a linear inequalities. Remind students that the graphing calculator can be used to do this.	Homework assigned.	
Review and Assess Complex Numbers, Completing the Square and the Quadratic Formula	2 days	Review complex numbers, completing the square, the quadratic formula, the discriminant, and solving quadratic inequalities. Assess student understanding of above topics.	Provide review problems on complex numbers, completing the square, the quadratic formula, the discriminant, and solving quadratic inequalities. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS N.CN.7 HS A.SSE.3b HS A.CED.1 HS A.REI.4a HS A.REI.4b HS F.IF.8a ELA- LITERACY.RST.9-10.4
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections:					

Sayreville Public Schools
Algebra II Honors – 5 Credits

- 91 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.
- 92 21st Century Life and Career Skills: 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.
- 93 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Unit 2: Polynomials and Polynomial Functions

Summary of the Unit: In this unit, students learn and apply properties of exponents as they simplify expressions involving powers and add, subtract, and multiply polynomials. They learn methods to factor and solve polynomial equations, including the Remainder and Factor Theorems. Using intercepts and other methods, they graph polynomial functions, classify the zeros of the function, and find all real zeros.

Enduring Understanding: Operations may be performed on polynomials. The graph of a polynomial can be used to find real zeros, describe end behavior, locate turning points, and indicate where a graph is increasing, decreasing, or constant. Polynomial functions can be evaluated by direct substitution, or by the Remainder Theorem. The Factor Theorem can be used to quickly determine whether a given x -value is a zero of the function.

Essential Questions: How do you graph polynomial functions? What operations can be performed on polynomials? How do you find the zeros of a polynomial equation?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Use Properties of Exponents	2 days	Simplify expressions using properties of exponents. As time permits, review scientific notation.	Review properties of exponents and provide sample problems of increasing level of difficulty. Include a word problem using scientific notation, as time permits.	Assess student recall of these Algebra 1 topics, and review where needed. Check student responses. Classwork assigned. Homework assigned.	HS N.RN.1 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

Evaluate and Graph Polynomial Functions	2 days	Understand and use polynomial function notation. Evaluate polynomial functions by direct substitution or synthetic substitution. Discuss end behavior of polynomial functions (based on degree and leading coefficient). Graph a polynomial function using a table of values and knowledge of end behaviors.	Review vocabulary: polynomial, descending degree, leading coefficient, constant. Review process of direct substitution, and show the process of synthetic substitution – both result in the same value. Discuss end behavior of polynomial functions (based on degree and leading coefficient). Review the use of the graphing calculator. Have students predict end behaviors of a polynomial function, then confirm it in the graphing calculator.	Check student understanding via oral participation. Check student work and graphs. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS F.IF.4 HS F.IF.7c ELA-LITERACY.RST.9-10.4
Add, Subtract, & Multiply Polynomials	2 days	Add, subtract, and multiply polynomials.	Review how to add, subtract, and multiply polynomials, including special	Assess student recall of these Algebra 1 topics, and review where needed.	HS A.SSE.2 HS A.APR.1 HS A.APR.4 HS F.BF.1b

Sayreville Public Schools
Algebra II Honors – 5 Credits

			products, as time permits. Include word problems that can be solved using operations on polynomials.	Check student responses. Classwork assigned. Homework assigned. *Quarterly 1 Assessment material ends here.	
Factor and Solve Polynomial Equations	2 days	Factor and solve polynomial equations.	Review all factoring techniques, and introduce sum/difference of cubes pattern. Review Zero Product Property, and its use in solving polynomial equations. Remind students to “check”.	Assess student understanding of new factoring pattern. Classwork assigned. Homework assigned.	HS A.SSE.2 HS A.SSE.3 HS A.APR.3 HS A.APR.4 HS A.CED.1
Review and Assess Properties of Exponents, Evaluating and Graphing Polynomial Functions, Operations on	2 days	Review all graphing techniques. Review properties of exponents, evaluating and graphing polynomial	Provide review problems on properties of exponents, evaluating and graphing polynomial functions, operations on	Circulate during review to assist students. Assessment to last all period.	HS N.RN.1 HS A.SSE.2 HS A.SSE.3 HS A.APR.1 HS A.APR.3 HS A.APR.4 HS A.CED.1 HS F.BF.1b

Sayreville Public Schools
Algebra II Honors – 5 Credits

Polynomials, and Factoring Polynomials.		functions, operations on polynomials, and factoring polynomials. Assess student understanding of above topics	polynomials, and factoring polynomials. Assessment to last all period.		ELA- LITERACY.RST.9-10.4
Apply the Remainder and Factor Theorems	2 days	Divide polynomials using long or synthetic division. Factor polynomials using synthetic division.	Review the steps on long division using an arithmetic problem first, then show that the steps are similar in polynomial long division. Show how to “check” by hand. Provide notes on when and how to use synthetic division. Show that it gets the same answer as long division. Revisit synthetic substitution, and relate it to the Remainder Theorem. Remind students what “goes in	Circulate to assess student understanding of new division process, and of the two new theorems. Classwork assigned. Homework assigned.	HS A.SSE.2 HS A.SSE.3 HS A.APR.2 HS A.APR.3 HS A.APR.6 ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			evenly” means, and how that relates to the Factor Theorem. Include word problems that can be solved using long or synthetic division, or the Remainder and Factor Theorems.		
Find Rational Zeros	1 day	Find rational zeros using the Rational Zero Theorem.	Introduce the Rational Zero Theorem, and use it to make a list of possible zeros. Then, test the possible zeros to see which of them truly are zeros. (Use a graphing calculator to narrow the list.) Once one is found, the lower-degree polynomial function can be used or solved, if it is a quadratic.	Circulate to assess student understanding of new theorem. Classwork assigned. Homework assigned.	HS N.CN.7 HS A.APR.2 HS A.APR.3 HS A.CED.1 ELA- LITERACY.RST.9-10.5
Apply the Fundamental Theorem of Algebra	2 days	Use the Fundamental Theorem of Algebra to determine the number of solutions	Reintroduce the Fundamental Theorem of Algebra (used to determine the number of solutions that need	Circulate to assess student understanding of new theorems.	HS N.CN.7 HS N.CN.9 HS A.APR.3 HS F.IF.7c

Sayreville Public Schools
Algebra II Honors – 5 Credits

		that need to be accounted for. Use the Complex Conjugate and Irrational Conjugate Theorems to identify other solutions. Use Descartes' Rule of Signs to determine the number of possible positive and possible negative real zeros. (Confirm what is correct on the graphing calculator.)	to be accounted for – solutions may be repeated). Give solutions to a polynomial function, and discuss how to make a polynomial function that has those solutions. Use the Complex Conjugate and Irrational Conjugate Theorems to identify other solutions, and repeat the above exercise. Provide notes on how to use Descartes' Rule of Signs to determine the number of possible positive and possible negative real zeros. Create a chart to organize the information. (Show how to confirm what is correct on the graphing calculator.)	Classwork assigned. Homework assigned.	
--	--	--	--	--	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

Analyze Graphs of Polynomial Functions	1 day	Use knowledge of x -intercepts and end behavior to graph a polynomial function.	Use knowledge of x -intercepts and end behavior to graph a polynomial function, using an example where you can tell what the zeros are by looking at the equation. (Create a table using those zeros, plus some x -values on the ends, and some x -values in between. Make the picture matches what you think should happen. Review the concept of turning points and the max number of turning points a graph could have. Explore increasing, decreasing, and constant intervals, as time permits.	Check student understanding via oral participation. Check student work and graphs. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS N.CN.9 HS A.APR.3 HS A.CED.2 HS F.IF.4 HS F.IF.7c ELA- LITERACY.RST.9-10.5
Review and Assess Remainder and Factor Theorems, Finding Rational Zeros, Fundamental Theorem of	2 days	Review Remainder and Factor Theorems, finding rational zeros, Fundamental Theorem of Algebra, and	Provide review problems on Remainder and Factor Theorems, finding rational zeros, Fundamental Theorem of	Circulate during review to assist students. Assessment to last all period.	HS N.CN.9 HS A.APR.2 HS A.APR.3 HS A.CED.2 HS F.IF.4 HS F.IF.7c

Sayreville Public Schools
Algebra II Honors – 5 Credits

Algebra, and Analyzing Graphs of Polynomial Functions		analyzing graphs of polynomial functions. Assess student understanding of above topics.	Algebra, and analyzing graphs of polynomial functions. Assessment to last all period.		ELA- LITERACY.RST.9- 10.4
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 91 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 92 21 st Century Life and Career Skills: 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. 93 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

Unit 3: Rational Exponents and Radical Functions

Summary of the Unit: First, students will learn the meaning of n^{th} roots and rational exponent notation, and how to apply the properties of rational exponents. Next, they will learn to perform function operations, including composition. Then, they will learn how to determine whether a given function has an inverse that is also a function. Finally, students will learn to graph square root and cube root functions and to solve radical equations.

Enduring Understanding: Rational exponents and radical notation can be converted into each other, and simplified. Operations, plus compositions, can be performed on functions. Some functions have inverses that are also functions. Be careful when solving radical equations, as extraneous solutions may occur.

Essential Questions: How do you use rational exponents and what do they mean? How do you perform operations on functions? How do you find the inverse of a function? How do you graph radical equations? Why do you need to check your solutions when solving radical equations?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Evaluate n^{th} Roots and Use Rational Exponents	2 days	Evaluate expressions using rational exponents by converting them into radical form. Solve questions by taking n^{th} roots, and check solutions.	Provide notes on n^{th} roots (different cases based on whether the index is even or odd). Provide directions how to convert expression using rational exponents to radicals. Model simplifying these expressions	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned.	HS N.RN.1 HS A.REI.2 ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			and provide increasingly difficult problems. Practice solving equations by taking n^{th} roots, and check solutions. Include word problems, as time permits.	Homework assigned.	
Apply Properties of Rational Exponents	2 days	Use properties of exponents to simplify expressions having rational exponents. Write radicals in simplest form. Add, subtract, multiply and rationalize radicals.	Remind students of the properties of exponents that they already know, and what they looks like with rational exponents. Review the idea of “like”, and for radicals to be “like”, they need the same index and radicand. Model adding, subtracting, and multiplying radicals. Try to get student to recall rationalizing denominators (simple), and explain the process	Assess student recall of the Algebra 1 topics, and review where needed. Check student responses. Classwork assigned. Homework assigned.	HS N.RN.1 HS N.RN.2 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			for rationalizing denominators using conjugates.		
Review and Assess Using Rational Exponents, and Applying Properties	2 days	Review using rational exponents, and applying properties. Assess student understanding of above topics.	Provide review problems on using rational exponents, and applying properties. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS N.RN.1 HS N.RN.2 HS A.REI.2 ELA-LITERACY.RST.9-10.4
Perform Function Operations and Compositions	2 days	Add, subtract, multiply, and divide functions. Find the composition of functions.	Encourage students to think about how they would add, subtract, multiply, or divide two functions. (This should be fairly intuitive.) Extend discussion to talk about the domain of the original functions and the domain of the resulting function. Provide direction on how to compose functions (using one function as the “input” of the other).	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS F.BF.1b HS F.BF.1c ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Model problems and provide independent practice. As time permits, include a word problem that uses compositions. As time permits, show how to check compositions on the graphing calculator.		
Use Inverse Functions	2 days	Find the inverse of a relation or function, and identify properties of inverses. Determine whether two functions are inverses of each other. Determine whether a function has an inverse that is also a function.	Begin with a discussion about inverse “undoing” each other. Have students think of examples of things, and then functions that “undo” each other. Introduce function notation, and verifying that two functions are inverses of each other. Develop 4-step process of finding inverses. Graph a function, its inverse and the identity	Check student understanding via oral participation. Check student work and graphs. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS F.BF.4a HS F.BF.4b HS F.BF.4c HS F.BF.4d ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			function, and have students describe what they see (should be reflections across the identity). Use a graphing calculator to get the same picture. Explain the Horizontal Line Test, and what it determines. As time permits, look at the parent quadratic function, use the HLT, but then restrict the domain of the parent graph so it passes the HLT to create an invertible function.		
Review and Assess Operations, Compositions, and Inverses	2 days	Review performing operations and compositions and finding inverses of functions. Assess student understanding of above topics.	Provide review problems on performing operations and compositions and finding inverses of functions. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS F.BF.1b HS F.BF.1c HS F.BF.4a HS F.BF.4b HS F.BF.4c ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

Graph Square Root and Cube Root Functions	1 day	Graph square root and cube root functions.	Graph square root and cube root functions using a table of values, or a graphing calculator. State the domain and range. Translate the graphs by manipulating h and k. Provide practice problems that cover both types of roots.	Check student graphs. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS F.IF.4 HS F.IF.5 HS F.IF.7b HS F.BF.3
Solve Radical Equations	2 days	Solve and check radical equations (or equations with rational exponents), and check for extraneous solutions.	Define radical equations. Introduce raising both sides to the n^{th} power property. Provide direction how to solve radical equations and highlight why a check must be done. As time permits, solve equations with two radicals.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.REI.2

Sayreville Public Schools
Algebra II Honors – 5 Credits

			As time permits, include word problems.		
Review and Assess Graphing Square Root and Cube Root Functions and Solving Radical Equations	2 days	Review graphing square and cube root functions and solving radical equations. Assess student understanding of above topics.	Provide review problems on graphing square and cube root functions and solving radical equations. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS F.IF.4 HS F.IF.5 HS F.IF.7b HS F.BF.3 HS A.REI.2
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 91 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 92 21 st Century Life and Career Skills: 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. 93 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

Unit 4: Rational Functions

Summary of the Unit: In this unit, students will learn to graph rational functions, to multiply, divide, add, and subtract rational expressions, and simplify complex fractions. Students will learn to solve rational equations. Finally, they will learn to identify characteristics of functions, and to compare properties of functions.

Enduring Understanding: Rational functions have discontinuities where the denominator is equal to zero. Knowledge of adding, subtracting, multiplying, and dividing are extended to rational expressions. Rational equations may have extraneous solutions, so a check is always needed. Functions can be increasing, decreasing, or constant over an interval, or may have even or odd symmetry, or no symmetry at all.

Essential Questions: How do you graph rational functions and where do discontinuities occur? How do you perform operations with rational expressions? How do you solve rational equations?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Graph Simple Rational Functions	1 day	Graph simple rational functions by identifying vertical and horizontal asymptotes, and plotting points to the left and the right of the vertical asymptotes. Identify the domain and the range of the function.	Graph the parent rational function in order to discuss discontinuity, vertical asymptote, horizontal asymptote, domain and range. Provide directions how to graph rational functions (find vertical and horizontal asymptotes, and plot	Check student understanding via oral participation. Check student work and graphs. Classwork assigned. Homework assigned.	HS A.CED.2 HS A.CED.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			points to the left and right to get the branches). Translate the graphs by manipulating h and k.		
Graph General Rational Functions	2 days	Graph general rational functions by identifying vertical and horizontal asymptotes (or removable discontinuities), and plotting points to the left and the right of the vertical asymptotes (or removable discontinuities).	Graph rational functions (factor denominator to see where discontinuities will be), factor numerator to determine what kind of discontinuities will be present (non-removable or removable discontinuities), find equations of vertical asymptotes or coordinates of the point discontinuities, find equation of horizontal asymptote, if one exists, and discuss domain and range. Model a few graphs and provide practice problems.	Check student understanding via oral participation. Check student work and graphs. Classwork assigned. Homework assigned. Take-home assessment may be started in class.	HS F.IF.7d

Sayreville Public Schools
Algebra II Honors – 5 Credits

Multiply and Divide Rational Expressions	1 day	Multiply and divide rational expressions correctly.	Start with simplifying rational expressions first. Factor numerator and denominator, identify domain restrictions, then cancel common factors. Then move onto multiplying and dividing rational expressions. Model, then provide practice problems.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.APR.7
Add and Subtract Rational Expressions	2 days	Add and subtract rational expressions correctly after finding the LCD.	Help students recall how to find the LCD in simple arithmetic problems and extend that knowledge to algebraic expressions (may have to factor denominators). Provide a method to find the LCD, and then a way to make both denominators “match”, in order to add or subtract correctly.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.APR.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Model problems, and provide practice problems.		
Solve Rational Equations	1 day	Solve rational equations by finding, and multiplying through by the LCD to create a simpler equation to solve.	Provide directions on how to solve rational equations by finding, and multiplying through by the LCD to create a simpler equation to solve. Remind students that a check must be done because extraneous solutions can occur. Model sample problems, and provide practice. See if students can point out when cross-multiplying can be used to solve rational	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.REI.2
Describe and Compare Function Characteristics	2 days	Analyze and compare functions, and describe functions over intervals using the words increasing, decreasing, and constant.	Define increasing, decreasing and constant. Show graphs that exhibit these characteristics, and see if students can describe the intervals over which	Check student understanding via oral participation. Check student work.	HS F.IF.6 HS F.IF.9 ELA-LITERACY.RST.9-10.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Investigate rate of change. Explore even vs. odd symmetry.	each of these are occurring. Revisit idea of local maximum and local minimum. Investigate average rate of change through word problems. Explore even vs. odd symmetry graphically and algebraically.	Classwork assigned. Homework assigned.	
Assessment on Multiplying, Dividing, Adding, and Subtracting Rational Expressions, Solving Rational Equations, and Describing Function Characteristics	1 day	Review multiplying, dividing, adding, and subtracting rational expressions, solving rational equations, and describing function characteristics. Assess student understanding of above topics.	Provide review problems on multiplying, dividing, adding, and subtracting rational expressions, solving rational equations, and describing function characteristics. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS A.APR.7 HS A.REI.2 ELA-LITERACY.RST.9-10.5

Suggested Modifications for Special Education, English Language Learners and Gifted Students:

Students will be allowed to submit assignments using additional time per IEP modifications.

Students will be encouraged to use different size and type of font in order to avoid print confusion.

LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly.

Sayreville Public Schools
Algebra II Honors – 5 Credits

LEP students may be allowed to work with another student who is fluent in their native language.

Suggested Technological Innovations/ Use:

Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc.

Teachers are encouraged to use electronic assessments to determine mastery of concepts taught.

Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.

Cross Curricular/ 21st Century Connections:

91 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

92 21st Century Life and Career Skills: 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.

93 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Unit 5: Exponential and Logarithmic Functions

Summary of the Unit: Students will learn to graph and use exponential growth and decay functions, including functions using the natural base e . Next, they will learn to evaluate and graph logarithmic functions and to use the properties of logarithms to rewrite logarithmic expressions. Then, students will learn to solve exponential and logarithmic equations. Finally, students will learn to write and apply exponential and power functions.

Enduring Understanding: Exponential and logarithmic functions are inverses of each other. Exponential growth and decay functions model real-world phenomena, such as bacteria growth or radioactive decay. Properties of logarithms mirror properties of exponents because a logarithm is an exponent. Solving exponential equations involves taking the logarithm of both sides of the equation. Logarithmic equations may have extraneous solutions, so a check is always needed.

Essential Questions: How do you graph exponential and logarithmic functions? What is the domain and range of an exponential function or a logarithmic function? How do you solve exponential and logarithmic equations? What real-world scenarios can be solved using exponential and logarithmic equations?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Graph Exponential Growth Functions	1 day	Graph exponential growth functions and their transformations, and identify their growth factors, domains, ranges, intercepts and asymptotes. Use exponential growth formula and compound interest	Students will graph a simple exponential growth function, such as $y = 2^{xx}$ by hand or by calculator, and as a class will explore domain, range, asymptotes and intercepts. Formalize notes on the graph of $yy(xx) =$	Check student understanding via oral participation. Check student work and graphs. Check for correct use of graphing calculator. Classwork assigned.	HS F.IF.4 HS F.IF.7e HS F.IF.8b HS F.BF.3 HS F.LE.5 ELA-LITERACY.RST.9-10.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

		formula to solve real-word problems.	$a > 0$ to include definition of a growth factor, and a restriction that $b > 1$. Use the graphing calculator to explore changes to a, h, and k in the equation $y = a \cdot b^{x-h} + k$. Define exponential growth model and introduce the compound interest formula, and use them to solve word problems.	Homework assigned.	
Graph Exponential Decay Functions	1 day	Graph exponential decay functions and their transformations, and identify their growth factors, domains, ranges, intercepts and asymptotes. Use exponential decay formula to solve real-word problems.	Students will graph a simple exponential decay function, such as $y = \frac{1}{2} \cdot 2^x$ by hand or by calculator, and as a class will explore domain, range, asymptotes and intercepts. Formalize notes on the graph of $y = a \cdot b^{x-h} + k$ to include definition of a decay factor, and a	Check student understanding via oral participation. Check student work and graphs. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS F.IF.4 HS F.IF.7e HS F.IF.8b HS F.BF.3 HS F.LE.5 ELA- LITERACY.RST.9-10.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

			restriction that $0 < b < 1$. Use the graphing calculator to explore changes to a, h, and k in the equation $ff = ffff^{a-h} + kk$. Define exponential decay model use it to solve word problems.	*Quarterly 2 Assessment material ends here.	
Extension – Transform Expressions of Exponential Functions	1 day	Rewrite exponential growth and decay functions to understand more completely the real-life situations these functions model.	Use examples of real-life problems to show students how to use properties of rational exponents to transform expressions of exponential functions, so the rate of increase or decrease are more clear. (Include problems such as converting annual percent increase to a monthly percent increase, radioactive decay, and “doubling” functions.)	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.SSE.3c HS F.LE.5 ELA-LITERACY.RST.9-10.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

Use Functions Involving e	1 day	Understand where the natural base e comes from. Simplify natural base expressions, graph the natural base function and translations of it. Use the formula for interest compounded continuously.	Develop the idea of where the natural base e comes from by using the graphing calculator to explore where the y-value of $y = 1 + \frac{1}{n}$ approaches as n the x-values approach infinity. Graph $y = 2^x$ and $y = 2^{-x}$, and discuss why one is growth and the other is decay. Graph translations of the natural base function. Introduce the formula for interest compounded continuously, and use it to solve word problems.	Check student understanding via oral participation. Check student work and graphs. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS F.IF.4 HS F.IF.7e HS F.IF.8b HS F.BF.3 HS F.LE.5
Evaluate Logarithms and Graph Logarithmic Functions	2 days	Rewrite logarithmic and exponential form and evaluate logarithms. Use inverse properties of	Explore what a logarithm is by posing the questions: “$10^0 = ?$, $10^1 = ?$, $10^2 = ?$, so then what is x in	Check student understanding via oral participation. Check student work and graphs.	HS F.IF.7e HS F.BF.3 HS F.BF.4b HS F.BF.5 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

		logarithms to find inverse functions.	$10^{\log 50} = 50$?" Use the graphing calculator to make guesses and to discover that a logarithm is an exponent. Graph an exponential function such as $y = 2^x$. Have students recall all they can about inverse functions, and use that knowledge to graph the inverse of that exponential function (the result will be a logarithmic function). Discuss domain, range, asymptotes and intercept. Graph translations of logarithmic functions. Explain how to convert from exponential form to logarithmic form and vice versa, and use this knowledge	Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	
--	--	--	---	---	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

			to evaluate logarithms.		
Review and Assess Graphing Exponential and Logarithmic Functions, Transforming Expressions of Exponential Functions, Using Functions Involving e , and Evaluating Logarithms	2 days	Review graphing exponential and logarithmic functions, transforming expressions of exponential functions, using functions involving e , and evaluating logarithms. Assess student understanding of above topics.	Provide review problems on graphing exponential and logarithmic functions, transforming expressions of exponential functions, using functions involving e , and evaluating logarithms. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS F.IF.4 HS F.IF.7e HS F.IF.8b HS F.BF.3 HS F.BF.4b HS F.BF.5 HS F.LE.5 ELA- LITERACY.RST.9-10.4 ELA- LITERACY.RST.9-10.7
Apply Properties of Logarithms	2 days	Simplify and evaluate expressions using properties of logarithms. Use the Change of Base Formula.	Have students recall properties of exponents (specifically product, quotient, and power), and frame a discussion about properties of logarithms around this information, since logarithms are exponents. Use increasingly difficult levels of problems expanding	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS A.SSE.3 HS F.BF.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

			and condensing logarithms. Introduce the Change of Base Formula, and use it to evaluate logarithms that do not use the common base. (“Check” that the answer is correct using the definition of logarithm and storing the value into the graphing calculator.) As time permits, include word problems that use logarithms.		
Solve Exponential and Logarithmic Equations	3 days	Solve exponential equations where the bases on each side can be converted to the same base. Solve exponential equations where the bases on each side can NOT be converted to the same base.	Provide notes and examples on solve exponential equations where the bases on each side can be converted to the same base. Use the graphing calculator to “check” solutions. Provide notes and examples on solve exponential	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned.	HS F.BF.5 HS F.LE.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Solve logarithmic equations, in one of the two following cases: 1) in problems where you have (or can obtain by using log properties) "log" with the same base on BOTH sides, or 2) in problems where you have (or can obtain by using log properties) one "log" on one side, but not on the other.	equations where the bases on each side can NOT be converted to the same base. Use the graphing calculator to "check" solutions. Provide notes and examples on how to solve logarithmic equations, in one of the two following cases: 1) in problems where you have (or can obtain by using log properties) "log" with the same base on BOTH sides, or 2) in problems where you have (or can obtain by using log properties) one "log" on one side, but not on the other. Use the graphing calculator to "check" solutions. As time permits, include word problems.	Homework assigned.	
--	--	--	---	--------------------	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

Write and Apply Exponential and Power Functions	2 days	Write an exponential model or a power model for a graph, given two points that the graph passes through.	Model writing an exponential model or a power model for a graph, given two points that the graph passes through. Use multiple example reinforce concepts (remind students that they have solved systems of equations before, and they will use those skills now). As time permits, write exponential and power models for sets of data points, using the calculator to perform regressions.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS F.LE.2 HS S.ID.6 (as time permits)
Review and Assess Applying Properties of Logarithms, Solving Exponential and Logarithmic Equations, and Writing and Applying Exponential and Power Functions	2 days	Review applying properties of logarithms, solving exponential and logarithmic equations, and writing and applying exponential and power functions.	Provide review problems on applying properties of logarithms, solving exponential and logarithmic equations, and writing and applying exponential and power functions.	Circulate during review to assist students. Assessment to last all period.	HS A.SSE.3 HS F.BF.5 HS F.LE.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Assess student understanding of above topics.	Assessment to last all period.		
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 91 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 92 21 st Century Life and Career Skills: 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. 93 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

Unit 6: Quadratic Relations and Conic Sections

Summary of the Unit: This unit introduces students to the properties and characteristics of the parabola (as time permits at the end of the course, other conics may be explored). Students will graph and write equations of parabolas. Finally, students will use graphing, substitution, or elimination to solve quadratic systems.

Enduring Understanding: Students will understand and be able to visualize and sketch key parts of a parabola, whether it is a function or not. Equations of parabolas can be written given characteristics of it. Students will be able to recognize that techniques used in solving systems of linear equations can also be used to solve quadratic systems.

Essential Questions: What are the key parts of a parabola? How do you write the equation of a parabola given certain characteristics of it? How do you graph a parabola given its equations? What techniques can be used to solve a quadratics system? What does/do the solution(s) of a quadratic system represent?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Graph and Write Equations of Parabolas	2 days	Graph and write equations of parabolas.	Highlight key parts of a parabola (vertex, focus, directrix, axis of symmetry, direction of opening, latus rectum and its length). Graph a parabola given its equation and write an equation of a parabola given characteristics of it.	Check student understanding via oral participation. Check student work and graphs. Classwork assigned. Homework assigned.	HS A.REI.10 HS G.GPE.2

Sayreville Public Schools
Algebra II Honors – 5 Credits

			As time permits, explore real-world problems using parabolas, such as satellite dishes.		
Solve Quadratic Systems	2 days	Solve quadratic systems by graphing, substitution, or elimination.	Have students recall methods of solving linear systems (graphing, elimination, and substitution). Have students recall how many solutions a systems of linear equations can have. Indicate that the same techniques can be used for quadratic systems. Discuss the number of solutions possible in a quadratic system. Solve multiple systems using the above techniques, stressing that solutions can be checked algebraically.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS A.REI.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

			As time permits, show how to use the graphing calculator to draw conics (may need plus or minus to get both parts), and find points of intersection.		
Assess Graphing and Writing Equations of Parabolas, and Solving Quadratic Systems	1 day	Assess student understanding of graphing and writing equations of parabolas, and solving quadratic systems.	Assessment to last all period.	Assessment to last all period.	HS A.REI.10 HS G.GPE.2 HS A.REI.7
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 91 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 92 21 st Century Life and Career Skills: 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. 93 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply					

knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Unit 7: Trigonometric Ratios

Summary of the Unit: Students will learn the right triangle definitions of the six trigonometric functions and how to use right triangle trigonometry. Next, they will learn to use radian measure and to evaluate trigonometric functions of any angle.

Enduring Understanding: The trigonometric ratios used in right triangle trigonometry are based on the concept of similar triangles. Concepts such as the Pythagorean Theorem are carried over from the study of Geometry. Angles can be measured in degrees or radians. Trigonometric ratios can be found for acute angles using right triangle trigonometry, and can be found for other types of angles using radian measure and/or the unit circle.

Essential Questions: How are trigonometric functions used in right triangles? What is radian measure? How can you evaluate trigonometric functions of any angle?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Use Trigonometry with Right Triangles	5 days (includes assessment)	Solve right triangles using properties of special right triangles and right triangle definitions of the six trigonometric functions. Solve word problems involving angle of elevation	Review what students can/should recall from Geometry: Pythagorean Theorem, Pythagorean triples, and 30-60-90 and 45-45-90 triangles. Derive the relationships of the sides in the special right triangles, as	Check student understanding via oral participation. Check student work and diagrams. Check for correct use of graphing calculator (degree mode vs. radian mode).	HS G.SRT.6 HS G.SRT.8 ELA-LITERACY.RST.9-10.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

		and angle of depression. Solve for all missing parts of a right triangle, given two sides, or given one trigonometric ratio in the triangle.	needed. Point out trigonometric ratios are equal in similar triangles. Review right triangle trigonometry when solving for sides, and using inverse trigonometry when solving for angles. Introduce the reciprocal functions, and point out co-function relationships. Work on word problems that involve angle of elevation and angle of depression. As time permits, discuss GPS, latitude and longitude, and converting angles in degree to degree, minutes and seconds, and vice versa.	Classwork assigned. Homework assigned. Quiz covering these topics.	
Define General Angles and Use Radian Measure	4 days (includes assessment)	Define angles in standard position, initial side, and	Intro key vocabulary: Angle, made by rotating a	Check student understanding via oral participation.	HS F.TF.1 HS F.TF.2 HS F.TF.3

Sayreville Public Schools
Algebra II Honors – 5 Credits

		terminal side; distinguish between positive and negative angles; find co-terminal angles, complementary angles and supplementary angles, and sketch angle (both in degree measure and radian measure). Define radian in terms of the measure of the central angle of a circle. Find arc length and area of a sector.	ray about a point, Angle in standard position, vertex, initial ray, terminal ray, positive angle, negative angle. Draw a positive angle and negative angle that are co-terminal, and have student supply definition of co-terminal. Recall Quadrants, degrees in full and $\frac{1}{2}$ rotation, complementary, supplementary, acute, right, obtuse, reflexive, angles greater than 360 and Quadrantal angles. Write the definition of radian on the board, ask students to read. What does it mean? To explain, draw a circle on the board and draw in a radius (where initial ray in standard position would be). Cut a length of	Check student work and diagrams. Review fraction work, as needed. Classwork assigned. Homework assigned. Quiz covering these topics.	HS G.C.5 ELA- LITERACY.RST.9-10.4
--	--	---	--	---	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

			twine equal to the length of the radius. Use the twine to measure an arc on the circle. Draw terminal ray to meet end of arc. That central angle is a radian. Have students estimate the degree measure (about 60° is fine for now.). Intro formula for $s=r\theta$. In a circle, $C=2\pi r$, and circumference is an arc made rotating and angle a full rotation. Plug into $s=r\theta$ to show a full rotation in radians is 2π. Draw xy axes, and label radian measures for 0, 90, 180, 270 and 360 degrees. Draw xy axes again, and draw 1, 2, 3, 4, 5, 6 radians....a bit more than 3 fit in 180 degrees (3.14!).		
--	--	--	---	--	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Also show area of a sector formula, and where it comes from $A = \frac{1}{2}(r^2)\pi$. Develop conversion factor for degrees and radians from the fact that $180^\circ = \pi$ radians. Show what 1° equals and what one radian equals (and use a calculator to show it is about 57°). Formalize: To convert degrees to radians, multiply degrees by $\pi/180$ degrees; and to convert radians to degrees, multiply radians by 180 degrees/π. Introduce 17 special angles, and how to find the radian measures quickly. Review co-terminal, complementary and supplementary		
--	--	--	--	--	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

			angles, and find them in radian measure (review fraction work as needed).		
Evaluate Trigonometric Functions of Any Angle	5 days (includes assessment)	Find reference angles, and evaluate the trigonometric function of any special angle using reference angles. Given an ordered pair on the terminal ray of an angle in standard position, SWBAT evaluate the 6 trigonometric functions of that angle. Predict the sign of a trigonometric function depending on the Quadrant its terminal ray lies in. Use this knowledge to develop the definitions of the 6 trigonometric functions based on x, y, and r. Evaluate trigonometric functions of any	Define a reference angle for an angle θ (the reference angle, θ', is the acute angle between the terminal ray of the angle θ and the horizontal axis). Draw an angle in each of the 4 quadrants and have students show where the reference angle is. Then give an angle measure for θ, and have students find the measure of θ' (start with degrees i.e. 300, -135, and then formalize process, so they can do this for radian measure i.e. $3\pi/4$). Review sides of 30-60-90 and 45-45-90 triangles. Then, given a special angle θ, find θ', and use θ' to draw a special	Check student understanding via oral participation. Check student work and diagrams. Classwork assigned. Homework assigned. Quiz covering these topics.	HS F.TF.2 HS F.TF.3 ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

		angle with respect to x, y, and r (including quadrantal angles).	right triangle and evaluate the 6 trig functions for that angle (use right triangle trigonometry). Practice: given a point on the terminal ray of an angle θ, find $\sin \theta$, $\cos \theta$ and $\tan \theta$. Expand definition to include points on terminal ray of an angle (x, y) more/less than one unit away from the origin (introduce “r”). $r^2 = x^2 + y^2$. Have students come up with the definitions of the 6 trigonometric functions in terms of x, y, and r. Expand exploration to have students predict the sign of the 6 trigonometric functions in each quadrant based on the signs of the (x, y) pair.		
--	--	--	--	--	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Do problems where one trigonometric ratio of an angle and the Quadrant where the terminal ray lie are given, and find the remaining trigonometric functions. Or problems where one trigonometric ratio of an angle is given, and the sign of another trigonometric ratio is given, find the remaining ratios.		
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 91 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 92 21st Century Life and Career Skills: 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.

9.3 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Unit 8: Trigonometric Graphs and Identities

Summary of the Unit: Students are introduced to the graphs of sine, cosine, and tangent functions, as well as translations and reflections of the functions. Then students will study and prove trigonometric identities.

Enduring Understanding: Sine, cosine, and tangent functions are periodic. Sine and cosine functions oscillate about a midline, with a specific amplitude, and their domain is all real numbers. The parent tangent function is undefined for odd multiples of $\frac{\pi}{2}$, and has vertical asymptotes at those values.

Essential Questions: How do you graph the sine, cosine, and tangent functions? What causes a trigonometric function to be translated or reflected? How do you prove a trigonometric identity?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Graph Sine, Cosine, and Tangent Functions	3 days	Sketch the graphs of sine and cosine functions, after identifying amplitude, period, and the 5 key points needed to sketch the graph. Sketch the graph of the tangent function	Provide sketches of the parent graphs of $y=\sin x$ and $y=\cos x$, and discuss domain, range, amplitude, period, and x -intercepts (note the 5 key points that are needed to sketch a complete curve).	Check student understanding via oral participation. Check student work and diagrams. Classwork assigned.	HS F.IF.7e HS F.TF.5 ELA- LITERACY.RST.9-10.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

		after identifying period and asymptotes.	Discuss and practice graphing $y = a \sin bx$ and $y = a \cos bx$, making changes in a and b. Repeat for the graphs of $y = \tan x$ and $y = a \tan bx$, discussing period, domain (results in vertical asymptotes), range, and x- intercepts. As time permits, include word problems.	Homework assigned.	
Translate and Reflect Trigonometric Graphs	3 days	Translate and reflect sine, cosine, and tangent graphs.	Have students recall what changing h and k does to a graph. Discuss how to graph $y = a \sin(b(x-h)) + k$ and $y = a \cos(b(x-h)) + k$, by finding the period and amplitude, drawing the midline $y = k$, and locating the 5 key points by translating the graph of $y = \sin x$ or $y = \cos x$.	Check student understanding via oral participation. Check student work and diagrams. Classwork assigned. Homework assigned.	HS F.IF.7e HS F.BF.3 HS F.TF.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

			horizontally, and k units vertically. Repeat discussion for $y = \tan(bx + c)$ $y = \tan(bx + c)$ – h units horizontally, and k units vertically. Indicate that when $a < 0$, the graph is reflected. Start with simple translations and reflections, then move into problems that have both.		
Verify Trigonometric Identities	2 days	Use fundamental trigonometric identities to simplify trigonometric expressions. Verify trigonometric identities.	Provide notes on the reciprocal identities, tangent and cotangent identities, Pythagorean Identities, Co-function Identities, and negative angle identities.	Check student understanding via oral participation. Check student work. Circulate to assist student who get stuck on the proofs.	HS F.TF.8 HS G.SRT.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Provide tips on how to simplify and verify trigonometric identities (for example, change everything into sine and cosine). Model several examples, then provide independent or paired practice.	Classwork assigned. Homework assigned.	
Review and Assess Graphing Sine, Cosine, and Tangent Functions, Their Translations and Reflections, and Verifying Trigonometric Identities	2 days	Review graphing sine, cosine, and tangent functions, their translations and reflections, and verifying trigonometric identities. Assess student understanding of above topics.	Provide review problems on graphing sine, cosine, and tangent functions, their translations and reflections, and verifying trigonometric identities. Assessment to last all period.	Circulate during review to assist students. Assessment to last all period. *Quarterly 3 Assessment material ends here.	HS F.IF.7e HS F.BF.3 HS F.TF.5 HS F.TF.8 HS G.SRT.7
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught.					

Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.

Cross Curricular/ 21st Century Connections:

91 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

92 21st Century Life and Career Skills: 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.

93 21st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Unit 9: Sequences and Series

Summary of the Unit: Students will explore sequences and series. They will define explicit rules that generate number sequences whose terms have a common difference or common ratio, and will use summation notation to represent and find the sum of the terms in a series. They will use rules for the sum of arithmetic series, finite geometric series, and infinite geometric series. Also, students will define recursive rules for generating arithmetic and geometric sequences

Enduring Understanding: Arithmetic sequences have a common difference, and geometric sequences have a common ratio. The sum of the terms in a sequence is called a series. Rules for generating arithmetic sequences or geometric sequences can be explicit or recursive.

Essential Questions: What is the difference between an arithmetic sequence and a geometric sequence? How do you define a sequence explicitly? How do you find the sum of a series? How do you define a sequence recursively?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Define and Use Sequences and Series	2 days	Define and use sequences and series.	Define a sequence as a function whose domain is a set of consecutive integers. The values of the sequence are called terms of the sequence. A sequences can be finite or infinite. Provide practice problems of writing the terms in a sequence given a	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS F.IF.3 HS F.BF.1a HS F.BF.2

Sayreville Public Schools
Algebra II Honors – 5 Credits

			rule, and of identifying a pattern in a sequence and trying to write a rule. Define series and summation notation. Series can be wither finite or infinite. Provide practice problems of writing series in summation notation, and finding the sums of series. As time permits, show formulas for special series, and world problems.		
Analyze Arithmetic Sequences and Series	2 days	Identify arithmetic sequences. Write explicit rules for arithmetic sequences. Find the sum of a finite arithmetic series.	Define arithmetic sequence and common difference. Practice writing explicit rules for arithmetic sequences (given the first few terms, or given a term and a common difference, or given two terms).	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS F.BF.2 HS F.LE.2 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Define arithmetic series and derive the formula for the sum of a finite arithmetic series. Use the formula to find the sum of a finite arithmetic series, given a problem written in summation notation form. As time permits, include word problems.		
Analyze Geometric Sequences and Series	2 days	Identify geometric sequences. Write explicit rules for geometric sequences. Find the sum of a finite geometric series.	Define geometric sequence and common ratio. Practice writing explicit rules for geometric sequences (given the first few terms, or given a term and a common ratio, or given two terms). Define geometric series and derive the formula for the sum of a finite geometric series.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.SSE.4 HS F.BF.2 HS F.LE.2 ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Use the formula to find the sum of a finite geometric series, given a problem written in summation notation form. As time permits, include word problems.		
Finding Sums of Infinite Geometric Sequences	2 days	Find the sum of an infinite geometric sequence, if it exists.	Define a partial sum of an infinite geometric series. Use the example of $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \dots$, find the first 5 partial sums, to show that the partial sums approach a limit. Derive the Sum of an Infinite Geometric Series formula, and discuss when a sum does not exist. Provide practice problems in summation notation	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.SSE.3 ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			form, and as an expanded series. As time permits, include word problems, such as the total distance a pendulum swings.		
Using Recursive Rules	2 days	Write recursive rules for arithmetic and geometric sequences. Write a recursive rule for special sequences, such as the Fibonacci sequence.	Explain the difference between explicit and recursive rules. Explain the notation used in recursive rules. Provide practice problems for writing recursive rules for arithmetic and geometric sequences, and for special sequences, such as the Fibonacci sequence. Include word problems, as time permits.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS F.IF.3 HS F.BF.1a HS F.BF.2 ELA-LITERACY.RST.9-10.4
Review and Assess Sequences and Series	2 days	Review sequences and series.	Provide review problems on sequences and series.	Circulate during review to assist students.	HS F.IF.3 HS F.BF.1a HS F.BF.2

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Assess student understanding of above topics.	Assessment to last all period.	Assessment to last all period.	ELA-LITERACY.RST.9-10.4
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 9.1 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 9.2 21 st Century Life and Career Skills: 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. 9.3 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

Sayreville Public Schools
Algebra II Honors – 5 Credits

Unit 10: Probability

Summary of the Unit: In this unit, students will study the Fundamental Counting Principle, permutations (with and without repetition), and combinations (simple or multiple events). They will then study probability and odds, and how to construct a probability distribution. They will then study when is it appropriate to multiply probabilities vs. add probabilities.

Enduring Understanding: There are many different ways to count the number of possibilities, but it depends on whether or not order matters. Probabilities can also be computed, but you must be mindful of whether events are independent or dependent. When adding probabilities, you must be aware whether events are mutually exclusive or inclusive.

Essential Questions: When do I use a permutation vs. a combination? When do I multiply probabilities vs. add probabilities?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Glencoe Algebra 2 New Jersey Edition (©2005) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
The Counting Principle	2 days	Use the Fundamental Counting Principle.	Define key vocabulary such as outcome, sample space, event, and independent vs. dependent. Introduce the idea of ways to count by hand, such as with a tree diagram or a table. Introduce the Fundamental Counting Principle, and provide practice	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS MP.4 ELA-LITERACY.RST.9-10.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

			problems using it (both independent and dependent events).		
Permutations and Combinations	2 days	Solve problems using permutations and permutations with repetition. Solve problems using combinations and combinations with multiple events.	Define a permutation and introduce factorial notation. Introduce the permutation formula, and show how to use it in the graphing calculator. Show the formula for permutation with repetition, and provide practice problems to use it. Define a combination. Introduce the combination formula, and show how to use it in the graphing calculator. Provide practice problems with simple events, and multiple events.	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS S.CP.B.9 ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

Probability and Odds	2 days	Indicate probability of success or failure. Indicate odds of success or failure. Read and create a probability distribution.	Define probability, success, and failure. Probability is always over total. Probability is a number between 0 and 1, inclusive. Do a simple probability problem, such as, “When two coins are tossed, what is the probability that both are tails?”, where the total number of outcomes can be counted quickly. Move to more complicated problems involving combinations and/or multiplying probabilities. Define odds, and do a word problem involving odds. Describe a probability distribution. First, do a simple one with a uniform distribution (the	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS S.CP.A.4 HS S.CP.B.9 HS S.MD.A.3
----------------------	--------	---	--	---	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

			probability of rolling each of the 6 numbers on a die is $\frac{1}{6}$), then work together to construct a more complicated one (the probability of rolling two dice and getting a sum of 2 through 12 is NOT uniform).		
Multiplying Probabilities	2 days	Understand why and when to multiply probabilities, and compute multiplied probabilities correctly.	Provide notes that: If 2 events are independent, then the probability of both events happening is the product of the two independent probabilities. Practice problems together, and extend the above to more than two independent events. Provide notes about dependent events. If two events are dependent, then the probability of both events happening is the probability of the first event multiplied by the	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS S.CP.A.2 ELA- LITERACY.RST.9-10.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

			probability of the second event, following the first event happening. Practice problems together.		
Adding Probabilities	2 days	Understand why and when to add probabilities, and compute added probabilities correctly.	Define simple event, compound event, mutually exclusive, and inclusive. Provide notes that: If two events are mutually exclusive, then the probability of either the first or the second event occurs is the sum of their probabilities. Model problems before providing practice problems. Provide notes that: If two events are inclusive, then the probability of either the first or the second event occurs is the sum of their probabilities decreased by the probability of both occurring. Model problems before	Check student understanding via oral participation. Check student work. Check for correct use of graphing calculator. Classwork assigned. Homework assigned.	HS S.CP.B.7 ELA- LITERACY.RST.9-10.5

Sayreville Public Schools
Algebra II Honors – 5 Credits

			providing practice problems.		
Review and Assess Probability	3 days	Review probability (all types). Assess student understanding of above topics.	Provide review problems on probability (all types). Assessment to last all period.	Circulate during review to assist students. Assessment to last all period.	HS MP.4 HS S.CP.B.7 HS S.CP.B.9 HS S.CP.A.2 HS S.CP.A.4 ELA- LITERACY.RST.9-10.4 ELA- LITERACY.RST.9-10.5
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 9.1 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 9.2 21 st Century Life and Career Skills: 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. 9.3 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

Unit 11: Data Analysis and Statistics

Summary of the Unit: Students will examine the patterns found in Pascal's triangle and apply these patterns to binomial expansions. They will extend their understanding of probability distributions and measures of central tendency to the study of normal distributions. Students will then study sampling methods for collecting data, how to identify biased samples, and how to calculate a margin of error. Finally, they will compare surveys, experiments, and observational studies.

Enduring Understanding: In everyday reading, statistics and data analysis can be encountered. Knowing whether a sample is biased or unbiased can help given the reader a better ways to understand what they are reading. In polling reports, margin of error is often encountered, and knowing what it means again will help the reader.

Essential Questions: What is a binomial distribution? Where are the values in a normal distribution that rarely occur displayed on a normal curve? What should be true of the sample when you conduct a survey? How do you collect data that accurately represents a population?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Use Combinations and the Binomial Theorem	1 day	Use the Binomial Theorem to expand a power of a binomial expression completely, or to find a specific term in the expansion.	Introduce Pascal's Triangle using numbers, and then using combinations. Solve problems such as "How many different combinations of 2 Model UN members can be chosen from the 6 Model UN students in the	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS A.APR.5 ELA- LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			club?" using Pascal's Triangle (confirm with combinations). Then expand $(x + y)^n$ for $n=0, 1, 2, 3$, and 4, and show that the coefficients match Pascal's Triangle. Introduce the Binomial Theorem, then use it to expand $(x^2 + y)^3$ and other practice problems. As time permits, find specific terms or coefficients of terms, using knowledge of the Binomial Theorem		
Construct and Interpret Binomial Distributions	2 days	Construct and interpret binomial distributions	Revisit probability distributions from "Probability" section (roll on one die, vs. sum on the rolls of two dice) Define a binomial experiment, and provide the formula for the probability of k successes.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS S.MD.3 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Construct a binomial distribution using an example such as: “According to a survey, about 41% of U.S. households have a soccer ball. Suppose you ask 6 randomly chosen U.S. households whether they have a soccer ball. Draw a histogram of the binomial distribution for your survey.” Define symmetric vs. skewed, show pictures of both types to ensure students can see the difference.		
Use Normal Distributions	2 days	Use normal distributions, or z-scores and the standard normal table to find probabilities.	Introduce another type of probability distribution called the normal distribution. A normal curve is a bell-shaped curve that is symmetric about the mean of the data.	Check student understanding via oral participation. Check student work. Classwork assigned.	HS S.ID.4 ELA-LITERACY.RST.9-10.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			Provide notes about the area under the normal curve and the probability (two different ways of interpreting the graph). Practice reading probabilities off of the normal curve. Then, move to a real world examples that can be solved using the normal curve. Introduce another way to read the standard normal curve using a z-score. Provide the formula for a z-score, and practice using the z-score to read the standard normal table. Practice real world problems that can be solved using z-scores and the	Homework assigned.	
--	--	--	---	--------------------	--

Sayreville Public Schools
Algebra II Honors – 5 Credits

			standard normal table.		
Select and Draw Conclusions from Samples	1 day	Select and draw conclusions from samples.	Define population and subset of the population (sample). Define different sample types: self-selected, systematic, convenience and random sample. Provide exercises to classify samples. Define biased vs unbiased sample - and provide exercises in identifying a biased sample. Describe how to choose an unbiased sample, and practice developing ways to choose an unbiased sample. Provide margin of error formula, and practice determining the margin of error for a given sample size, and finding the correct sample size	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS S.IC.1 HS S.IC.3 HS S.IC.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

			for a given margin of error.		
Compare Surveys, Experiments, and Observational Studies	1 day	Compare surveys, experiments, and observational studies.	Provide notes that surveys may have biased questions (define biased). Practice identifying and correcting biased questions. Define experiment vs. observational study. Practice identifying examples of each kind. Define controlled experiment, control group and treatment group, and randomized comparative experiment. Practice determining if a given situation is a randomized comparative experiment.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS S.IC.1 HS S.IC.3 HS S.IC.6
Review and Assess Data Analysis and Statistics	2 days	Review data analysis and statistics.	Provide review problems on data analysis and statistics.	Circulate during review to assist students. Assessment to last all period.	HS S.IC.1 HS S.IC.3 HS S.IC.4 HS A.APR.5 HS S.MD.3 HS S.ID.4

Sayreville Public Schools
Algebra II Honors – 5 Credits

		Assess student understanding of above topics.	Assessment to last all period.	*Quarterly 4 Assessment material ends here.	
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 91 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 92 21 st Century Life and Career Skills: 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. 93 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

Unit 12: Quadratic Relations and Conic Sections (continued) – as time permits

Summary of the Unit: Students will start by applying distance and midpoint formulas, then learn how to graph and write equations of circles, ellipses and hyperbolas (they studied parabolas earlier in the year). They will investigate translations of conics.

Enduring Understanding: Conics sections are formed when a plane intersects a double cone. Depending on the angle of the plane, a circle, parabola, ellipse or hyperbola is created. Conic section can be centered at the origin, or be translated.

Essential Questions: Where does the distance formula come from? What are the general forms of equations for circle, ellipses, and hyperbolas centered at the origin? What are the general forms of equations for circle, ellipses, and hyperbolas NOT centered at the origin?

Summative Assessment and/ or Summative Criteria to demonstrate mastery of the Unit.

Section Quizzes, End of Unit Tests, and End of Quarter Exam

Resources: Larson Algebra 2 Common Core Edition (©2012) and New Jersey Student Learning Standards

Topic/ Selection	Suggested Timeline per topic	General Objectives	Instructional Activities	Suggested Benchmarks/ Assessments	New Jersey Student Learning Standards
Apply the Distance and Midpoint Formulas	1 day	Apply the distance and midpoint formulas	Derive the distance formula from the Pythagorean Theorem. Practice using the distance formula. Provide the midpoint formula and practice problems to work on.	Check student understanding via oral participation. Check student work. Classwork assigned. Homework assigned.	HS G.GPE.4 HS G.GPE.7

Sayreville Public Schools
Algebra II Honors – 5 Credits

Graph and Write Equations of Circles	3 days (includes assessment)	Graph and write equations of circles.	Provide standard equation of a circle with center at the origin. Practice	Check student understanding via oral participation.	HS G.GPE.1 HS A.REI.10
--------------------------------------	------------------------------	---------------------------------------	---	---	---------------------------

Sayreville Public Schools
Algebra II Honors – 5 Credits

			writing equations, and graphing circles centered at the origin. Then provide equation for a circle translated away from the origin. Practice writing equations, and graphing circles NOT centered at the origin. Use completing the square to convert an equation of a circle in expanded form to standard form.	Check student work and graphs. Classwork assigned. Homework assigned. Quiz covering these topics.	
Graph and Write Equations of Ellipses	4 days (includes assessment)	Graph and write equations of ellipses.	Provide standard equation of an ellipse with center at the origin. Practice writing equations, and graphing ellipses centered at the origin. Then provide equation for an ellipse translated away from the origin. Practice writing equations,	Check student understanding via oral participation. Check student work and graphs. Classwork assigned. Homework assigned. Quiz covering these topics.	HS G.GPE.3 HS A.REI.10

Sayreville Public Schools
Algebra II Honors – 5 Credits

			and graphing ellipses NOT centered at the origin. Use completing the square to convert an equation of an ellipse in expanded form to standard form.		
Graph and Write Equations of Hyperbolas	4 days (includes assessment)	Graph and write equations of hyperbolas.	Provide standard equation of a hyperbola with center at the origin. Practice writing equations, and graphing hyperbolas centered at the origin. Then provide equation for a hyperbola translated away from the origin. Practice writing equations, and graphing hyperbolas NOT centered at the origin. Use completing the square to convert an equation of a	Check student understanding via oral participation. Check student work and graphs. Classwork assigned. Homework assigned. Quiz covering these topics.	HS G.GPE.3 HS A.REI.10

Sayreville Public Schools
Algebra II Honors – 5 Credits

			hyperbola in expanded form to standard form.		
Suggested Modifications for Special Education, English Language Learners and Gifted Students: Students will be allowed to submit assignments using additional time per IEP modifications. Students will be encouraged to use different size and type of font in order to avoid print confusion. LEP students will be allowed to use an internet translator or language glossary in order to translate vocabulary and assignments properly. LEP students may be allowed to work with another student who is fluent in their native language.					
Suggested Technological Innovations/ Use: Instructional technology, where available, should be used to present and assess lessons such as; PowerPoint, SMART Board, Quia, Kahoot, etc. Teachers are encouraged to use electronic assessments to determine mastery of concepts taught. Demonstration of the graphing calculator, and student use of the graphing calculator should be mandatory.					
Cross Curricular/ 21st Century Connections: 91 21 st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures. 92 21 st Century Life and Career Skills: 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. 93 21 st Century Life and Career Skills: Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.					

If time remains at the end of the year, consider extending studies in trigonometry, such as inverse trigonometry, Law of Sines, Law of Cosines, solving trigonometric equations, writing trigonometric functions and model, Sum and Difference Formulas, and Double-Angle and Half-Angle formulas.