SPARTA TWP. PUBLIC SCHOOLS

Introduction to Algebra 1

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Adapted from:
New Jersey Student Learning Standards

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Sparta Township School District

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Sparta, NJ 07871
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VISION

The Sparta School district believes that the Sparta school system produces students who will exemplify mastery in mathematical practices. It is the responsibility of administrators, teachers, students, and parents to create learning opportunities to persevere in modeling mathematics precisely and strategically with reasoning, tools, and algebraic structure. Through this collaboration, students will develop into independent, competent, mathematical thinkers who are college and career ready.

BELIEF STATEMENTS

- Technology can enhance the learning process and prepare students to be 21st century learners.
- Student-centered learning activities will enable students to develop ownership for their education.
- A coherent K-12 curriculum will allow for authentic real-world learning opportunities.
- Our assessments will require students to demonstrate in-depth understanding rather than recalling simple facts and algorithms.
- Students will be confident in participating in higher level discussions that will assess and advance the understanding of concepts.
- The use of various resources, tools, and technology will engage students to solve mathematically rich, real-world problems that meet the needs of a diverse population of learners.
- Collaborative and hands-on learning activities will promote creative and critical thinking skills for all students.

COURSE OVERVIEW

The Sparta School District Introduction to Algebra program has been constructed within a multi-faceted, standards-based Philosophy. In this course, students will extend their knowledge of equations and rational number operations to manipulate multi-step equations involving the distributive property and variables on both sides to model and solve geometrical and real-world problems. Students will develop a basic understanding of functions, and begin to explore linear functions by writing, graphing, and interpreting key features of linear equations and systems of linear equations in context.

COMPONENTS OF THE COURSE

The Components of a successful Introduction to Algebra program are:

- Glencoe Algebra I
- Engage NY

SCOPE AND SEQUENCE

(Pacing Guide)

Weeks Taught *(40 Total)*	**Units of Study**
3	Solving Linear Equations and Inequalities
3	Writing and Graphing Equations
3	Systems of Equations
2	Radical Expressions and Equations
4	Polynomials
3	Functions
4	Quadratics
4	Exponential Functions

CONTENT AREA:	Math	**GRADE LEVEL**	9
UNIT 1:	Unit 1 Solving Linear Equations & Inequalities		

UNIT SUMMARY

In this unit, students will solve equations, and problems involving equations, using deductive reasoning, the Distributive Property, and variables on both sides. Students will represent and use numbers in equivalent forms to describe real life situations and solve problems arising from those situations; use estimation and proportional reasoning to solve problems. They will use algebraic expressions to model real world phenomena. Write and solve linear equations to model relationships between quantities. Students will manipulate equations to highlight a variable of interest. Students extend the skills of this unit, related to solving various kinds of equations, to the solving of inequalities. Many of the procedures used are the same, reflecting the fact that the properties for inequalities are very similar to those for equations. Students solve and graph inequalities using addition, subtraction, multiplication, and division, progressing from one-step to multi-step inequalities, first with the variable on one side only, and then with variables on both sides. They also solve compound inequalities as well as equations and inequalities containing absolute values.

NEW JERSEY STUDENT LEARNING STANDARDS

A.REI.1 - Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A.REI.3 - Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A.CED.1 - Create equations and inequalities in one variable and use them to solve problems.

A.CED.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

F.LE.5 - Interpret the parameters in a linear or exponential function in terms of a context.

A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half planes.

21st CENTURY LIFE AND CAREER READY PRACTICES

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

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

CRP9. Model integrity, ethical leadership and effective management.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

TECHNOLOGY STANDARDS

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

CROSS CURRICULAR CONNECTIONS

Science: Students will make connections based on topics presented in unit 1.

READING ACROSS CONTENT AREAS	WRITING ACROSS CONTENT AREAS
RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

	NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
Students will understand that: ● The properties of real numbers can be applied to a variety of mathematical expressions and equations. ● An inequality is a mathematical sentence that uses an inequality symbol to compare the values of two expressions. ● Just as properties of equality can be used to solve equations, properties of inequality can be used to solve inequalities. ● Unlike equations, inequalities can be displayed in simple and compound form.	● How are variable expressions written and evaluated? ● How are equations solved and applied to real-world situations? ● Can two things that appear different actually be the same? ● How do we write and solve single variable linear inequalities? ● How do we solve 2 variable inequalities ● How do you represent relationships between quantities that are not equal? ● Can inequalities that appear to be different be equivalent?
UNIT LEARNING TARGETS (Students will know how to…)	
● Students will develop and evaluate expressions and equations based on verbal and written input. ● Students will solve one, two, and multi-step equations. ● Given a variable to solve for, students will transform equations. ● Students will develop mathematical writing given an open-ended problem to be solved using using an equation. ● Students will solve equations using consecutive integers. ● Students will solve equations involving grouping symbols. ● Students will learn to write and graph inequalities. ● Students will use properties to generate equivalent inequalities. ● Students will be able to establish a set of rules for solving linear and absolute value inequalities. ● Students will be able to compare the graphs of linear equations and inequalities.	
LEARNING ACTIVITIES: (Students will be able to…)	
● Students will make sense of problems and persevere in solving them. ● Students will reason abstractly and quantitatively. ● Construct viable arguments and critique the reasoning of others ● Students will model with mathematics. ● Students will use appropriate tools strategically. ● Students will attend to precision. ● Students will look for and make use of structure. ● Students will look for and express regularity in repeated reasoning.	

- Students can explain correspondences between equations or expressions.
- Students will check their answers do demonstrate mathematical proficiency.
- Students make sense of quantities and their relationships in problem situations.
- Students quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities.
- Students look closely to discern a pattern or structure.
- Students will transform algebraic expressions.
- Students will make conjectures about the form and meaning of the problem and the solution**.**

EVIDENCE OF LEARNING:		
FORMATIVE ASSESSMENTS	**SUMMATIVE ASSESSMENTS**	**ALTERNATIVE ASSESSMENTS**
• Student Questions and Interactions • Classwork • Teacher observations • Homework • Various worksheets and problems from text • Quizzes • Quiz 1 - Assess knowledge of evaluating expressions, solving equations, writing expressions, writing equations, • Quiz 2 - Assess knowledge of literal equations • Quiz 3- A quiz on solving one-step inequalities • Quiz 4- A quiz on solving multi-step and compound inequalities	Unit Summative - Solving Linear Equations	• IXL • Student Presentation • Teacher Observation • Problem Based Activities
INSTRUCTIONAL MATERIALS/RESOURCES		**TECHNOLOGY RESOURCES**
• Algebra 1 Textbook • connected.mcgraw-hill.com		https://learnzillion.com/lesson_plans/3097-1-understand-that-linear-equations-in-one-variable-may-have-one-solution-no-solution-or-infinitely-many-solutions-c

	https://www.ixl.com/math/algebra-1/solve-absolute-value-equations http://www.algebralab.org/lessons/lesson.aspx?file=Algebra_FunctionsRelationsLiteralEquations.xml https://www.ixl.com/math/algebra-1/solve-one-step-linear-inequalities-addition-and-subtraction https://www.illustrativemathematics.org/content-standards/HSA/REI/B/3/tasks/807
DIFFERENTIATION:	
Sparta Twp. Public Schools Differentiation Strategies	
TEACHER NOTES:	

CONTENT AREA:	Math	**GRADE LEVEL**	9
UNIT 2:	Unit 2 Writing and Graphing Equations		
UNIT SUMMARY			
This unit introduces rates of change and defines slope of a line as the ratio of the vertical change to the horizontal change. This leads to graphing a linear equation and writing the equation of a line in three different forms, using the slope, intercepts, or points on the line. From there, the characteristics of parallel and perpendicular lines are examined.			
NEW JERSEY STUDENT LEARNING STANDARDS			

F.IF.4 - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

F.IF.6 - Calculate and interpret the average rate of change of a function over a specified interval. Estimate the rate of change from a graph.

A.CED.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels/scales.

A.REI.10 - Understand that the graph of an equation is two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve.

8.F.2 - Compare properties of two functions each represented in a different way

8.F.3 - Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear

8.F.4 - Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, including reading these from a table or from a graph. Interpret rate of change.

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CRP9. Model integrity, ethical leadership and effective management.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

TECHNOLOGY STANDARDS

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

CROSS CURRICULAR CONNECTIONS

Science: Students will make connections based on topics presented in unit 2.

READING ACROSS CONTENT AREAS	WRITING ACROSS CONTENT AREAS
RI.11-12.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
Students will understand that: ● The slope of a line can be viewed as rate of change in real world problems. ● Equations can be graphed on a coordinate plane using a table of values, intercepts, and equations rearranged into slope-intercept form. ● Equations can be written in function form.	● How are linear equations represented in graphs? ● How is slope calculated given two points, a graph, or an equation? ● How are linear equations written in slope-intercept form and standard form? ● How are graphs used to develop equations? ● What is direct variation and how is it applied to real world problems?

UNIT LEARNING TARGETS (Students will know how to…)

- Identify linear equations, intercepts, and zeros
- Graph linear equations using a table of values and with one variable using intercepts.

- Solve equations by graphing.
- Use rate of change to solve problems.
- Find the slope of a line.
- Write a linear equation in point slope form given the coordinates or a point on a line and the slope of a line
- Write a linear equation in slope intercept form given the slope and y-intercept
- Graph linear equations using the x and y intercepts or the slope and y-intercept
- Explore the effects of changing the slopes and y-intercepts of linear functions
- Write an equation of a line that is parallel or perpendicular to the graph of a given equation that passes through a given point
- Graph vertical and horizontal lines
- Model direct variation
- Graph and evaluate linear functions

LEARNING ACTIVITIES: (Students will be able to…)

- Students will make sense of problems and persevere in solving them.
- Students will reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others
- Students will model with mathematics.
- Students will use appropriate tools strategically.
- Students will attend to precision.
- Students will look for and make use of structure.
- Students will look for and express regularity in repeated reasoning.
- Students will solve equations with real world context.
- Students will interpret parts of expressions, equations, solutions, and visual models within context of the given problem.
- Students will contextualize different representations used throughout the problem solving process.
- Students will use desmos, graphing calculators, or geometer's sketchpad to model transformations of functions.
- Students will use graphs, tables, digital manipulatives, and calculators as necessary to assist in solving problems.
- Students will use proper mathematical vocabulary when justifying their reasoning.
- Students will also pay close attention to directions.
- Students will deconstruct functions by knowing the proper components of a particular form of a function.

EVIDENCE OF LEARNING:

FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS	ALTERNATIVE ASSESSMENTS
• Student Questions and Interactions • Classwork	Unit Summative - Graphing Linear Equations	• IXL • Student Presentation • Teacher Observation

• Teacher observations • Homework • Various worksheets and problems from text • **Quiz 1** - graphing equations using intercepts, finding slope, graphing using slope-intercept form. • **Quiz 2** - writing equations of lines		• Problem Based Activities

INSTRUCTIONAL MATERIALS/RESOURCES	**TECHNOLOGY RESOURCES**
• Algebra 1 • connected.mcgraw-hill.com	https://www.illustrativemathematics.org/content-standards/HSF/IF/B/6/tasks/686 https://www.ixl.com/math/algebra-1/write-variable-equations https://www.ixl.com/math/algebra-1/graph-a-linear-inequality-in-the-coordinate-plane

DIFFERENTIATION:

Sparta Twp. Public Schools Differentiation Strategies

TEACHER NOTES:

CONTENT AREA:	Math	**GRADE LEVEL**	9
UNIT 3:	Systems of Equations		

UNIT SUMMARY

In this unit students will learn to understand the nature of solutions to a linear system of equations. Students will learn to inspect a linear system to determine how many solutions it has. If the system has one solution, students will be able to solve it using either graphing or algebraic techniques (substitution

and/or elimination). Students will learn to apply linear systems to real world situations including checking if a line through one set of coordinate points will intersect a line through a second set of coordinate points.

NEW JERSEY STUDENT LEARNING STANDARDS

8.EE.8.A Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

8.EE.8.B Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*

8.EE.8.C Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

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TECHNOLOGY STANDARDS

8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results

8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results.
8.1.8.B.1 Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
8.1.8.D.4 Assess the credibility and accuracy of digital content.
8.1.8.E.1 Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.
8.1.8.F.1 Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.
8.2.8.C.8 Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.

CROSS CURRICULAR CONNECTIONS

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READING ACROSS CONTENT AREAS	WRITING ACROSS CONTENT AREAS
NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. NJSLSA.R4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence. NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation. NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

	NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
Students will understand that: ● A linear system is a set of two or more linear equations. ● The solution to a linear system is the point of intersection of the lines which is a solution to both equations. Because each linear equation represents a line in the coordinate plane, then there are three possibilities: (1) the lines intersect in one place, (2) the lines do not intersect and are thus parallel, and (3) the lines are identical and thus have infinite solutions. ● Solving a system of two equations in two variables requires at least two equations and the solution can be graphed on a two dimensional coordinate plane. ● the methods for solving a linear system include graphing, inspection, substitution, and elimination. ● the algebraic methods of elimination and substitution seek to turn two equations in two unknowns to one equation in one unknown so inverse operations can be applied. ● the substitution method requires at least one equation to have a variable isolated so that it can be substituted into the other equation to create a one-variable equation. ● the elimination method involves adding the equations together (addition property of equality) forcing (through multiplication property of equality) a variable to cancel out and leaving a single equation in one variable to solve. ● there are many applications of linear systems in mathematics and the real world in many areas including: geometry, number theory, business cost analysis, consumer math, and other areas.	● How can a system of equations model a real world situation? ● How does solving a linear system compare to solving a single equation in one variable? ● What are the methods for solving a linear system?

UNIT LEARNING TARGETS (Students will know how to…)

- Identify the number of solutions to a linear system graphically and algebraically.
- Interpret solutions to linear systems in the real world and with respect to the coordinate plane.
- Test if a given coordinate point is a solution to a linear system.
- Create a linear system with a given number of solutions.

LEARNING ACTIVITIES: (Students will be able to…)

- Solve a linear system (with or without context) using a graphical method.
- Solve a linear system (with or without context) using substitution method.
- Solve a linear system (with or without context) using elimination method.
- Model mathematical situations with linear systems of equations.
- Model real-world situations with linear systems of equations.

EVIDENCE OF LEARNING:

FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS	ALTERNATIVE ASSESSMENTS
Paper-based assessments Computer-based assessments	Paper-based assessment Computer-based assessment	Performance task

INSTRUCTIONAL MATERIALS/RESOURCES	TECHNOLOGY RESOURCES
Classifying Solutions to Systems of Equations Math Assessment Project Solving Linear Equations in Two Variables Math Assessment Project Polygraph: Linear Systems Systems of Two Linear Equations Solutions to Systems of Linear Equations Playing Catch-up Racing Dots Wafers and Creme Card Sort: Linear Systems The Detention Buy-Out 3 Act Task Piling Up Systems of Linear Equations 3 Act Task Counting Candy Sequel 3 Act Task	Khan Academy: Systems of Equations IXL Systems of Equations Skills AA.1 - AA.11 Systems of Equations Jeopardy

DIFFERENTIATION:

Sparta Twp. Public Schools Differentiation Strategies

TEACHER NOTES:

CONTENT AREA:	Math	**GRADE LEVEL**	9
UNIT 4:	Working with Radicals		

UNIT SUMMARY

In this unit, students will begin to analyze graphs of square root function. They will observe basic transformations of the parent graph f(x) = $\sqrt{x}$. Afterwards, students will be begin to work with properties of radicals and simplifying in order to prepare for operations with radicals.

NEW JERSEY STUDENT LEARNING STANDARDS

F.IF.4 - For a linear or quadratic function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

F.IF.7b- Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F.IF.5-2- Relate the domain of a function to a graph and where applicable to the quantitative relationship it describes.

A.REI.4a- Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

N.RN.3- Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

N.RN.2- Rewrite expressions involving radicals and rational exponents using the properties of exponents.

A.CED.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

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CROSS CURRICULAR CONNECTIONS

Science: Students will make connections based on topics presented in unit 4.

READING ACROSS CONTENT AREAS	WRITING ACROSS CONTENT AREAS
RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**

Students will understand that: ● In order for square root to be a real number, the radicand cannot be negative	● What is the domain of a square root function? ● How do you simplify radical numbers? ● How do you perform operations with radicals?

UNIT LEARNING TARGETS (Students will know how to…)

- Students will simplify expressions using properties of exponents, including rational exponents..
- Graph and analyze dilations of radical functions
- Graph and analyze reflections and translations of radical functions.
- Simplify radical expressions by using the Product Property of Square Roots
- Simplify radical expressions by using the Quotient Property of Square Roots
- Investigate the products and sums of two rational numbers, two irrational numbers and a rational and irrational number.
- Add and subtract radical expressions.
- Multiply radical expressions
- Solve simple radical equations

LEARNING ACTIVITIES: (Students will be able to…)

- Students will make sense of problems and persevere in solving them.
- Students will reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others
- Students will model with mathematics.
- Students will use appropriate tools strategically.
- Students will attend to precision.
- Students will look for and make use of structure.
- Students will look for and express regularity in repeated reasoning.
- Mathematically proficient students analyze givens, constraints, relationships and goals. When students are given complicated problems, they can break it down to simpler situations in order to find the solution.
- Mathematically proficient students make conjectures and build logical progression of statements to explore the truth of their conjectures. Students can make a conjecture about the sum of a rational number and an irrational number. Is the sum rational or irrational? Is the product of a nonzero rational number and an irrational number rational or irrational?
- Mathematically proficient students detect possible errors by strategically using estimation. Determining the length of a hypotenuse from the graph doesn't provide a precise answer, but it would allow for an estimate that would serve as a check.
- Mathematically proficient students express numerical answers with a degree of precision appropriate for the problem context.
- Mathematically proficient students can see complicated things as single objects or as being composed of several objects. Simplifying the radicand first doesn't change the answer, but it does simplify the calculations.

EVIDENCE OF LEARNING:		
FORMATIVE ASSESSMENTS	**SUMMATIVE ASSESSMENTS**	**ALTERNATIVE ASSESSMENTS**
• Graphing Square Roots and Simplifying Radicals • Operations with Radical Expressions and Radical Equations	Summative on Working with Radials	• IXL • Student Presentation • Teacher Observation • Problem Based Activities
INSTRUCTIONAL MATERIALS/RESOURCES		**TECHNOLOGY RESOURCES**
• Algebra 1 • Connected.mcgraw-hill.com		https://www.ixl.com/math/algebra-1/evaluate-a-radical-function https://www.khanacademy.org/math/algebra2/radical-equations-and-functions/graphs-of-radical-functions/e/graphs-of-radical-functions https://www.ixl.com/math/algebra-1/square-roots https://www.khanacademy.org/math/algebra/rational-exponents-and-radicals/rational-exponents-and-the-properties-of-exponents/v/multiply-and-simplify-a-radical-expression-1
DIFFERENTIATION:		
Sparta Twp. Public Schools Differentiation Strategies		
TEACHER NOTES:		

CONTENT AREA:	Math	GRADE LEVEL	9
UNIT 5:	Unit 7 Factoring Polynomials		

UNIT SUMMARY

This unit has students build skills on factoring polynomials. Factoring, the inverse process for multiplying polynomials, is used to factor trinomials, including recognizing certain special patterns and factoring by grouping. The unit begins by finding GCF of monomials then moves into factoring by grouping and applies the concept of factoring by grouping into factoring trinomials of the form $ax^2 + bx + c$.

NEW JERSEY STUDENT LEARNING STANDARDS

A.SSE.2- Use the structure of an expression to identify ways to rewrite it.

A.SSE.3a- Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression

A.REI.4b- Solve quadratic equations in one variable

21st CENTURY LIFE AND CAREER READY PRACTICES

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

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

CRP9. Model integrity, ethical leadership and effective management.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

TECHNOLOGY STANDARDS

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

CROSS CURRICULAR CONNECTIONS

Science: Students will make connections based on topics presented in unit 5.

READING ACROSS CONTENT AREAS	WRITING ACROSS CONTENT AREAS
RI.11-12.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
Students will understand that: ● In many cases, there are multiple algorithms for finding a mathematical solution. ● Computational fluency includes understanding the meaning and the appropriate use of numerical values. ● The magnitude of numbers affects the outcome of operations on them.	● How can we rewrite a polynomial expression by factoring it? ● How are properties of real numbers related to polynomials? ● How are mathematical operations applied to polynomials?

UNIT LEARNING TARGETS (Students will know how to…)
● Students will find the greatest common factor of a set of numbers and monomials ● Students will use the GCF and distributive property to factor polynomials ● Students will be able to factor by grouping ● Students will be able to factor trinomials of the form $x^2 + bx + c$ and of the form $ax^2 + bx + c$ ● Students will be able to recognize and factor the differences of squares and perfect square trinomials ● Students will be able to rewrite polynomials in factored form.
LEARNING ACTIVITIES: (Students will be able to…)
● Students will make sense of problems and persevere in solving them. ● Students will reason abstractly and quantitatively. ● Construct viable arguments and critique the reasoning of others ● Students will model with mathematics. ● Students will use appropriate tools strategically. ● Students will attend to precision. ● Students will look for and make use of structure. ● Students will look for and express regularity in repeated reasoning. ● Students will make sense of quantities and their relationships in problem situations for polynomials. ● Students notice if calculations are repeated, and look both for general methods and for shortcuts with factoring polynomials.

EVIDENCE OF LEARNING:		
FORMATIVE ASSESSMENTS	**SUMMATIVE ASSESSMENTS**	**ALTERNATIVE ASSESSMENTS**
● Quiz- Assess knowledge of: factoring polynomials ● Quiz- Assess knowledge of: factoring special products, factoring completely ● Algebra Labs ● Student Questions and Interactions ● Classwork ● Teacher observations ● Homework ● Various worksheets and problems from text	● Summative Assessment- assess knowledge of factoring polynomials	● IXL ● Student Presentation ● Teacher Observation ● Problem Based Activities

INSTRUCTIONAL MATERIALS/RESOURCES	TECHNOLOGY RESOURCES
Algebra 1 Textbook connectED.mcgraw-hill.com https://njctl.org/courses/math/algebra-i/polynomials/	https://www.illustrativemathematics.org/content-standards/HSA/SSE/B/3 http://www.math-aids.com/Algebra/Algebra_1/Polynomials/ https://learnzillion.com/lesson_plans/1263 https://www.khanacademy.org/math/algebra-basics/quadratics-polynomials-topic/factoring-special-products-core-algebra/e/factoring_difference_of_squares_1
DIFFERENTIATION:	
Sparta Twp. Public Schools Differentiation Strategies	
TEACHER NOTES:	

CONTENT AREA:	Math	**GRADE LEVEL**	9
UNIT 5:	Functions		
UNIT SUMMARY			
Students will use tables, graphs, and equations to view a relationship between two variables in which one variable is a function of another. Students will analyze whether a given relationship represents a function in two variables, identify linear and non-linear functions, and identify increasing, decreasing, and constant domain intervals.			
NEW JERSEY STUDENT LEARNING STANDARDS			
8.EE.B. Understand the connections between proportional relationships, lines, and linear equations.			

8.EE.B.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

8.EE.B.6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

8.F.A. Define, evaluate, and compare functions.

8.F.A.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.A.3. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

8.F.B. Use functions to model relationships between quantities.

8.F.B.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

21st CENTURY LIFE AND CAREER READY PRACTICES

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

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

CRP11. Use technology to enhance productivity.

TECHNOLOGY STANDARDS

8.1.8.A.1 Demonstrate knowledge of a real world problem using digital tools.
8.1.8.A.2 Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results

8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results.
8.1.8.E.1 Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

CROSS CURRICULAR CONNECTIONS	
Story Graphs	
READING ACROSS CONTENT AREAS	**WRITING ACROSS CONTENT AREAS**
NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence. NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences. Production and Distribution of Writing NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. N JSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research. NJSLSA.W10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
Students will understand that: ● a function is a relation in which for each input there is one output. ● a function can be represented with words (equation), tables, or graphs. ● a linear function is one in which there are no more than two variables with highest exponent of 1 and that the graph will form a straight line.	● What is a function? ● What types of functions are there? ● How can we describe functions? ● How are functions represented? ● What do graphs tell us about specific situations?

- all linear relationships are functions unless they are vertical lines.
- linear proportional relationships are linear relationships in which one variable depends directly on the other.
- the constant of proportionality is related to how quickly the line of the graph rises or falls.
- the rate of change of a relationship describes how one quantity changes in relation to another.
- that the slope of a line is a more formal mathematical definition for a rate of change and can be found when units are not specified as the change in the dependent variable divided by the change in the independent variable.
- linear relationships have a constant slope.
- there are four types of linear relations (rising, falling, vertical, and horizontal) and will know their slopes respectively as positive, negative, undefined, and zero.
- that AA similarity and parallel line angles justify why the slope along a line remains constant.

UNIT LEARNING TARGETS (Students will know how to…)

- identify functions from tables, maps, graphs, ordered pairs, and equations.
- graph a linear or non-linear function by creating a table of values based on the equation.
- write a domain with upper and lower bounds.
- analyze whether there is an increasing, decreasing, or constant relationship.
- analyze a graph in order to match it to a story situation, or table of values.
- find the rate of change of a relationship between any two data points whether they are given in words, tables, or graphs.
- find the slope given a word scenario, graph, table, or two coordinate points.

LEARNING ACTIVITIES: (Students will be able to…)

- determine whether a given relationship is a function.
- represent relationships on the coordinate plane.
- describe the attributes of a function.

● find the slope of a linear function.

EVIDENCE OF LEARNING:		
FORMATIVE ASSESSMENTS	**SUMMATIVE ASSESSMENTS**	**ALTERNATIVE ASSESSMENTS**
Paper-based assessments Computer-based assessments	Paper-based assessment Computer-based assessment	Performance task

INSTRUCTIONAL MATERIALS/RESOURCES	TECHNOLOGY RESOURCES
Polygraph: Lines Polygraph: Lines, Part 2 Put the Point on the Line Match my Line Land the Plane Card Sort: Linear Functions Marbleslides: Lines Function Carnival Graphing Stories Function Carnival, Part 2 Card Sort: Functions Coin Capture Click Battle Walk Out 3-Act Task Math Assessment Project: Interpreting Distance Time Graphs Math Assessment Project: Defining Lines by Points, Slopes, and Equations The Customers Task Foxes and Rabbits Task Function Rules Task US Garbage, Version 1 Task Introducing Functions Task Tides Task Distance Task Bike Race Task Riding by the Library Task	IXL Level J Skills Y.1 - Y.13 IXL Level J Skills Z.1 - Z.18 Khan Academy: Graphing Proportional Relationships Khan Academy: Solutions to Linear Equations Khan Academy: Intercepts Khan Academy: Slope Khan Academy: Intro to slope-intercept form Khan Academy: Graphing slope-intercept form Khan Academy: Writing slope-intercept equations Khan Academy: Functions Khan Academy: Recognizing Functions Khan Academy: Linear and Non-linear functions

DIFFERENTIATION:
Sparta Twp. Public Schools Differentiation Strategies

TEACHER NOTES:

CONTENT AREA:	Math	**GRADE LEVEL**	9
UNIT 7:	Unit 7 Quadratics		

UNIT SUMMARY

In this unit, students extend their skills in graphing and solving linear equations and inequalities to quadratic equations and inequalities. Students apply the skills of the previous unit as they factor to solve quadratic equations. To prepare for the derivation of the general quadratic formula, students use the quadratic formula to solve any quadratic equation. The discriminant is used to characterize the roots of a quadratic equation.

NEW JERSEY STUDENT LEARNING STANDARDS

A.APR.3 - Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

A.SSE.3a - Factor a quadratic expression to reveal the zeros of the function it defines.

A.SSE.3b - Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

A.REI.4 - Solve quadratic equations in one variable.

A.REI.4a - Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

A.REI.4b - Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

A.REI.7 - Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.

F.BF.3 - Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F.IF.4 - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

F.IF.5-1 - Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

F.IF.7a - Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.8 - Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square

in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
F.IF.9 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
F.LE.3 - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

21st CENTURY LIFE AND CAREER READY PRACTICES

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

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

CRP9. Model integrity, ethical leadership and effective management.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

TECHNOLOGY STANDARDS

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

CROSS CURRICULAR CONNECTIONS

Science: Students will make connections based on topics presented in unit 7.

READING ACROSS CONTENT AREAS	WRITING ACROSS CONTENT AREAS

RI.11-12.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
Students will understand that: ● Quadratic equations are a type of nonlinear graph. ● Quadratic equations can be solved using a variety of methods. ● Solving quadratic requires the use of radicals.	● What are radicals and how are they simplified? ● What are the characteristics of quadratic functions? ● How can you use functions to model real-world situations? ● What are some different ways a quadratic equation can be solved? ● What do the solutions of a quadratic equation actually mean? ● How can you determine the number of solutions to a quadratic equation?
UNIT LEARNING TARGETS (Students will know how to…)	
● Students will graph quadratic functions. ● Students will learn the characteristics of families of parabolas ● Students will locate the roots of quadratic equations by graphing ● Students will solve quadratic equations by graphing, factoring, completing the square. ● Students will solve quadratic equations by applying the quadratic formula and simplifying the result. ● Students will analyze the discriminant to determine how many times a function crosses the x-axis. ● Students will solve and apply quadratic functions to real-world situations.	

LEARNING ACTIVITIES: (Students will be able to…)

- Students will make sense of problems and persevere in solving them.
- Students will reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others
- Students will model with mathematics.
- Students will use appropriate tools strategically.
- Students will attend to precision.
- Students will look for and make use of structure.
- Students will look for and express regularity in repeated reasoning.
- Students should make connections to transformations they have learned previously. (Stress that dilations in this lesson are with respect to the y-axis.)
- Students make sense of quantities and their relationships in problem situations. Discuss with students why the coefficient of x^2 is negative in some real world situations.
- Ask students how the square and square root functions are related.
- Students calculate accurately and efficiently. Discuss with students why a graph may not give an exact answer.
- Ask students to recall that the solutions or roots of an equation can be identified by finding the x-intercepts or zeros of the related function.
- Students are able to analyze situations by breaking them into cases. Students should look back at the graphs that appear throughout the lesson to see various types of graphs.
- Students can analyze relationships mathematically by drawing a diagram to represent the situation.
- Students need to make sure that their answer fits the criteria of the problem.
- Students need to know when an exact answer is required.
- Explain to students that sometimes a mathematical model can fit data for part, but not all, of the domain.

EVIDENCE OF LEARNING:

FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS	ALTERNATIVE ASSESSMENTS
• Student Questions and Interactions • Classwork • Teacher observations • Homework • Various worksheets and problems from text • Quiz- Assess knowledge solving quadratic equations by graphing • Quiz- Assess knowledge on solving quadratics through completing the	Summative Assessment - assess knowledge of quadratic equations and functions	• IXL • Student Presentation • Teacher Observation • Problem Based Activities

square, square roots and using the formula		

INSTRUCTIONAL MATERIALS/RESOURCES	TECHNOLOGY RESOURCES
Algebra 1 Connected.mcgraw-hill.com Algebra Lab: Factoring Trinomials Page 501	https://www.illustrativemathematics.org/content-standards/HSA/SSE/B/3 https://www.illustrativemathematics.org/content-standards/HSA/REI/B/4 https://www.illustrativemathematics.org/content-standards/HSF/IF/C/7/tasks/388 https://www.ixl.com/math/algebra-2/graph-a-quadratic-function http://www.algebralab.org/lessons/lesson.aspx?file=algebra_quad_translations.xml https://www.illustrativemathematics.org/content-standards/HSA/REI/C/7 https://www.khanacademy.org/math/algebra/quadratics/systems-of-quadratic-equations/v/non-linear-systems-of-equations-1 https://www.ixl.com/math/algebra-1/systems-of-linear-and-quadratic-equations

DIFFERENTIATION:
Sparta Twp. Public Schools Differentiation Strategies

TEACHER NOTES:

CONTENT AREA:	Math	**GRADE LEVEL**	9
UNIT 8:	Unit 8 Exponential Functions		

UNIT SUMMARY

The purpose of this unit is to solidify understanding of function families from previous lessons and to extend knowledge into exponential functions. This unit will introduce the general principle of transformations, in that they always have the same effect regardless of the function to which they are applied.

NEW JERSEY STUDENT LEARNING STANDARDS

F.IF.7e Graph exponential functions showing intercepts and end behavior.

F.LE.2 Construct exponential functions given a graph, a description of a relationship or two input-output pairs.

A.SSE.3c-1 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression, where exponentials are limited to integer exponents

F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx) and f(x+k) for both positive and negative values of k

S.ID.1 Solve multi-step contextual word problems with degree of difficulty.

F.IF.8b Use the properties of exponents to interpret expressions for exponential functions.

F.LE.5 Interpret expressions for functions in terms of the situation they model

21st CENTURY LIFE AND CAREER READY PRACTICES

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

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

CRP9. Model integrity, ethical leadership and effective management.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

TECHNOLOGY STANDARDS

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

CROSS CURRICULAR CONNECTIONS

Science: Students will make connections based on topics presented in unit 8.

READING ACROSS CONTENT AREAS	WRITING ACROSS CONTENT AREAS
RI.9-10.8. Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.	NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NJSLSA.W5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
• Exponential functions are in the form y = b^x The independent variable x is an exponent. • We can solve exponential equations by rewriting to have equivalent bases. • Some graphs have limits, or boundaries. • These asymptotes provide general understanding on the scope of both domain and range.	• What is an exponential function? How is it different from a linear equation? • How can we solve problems using exponential functions? • How do we compare linear, quadratic and exponential functions? • How do changes to the root equations of f(x) = a (b^(x-h)) + k affect the graph? • How is solving for an unknown in these functions similar to solving for an unknown in a general algebra problem? How is it different?

UNIT LEARNING TARGETS (Students will know how to…)

- Graph exponential functions.
- Identify data that display exponential behavior
- Solve problems involving exponential growth and decay.

LEARNING ACTIVITIES: (Students will be able to…)

- Students will make sense of problems and persevere in solving them.
- Students will reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others
- Students will model with mathematics.
- Students will use appropriate tools strategically.
- Students will attend to precision.
- Students will look for and make use of structure.
- Students will look for and express regularity in repeated reasoning.
- Mathematically proficient students are sufficiently familiar with tools appropriate to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. There are various methods for solving equations including graphing calculators.
- Mathematically proficient students can use a function to describe how one quantity of interest depends on another.
- Mathematically proficient students analyze problems. Example, Write an exponential function for which the graph passes through the points (0,3) and (1,6).
- Mathematically proficient students express answers with a degree of precision appropriate for the problem context, especially when working with exponential growth and decay.

EVIDENCE OF LEARNING:

FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS	ALTERNATIVE ASSESSMENTS

• Exponential functions • Exponential Growth and Decay • Exponential Applications	Summative Assessment on Exponential Functions	• IXL • Student Presentation • Teacher Observation • Problem Based Activities
INSTRUCTIONAL MATERIALS/RESOURCES		**TECHNOLOGY RESOURCES**
• Algebra 1 • Connected.mcgraw-hill.com		https://www.ixl.com/math/algebra-1/exponential-functions-over-unit-intervals https://www.ixl.com/math/algebra-1/exponential-growth-and-decay-word-problems
DIFFERENTIATION:		
Sparta Twp. Public Schools Differentiation Strategies		
TEACHER NOTES:		