Topic 1: Solving Equations and Inequalities

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 1**
Length: **3 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-RN.B.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.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MA.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 1 focuses on extending students' understanding of writing and solving equations and inequalities to include equations and inequalities that require multiple steps to solve, as well as those that have variables on both sides of the equation or inequality.

Concepts

Essential Questions

- How can you classify the results of operations on real numbers?
- How do you create equations and use them to solve problems?
- How do you create equations with a variable on both sides and use them to solve problems?
- How is rewriting literal equations useful when solving problems?
- How are the solutions of an inequality different from the solutions of an equation?
- What are compound inequalities and how are their solutions represented?
- Why does the solution for an absolute value equation or inequality typically result in a pair of equations or inequalities?

Understandings

- The set of real numbers includes both rational and irrational numbers. The sum or product of two rational numbers is rational. The sum of a rational number and an irrational number is irrational; and the product of a nonzero rational number and an irrational number is irrational.
- Linear equations can be used to solve mathematical and real-world problems. You can solve linear equations by using the properties of equality.
- The properties of equality are used to solve equations that have variables on each side. If an equation is true for all values of x, then it has infinitely many solutions; if it is not true for any value of x, then is has no solutions.
- Literal equations are equations with two or more variables. They are solved by rewriting the equation to highlight the variable of interest.
- The solution to an inequaltiy in one variable is solved by using the properties of inequalities.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- A compound inequality is a combination of two or more inequalities used to describe multiple constraints.
- The solution to an absolute value equation either has two solutions, one positive and one negative, or if

there is no value of x that makes the absolute value equation true, it has no solution. The solution to an absolute value inequality is a compound inequality that uses *or* or *and.*

Critical Knowledge and Skills

Knowledge

Students will know:

- irrational numbers
- rational number
- real numbers
- element of a set
- set subset
- equivalent equatinos
- inverse operations
- isolate
- solution of an equation
- variable
- like terms
- properties of equity
- solution of an equation
- identity
- isolate
- simple interest
- variable
- equivalent inequalities
- inequality
- properties of inequality
- solution to an inequality
- graph
- subset
- absolute value
- compound inequality

Skills

Students will be able to:

- Find the sum or product of two rational numbers and explain why the sum or product is rational.

- Find the sum or product of a rational and an irrational number and explain when the sum or product is irrational.
- Explain that each step in solving a linear equation follows from the equality in the previous step.
- Create and solve linear equations with one variable using the properties of equality.
- Use the properties of equality to solve linear equations with a variable on both sides.
- Identify whether linear equations have one solution, infinitely many solutions, or no solution.
- Rearrange formulas and equations to highlight a quantity of interest by isolating the variable using the same reasoning used to solve equations.
- Use formulas and equations to solve problems.
- Create and solve inequalities in one variable.
- Interpret solutions to inequalities within the context.
- Identify inequalities as true or false based on the number of solutions.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from a mathematical model might not align exactly with the problem situation.
- Create and solve a system of inequalities.
- Interpret the solution to a compound inequality within a modeling context.
- Solve absolute value equations and inequalities.
- Use absolute value equations and inequalities to solve problems.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
- Khan Academy
- Desmos
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- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
    - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
    - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**
    - All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

English Language Learners (N.J.A.C.6A:15)

❑ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.

❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Special Education Students (N.J.A.C.6A:8-3.1)

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Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE -

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS - Students will design a pendant using their knowledge of equations and inequalities.

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS - Students will solve linear equations to allocate smartphone memory. Students will determine the amount of food collected for a food drive.

Learning Plan / Pacing Guide

Week 1:

- Topic 1 Readiness Assessment (topics covered will be based upon the results of this pre-test)
- **Lesson 1-2 Solving Linear Equations
- **Lesson 1-3 Solving Equations with Variables on Both Sides

Week 2:

- Lesson 1-4 Literal Equations
- Lesson 1-5 Solving Inequalities in One Variable

Week 3:

- Lesson 1-6 Compound Inequalities
- Lesson 1-7 Absolute Value Equations and Inequalities

Week 4:

- Topic Review
- Topic 1 Assessment

Topic 2: Linear Equations

Content Area: **Math**
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Math Standards

MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MA.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
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MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 2 focuses on extending students' understanding of linear equations. Students analyze descriptions of lines and write their equations in different forms.

Concepts

Essential Questions

- What information does the slope-intercept form of a linear equation reveal about a line?
- What information does the point-slope form of a linear equation reveal about a line?
- What information does the standard form of a linear equation reveal about a line?
- How can the equations of lines help identify whether the lines are parallel, perpendicular, or neither?

Understandings

- When a linear equation is written in slope-intercept form, $y=mx+b$, m is the slope, and the line intersects the y-axis at $(0, b)$, so the y-intercept is b.
- The point-slope form of a linear equation is used to write the equation of a line using the slope and any point on the line.
- The standard form of a linear equation is helpful for identifying the x- and y-intercepts. These are used to graph the line and to aid in understanding the constraints within a real-world context.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- The equations of lines can be used to help identify whether the lines are parallel or perpendicular. Parallel lines have the same slope but different x- or y-intercepts; perpendicular lines have slopes that are opposite reciprocals.

Critical Knowledge and Skills

Knowledge

Students will know:

- linear equation
- slope
- slope-intercept form
- y-intercept
- point-slope form
- x-intercept
- standard form of a linear equation

Skills

Students will be able to:

- Write linear equations in two variables using slope-intercept form to represent the relationship between two quantities.
- Interpret the slope and the intercept of a linear model.
- Write and graph linear equations in point-slope form.
- Analyze different forms of a line to interpret the slope and y-intercept of a linear model in the context of data.
- Write and graph linear equations in standard form.
- Use linear equations in standard form to interpret both the x- and y-intercepts in the context of given data.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.
- Create equations to represent lines that are parallel or perpendicular to a given line.
- Graph lines to show an understanding of the relationship between the slopes of parallel and perpendicular lines.
- Solve real-world problems with parallel or perpendicular lines.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections

- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

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Technology Integration

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❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

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❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE - Students will use diffrerent units of measurements to express similar quantities of height. Students will make comparisons of real-world applications, which factor in components of weight, verses linear functions.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY - Students will use linear equations to compare wholesale technology prices.

BUSINESS EDUCATION -

GLOBAL AWARENESS - Students will learn how recycling can offset carbon dioxide production. They apply their understanding of linear functions to analyze trends in recycling data.

Learning Plan / Pacing Guide

Week 1:

- Introduce Stem Project - Design a Pitched Roof
- Lesson 2-1: Slope-Intercept Form
- Lesson 2-2: Point-Slope Form

Week 2:

- Lesson 2-3: Standard Form
- Review all forms of linear equations

Week 3:

- Quiz 2.1-2.3
- Mathematical Modeling: How Tall is Tall?
- Lesson 2-4: Parallel and perdendicular lines

Week 4:

- Topic Review
- Assessment
- Performance Assessment

Topic 3: Linear Functions

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 1**
Length: **4 weeks**
Status: **Published**

Standards

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TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.S-ID.B.6a	Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
MA.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in

	the context of the data.
MA.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
MA.S-ID.C.9	Distinguish between correlation and causation.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 3 focuses on extending students' understanding of linear equations to linear functions. Students learn methods to write, graph, and transform linear functions. They also apply analytic methods to tabular and graphic data sets that have linear relationships.

Concepts

Essential Questions

- What is a function? Why is domain and range important in defining a function?
- How can you identify a linear function?
- How does modifying the input or the output of a linear function rule transform its graph?
- How are arithmetic sequences related to linear functions?
- How can you use a scatter plot to describe the relationship between two data sets?
- How can you evaluate the goodness of fit of a line of best fit for a paired data set?

Understandings

- A relation is a function if each element of the domain is assigned to exactly one element of the range.
- Linear functions can be represented in multiple ways, using words, tables, graphs, and rules. Function notation is a way to write the rule for a function *f*. The output of the function *f(x)*, read *"f of x"*, means that *f* is a function of the input variable of *x*.
- A transformation of a function maps each point of its graph to a new location. Adding *k* to the function output causes a vertical translation, and adding *k* to the function input causes a horizontal translation. Multiplying the function output by $k>1$ causes a stretch, and multiplying the function input by $k>1$ causes a compression.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- Recursive and explicit formulas are used to describe arithmetic sequences. Arithmetic sequences, similar to linear functions, relate quantities that increase at a constant rate.
- When data presented in a scatter plot suggests a linear function, a line can be fitted to the data and a linear function can be written to represent the relationship.
- When a line is fitted to a set of data, the closer the data points are to the line, the stronger the correlation. A plot pf residuals can be used to determine the line of best fit, which is the trend line that most closely models the data.

Critical Knowledge and Skills

Knowledge

Students will know:

- continuous
- dicsrete
- domain
- function
- one-to-one
- range
- relation
- element
- horizontal
- vertical
- transformation
- translation
- arithmetic sequence
- commom difference
- explicit formula
- recursive formula
- sequence

- term of a sequence
- negative association
- negative correlation
- no association
- positive association
- positive correlation
- trend line
- causation
- correlation coefficient
- extrapolation
- interpolation
- line of best fit
- linear regression
- residual

Skills

Students will be able to:

- Understand that a relation is a function if each element of the domain is assigned to exactly one element in the range.
- Determine a reasonable domain and identify constraints on the domain based on the context of a real-world problem.
- Write and evaluate linear functions using function notation.
- Graph a linear function and relate the domain of a function to its graph.
- Interpret functions represented by graphs, tables, verbal descriptions, and function notation in terms of a context.
- Graph transformations of linear functions by identifying the effect of multiplying or adding specific values of k to the input or output of a function.
- Interpret the key features of the graph of a linear function and use them to write the function that the graph represents.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.
- Write arithmetic and geometric sequences both recursively and with an explicit formula.
- Use explicit formulas and recursive formulas to model real-world situations.
- Fit a function to linear data shown in a scatter plot and use fitted functions to solve problems in the context of the data.
- Interpret the slope of a trend line within the context of data.
- Compute and interpret the correlation coefficient for linear data.
- Plot and analyze residuals to assess the fit of a function.
- Distinguish between correlation and causation.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

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Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE - Students will learn how recycling can offset carbon dioxide production. They apply their understanding of linear functions to analyze trends in recycling data.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION - Students will use recursive and explicit formulas to determine the number of coins collected over time.

GLOBAL AWARENESS - Students will determine a strategy for picking a checkout lane at a grocery store.

Learning Plan / Pacing Guide

Week 1:

- Introduce Stem Project: Planning a Recycling Drive
- Lesson 3-1: Relations and Functions
- Lesson 3-2: Linear Functions

Week 2:

- Lesson 3-3; Transforming Linear Functions
- Mathematical Modeling: The Express Lane

Week 3:

- Review
- Quiz
- Lesson 3-4: Arthmetic Sequences

Week 3:

- Lesson 3-4: Arithmetic Sequences (continued)
- Lesson 3-5: Scatter Plots and Lines of Fit

Week 4:

- Lesson 3-5: Scatter Plots and Lines of Fit
- Topic Review

Week 5:

- Assessment
- Performance Assessment

Topic 4: Systems of Linear Equations and Inequalities

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 2**
Length: **4 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.A-REI.C.5	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
MA.A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
MA.A-REI.D.12	Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 4 focuses on students extending their understanding of linear equations and inequalities to systems of linear equations and inequalities. Students learn methods to solve systems of linear equations and inequalities. Students identify when each solution method is most useful.

Concepts

Essential Questions

- How can you use a graph to illustrate the solution to a system of linear equations?
- How do you use substitution to solve a system of linear equations?
- Why does the elimination method work when solving a system of equations?
- How does the graph of a linear inequality in two variables help you identify the solutions of the inequality?
- How is the graph of a system of linear inequalities related to the solutions of the system of inequalities?

Understandings

- The intersection of the graphs of a pair of linear equations is used to estimate the solution to the system. If two lines intersect at a point, there is exactly one solution. If two lines are the same, there are infinitely many solutions. If two lines are parallel, there is no solution.
- Substitution is one method for solving systems of equations. The process involves solving one equation for a variable and substituting the solution into the system's other equation. This results in an equation in one variable. Solve for the variable and substitute its value into one of the original equations in the system to find the value of the second variable.
- Elimination is an alternate method for solving systems of equations when it is not easy to use substitution. Multiply one or both equations by a constant to get like coefficients that are opposite to use elimination.
- The graph of a linear inequality in two variables shows that solutions of the inequality as a half-plane above or below the boundary line. The boundary line is included in the solution when the inequality symbol is $\leq$ or $\geq$ excluded when the inequality symbol is $<$ or $>$.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- Systems of linear inequalities can be solved by graphing. The solution of a system of inequalities is the intersection of the corresponding half-planes, excluding the boundary lines in the case of a strict inequality.

Critical Knowledge and Skills

Knowledge

Students will know:

- intersection
- solultion of a system of linear equations
- system of linear equations
- solution of a system
- substitution
- substitution method
- system of linear equations
- coefficient
- elimination
- opposites
- linear equation in two variables
- linear inequality in two variables
- solution of an inequality in two variables
- half-plane
- intersection
- plane

Skills

Students will be able to:

- Graph systems of linear equations in two variables to find an approximate solution.
- Write a system of linear equations in two variables to represent real-world problems.
- Use the substitution method to solve systems of equations.
- Represent situations as a system of equations and interpret solutions as viable/nonviable options for the situation.
- Solve systems of linear equations and prove that the sum of one equation and a multiple of the other produces a system with the same solutions as the original system.
- Represent constraints with a system of equations in a modeling context.
- Graph solutions to linear inequalities in two variables.
- Represent constraints with inequalities and interpret solutions as viable or nonviable options in a modeling context.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.

- Graph a solution set of a system of linear inequalities in two variables.
- Interpret solutions of linear inequalities in a modeling context.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices

- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
    - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
    - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**
    - All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

English Language Learners (N.J.A.C.6A:15)

❑ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.

❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Special Education Students (N.J.A.C.6A:8-3.1)

❑ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE - Students will compare the time difference between an express elevator and a local elevator.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION - Students will use systems of linear equations and inequalities to determine the amount of product needed to produce two different types of hot sauce for purchasing.

GLOBAL AWARENESS - Students allocate field space on a farm to various crops. They model their choices using a system of equations and/or inequalities and use that system to decide how to allocate space.

Learning Plan / Pacing Guide

Week 1:

- Introduce Stem Project: Growing Grain
- Lesson 4-1: Solving Systems of Equations by Graphing
- Lesson 4-2: Solving Systems of Equations by Substitution

Week 2:

- Lesson 4-2: Solving Systems of Equations by Substitution
- Lesson 4-3: Solving Systems of Equations by Elimination
- Review 4.1-4.3

Week 3:

- Review 4.1-4.3
- Quiz 4.1-4.3
- Lesson 4-4: Linear Inequalities in Two Variables

Week 4:

- Mathematical Modeling: Get Up There
- Lesson 4-5: Systems of Linear Inequalities
- Topic Review

Week 5:

- Topic Review
- Assessment
- Performance Assessment

Topic 5: Piecewise Functions

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 2**
Length: **3 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

Mathematical Practices

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 5 focuses on extending the concept of functions to include absolute value functions and other piecewise-defined functions. Students identify the characteristics of each of these types of functions and understand that transformations can be applied to these functions.

Concepts

Essential Questions

- What are the key features of the graph of the absolute value function?
- What are the key features of piecewise-defined functions?
- How are the step functions related to piecewise-defined functions?
- How do the constants affect the graphs of piecewise-defined functions?

Understandings

- The graph of an absolute value function has a vertex at the turning point, which represents either the minimum or maximum value of the function. The axis of symmetry is the vertical line that passes through the vertex.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- Piecewise-defined functions are functions whose domains are divided into intervals where each interval has a different function rule.
- A step function is a piecewise-defined function that pairs every number in an interval with a single value. Ceiling functions and floor functions are step functions that round numbers up or down to the nearest integer.
- For the absolute value function, $g(x) = a|x - h| + k$, the values of the constants h and k, translate the graph horizontally and vertically, and the value of the leading coefficient a affects the vertical stretch or compression.

Critical Knowledge and Skills

Knowledge

Students will know:

- absolute value function
- axis of symmetry
- vertex
- constant
- decreasing
- increasing
- integer
- interval
- ceiling function
- floor function
- step function
- compression
- stretch
- transformation
- translation

Skills

Students will be able to:

- Graph an absolute value function and identify the key features of the graph.
- Calculate and interpret the rate of change of an absolute value over a specified interval.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.
- Understand and graph piecewise-defined functions.
- Analyze the key features of the graph of a piecewise-defined function.
- Write and interpret a piecewise-defined function to solve application problems.
- Graph step functions including ceiling functions and floor functions.
- Calculate and interpret the average rate of change of step functions.
- Graph transformations of piecewise-defined functions.
- Identify the effect of changing constants and coefficients of absolute value functions on their graphs.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
    - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
    - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**
    - All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

English Language Learners (N.J.A.C.6A:15)

❑ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.

❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Special Education Students (N.J.A.C.6A:8-3.1)

❑ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE -Students will use piecewise functions to determine the amount of medication given to babies and children based on weight.

SOCIAL STUDIES - Students will use piecewise functions to represent how different geographical areas (terrains) effect speed over time for runners.

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS - Students learn about insect populations that have cyclical "booms" and "busts",

most notably the cicada, whose adult population booms every 17 years.

Learning Plan / Pacing Guide

Week 1:

- Introduce Stem Project: Predict a Population
- Lesson 5-1: The Absolute Value Function
- Lesson 5-4: Transformations of Piecewise-Defined Functions

Week 2:

- Lesson 5-4: Transformations of Piecewise-Defined Functions
- Review
- Quiz

Week 3

- Mathematical Modeling: A Mad Runner
- Lesson 5-2: Piecewise-Defined Functions

Week 4:

- Lesson 5-2: Piecewise-Defined Functions
- Topic Review

Week 5:

- Topic Review (continued)
- Assessment
- Performance Assessment

Topic 6: Exponents and Exponential Functions

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 2**
Length: **2 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
MA.F-BF.B.3	Identify the effect on the graph of replacing □(□) by □(□) + □, □□(□), □(□□), and □(□ + □) for specific values of □ (both positive and negative); find the value of □ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
MA.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
MA.F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MA.F-LE.A.1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
MA.F-LE.A.1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MA.F-LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.
MA.N-RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in

	terms of rational exponents.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 6 focuses on extending knowledge of functions to inlcude the exponential function. Students learn to identify, write, graph, and transform exponential functions. Students use exponential functions to model real-world situations to make predictions.

Concepts

Essential Questions

- What are the properties of rational exponents and how are they used to solve problems?
- What are the characteristics of exponential functions?
- What kinds of situations can be modeled with exponential growth or exponential decay functions?
- How are geometric sequences related to exponential functions?
- How do the changes in an exponential function relate to translations of its graph?

Understandings

- Radicals can be written using rational exponents. The properties of exponents can be used to solve equations with rational exponents.
- An exponential function models that relationship between two quantities that differ by a constant ratio. Exponential functions are modeled using $f(x) = ab^x$ where a is the initial amount and b is the constant ratio.
- An exponential growth function increases by a fixed percent over each interval. An exponential decay function decreases by a fixed percent over each interval. Exponential growth and decay functions can be used to model many real-world situations.
- Geometric sequences are number sequences in which each term is related to the next by a common ratio. They can be represented by recursive and explicit formulas. Exponential functions can represent geometric sequences.
- The values of the constants h and k affect the graphs of exponential functions. Changing the value of k results in a vertical shift in the function's graph. Changing the value of h results in a horizontal shift in the function's graph.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.

Critical Knowledge and Skills

Knowledge

Students will know:

- integer exponent
- Power of a Power Property
- Product of Powers Property
- Quotient of Powers Property
- rational exponent
- asymptote
- constant ratio
- exponential function
- compound interest
- decay factor
- exponential decay
- exponential growth
- growth factor
- arithmetic sequence
- explicit formula
- recursive formula
- constant

- translation

Skills

Students will be able to:

- Extend the properties of integer exponents to rational exponents to rewrite radical expressions using rational exponents.
- Solve equations with rational exponents using the properties of exponents.
- Sketch graphs showing key features of exponential functions.
- Write exponential functions using tables and graphs.
- Compare linear and exponential functions.
- Construct exponential growth and decay functions given a description of a relationship.
- Recognize if a situation can be modeled with exponential growth or exponential decay, and interpret the parameters of the model in context.
- Find explicit and recursive formulas for geometric sequences.
- Translate between recursive and explicit formulas for geometric sequences.
- Construct exponential functions to represent geometric sequences.
- Translate the graph of an exponential function vertically and horizontally, identifying the effect different values of h and k have on the graph of the function.
- Compare characteristics of two exponential functions represented in different ways, such as tables and graphs.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
    - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
    - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

● **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

● **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

English Language Learners (N.J.A.C.6A:15)

❑ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.

❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate

differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Special Education Students (N.J.A.C.6A:8-3.1)

❑ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE -

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION - Students will compare investment opportunitites including savings accounts, the stock market, and bonds.

GLOBAL AWARENESS - Students will use exponential functions to determine the decline of the African elephant population over time.

Learning Plan / Pacing Guide

Week 1:

- Introduce Stem Project: Predict the Future Using Moore's Law
- Lesson 6-2: Exponential Functions
- Lesson 6-5: Transformations of Exponential Functions

Week 2:

- Lesson 6-5: Transformations of Exponential Functions
- Lesson 6-3: Exponential Growth and Decay

Week 3:

- Mathematical Modeling: Big Time Pay Back
- Review
- Assessment

Topic 7: Polynomials and Factoring

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 3**
Length: **5 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.A-APR.A.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 7 focuses on extending polynomials. Students identify the parts and factors of polynomials. Students understand how to factor trinomials using the greatest dommon factor, binomial factors, and special patterns.

Students learn methods to add, subtract, and multiplyl polynomials.

Concepts

Essential Questions

- How does adding or subtracting polynomials compare to adding or subtracting integers?
- How does multiplying polynomials compare to multiplying integers?
- What patterns are there in the product of the square of a binomial and the product of a sum and a difference?
- How is factoring a polynomial similar to factoring integers?
- How does recognizing patterns in the signs of the terms help you factor polynomials?
- How is factoring a quadratic trinomial when a≠1 similar to factoring a quadratic trinomial when a=1?
- What special patterns are helpful when factoring a perfect-square trinomial and the difference of two squares?

Understandings

- A polynomial is a monomial or the sum or differences of two or more monomials (terms). Polynomials can be added or subtracted by combining like terms. Polynomials are closed under addition or subtraction, similar to integers.
- Polynomials can be multiplied by applying the Distributive Property or by using a table. They form a system similar to integers. Therefore, polynomials are closed under multiplication.
- The product of the square of a binomial in the form $(a + b)^2$ is always the square of the first term, plus twice the product of the first and last terms, plus the square of the last term. The product of a sum and a difference of two binomials in the form $(a + b)(a - b)$ is always the difference of two squares,
- The greatest common factor of the terms of a polynomial is the greatest common factor of the coefficients and the variables or variables, using the number of instances of the variable that are common to each term.
- When a trinomial is in the form $x^2 + b\text{x} + c$, the factors are found by identifying a pair of integers factors of c that have a sum of b and then using the factors to write binomials that have a product equal to the trinomial.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- A quadratic trinomial in the form $a\text{x}^2 + b\text{x} + c$ when $a \neq 1$ can either be factored by grouping or by substitution.
- When a trinomial has the pattern $a^2 + 2ab + b^2$, then it can be factored as $(a + b)^2$ or $(a - b)^2$ respectively. If a binomial has the pattern $a^2 - b^2$, then it can be factored as $(a + b)(a - b)$.

Critical Knowledge and Skills

Knowledge

Students will know:

- Closure Property
- degree of a monomial
- degree of a polynomial
- monomial
- polynomial
- standard form of a polynomial
- binomial
- closure
- polynomial
- term
- trinomial
- binomial
- polynomial
- square of a binomial
- coefficient
- factor
- greatest common factor
- polynomial
- binomial factor
- Distributive Property
- factor
- monomial
- quadratic trinomial
- difference of two squares
- perfect-square trinomial

Skills

Students will be able to:

- Identify the parts of a polynomial.
- Classify polynomials by number of terms and by degree.
- Write a polynomial in standard form.
- Add or subtract two polynomials.
- Use the Distributive Property with polynomials, recognizing that polynomials are closed under

multiplication.
- Multiply polynomials using a table and an area model.
- Determine the square of a binomial.
- Find the product of a sum and difference of two squares.
- Solve real-world problems involving the square of a binomial.
- Find the greatest common factor of the terms of a polynomial.
- Use the structure of a polynomial to rewrite it in factored form.
- Factor polynomials that represent real-world problems.
- Factor a trinomial in the form x^2+bx+x by finding two binomial factors whose product is equal to the trinomial.
- Identify and use patterns in the signs of the coefficients of the terms of a trinomial expression.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.
- Identify the common factor of the coefficients in the terms of a trinomial expression when a does not equal 1.
- Write a quadratic trinomial as a product of two binomial factors.
- Identify and factor a trinomial that is a perfect square or a binomial that is a difference of two squares.
- Factor special cases of polynomials within the context of real-world problems.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
    - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
    - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**
    - All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0

online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

English Language Learners (N.J.A.C.6A:15)

❑ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.

❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Special Education Students (N.J.A.C.6A:8-3.1)

❑ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE -

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS - Students will use irregular figures to determine the areas of a pond, a plant stand, and legos.

APPLIED TECHNOLOGY -

BUSINESS EDUCATION - Students will learn how market research affects business decisions.

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

Possibly complete before Unit 6?

Week 1:

- Introduce Stem Project: Make Business Decisions
- Lesson 7-1: Adding and Subtracting Polynomials (and vocab)

Week 2:

- Lesson 7-2 and 7-3: Multiplying Polynomials

Week 2:

- Review
- Quiz

- Lesson 7-4: Factoring Polynomials

Week 3:

- Lesson 7-5: Factoring x^2+bx+c
- Mathematical Modeling: Who's Right?
- Lesson 7-6: Factoring ax^2+bx+c **may not complete this lesson**

Week 4:

- Review
- Quiz
- Lesson 7-7: Factoring Special Cases (focus on Difference of Squares)

Week 5:

- Review
- Assessment
- Performance Assessment

Topic 8: Quadratic Functions

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 3**
Length: **4 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.F-LE.A.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.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.S-ID.B.6a	Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 8 focuses on extending students' previous understanding of functions to include quadratic functions: graphing them, using them to model real-world situations, and comparing them to liniear and exponential functions.

Concepts

Essential Questions

- What is the quadratic parent function and how can you recognize the key features of its graph?
- How can the vertex form of a quadratic function help you sketch the graph of a function?
- How is the standard form of a quadratic function different from the vertex form?
- What kinds of real-world situations can be modeled by quadratic functions?
- How can you determine whether a linear, exponential, or quadratic function best models data?

Understandings

- A quadratic function is a polynomial function in one or more variables in which the highest degree

term is of the second degree. The graph of a quadratic function $f(x) = ax^2$ is a parabola. The value of the leading coefficient a determines both the width of the parabola and the direction the parabola opens (upward or downward).

- The structure of a quadratic function in vertex form reveals the vertex and axis of symmetry of the graph it represents.
- The standard form of a quadratic function is $f(x) = ax^2 + bx + c$, where c is the y-coordinate of the y-intercept and the axis of symmetry is the line $x = -b/(2a)$.
- A quadratic function can be used to model area and vertical motion problems. These models can be written in the same form as the quadratic function $f(x) = ax^2 + bx + c$ using key features to interpret and understand the situation.
- Many real-world situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- Linear, quadratic, and exponential functions are differentiated by their average rates of change over different intervals. A linear function models a relationship between x and y in which the differences between successive y-values are constant. A quadratic function models a relationship in which the second differences, or the difference between the first differences, are constant. An exponential function models a relationship where the ratios of consecutive y-values are constant.

Critical Knowledge and Skills

Knowledge

Students will know:

- axis of symmetry
- quadratic function
- vertex
- parabola
- vertex form of a quadratic function
- residual
- quadratic regression
- vertical motion model

Skills

Students will be able to:

- Identify key features of the graph of a quadratic function using graphs, tables, and equations.
- Explain the effect of the value of a on the quadratic parent function.
- Identify key features of the graph of quadratic functions written in vertex form.

- Graph quadratic functions in vertex form.
- Graph quadratic functions in standard form and show intercepts, maxima, and minima.
- Determine how the values of a, b, and c affect the graph of $f(x)=ax^2+bx+c$.
- Identify key features of parabolas.
- Compare properties of quadratic functions presented in different forms (algebraically, in a table, graphically).
- Use quadratic functions fitted to datra to model real-world situations.
- Use the vertical motion model to write an equation.
- Compare a model to a data set by analyzing and evaluating residuals.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.
- Determine which model - linear, exponential, or quadratic - best fits a set of data.
- Use fitted funcion to solve problems in the context of data.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
    - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
    - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**
    - All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

English Language Learners (N.J.A.C.6A:15)

❑ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.

❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Special Education Students (N.J.A.C.6A:8-3.1)

❑ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

❑ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE -

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS - Students will use quadratic functions to determine the revenue of a high school drama club based on ticket prices.

APPLIED TECHNOLOGY -

BUSINESS EDUCATION - Students will learn the interplay between supply and demand. If supply is too low, there is a shortage and prices rise: if supply is too high, there is a surplus and prices fall.

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

****If time allows

Week 1:

- Introduce Stem Project: Make Business Decisions
- Lesson 8-1: Key Features of a Quadratic Function
- Lesson 8-2: Quadratic Functions in Vertex Form

Week 2:

- Lesson 8-2: Quadratic Functions in Vertex Form
- Lesson 8-3: Quadratic Functions in Standard Form
- Review
- Quiz

Week 3:

- Lesson 8-4 and 8-5: Modeling with Quadratic Functions AND Linear, Exponential and Quadratic Models

- Mathematical Modeling: The Long Shot

<u>Week 4:</u>

- Review
- Assessment
- Performance Assessment

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Topic 9: Solving Quadratic Equations

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 4**
Length: **4 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.F-IF.C.8a	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.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.A-APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.A-REI.B.4	Solve quadratic equations in one variable.
MA.A-REI.B.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.
MA.A-REI.B.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.
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
MA.A-REI.D.11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
MA.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$

	as $(\square^2)^2 - (\square^2)^2$, thus recognizing it as a difference of squares that can be factored as $(\square^2 - \square^2)(\square^2 + \square^2)$.
MA.A-SSE.B.3a	Factor a quadratic expression to reveal the zeros of the function it defines.
MA.A-SSE.B.3b	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 9 focuses on extending knowledge of quadratic functions. Students learn to solve quadratic equations using tables, graphs, and factoring. Students also solve quadratic equations using square roots, completing thte square, and the quadratic formula. Students elarn different methods, such as graphing, elimination, and substitution, for solving linear-quadratic systems.

Concepts

Essential Questions

- How can graphs and tables help you solve quadratic equations?
- How does factoring help you solve quadratic equations?
- How does rewriting radicals in different forms help you communicate your answers?
- How can square roots be used to solve quadratic equations?
- How is the technique of completing the square helpful for analyzing quadratic functions?
- When should you use the quadratic formula to solve equations?

- How is solving linear-quadratic systems of equations similar to and different from solving systems of linear equations?

Understandings

- A quadratic equation is an equation of the second degree. It can have 0, 1, or 2 solutions. The x-intercepts of a graph and the zeros in a table can be used to identify the real solutions.
- In the standard form of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$, the factors of the equation determine the solutions. The Zero-Product Property states that for all real numbers a and b, if $ab = 0$, then either $a = 0$ or $b = 0$.
- Properties of exponents are used to rewrite radical expressions in different forms. A radical expression is written in the simplest form when there is no perfect square factors other than 1 in the radicand.
- When a quadratic equation is in the form $ax^2 + bx + c$, it can be solved by isolating the ax^2 term, simplifying to remove the coefficients, and then taking the square root of each side of the equation.
- To complete the square, add the square of half of the coefficient of x to each side of the equation. Completing the square is useful when solving quadratic equations that are not factorable.
- The quadratic formula can be used to solve every quadratic equation and is particularly useful for those that cannot be easily factored. The discriminant of the quadratic formula indicates the number of solutions of the equation.
- Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- For any system of two equations in two variables, the solution consists of the ordered pairs that satisfy both equations.

Critical Knowledge and Skills

Knowledge

Students will know:

- degree
- intercept
- solution
- quadratic equation
- zeros of a function
- factored form
- parabola
- vertex
- perfect square factor
- radical
- radical expression
- radicand
- isolate

- linear equation
- properties equality
- quadratic equation
- binomial factor
- perfect square trinomial
- vertex form
- discriminant
- quadratic formula
- root
- elimination method
- substitution method
- linear-quadratic system

-

Skills

Students will be able to:

- Use a graph to identify the x-intercepts as solutions of a quadratic equation.
- Use a graphing calculator to make a table of values to approximate or solve a quadratic equation.
- Use the Zero-Product Property and factoring to find the solutions of a quadratic equation.
- Apply factoring to solve real-world problems.
- Use the zeros of a quadratic equation to sketch a graph.
- Write the factored form of a quadratic function from a graph.
- Use properties of exponents to rewrite radical expressions.
- Multiply radical expressions.
- Write a radical expression to model or represent a real-world problem.
- Solve quadratic equations by finding square roots.
- Determine reasonable solutions for real-world problems.
- Solve a quadratic trinomial by completing the square to transform a quadratic equation into a perfect square trinomial.
- Use completing the square to write a quadratic equation in vertex form.
- Derive the quadratic formula by completing the square.
- Solve quadratic equations in one variable by using the quadratic formula.
- Use the discriminant to determine the number and type of solutions to a quadratic equation.
- Use mathematical modeling to represent a problem situation.
- Test and verify the appropriateness of their math models.
- Explain why the results might not exactly match the problem situation.
- Describe a linear-quadratic system of equations.
- Solve a linear-quadratic system of equations by graphing, elimination, or substitution.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
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- Desmos
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- Quizlet
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- Fostering Math Practices
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Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
    - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
    - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**
    - All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

English Language Learners (N.J.A.C.6A:15)

❑ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students

might also benefit by using concrete objects to demonstrate different concepts.

❑ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

❑ Pair ELL students with a student who is fluent in English.

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At-Risk Students (N.J.A.C.6A:8-4.3c)

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Special Education Students (N.J.A.C.6A:8-3.1)

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❑ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

❑ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE - Students will learn how to combine the horizontal and vertical velocities of a projectile to determine its path.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY - Students will use quadratic equations to determine how far a car will travel before coming to a fill stop after the driver applies the brakes.

BUSINESS EDUCATION -

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

****if times allows**

Week 1:

- Introduce Stem Project: Designing a T-Shirt Launcher
- Lesson 9-1: Solving Quadratic Equations using Graphs and Tables
- Lesson 9-2: Solving Quadratic Equations by Factoring

Week 2:

- Lesson 9-2: Solving Quadratic Equations by Factoring
- Review
- Quiz

Week 3:

- Lesson 9-3: Rewriting Radical Expressions
- Lesson 9-4: Solving Quadratic Equations using Square Roots

Week 4:

- Lesson 9-5: Completing the Square
- Lesson 9-6: The Quadratic Formula and the Discriminant
- Review
- Quiz
- Mathematical Modeling - Unwrapping Change

Week 5:

- Review
- Assessment
- Performance Assessment

Topic 10: Working With Functions

Content Area: **Math**
Course(s): **ALGEBRA I**
Time Period: **Marking Period 4**
Length: **3 weeks**
Status: **Published**

Standards

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
TECH.9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.

Math Standards

MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.F-BF.B.4	Find inverse functions.
MA.F-BF.B.4a	Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse.
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.

MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Topic 10 extends students' knowledge of functions to include radical functions. Students identify the key features of the graphs of radical functions. They also learn to transform functions, combine functions, and find inverse functions.

Concepts

Essential Questions

- What key features are shared among the square root function and translations of the square function?
- What are the key features of the cube root function?
- What can you learn about a function by analyzing its graph?
- Do horizontal and vertical translations work in the same way for all types of functions?
- What change to a function will result in a vertical or horizontal stretch or compression of its graph?
- How can you extend addition, subtraction, and multiplication from numbers to functions?
- How can you use inverse functions to help solve problems?

Understandings

- A square root function contains a square root symbol with the independent variable in the radicand.
- The general form of a cube root function is $f(x) = \sqrt[3]{x}$. It intersects both axes at the origin, and the domain and range are all real numbers.
- The key features of the graphs of functions - including the domain, range, maximum, and minimum values, axis of symmetry, and end behavior - are used to identify and compare functions.
- Changes to the input and output of a function in the form $f(x - h) + k$ result in a translation of the graph of the function. Adding a constant k to the output of the function shifts the graph vertically. Subtracting a constant h from the input of the function shifts the graph horizontally.
- The graphs of functions are transformed when the input and output are multiplied by varying factors of k. Multiplying the output by a factor of k stretches or compresses the graph vertically. Multiplying the input by a factor of k stretches or compresses the graph horizontally.
- Many real-world problem situations can be represented with a mathematical model, but that model

might not represent the real-world situation exactly.

- Functions can be combined in the same way as numbers, expressions, and polynomials. Addition, subtraction, and multiplication can be used to find $(f + g)(x)$, $(f - g)(x)$, and $(f \cdot g)(x)$.
- A one-to-one function is a function for which each range value corresponds to exactly one domain value. For these functions, it is possible to describe an *inverse function*, which reverses the order of the outputs and inputs of the function.

Critical Knowledge and Skills

Knowledge

Students will know:

- average rate of change
- interval
- cube root function
- absolute value function
- exponential function
- linear function
- quadratic function
- square root function
- constant
- input
- output
- translation
- compression
- horizontal
- stretch
- vertical
- domain
- range
- function
- function notation
- inverse operations

Skills

Students will be able to:

- Graph translations of the square root function.
- Calculate and interpret the average rate of change for a square root function over a specified interval.
- Identify key features of the graph of cube root functions and graph translations of them.
- Model real-world situations using the cube root functions.
- Calculate and interpret the average rate of change of a cube root function over a specified interval.
- Relate domain and range of a function to its graph.
- Analyze the key features of the graph of a function to identify the type of function it represents.
- Graph translations of absolute value, exponential, quadratic, and radical functions.
- Determine how combining translations affects the key features of the graph of a function.
- Identify the effect on the graph of a function of multiplying the output by -1.
- Identify the effect on the graph of a function of replacing $f(x)$ by $kf(x)$ or $f(kx)$ for specific values of k.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.
- Combine functions using arithmetic operations, including addition, subtraction, and multiplication.
- Combine functions to solve real-world problems.
- Write an equation for the inverse of a linear function.
- Write the inverse of a quadratic function after restricting the domain so the original function is one-to-one.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

School Summative Assessment Plan

- Unit Assessment

Primary Resources

enVision Algebra 1

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

Technology Integration and Differentiated Instruction

Technology Integration

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Interdisciplinary Connections

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SCIENCE - Students will use functions to describe how refraction affects the amount of Earth's curved surface that you can see.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS - Students will design a tile pattern.

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

if time allows at the end of the year

Week 1:

- Introduce Stem Project: Program a Square Root Algorithm
- Lesson 10-1: The Square Root Function
- Lesson 10-2: The Cube Root Function

Week 2:

- Lesson 10-3: Analyzing Functions Graphically
- Review
- Quiz

Week 3:

- Lesson 10-4: Translations of Functions
- Lesson 10-5: Compressions and Stretches of Functions
- Mathematical Modeling: Edgy Tiles

Week 4:

- Review
- Assessment
- Performance Assessment