PUBLIC SCHOOLS OF EDISON TOWNSHIP

OFFICE OF CURRICULUM AND INSTRUCTION

Algebra 2- Honors/Accelerated/Academic

Length of Course:	Term
Elective/Required:	Required
Schools:	High School
Eligibility:	Grade 9-12
Credit Value:	5 Credits
Date Approved:	September 23, 2019

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Statement of Purpose

This course of study has been designed for the Algebra 2 course. The curriculum introduces algebraic topics, skills, and concepts. The material should be connected to real-world situations as often as possible, as suggested in the curriculum. This course curriculum guide provides a thorough preparation for algebraic questions that may be included on the NJSLA Algebra 2 state assessment.

In order to promote the effective implementation of this program, the following suggestions are provided:

1. Formative assessment should be used throughout this course, as with any math course, in order to monitor students' learning and instruction such be adjusted as needed.
2. Instruction should be differentiated in order to accommodate the different ways students learn.
3. Students should be encouraged to maintain an organized and thorough set of notes in a notebook. Teachers should indicate the expected format and content and should explain how notebooks can be effectively utilized.
4. Meaningful and relevant homework assignments should be given to students on a regular basis to encourage the practice of new skills and concepts.
5. Examples of application of mathematics and specifically Algebra in careers and everyday-life situations should be provided as motivation wherever possible.
6. Students should be required to use correct mathematical terminology at all times.
7. The use of technology is encouraged wherever possible in order to foster the impact on students' learning and understanding.
8. Modifications and accommodations should be included where necessary to meet student's Individual Education Plans (IEP).

Course Objectives

The student will be able to:

1. Evaluate and write expressions using verbal and algebraic models to solve problems.
2. Solve and graph linear equations and inequalities.
3. Graph transformations of functions.
4. Solve and graph quadratic equations and inequalities.
5. Solve systems of equations and inequalities by various methods.
6. Evaluate and graph exponential and logarithmic functions.
7. Perform operations with polynomial functions.
8. Perform operations on rational expressions.
9. Solve rational and radical equations.
10. Perform operations with functions.
11. Graph and write the equations of the conic sections.
12. Calculate the probability of a theoretical and experimental event.
13. Find the measures of central tendency and measures of variation for statistical data.
14. Analyze the arithmetic and geometric sequences and series.
15. Solve and graph trigonometric functions.

All objectives will include applications to real-life situations.

For NJSLS visit https://www.nj.gov/education/cccs/2016/math/standards.pdf

Introduction

The New Jersey Student Learning Standards for Mathematics are intended to provide students with a solid foundation. The Standards for Mathematical Content are a balanced combination of procedure and understanding.

The high school standards are listed in conceptual categories: • Number and Quantity • Algebra • Functions • Modeling • Geometry • Statistics and Probability

Mathematical Practice Standards:

This curriculum guide is standards based which reflects the New Jersey Student Learning Standards for Mathematics, the Mathematical Practices that are expected to be used in teaching mathematics K-12 are as follows and infused throughout the guide:

- Make sense of problems and persevere in solving them.
- Use appropriate tools strategically.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Technology infused within the Curriculum (refer to "Resources: Essential Materials, Supplementary Materials, Links to Best Practices")

National / International Technology Student Standards

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

- Empowered Learner: Students leverage technology to take an active role in choosing, achieving, and demonstrating competency in their learning goals, informed by the learning sciences.
- Digital Citizenship: Students recognize the rights, responsibilities, and opportunities of living, learning, and working in an interconnected digital world, and they act and model in ways that are safe, legal, and ethical.
- Knowledge Constructor: Students critically curate a variety of resources using digital tools to construct knowledge, produce
  creative artifacts, and make meaningful learning experiences for themselves and others.
- Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals.

Career Ready Practices within the Curriculum (refer to “Activities/Strategies”)
College Ready Practices are practices that have been linked to increase college, career, and life success.

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason
- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

Suggested Timeline (Honors)

Unit	# of Periods
Factoring	4
Chapter 1: Equations and Inequalities Section 1.2, 1.3, 1.4, 1.5, 1.6	11
Chapter 2: Linear Relations and Functions Section 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	14
Chapter 3: Systems of Equations and Inequalities Section 3.1, 3.2, 3.3, 3.4	9
Chapter 0 / 11: Statistics and Probability	
Section 0.4, 0.5, 0.6, 0.9, 10.6	4
Section 11.1, 11.2, 11.3, 11.4	8
Chapter 4: Quadratic Functions and Relations Section 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8	11
Chapter 5: Polynomials and Polynomial Functions Section 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8	13
Chapter 6: Inverse and Radical Functions and Relations Section 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7	11
Chapter 7: Exponential and Logarithmic Functions and Relations Section 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8	14

Chapter 8: Rational Functions and Relations Section 8.1, 8.2, 8.3, 8.4, 8.5, 8.6	13
Chapter 12: Trigonometric Functions Section 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9	20
Chapter 13: Trigonometric Identities and Equations Section 13.1, 13.2, 13.3, 13.4, 13.5	12
Chapter 9: Conic Sections 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7	13
Chapter 10: Sequences and Series Section 10.1, 10.2, 10.3, 10.4, 10.5	10
Total Class Periods:	**167**

Marking Period 1	Factoring, Chapter 1, 2, 3.1-3.4, Chapter 0.4, 0.5, 0.6, 0.9
Marking Period 2	Chapter 11, 4, 5, 6
Marking Period 3	Chapter 7, 8, 12
Marking Period 4	Chapter 13, 9, 10.1-10.5

Note - Teachers will adjust their timing and pacing as they feel necessary to accommodate actual class periods available.

Suggested Timeline (Accelerated)

Unit	# of Periods
Algebra 1 Review	7
Chapter 1: Equations and Inequalities and Chapter 2: Linear Relations and Functions Section 1.4, 1.5, 1.6, 2.6, 2.7	10
Chapter 3: Systems of Equations and Inequalities Section 3.1, 3.2, 3.4	10
Chapter 0 / 11: Statistics and Probability Section 0.4, 0.5, 0.6, 0.9, Section 11.1, 11.2, 11.3,	11
Chapter 4: Quadratic Functions and Relations Section 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8	14
Chapter 5: Polynomials and Polynomial Functions Section 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8	15
Chapter 6: Inverse and Radical Functions and Relations Section 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7	14
Chapter 7: Exponential and Logarithmic Functions and Relations Section 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8	12
Chapter 8: Rational Functions and Relations Section 8.1, 8.2, 8.3, 8.4, 8.5, 8.6	13

Chapter 12: Trigonometric Functions Section 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9	18
Chapter 13: Trigonometric Identities and Equations Section 13.1, 13.2, 13.3, 13.4, 13.5	12
Chapter 10: Sequences and Series Section 10.1, 10.2, 10.3, 10.4, 10.5	10
Chapter 9: Conic Sections 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7	18
Total Class Periods:	**164**

Marking Period 1	Algebra 1 Review, Chapters 1, 2, 3, 0, 11
Marking Period 2	Chapter 4, 5, 6
Marking Period 3	Chapter 7, 8, 12
Marking Period 4	Chapter 13, 10.1-10.5, 9

Note - Teachers will adjust their timing and pacing as they feel necessary to accommodate actual class periods available.

Suggested Timeline (Academic)

Unit	# of Periods
Chapter 1: Equations and Inequalities Section 1.1, 1.2, 1.3, 1.4, 1.5, 1.6	10
Chapter 2: Linear Relations and Functions Section 2.1, 2.3, 2.4, 2.5, 2.6	11
Chapter 3: Systems of Equations and Inequalities Section 3.1, 3.2, 3.4	11
Chapter 0 Statistics and Probability Section 0.4, 0.5, 0.6, 0.9	9
Chapter 4: Quadratic Functions and Relations Section 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8	21
Chapter 5: Polynomials and Polynomial Functions Section 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8	16
Chapter 6: Inverse and Radical Functions and Relations Section 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7	19
Chapter 7: Exponential and Logarithmic Functions and Relations Section 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8	16
Chapter 8: Rational Functions and Relations Section 8.1, 8.2, 8.3, 8.4, 8.5, 8.6	14

Chapter 12: Trigonometric Functions Section 12.1, 12.2, 12.3, 12.4, 12.6, 12.7, 12.8, 12.9	20
Chapter 13: Trigonometric Identities and Equations Section 13.1, 13.2, 13.3, 13.5	8
Chapter 10: Sequences and Series Section 10.1, 10.2, 10.3, 10.4	9

* **If time permits***

Chapter 9: Conic Sections
9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7

Total Class Periods: **164**

Marking Period 1	Chapter 1, 2, 3, 0/11
Marking Period 2	Chapter 4, 5, 6.1-6.2
Marking Period 3	Chapter 6.3-6.7, 7, 8
Marking Period 4	Chapter 12, 13, 10, *9 (if time permits)

Note - Teachers will adjust their timing and pacing as they feel necessary to accommodate actual class periods available.

Unit Title: Chapter 1: Equations and Inequalities

Targeted Standards: A-SSE: Interpret the structure of expressions. Write expressions in equivalent forms to solve problems. A-CED: Create equations that describe numbers or relationships.

Unit Objectives/Conceptual Understandings: Students will be able to simplify and evaluate algebraic expressions, solve linear and absolute value equations, and solve and graph inequalities.

Essential Questions: How are symbols useful in mathematics? Why is it important to understand what the symbols in a formula represent? How are symbols used to write expressions, equations, and inequalities?

Unit Assessment: Teacher-generated assessments will be given using various forms of technology.

	Core Content Objectives	Instructional Actions

Cumulative Progress Indicators	Concepts	Skills	Activities/Strategies	Assessment Check Points
A.SSE.2 Use the structure of an expression to identify ways to rewrite it. A.CED.1 Create equations and inequalities in one variable and use them to solve problems. A.SSE.1.b Interpret complicated expressions by viewing one or more of their parts as a single entity. A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret	Vocabulary including: variable (Lesson 1-1) algebraic expression (Lesson 1-1) order of operations (Lesson 1-1) formula (Lesson 1-1) real numbers (Lesson 1-2) rational numbers (Lesson 1-2) irrational numbers (Lesson 1-2) integers (Lesson 1-2) whole numbers (Lesson 1-2)	• Recognize and use the vocabulary terms in context. • use the properties of real numbers to evaluate expressions and formulas • classify real numbers • use the properties of equality to solve equations	Help students to recall the Distributive Property by connecting the name to *distributing*, "handing out papers, for example, one to each person." Point out that the factor outside the parentheses acts as a multiplier for each term within the parentheses. **Interactive Whiteboard** Draw a set diagram on the board showing how the set of real numbers is	**Ticket Out the Door** Have each student write the name and an example of one of the properties in this lesson. Quiz 1, p. 45 Quiz 2, p. 45

solutions as viable or nonviable options in a modeling context.	natural numbers (Lesson 1-2) open sentence (Lesson 1-3) equation (Lesson 1-3) solution (Lesson 1-3) absolute value (Lesson 1-4) empty set (Lesson 1-4) set-builder notation (Lesson 1-5) compound inequality (Lesson 1-6) intersection (Lesson 1-6) union (Lesson 1-6) An algebraic expression is an expression that contains at least one variable. It may also contain numbers and operations. When evaluating an algebraic expression, each variable must be replaced with a given value, and the order of operations must be followed. Every real number corresponds to exactly one point on the number line, and every point on the number line represents exactly one real number. Real numbers are classified as either rational or irrational.	• solve absolute value equations • solve inequalities, compound inequalities, and absolute value inequalities • Translate verbal expressions into algebraic expressions and equations, and vice versa. • Solve equations using the properties of equality. • Evaluate expressions involving absolute values. • Solve absolute value equations. • Describe the solution set of an inequality using interval notation. • Solve one-step inequalities. • Solve multi-step inequalities. • Solve compound inequalities. • Solve absolute value inequalities.	separated into rational and irrational numbers, integers, whole numbers, etc. Write a list of 12 real numbers, and choose students to come to the board to drag them into the correct set in the diagram. **Reading** Students may find it helpful to read the first absolute value bar as "the distance of" and the last absolute value bar as "from zero, without regard to direction." So, the expression $\|6 - 2x\|$ would be read as "the distance of the value of $6 - 2x$ from zero, without regard to direction." **Preventing Errors** Absolute value signs need to be interpreted so that the statement containing the absolute value signs can be rewritten as an equivalent statement without absolute value signs.	**Ticket Out the Door** Have each student write a list for solving inequalities. Each list should include when to reverse the inequality symbol and how to tell when the graph begins with a circle or with a dot. Quiz 3, p. 46 **Ticket Out the Door** Have each student tell a partner or write the steps used to solve $\|x - 4\| < 3$. Quiz 4, p. 46

	Properties of real numbers are used to justify the steps used in solving equations and to describe mathematical relationships. An equation is a mathematical sentence stating that two mathematical expressions are equal. Solving an equation requires a series of equations, equivalent to the given equation, that result in a final equation that isolates the variable on one side of the equals sign. The Properties of Equality can be used to solve equations. An open sentence that contains the symbol $<$, $\leq$, $>$, or $\geq$ is called an *inequality*. For any two real numbers, a and b, exactly one of the following statements is true: $a < b$, $a = b$, or $a > b$. Solving an inequality involves using the Properties of Inequality to write a series of equivalent inequalities, ending with one that isolates the variable.			

	There are infinitely many solutions to an inequality. These solutions can be expressed in more than one way: • **Graphs** When the solution is graphed on a number line, an open circle indicates a value that is not included in the solution, and a closed circle indicates a value that is included. Circles are used with < and >, and dots are used with ≤ and ≥. • **Set Builder Notation** Solutions can be written using set-builder notation. A solution such as $x \geq 4$ would be written $\{x \mid x \geq 4\}$, and read *the set of values* x *such that* x *is greater than or equal to 4.* An inequality that consists of two inequalities joined by the word *and* or the word *or* is called a *compound inequality*. To solve a			

	compound inequality, each part of the inequality must be solved. **Compound Inequalities** A number is a solution to a compound inequality with *and* if the number is a solution to both inequalities. A number is a solution to a compound inequality with *or* if the number is a solution to either inequality.			

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 2: Linear Relations and Functions

Targeted Standards: F-IF: Interpret functions that arise in applications in terms of the context. Analyze functions using different representations.

Unit Objectives/Conceptual Understandings: Students will be able to use equations of relations and functions, determine the slope of a line, use scatter plots and prediction equations, and graph linear inequalities.

Essential Questions: How can mathematical ideas be represented? How can a linear relationship be represented?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	Instructional Actions

Cumulative Progress Indicators	Concepts	Skills	Activities/Strategies	Assessment Check Points
F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. F.IF.9 Compare properties of two functions each represented in a	Vocabulary including: one-to-one function (Lesson 2-1) onto function (Lesson 2-1) discrete relation (Lesson 2-1) continuous relation (Lesson 2-1) vertical line test (Lesson 2-1) independent variable (Lesson 2-1) dependent variable (Lesson 2-1) linear equation (Lesson 2-2) linear function (Lesson 2-2)	• Analyze relations and functions. • Use equations of relations and functions. • Distinguish between discrete and continuous functions to explore real-world problems. • Identify linear relations and functions.	**Interactive Whiteboard** Display a graph on the board and demonstrate the vertical line test. Draw a vertical line and drag it from left to right across the graph. Show students that if there is any place where a vertical line intersects the graph at more than one point, the graph is not a function. **Teach with Tech**	**Ticket Out the Door** Ask each student to write a short explanation of how to determine if an equation is linear. Quiz 1, p. 59 Quiz 2, p. 59

different way (algebraically, graphically, numerically in tables, or by verbal descriptions). F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. A.SSE.1.b Interpret complicated expressions by viewing one or more of their parts as a single entity. A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. F.IF.7.b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.	rate of change (Lesson 2-3) bivariate data (Lesson 2-5) positive correlation (Lesson 2-5) negative correlation (Lesson 2-5) line of fit (Lesson 2-5) regression line (Lesson 2-5) piecewise-linear function (Lesson 2-6) absolute value function (Lesson 2-6) parent function (Lesson 2-7) quadratic function (Lesson 2-7) linear inequality (Lesson 2-8) **Relations and Functions** A function is a special type of relation, just as a square is a special type of rectangle. All functions are relations. Relations and functions in which the domain is a set of individual points are said to be discrete. If the domain can be graphed with a line or smooth curve, then it is continuous. **Linear Equations** When determining whether an equation is linear, it is helpful to examine the	• Write linear equations in standard form. • Find the rate of change. • Determine the slope of a line. • Write an equation of a line given the slope and a point on the line. • Write an equation of a line parallel or perpendicular to a given line. • Use functions to model direct variation. • Use scatter plots and prediction equations. • Model data using lines of regression. • Write and graph piecewise-defined functions. • Write and graph step and absolute value functions. • Identify and use parent functions. • Describe transformations of functions. • Graph linear inequalities.	**Blog** Have students write a blog entry explaining how to find the slope of a line. Have them explain how the slope describes the appearance of the line. **Teach with Tech** **Blog** Give students several pictures of graphs of piecewise functions. Have students write a blog entry explaining how to interpret each of the graphs.	Quiz 3, p. 60 **Ticket Out the Door** Have students write the names of the parent functions on separate slips of paper. Then have them describe the characteristics of one function's graph. **Name the Math** Have students write how they know when the graph of an inequality has a dashed boundary and when it has a solid boundary. Quiz 4, p. 60

A.CED.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.	equation for certain characteristics. A linear equation has no operations other than addition, subtraction, and multiplication of a variable by a constant. The variables may not be multiplied together or appear in the denominator. A linear equation does not contain variables with exponents other than 1. **Slope** The steepness of a line is measured by its slope. The slope of a nonvertical line is found by identifying two points on the line and dividing the difference in their *y*-coordinates by the difference in their *x*-coordinates. The slope of a horizontal line is 0, and the slope of a vertical line is undefined. When two points or a point and the slope of a line are known, an equation of the line can be found. If you know the slopes of two lines, you can determine whether they are parallel or perpendicular.	• Graph absolute value inequalities. •		

	When *bivariate data* are graphed as ordered pairs on a coordinate plane, the graph is called a *scatter plot*. If a set of data exhibits a linear trend, an equation of a line of fit can be used to approximate the relation between domain values and range values of the data. This line of fit, also called a prediction equation, can be used to make predictions. Special types of linear functions include the following. • *Piecewise-defined functions* are usually written using two or more algebraic expressions. • A common *piecewise-linear function*, called a *step function*, consists of a series of line segments that look like steps. • The graph of an *absolute value function* is shaped like a V and is made up of portions of two lines.			

	A family of graphs is a group of graphs that display one or more similar characteristics. The parent graph, which is a graph of the parent function, is the simplest of the graphs in a family. This graph can be transformed to create other members in a family of graphs. The solution set of a linear inequality is the set of all ordered pairs that make the statement true. The graph of a linear inequality can be shown as a shaded region that is formed by a linear boundary that divides the coordinate plane into two regions.			

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 3: Systems of Equations and Inequalities

Targeted Standards: A.CED: Create equations that describe numbers or relationships. A-REI: Understand solving equations as a process of reasoning and explain the reasoning. Represent and solve equations and inequalities graphically.

Unit Objectives/Conceptual Understandings: Students will be able to solve systems of linear equations and inequalities, solve problems by using linear programming, and perform operations with matrices and determinants.

Essential Questions: How can you find the solution to a math problem? What are the benefits of having different strategies for solving systems of equations? What are the advantages of using matrices to solve problems?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
A.CED.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. A.REI.11 Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the	Vocabulary including: break-even point (Lesson 3-1) consistent (Lesson 3-1) inconsistent (Lesson 3-1) independent (Lesson 3-1) dependent (Lesson 3-1) substitution method (Lesson 3-1) elimination method (Lesson 3-1) feasible region (Lesson 3-3) bounded (Lesson 3-3) unbounded (Lesson 3-3) optimize (Lesson 3-3)	• Solve systems of linear equations graphically. • Solve systems of linear equations algebraically. • Find intersections of graphs using a graphing calculator. • Solve systems of inequalities by graphing. • Determine the coordinates of the	**Sense-Making** Make sure that students understand that the solution of an inequality must be true for all of the inequalities of the system. Have them test the coordinates of points in different regions of the graph and analyze the results. **Teach with Tech** **Wiki** Have students work in pairs to create a wiki	**Name the Math** Have students either write on a piece of paper or tell you whether elimination or substitution would be better to solve this system of equations. $2m - n = 2$ $2m + 3n = 22$ Quiz 1, p. 59

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.	dimensions (Lesson 3-5) scalar (Lesson 3-5) determinant (Lesson 3-7) Cramer's Rule (Lesson 3-7) coefficient matrix (Lesson 3-7) identity matrix (Lesson 3-8) square matrix (Lesson 3-8) inverse matrix (Lesson 3-8) variable matrix (Lesson 3-8) constant matrix (Lesson 3-8) Two or more equations with the same variables are called a *system of equations*. A system of equations can be solved by graphing each equation on the same coordinate plane. A solution to a system is an ordered pair that represents a point on both lines and satisfies both equations. The inequalities in the system are graphed on the same coordinate plane, and the ordered pairs that satisfy all of the inequalities in the system are in the region that is common to the inequalities. If the regions do not intersect, the	vertices of a region formed by the graph of a system of inequalities. • Use a graphing calculator to solve systems of linear inequalities. • Find the maximum and minimum values of a function over a region. • Solve real-world optimization problems using linear programming. • Solve systems of linear equations in three variables. • Solve real-world problems using systems of linear equations in three variables. • Analyze data in matrices. • Perform algebraic operations with matrices. • Multiply matrices. • Use the properties of matrix multiplication. • Use a graphing calculator to	describing how to graph a system of inequalities. Be sure they describe how to decide whether to use a solid or dashed line and how to decide which region to shade. Be sure they also explain how to interpret the graph to find the solutions of the system of inequalities. **Problem Solving Tip** Remind students that neither the maximum nor minimum automatically occurs at the smallest/largest (x, y) coordinate. The max/min depend on the $f(x, y)$ function in the situation. **Teach with Tech** **Video Recording** Have students work in groups to create a video showing how to solve a system of equations in three variables. Be sure students show how to check the solution in the original system of equations. Share each	Quiz 2, p. 59 **Ticket Out the Door** Have students write on pieces of paper whether or not a 4 × 3 matrix can be multiplied by a 2 × 3 matrix. Ask them to explain their answers. Quiz 3, p. 60 **Ticket Out the Door** Have students describe how matrix equations can be used to solve systems of two equations in two variables. Quiz 4, p. 60

	solution is the empty set, and no solution exists. If the graph of a system of three or more linear inequalities forms an enclosed bounded region, the vertices of the region can be found by determining the coordinates of where the boundary lines intersect. **Linear Programming** The process of finding maximum or minimum values of a function for a region defined by linear inequalities is called linear programming. Linear programming is a very useful tool for solving many real-world problems. The graph of a first-degree equation in three variables is a plane. There are several possibilities for the solution to a system of equations in three variables, since the three planes can intersect in a variety of ways. • at a *point*: The ordered triple for that point is a single	explore operations with matrices. • Evaluate determinants. • Solve systems of linear equations by using Cramer's Rule. • Find the inverse of a 2 × 2 matrix. • Write and solve matrix equations for a system of equations. •	group's video with the entire class. **Teach with Tech** **Video Recording** Have students write a rap or song to help them remember the steps for matrix multiplication. Then videotape their presentation and post to your favorite video sharing site. One such song can be sung to the tune of "My Darling Clementine." *Row by column, row by column* *Multiply them line by line* *Add them up to form a matrix* *Now you're doing it just fine!* **Sense-Making** Remind students that Cramer's Rule does not apply when the determinant of the coefficient matrix is 0, because the solution would have a denominator of 0, which is undefined.	

	solution to the system. • in a *line*: The system has an infinite number of solutions, any point on the line. • in the same *plane*: This system would also have an infinite number of solutions, all points in the plane. • *no points in common*: The solution is the empty set. **Multiplying Matrices** Before you multiply two matrices, you must determine whether the matrix product is defined. Two matrices can be multiplied if and only if the number of columns in the first matrix is equal to the number of rows in the second matrix. Every square matrix has a determinant. Cramer's Rule can be used to solve systems of equations.		**Preventing Errors** Have students make posters that show the process for finding the determinant of a 3 × 3 matrix, using colored markers to clearly identify the diagonals. **Teach with Tech** **Blog** Have students write blog entries explaining what it means when the coefficient matrix for a system of equations does not have an inverse. Be sure students use examples in their explanations.	

	Solving a System of Equations Using A^{-1} If a system of equations has a unique solution, then the solution is given by $X = A^{-1}B$, where A is the coefficient matrix, B is the constant matrix, and X is the variable matrix. If there is no solution, or there are infinitely many solutions to the system, the coefficient matrix does not have an inverse, or is not invertible.			

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 4: Quadratic Functions and Relations

Targeted Standards: N-CN: Perform arithmetic operations with complex numbers. F-IF: Interpret functions that arise in applications in terms of the context. Analyze functions using different representations. A-CED: Create equations that describe numbers or relationships. F-BF: Build new functions from existing functions.

Unit Objectives/Conceptual Understandings: Students will be able to graph quadratic functions, solve quadratic equations, perform operations with complex numbers, and graph and solve quadratic inequalities.

Essential Questions: Why do we use different methods to solve math problems? How do you know what method to use when solving a quadratic equation?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives		Instructional Actions	
Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
A.SSE.1.a Interpret parts of an expression, such as terms, factors, and coefficients. F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). F.IF.4 For a function that models a relationship between two quantities, interpret key features	Vocabulary including: quadratic term (Lesson 4-1) linear term (Lesson 4-1) constant term (Lesson 4-1) vertex (Lesson 4-1) maximum value (Lesson 4-1) minimum value (Lesson 4-1) quadratic equation (Lesson 4-2) standard form (Lesson 4-2) root (Lesson 4-2) zero (Lesson 4-2) imaginary unit (Lesson 4-4)	• Graph quadratic functions. • Find and interpret the maximum and minimum values of a quadratic function. • Use a graphing calculator to model data	**Extending the Concept** Make sure students understand that the graph shows values for all the points that satisfy the function, even when the *x*-value is not an integer. **Preventing Errors** When discussing the steps for completing the square, emphasize that the coefficient of the	**Name the Math** Have students explain how to tell by examining a quadratic function whether its graph will have a maximum or minimum value. Then have them give examples of what such values might mean in a real-world problem.

of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. A.SSE.2 Use the structure of an expression to identify ways to rewrite it. F.IF.8.a 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. N.CN.1 Know there is a complex number *i* such that $i^2 = –1$, and every complex number has the form $a + bi$ with *a* and *b* real. N.CN.2 Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. N.CN.7 Solve quadratic equations with real coefficients that have complex solutions. F.IF.8.a Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and	pure imaginary number (Lesson 4-4) complex number (Lesson 4-4) complex conjugates (Lesson 4-4) completing the square (Lesson 4-5) Quadratic Formula (Lesson 4-6) discriminant (Lesson 4-6) vertex form (Lesson 4-7) quadratic inequality (Lesson 4-8) **Graphs of Quadratic Functions** Graphs of quadratic functions of the form $f(x) = ax^2 + bx + c$, where $a \neq 0$, are called parabolas. **Solving Quadratics by Factoring** Quadratic equations can be solved using several different methods. Factoring can be a quick method. Once a polynomial has been factored, the Zero Product Property may be used to find the roots of the equation. If the polynomial is difficult to factor or is not factorable, then other methods must be used.	points for which the curve of best fit is a quadratic function. • Write quadratic equations in standard form. • Solve quadratic equations by factoring. • Perform operations with pure imaginary numbers. • Perform operations with complex numbers. • Solve quadratic equations by using the Square Root Property. • Solve quadratic equations by completing the square. • Solve quadratic	quadratic term must be 1. **Teach with Tech** **Interactive Whiteboard** Show a coordinate grid on the board. Draw a graph of a quadratic function, give students the equation of the graph, and show students how to write the equation of the graph in vertex form. Drag the graph to move its vertex to other locations on the grid and have students find the equations of the new graphs. Discuss how the equations are similar and different. **Teach with Tech** **Blog** Have students write a blog entry describing how graphing a quadratic inequality is similar to and different from graphing a linear inequality.	Quiz 1, p. 59 **Name the Math** Have students explain the Zero Product Property. Have them discuss why it is true and how it is used in finding the roots of a quadratic equation. **Ticket Out the Door** Have students write two complex numbers that have a product of 10 on small pieces of paper and hand them to you as they leave the classroom. Sample answer: $1 + 3i$ and $1 – 3i$ Quiz 2, p. 59 Quiz 3, p. 60 **Ticket Out the Door** Write a quadratic inequality in one

symmetry of the graph, and interpret these in terms of a context. A.SSE.1.b Interpret complicated expressions by viewing one or more of their parts as a single entity. F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. A.CED.1 Create equations and inequalities in one variable and use them to solve problems. A.CED.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.	**Complex Numbers** A complex number is any number that can be written in the form $a + bi$, where a and b are real numbers and i is the imaginary unit. If $b = 0$, the complex number is a real number. If $b \neq 0$, the complex number is imaginary. If $a = 0$, the complex number is a pure imaginary number. Pure imaginary and real numbers are both subsets of the set of complex numbers. Hence, every real number is complex, and every pure imaginary number is complex. **Completing the Square** To complete the square for an expression of the form $x^2 + bx$, add the square of one half of the coefficient b to $x^2 + bx$. Written in symbols: $x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$ **The Quadratic Formula** The *Quadratic Formula* can be used to solve any equation in the form $ax^2 + bx + c = 0$, where $a \neq 0$. **Quadratic Function in Vertex Form** The values of a, k, and h, in the vertex form	equations by using the Quadratic Formula. • Use the discriminant to determine the number and type of roots of a quadratic equation. • Use a graphing calculator to investigate changes to parabolas. • Write a quadratic function in the form $y = a(x – h)^2 + k$. • Transform graphs of quadratic functions of the form $y = a(x – h)^2 + k$. • Graph quadratic inequalities in two variables. • Solve quadratic inequalities in one variable.		variable on the board. On an index card, have students solve the inequality graphically and algebraically. Quiz 4, p. 60

	of a quadratic function, $y = a(x - h)^2 + k$, affect the graph of the parabola.			

Resources: Essential Materials, Supplementary Materials, Links to Best Practices	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings
-E-Tool Kit **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 5: Polynomials and Polynomial Functions

Targeted Standards: A-APR: Perform arithmetic operations on polynomials. Understand the relationship between zeros and factors of polynomials. Use polynomial identities to solve problems. F-IF: Interpret functions that arise in applications in terms of the context. Analyze functions using different representations.

Unit Objectives/Conceptual Understandings: Students will be able to perform operations with polynomials, analyze and graph polynomial functions, solve polynomial equations, and find factors and zeros of polynomial functions.

Essential Questions: Why is math used to model real-world situations? When would a nonlinear function be a good model? What are the advantages of using polynomial functions for modeling? What are the limitations of mathematical modeling?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. A.APR.6 Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the	Vocabulary including: simplify (Lesson 5-1) degree of a polynomial (Lesson 5-1) synthetic division (Lesson 5-2) polynomial in one variable (Lesson 5-3) leading coefficient (Lesson 5-3) polynomial function (Lesson 5-3) power function (Lesson 5-3) end behavior (Lesson 5-3)	• Multiply, divide, and simplify monomials and expressions involving powers. • Add, subtract, and multiply polynomials. • Divide polynomials using long division. • Divide polynomials using synthetic division.	**Extending the Concept** Since the graphs on this page show the *maximum* number of times each type of graph may intersect the *x*-axis, some students may ask about the minimum number of times each graph type may intersect the *x*-axis. Have students work in pairs using the given graphs to discuss this issue.	**Name the Math** Ask students to explain how to use synthetic division to divide a polynomial by a binomial. Ask them to demonstrate the technique using the polynomial $3x^3 - 4x^2 + 5x^2 - 7$ and the binomial $x - 2$.

degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. F.IF.7.c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. A.CED.1 Create equations and inequalities in one variable and use them to solve problems. A.APR.2 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$. N.CN.9 Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	relative maximum (Lesson 5-4) relative minimum (Lesson 5-4) extrema (Lesson 5-4) turning points (Lesson 5-4) prime polynomials (Lesson 5-5) quadratic form (Lesson 5-5) synthetic substitution (Lesson 5-6) depressed polynomial (Lesson 5-6) **Dividing Polynomials** You can use synthetic division to divide a polynomial by a binomial. The terms in both the divisor and dividend must be in descending order of power, and a coefficient of 0 must be included for any term that is missing. If the divisor is not in the form $x - r$, divide every term in both the divisor and dividend by the coefficient of the first term of the divisor and then use synthetic division. If you know an element in the domain, x, of any polynomial function, you can find the corresponding value in the range, $f(x)$. Resulting sets of ordered	• Use a graphing calculator to explore power functions. • Evaluate polynomial functions. • Identify general shapes of graphs of polynomial functions. • Graph polynomial functions and locate their zeros. • Find the relative maxima and minima of polynomial functions. • Use a graphing calculator to model data whose curve of best fit is a polynomial function. • Use a graphing calculator to find approximate solutions for polynomial equations. • Factor polynomials. • Solve polynomial equations by factoring.	Lead students to see that, for functions of degree 1 the minimum is 1 (the same as the maximum), for functions of degree 2 the minimum is 0, for functions of degree 4 the minimum is 0, and for functions of degree 5 the minimum is 1. Some students may notice the pattern for functions with odd and even degrees. **Teach with Tech** **Blog** Have students write a blog entry explaining how the Remainder and Factor Theorems are related—specifically, have students describe how the Factor Theorem is a special case of the Remainder Theorem. **Teach with Tech** **Interactive Whiteboard** Write a polynomial function on the board. Show students how to apply Descartes' Rule of Signs by highlighting	Quiz 1, p. 57 **Ticket Out the Door** Make several copies of five different polynomial functions. Give one function to each student. As students leave the room, ask them to tell you the values of the functions for a given numerical value, variable, or algebraic expression. Quiz 2, p. 57 **Name the Math** Prepare two paper bags containing small pieces of paper: one containing polynomial equations that can be solved by factoring, and the other containing polynomial equations that are in

A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	pairs can be used to graph the functions. The maximum number of real zeros, where $f(x) = 0$, that a function will have is equal to the degree of the function. The degree and leading term of a polynomial function determine the graph's end behavior. Tables of values can be used to explore two types of changes in the values of a polynomial function. • A change of signs in the value of $f(x)$ from one value of x to the next indicates that the graph of the function crosses the x-axis between the two x-values. • A change between increasing values and decreasing values indicates that the graph is turning for that interval. A turning point on a graph is a relative maximum or minimum. **Solving Polynomial Equations** If a polynomial can be written as a product	• Evaluate functions by using synthetic substitution. • Determine whether a binomial is a factor of a polynomial by using synthetic substitution. • Determine the number and type of roots of a polynomial equation. • Find the zeros of a polynomial function. • Use a graphing calculator to analyze polynomial functions. • Identify possible rational zeros of a polynomial function. • Find all of the rational zeros of a polynomial function.	each change in signs in the coefficients.	quadratic form. Have each student select one equation from each bag and solve both equations. **Ticket out the Door** Ask students to explain how synthetic substitution is related to synthetic division. Quiz 3, p. 58 **Name the Math** Ask students: • What must be true about the coefficients of a polynomial function in order to apply the Rational Zero Theorem? • How can the possible zeros of a polynomial

	of linear and quadratic factors, its zeros can be found. Set each of the factors equal to 0 and solve the resulting equations. **Factor Theorem** The Remainder Theorem says that the value of $f(a)$ is the same as the remainder when the polynomial is divided by $x - a$. The Factor Theorem is a special case of the Remainder Theorem. It says: If $f(a)$ has a value of 0, then $x - a$ is a factor of the polynomial. **Zeros** The real zeros of a polynomial function f are the x-intercepts of the graph of f. They are also the real solutions of the polynomial equation $f(x) = 0$. A polynomial function cannot have more zeros than its degree. If a simplified fraction $\frac{p}{q}$ is a zero of a polynomial function with integral coefficients, then the			function be identified? Quiz 4, p. 58

	fraction's numerator, *p*, must be a factor of the constant term of the function, and the denominator, *q*, must be a factor of the leading coefficient.			

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 6: Inverse and Radical Functions and Relations

Targeted Standards: F-IF: Interpret functions that arise in applications in terms of the context. Analyze functions using different representations. F-BF: Build new functions from existing functions. A-REI: Understand solving equations as a process of reasoning and explain the reasoning. Represent and solve equations and inequalities graphically. A-SSE: Interpret the structure of expressions. Write expressions in equivalent forms to solve problems.

Unit Objectives/Conceptual Understandings: Students will be able to find compositions and inverses of functions, graph and analyze square root functions and inequalities, and simplify and solve equations involving roots, radicals and rational exponents.

Essential Questions: How can you choose a model to represent a set of data? Why would you use the inverse of a function to model a real-world situation? Why would you choose a square root function to model a set of data instead of a polynomial function?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts**	**Skills**	**Activities/Strategies**	**Assessment Check Points**
F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). F.BF.1.b Combine standard function types using arithmetic operations. F.IF.4For a function that models a relationship between two	Vocabulary including: composition of functions (Lesson 6-1) inverse relation (Lesson 6-2) inverse function (Lesson 6-2) square root function (Lesson 6-3) radical function (Lesson 6-3) square root inequality (Lesson 6-3)	• Find the sum, difference, product, and quotient of functions. • Find the composition of functions. • Find the inverse of a function or relation. • Determine whether two	**Teach with Tech** **Interactive Whiteboard** Write two functions $f(x)$ and $g(x)$ on the board. To show students how to write $f(g(x))$, drag the expression for $g(x)$ and replace each x in $f(x)$. Repeat for $g(f(x))$.	**Yesterday's News** Have students write how yesterday's concept of composition of functions helped them verify that two functions are inverses. Quiz 1, p. 53 Quiz 2, p. 53

quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. F.BF.4.a Find inverse functions. - Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. F.IF.7.b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. A.SSE.2 Use the structure of an expression to identify ways to rewrite it. A.SSE.2 Use the structure of an expression to identify ways to rewrite it.	*n*th root (Lesson 6-4) radical sign (Lesson 6-4) index (Lesson 6-4) radicand (Lesson 6-4) principal root (Lesson 6-4) rationalizing the denominator (Lesson 6-5) conjugates (Lesson 6-5) radical equation (Lesson 6-7) extraneous solution (Lesson 6-7) radical inequality (Lesson 6-7) Any two functions, $f(x)$ and $g(x)$, can be added, subtracted, multiplied, and divided. The *composition of functions* provides another way of combining functions. Given two functions f and g, the composition, $f \circ g$, is described by $[f \circ g](x) = f[g(x)]$. The inverse of a function can be found by exchanging the domain and the range of the function. To test whether two functions $f(x)$ and $g(x)$ are inverses, check that each of the two compositions $[f \circ$	functions or relations are inverses. • Compare a function and its inverse using a graphing calculator. • Graph and analyze square root functions. • Graph square root inequalities. • Simplify radicals. • Use a calculator to approximate radicals. • Use a graphing calculator to graph *n*th root functions. • Simplify radical expressions. • Add, subtract, multiply, and divide radical expressions. • Write expressions with rational exponents in radical form and vice versa. • Simplify expressions in	**Teach with Tech** **Audio Recording** Have students create audio recordings explaining how to find the inverse of a function. Also have students explain how they can check if two given functions are inverses of each other. **Teach with Tech** **Video Recording** Have students work in groups to create a video showing how to graph a square root function. Be sure they explain how they determined the domain of the function. Share each group's video with the class. **Teach with Tech** **Blog** Have students write a blog entry explaining how to find the number of roots (and their signs) before performing any calculations.	**Name the Math** Ask students to describe how combining radicals is the same as and different from combining expressions with variables. Quiz 3, p. 54 **Ticket Out the Door** Make several copies each of five different radical equations or inequalities. Give one equation or inequality to each student. Have students solve their equations (or inequalities) and hand them to you as they leave the room. Quiz 4, p. 54

A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. A.REI.11 Explain why the *x*-coordinates of the points where the graphs of the equations *y* = *f*(*x*) and *y* = *g*(*x*) intersect are the solutions of the equation *f*(*x*) = *g*(*x*); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f*(*x*) and/or *g*(*x*) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	*g*](*x*) and [*g* ◦ *f*](*x*) has the value *x*. When the inverse of a function is a function, then the original function is said to be *one-to-one*. A function that contains a variable inside a square root symbol is called a *square root function*. The domains and ranges of these functions are limited to values for which the function is defined. The *principal root* of a number is always a nonnegative number. Radical expressions can be simplified using the *Product Property of Radicals* and the *Quotient Property of Radicals.* In order to add or subtract radical expressions, the two radical expressions must be *like radical expressions*; that is, both the index and radicand are identical. A process called *rationalizing the denominator* is used to eliminate radicals from a	exponential or radical form. • Solve equations containing radicals. • Solve inequalities containing radicals. • Use a graphing calculator to solve radical equations and inequalities.	**Product Property of Radicals** When discussing the Product Property of Radicals, stress that *a* and *b* must both be nonnegative if *n* is even. This means that $\sqrt{-2}$ $\sqrt{-8}$ times *may not* be written as $\sqrt{16}$. This condition is necessary because $\sqrt{-2}$ and $\sqrt{-8}$ are *not* real numbers. **Teach with Tech** **Blog** Have students write a blog entry about extraneous solutions. Have them explain what extraneous solutions are and how they can check their solutions graphically and algebraically. **Preventing Errors** Have a discussion with students about which operations may introduce extraneous solutions when solving an equation that	

	denominator or fractions from a radicand. An expression with rational exponents is in simplest form when all the exponents are positive and no fractional exponents are in the denominator. Also, the index used should be as small as possible. **Extraneous Roots** It is always important to check the solution to an equation or inequality in the *original* equation, but it is especially important when both sides of an equation are raised to a power. If a solution is an approximation, it is sometimes difficult to determine whether a discrepancy is due to rounding or if it is an incorrect solution. Students should check exact solutions whenever possible.		contains a radical. Remind students that the square root sign in an equation means the principal root.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 7: Exponential and Logarithmic Functions and Relations

Targeted Standards: F-IF: Interpret functions that arise in applications in terms of the context. Analyze functions using different representations. F-BF: Build new functions from existing functions.

Unit Objectives/Conceptual Understandings:

Essential Questions: How can mathematical models help you make good decisions? What factors can affect good decision making? How can being financially literate help you to make good decisions?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	Instructional Actions

Cumulative Progress Indicators	Concepts	Skills	Activities/Strategies	Assessment Check Points
F.IF.7.e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. F.IF.8.b Use the properties of exponents to interpret expressions for exponential functions. A.CED.1Create equations and inequalities in one variable and use them to solve problems.	Vocabulary including: exponential function (Lesson 7-1) exponential growth (Lesson 7-1) asymptote (Lesson 7-1) growth factor (Lesson 7-1) exponential decay (Lesson 7-1) decay factor (Lesson 7-1) exponential equation (Lesson 7-2) compound interest (Lesson 7-2) exponential inequality (Lesson 7-2)	• Graph exponential growth functions. • Graph exponential decay functions. • Use a graphing calculator to solve exponential equations by graphing or by using the table feature. • Solve exponential equations.	**Common Misconceptions** Be sure students do not confuse polynomial functions and exponential functions. While $y = x^2$ and $y = 2^x$ each have an exponent, $y = x^2$ is a polynomial function, and $y = 2^x$ is an exponential function. **Teach with Tech** **Blog** Have students write a blog entry explaining the properties of equality	**Ticket Out the Door** Make several copies each of five exponential functions. Give one function to each student. As the students leave the room, ask them to tell you whether their functions represent exponential growth or decay.

F.LE.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for 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. A.SSE.2 Use the structure of an expression to identify ways to rewrite it.	logarithm (Lesson 7-3) logarithmic function (Lesson 7-3) logarithmic equation (Lesson 7-4) logarithmic inequality (Lesson 7-4) common logarithm (Lesson 7-6) Change of Base Formula (Lesson 7-6) natural base, e (Lesson 7-7) natural base exponential function (Lesson 7-7) natural logarithm (Lesson 7-7) **Exponential Functions** The function $f(x) = b^x$, where b is a positive real number and $b \neq 1$, is an exponential function. When $b > 1$, the function has no x-intercepts and one y-intercept. It is an increasing function with a horizontal asymptote (the x-axis). When $0 < b < 1$, the function has no x-intercepts and one y-intercept. It is a decreasing function with a horizontal asymptote (the x-axis). **Solving Exponential Equations** Simple exponential equations can be solved by rewriting one	• Solve exponential inequalities. • Evaluate logarithmic expressions. • Graph logarithmic functions. • Use a graphing calculator to find an equation of best fit for exponential and logarithmic functions. • Solve logarithmic equations. • Solve logarithmic inequalities. • Simplify and evaluate expressions using the properties of logarithms. • Solve logarithmic equations using the properties of logarithms. • Solve exponential equations and inequalities using common logarithms. • Evaluate logarithmic expressions using the Change of Base Formula.	and inequality for exponential functions. **Teach with Tech** **Interactive Whiteboard** As you introduce logarithms to your class, use a color code for each part of corresponding exponential and logarithmic functions. For example, use different colors for x, y, and b when showing that $\log_b x = y$ corresponds to $x = b^y$. **Teach with Tech** **Video Recording** Have students work in pairs to create a video showing how to solve a logarithmic inequality. Be sure they explain each step of their work, specifically how to rewrite the logarithmic inequality as an exponential inequality. **Reasoning** As you discuss the Change of Base Formula, point out that the base b that students are changing to	**Name the Math** Have students describe the set of values for b that are possible in an exponential function of the form $y = b^x$. Quiz 1, p. 63 **Name the Math** Have students write a step-by-step explanation of the procedure for solving a logarithmic equation such as $\log_8 n = \frac{7}{3}$. Quiz 2, p. 63 **Yesterday's News** Have students write how knowing the properties of logarithms has helped them with solving the

	or both sides of the equation so that the bases are the same. Once that has been achieved, the Property of Equality for Exponential Functions can be used to solve for the variable. **Logarithms** The equation $y = \log_b x$ is read "y equals the logarithm to the base b of the number x." The base b is always positive and $b \neq 1$. And since the equation $y = \log_b x$ is equivalent to the exponential equation $x = b^y$, a logarithm is an exponent. It is the exponent that the base b requires in order to equal the number x. When solving logarithmic equations and inequalities, it is important to remember that a defining characteristic of a logarithmic function is that its domain is the set of all *positive* numbers. Logarithms were invented to make computation easier. **Common Logarithms** Base 10 logarithms are called *common logarithms*. When the base of a	• Use a graphing calculator to solve exponential and logarithmic equations and inequalities. • Evaluate expressions involving the natural base and natural logarithm. • Solve exponential equations and inequalities using natural logarithms. • Use logarithms to solve problems involving exponential growth and decay. • Use logarithms to solve problems involving logistic growth. • •	does not have to be 10. Any base could be used; however, 10 is the most common because this allows for the logarithms to be evaluated with a calculator. When the base of a logarithm is not shown, the base is assumed to be 10. **Teach with Tech** **Interactive Whiteboard** Display a template such as $\log_{\square}\square = \frac{\log_b \square}{\log_b \square}$. Drag the values from the original logarithm to demonstrate the Change of Base Formula. **Common Misconceptions** Stress that e is a constant like π and not a variable like x or y.	exponential equations and inequalities in today's lesson. Quiz 3, p. 64 **Name the Math** Have each student write a natural logarithmic equation and a natural logarithmic inequality. Then have students write out all the steps for solving their problems. **Ticket Out the Door** Ask students to write questions that can be solved using $y = ae^{kt}$ on one side of an index card. Then have students solve their problems on the reverse side of the cards. Quiz 6, p. 64

	logarithm is not shown, the base is assumed to be 10. When you have a logarithmic expression of any base, you can evaluate it using the Change of Base Formula to translate the expression into one that involves common logarithms. **Base *e*** A logarithm with base *e* is called a natural logarithm, written as $\log_e x$ or ln *x*. The natural logarithmic function, $y = \ln x$, is the inverse of the natural base exponential function $y = e^x$. **Exponential Growth and Decay** The exponential decay formulas are of the form $y = a(1 - r)t$, or $y = ae^{-kt}$. The exponential growth formulas are of the form $y = a(1 + r)^t$, or $y = ae^{kt}$. Logarithms can be used to solve problems involving exponential growth and decay.			

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 8: Rational Functions and Relations

Targeted Standards: **A.APR.7 Understand** that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. **A.CED.2 Create** equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **F.BF.3** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. **F.IF.9 Compare** properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **A.REI.2 Solve** simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Unit Objectives/Conceptual Understandings: Students will be able to perform operations involving rational functions and graph rational functions by using asymptotes. Also to understand the relationship between 2 quantities.

Essential Questions: Why are graphs useful? How are the properties of a rational function reflected in its graph?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts** What students will know	**Skills** What students will be able to do	**Activities/Strategies**	**Assessment Check Points**
A.APR.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	Unit vocabulary explored: a) rational expression b) complex fraction c) reciprocal function d) hyperbola e) rational function f) vertical asymptote	• determine properties of reciprocal functions and graph their transformations	• Use Guided Practice & Check Your Understanding exercises to determine students' understanding of concepts.	• Check for student understanding of concepts in Chapter 8.

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **F.BF.3** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. **F.IF.9 Compare** properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **A.REI.2 Solve** simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	g) horizontal asymptote h) oblique asymptote i) point discontinuity j) direct variation k) constant of variation l) joint variation m) inverse variation n) combined variation o) rational equation p) weighted average q) rational inequality • analyze a situation modeled by a rational function, formulate an equation composed of a linear or quadratic function, and solve the problem • use functions to model and make predictions in problem situations involving direct and inverse variation	• use quotients of polynomials to describe the graphs of rational functions, describe limitations on the domains and ranges, and examine asymptotic behavior • determine the reasonable domain and range values of rational functions and determine the reasonableness of solutions to rational equations and inequalities	• When using graphing calculators place students into groups of 2 or 3. • Provide graphing grids to enable students to understand how transformations affect the graph. • **Interactive Whiteboard** Use the board to help demonstrate canceling out common factors. Cross out the common factors as you simplify the expression, and drag the remaining factors to create the simplified expression • .**Document Camera** Choose several students to work through examples in front of the class. Be sure they clearly explain how to find the LCD. • **Document Camera** Choose	• Quiz 1, p. 47 • Quiz 2, p. 47 • Quiz 3, p. 48 • Quiz 4, p. 48 • **Name the Math** Have students write their own real-world problems similar to those they have seen in this lesson but using their own data. Have students solve the problems .

			a student to show and explain how to solve a rational inequality. Be sure the student shows how to use test points and a sign chart to find the solution set.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices	**Instructional Adjustments:**
-E-Tool Kit **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 9: Conic Sections

Targeted Standards: A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. **A.SSE.1.b** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **A.REI.11** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Unit Objectives/Conceptual Understandings: Students will be able to identify and graph the conic sections. Students will be able to solve systems of nonlinear equations.

Essential Questions: How does mathematics help us to describe the physical world? What are the similarities and differences between parabolas and ellipses? What are the similarities and differences between hyperbolas and the other conic sections?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts** What students will know	**Skills** What the students will be able to do	**Activities/Strategies**	**Assessment Check Points**
A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. **A.SSE.1.b** Create equations in two or more variables to represent relationships between quantities; graph equations on	Unit vocabulary explored: a) parabola b) focus c) directrix d) circle e) center of a circle f) radius g) ellipse	• Apply vocabulary to math content and use appropriately in real-world contexts • Write the equation and graph circles	• Use the Guided Practice exercises & Check Your Understanding after each example to determine students'	• Check for student understanding of concepts in Chapter 9. • Quiz 1, p. 53 • Quiz 2, p. 53 • Quiz 3, p. 54 • Quiz 4, p. 54

coordinate axes with labels and scales. **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **A.REI.11** Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	h) foci i) major axis j) minor axis k) center of an ellipse l) vertices m) co-vertices n) constant sum o) hyperbola p) transverse axis q) conjugate axis r) constant difference • How conic sections are formed from a double right cone and a plane • The characteristics of a circle algebraically and graphically • The characteristics of an ellipse algebraically and graphically • The characteristics of a hyperbola algebraically and graphically • The characteristics of a parabola algebraically and graphically • How to identify conic sections in standard form and general form	• Write the equation and graph ellipses • Write the equation and graph hyperbolas • Write the equation and graph parabolas • sketch graphs of conic sections to relate simple parameter changes in the equation to corresponding changes in the graph • describe a conic section as the intersection of a plane and a cone • identify symmetries from graphs of conic sections • identify the conic section from a given equation	understanding of concepts. • Use two cones to demonstrate how conic sections are formed. Model how the intersection of the cones with a plane will create a circle, ellipse, hyperbola, or parabola. • Use the website http://illuminations.nctm.org/Detail.aspx?ID=195 to see a visual representation of a plane intersecting two cones. • Demonstrate how the distance formula is related to the equation of a circle. Students can represent the foci of an ellipse using string and two tacks. They can explore how the shape of the ellipse changes if the distance between the tacks changes. • Conduct the "Locate the Foci of	• **Ticket Out the Door** • Write five different equations for circles on separate sheets of paper. Make several copies of each. Give one equation to each student. As students leave the room, ask them to tell you either the center or the radius of the circles formed by the equations. • **Name the Math** Prepare two bags: one containing an ordered pair for the center of a hyperbola on each paper, the other with

	• use algebraic methods and graphs to solve systems of linear and nonlinear equations or inequalities		an Ellipse" activity on page 837. • Compare and contrast ellipses and hyperbolas. • Reflect upon what students already know about parabolas, and relate these previous facts to the new lesson about parabolas. • Use a graphic organizer to organize the information about all of the conic sections. • For a project, have students create conic- section art. Students can use equations of the conic sections to graph pictures or designs. • Before solving systems of nonlinear equations, review the methods used for solving systems of linear equations.	values for *a* and *b* on each paper. Have each student select both an ordered pair and values for *a* and *b*. Have students write the equations for the hyperbolas and tell as much about them as possible given the values they chose. •

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 10: Sequences and Series

Targeted Standards: F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **A.CED.4 Rearrange** formulas to highlight a quantity of interest, using the same reasoning as in solving equations. **A.SSE.4 Derive** the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. **A.APR.5 Know** and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle. **A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity.

Unit Objectives/Conceptual Understandings: The students will be able to distinguish between arithmetic and geometric sequences and series and develop mathematical induction to prove statements.

Essential Questions: Where are patterns found in the real world? How can recognizing patterns help you solve real-world problems?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives		**Instructional Actions**	
Cumulative Progress Indicators	**Concepts** What students will know	**Skills** What students will be able to do	**Activities/Strategies**	**Assessment Check Points**
F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **A.CED.4 Rearrange** formulas to highlight a quantity of interest,	Unit vocabulary explored: a) sequence b) finite sequence c) infinite sequence d) arithmetic sequence e) common difference f) geometric sequence g) common ratio h) arithmetic means i) series	• Apply vocabulary to math content and use appropriately in real- world contexts • Use arithmetic and geometric sequences to model	• Make sure students understand that the subscript an■ refers to a term and is not an exponent. • Encourage students to begin a geometric sequence problem	• Have students explain how to find any term of an arithmetic sequence or geometric sequence when the first few terms are given.

using the same reasoning as in solving equations. **A.SSE.4 Derive** the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. **A.APR.5 Know** and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal's Triangle. **A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity.	j) sigma notation k) arithmetic series l) partial sum m) geometric means n) geometric series o) convergent series p) divergent series q) recursive sequence r) iteration s) mathematical induction t) induction hypothesis • How to find the nth term in a sequence • How to write a rule for a sequence • Summation notation • The difference between an arithmetic sequence and a geometric sequence • How to find the sum of an arithmetic sequence • How to represent a geometric sequence • Convergent and Divergent Series • recognize and use special sequences and iterate functions • use Pascal's triangle and the Binomial Theorem to expand powers of binomials	scenarios in real- world applications • Use summation notation to represent a series • Write rules for arithmetic and geometric sequences • Find the nth term of an arithmetic sequence and a geometric sequence • Determine whether a geometric series converges or diverges • Use mathematical induction to prove statements • Find the sum of an infinite geometric series • relate arithmetic sequences to linear	by writing the known values for each of the variables *n*, *a* and *r*. • Use the Guided Practice exercises & Check Your Understanding after each example to determine students' understanding of concepts. • **Interactive Whiteboard** Show an example on the board to help explain the formula for finding the sum of an arithmetic series. Write a sequence of numbers from 1 to 10, and drag the numbers to form the sums 1 + 10, 2 + 9, 3 + 8, etc., and find the sum of the series. Then show how the formula simplifies this calculation. • **Document Camera** Assign several exercises	• Check for student understanding of Chapter 10. • Quiz 1, p. 53 • Quiz 2, p. 53 • Quiz 3, p. 54 • Quiz 4, p. 54 • **Ticket Out the Door** Make several copies of each of five different infinite geometric series—some that have sums and some that do not. Give a copy of one series to each student. As students leave the room, ask them to tell whether the series are convergent or divergent. • **Ticket Out the Door** Give students small pieces of paper. Have them write the first seven rows of

	● use mathematical induction to prove statements	functions and relate geometric sequences to exponential functions ● find the sum of an infinite geometric series and write repeating decimals as fractions	to the class, and give students time to work through them independently. Then choose students to share and explain their work to the class. ● **Interactive Whiteboard** Show students how to calculate successive terms using a recursive formula. Use different colors and the highlight tool in your calculations to help show how each term is linked to the previous terms.	Pascal's triangle on the papers and hand them to you as they leave the room.

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz**	**Instructional Adjustments:** For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 11: Statistics and Probability

Targeted Standards: S.IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S.IC.5 Use** data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **S.IC.1 Understand** statistics as a process for making inferences about population parameters based on a random sample from that population. **S.MD.7 Analyze** decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). **S.MD.6 Use** probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). **S.ID.4 Use** the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Unit Objectives/Conceptual Understandings: Students will be able to find the number of possible outcomes of a group of objects using the Fundamental Counting Principle, permutations, and combinations. Students will be able to find the theoretical and experimental probability of an event. Students will be able to determine whether events are independent or dependent, and find the probability of an independent or dependent event. Students will be able to calculate the probability of mutually exclusive events and inclusive events.

Essential Questions: How can you effectively evaluate information? How can you use information to make decisions? How can probability be used in decision making? Can statistics lie?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts** What students will know	**Skills** What students will be able to do	**Activities/Strategies**	**Assessment Check Points**
S.IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	Unit vocabulary explored: a) parameter b) statistic c) survey d) experiment e) observational study f) random variable	• use combinations and permutations to find probability and use them	**Teach with Tech** **Graphing Calculator** Have students enter the data points from Example 2 in a graphing calculator. Have students calculate	• **Ticket Out the Door** Have each student research an experiment of their choosing, and identify the

S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **S.IC.1 Understand** statistics as a process for making inferences about population parameters based on a random sample from that population. **S.MD.7 Analyze** decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). **S.MD.6 Use** probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). **S.ID.4 Use** the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	g) probability distribution h) expected value i) binomial experiment j) binomial distribution k) normal distribution l) *z*-value m) confidence interval n) inferential statistics o) statistical inference p) hypothesis test q) null hypothesis r) alternative hypothesis • use a measure of central tendency to represent a set of data and find measures of variation for a set of data • determine whether a sample is biased and find margins of sampling error • **Survey and Census** When a census is conducted, data are collected from every member of a population. Therefore, the results are known to be correct. Since a survey investigates only part of a population, the	to solve problems • find probabilities of two independent and two dependent events • find the probability of mutually exclusive and inclusive events • create and use graphs of probability distributions • solve problems involving normally distributed data • use binomial expressions to find probabilities • use confidence intervals to estimate population parameters	the mean and median of the data set. Have students add outliers to the data set and then have them recalculate the mean and median. After they have reviewed their results, reiterate the concept of the median being less resistant to the effect of outliers. **Tips for New Teachers** **Skewed Distributions** Students may confuse negatively and positively skewed distributions. Remind them that when the tail is on the left of a distribution, the data appear to be going uphill, and since it is harder to go uphill, the distribution is negatively skewed. When the tail is on the right of a distribution, the data appear to be going downhill, and since it is easier to go downhill, the distribution is positively skewed. **Teach with Tech** **Web Search** Have students search the Web for binomial distribution applets. Allow students to	objective of the experiment, the population, the experimental and control groups, and the procedure. • **Ticket Out the Door** Have students generate a set of data, create a histogram using the data, and describe the shape of the distribution. Then have the students describe the center and spread of the data using either the mean and standard deviation or the five-number summary. • Check for student understanding of Chapter 11. • Quiz 1, p. 45 • Quiz 2, p. 45 • Quiz 3, p. 46

	results always involve some uncertainty.		create and explore binomial probability histograms, and search for additional examples of binomial experiments. **Blog** Have students write a blog entry to describe hypothesis testing in their own words. Check students' entries to be sure they understand the concept and importance of hypothesis testing.	• Quiz 4, p. 46 • **Name the Math** Ask students to explain the difference between a normal distribution and the standard normal distribution. • Ask students to describe how their study of normal distributions relates to their study of confidence intervals and hypothesis testing.

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** For the approaching, on level, ELL, and beyond level student… • Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook • Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 12: Trigonometric Functions

Targeted Standards: F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **F.TF.2 Explain** how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. **F.IF.7.e Graph** exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F.TF.5 Choose** trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. **F.BF.3** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. **A.CED.2 Create** equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Unit Objectives/Conceptual Understandings: Students will be able to define trig functions of acute angles as well as points on the unit circle. Students will also be able to graph the trig functions and apply the Law of Sines and Law of Cosines to application problems.

Essential Questions: What types of real-world problems can be modeled and solved using trigonometry? How are inverses of trigonometric functions similar to inverses of other functions you have studied?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts** What students will know	**Skills** What students will be able to do	**Activities/Strategies**	**Assessment Check Points**
F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **F.TF.2 Explain** how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real	Unit vocabulary explored: a) trigonometry b) sine c) cosine d) tangent e) cosecant f) secant g) cotangent	• reference angles • Convert between degrees and radians • Find the trigonometric values of	• Review the relationships among the sides of a 30º- 60º-90º triangle and a 45º-45º-90º triangle (See page 692) • Show students how the value of a	• **Ticket Out the Door** Have students write the minimum information one must have about a right triangle in order to solve it for a

numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. **F.IF.7.e Graph** exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F.TF.5 Choose** trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. **F.BF.3** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\ f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. **A.CED.2 Create** equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	h) angle of elevation i) angle of depression j) standard position k) radian m) Law of Sines n) ambiguous case) o) Law of Cosines p) unit circle q) circular function r) periodic function s) cycle t) period u) amplitude vv) frequency ● Trigonometric functions ● The relationship among the sides of a 30º-60º- 90º triangle and a 45º-45º-90º triangle ● How to use reference angles to find trigonometric functions in all four quadrants ● The unit circle ● How to convert angles in degrees and radians ● The values of trigonometric functions on the unit circle ● How to find the inverse of	angles measured in radians ● Use the unit circle to evaluate trigonometric functions ● Evaluate inverse trigonometric functions ● Use the Law of Sines to find the missing sides and angles of a triangle ● Use the Law of Cosines to find the missing sides and angles of a triangle ● develop inverses for the sine, cosine, and tangent functions ● use trigonometric functions to explore amplitude and period	trigonometric function depends only on the angle measure. Draw a small and large triangle, each with the same angle. Have students measure the side lengths and find the sine of that angle. They should determine that the sine value is the same for both triangles. ● Model angle of elevation and angle of depression using real-life examples. ● Give students copies of blank unit circles to label. Students could use different colored pencils to organize the information. ● Have students create a mnemonic for "ASTC" to remember which trigonometric ratios are positive in which quadrant.	missing side or angle value. ● Check for student understanding of concepts in Chapter 12. ● Quiz 1, p. 61 ● Quiz 2, p. 61 ● Quiz 3, p. 62 ● Quiz 4, p. 62 ● **Interactive Whiteboard** Use the board to demonstrate the ambiguous case with the Law of Sines. Use a drawing program to accurately draw the two given sides of the triangle and the given angle. Draw one of the possible third sides of the triangle. Then drag the segment to show how to construct the other possible triangle. ● **Ticket Out the Door**

	trigonometric functions • The Law of Sines • The Law of Cosines • The characteristics of a periodic function • The characteristics of the trigonometric functions • How to graph the trigonometric functions	• investigate phase shifts and vertical shifts in the graphs of trigonometric functions • derive and use the Law of Sines and the Law of Cosines as applications of trigonometric functions	• Review and summarize the different methods for finding the values of trigonometric functions: - by using the side lengths of right triangles - by using a point on the terminal side of an angle in standard position - by using the unit circle - by using reference angles • Show students how to determine the number of triangles that can be formed in the ambiguous case in the Law of Sines. • Use real-life applications of the Law of Sines and Cosines. • **Interactive Whiteboard** Draw a right triangle on the board and label each of the side lengths. To write the trigonometric ratios, drag the	• Have students write a function of the form $y = a \sin b\theta$ or $y = a \cos b\theta$. Then have them state the amplitude and period of the graph. • **Ticket Out the Door** Have students write the domain and range for the Arcsin, Arccos, and Arctan functions. •

			measurement from the side of the triangle to the ratio. ● **Student Response System** Present students with a number of examples (such as cos 120°, csc (–35°), and tan (–165°)). Ask students if the value of each trigonometric function is positive or negative. Have students respond with A for positive and B for negative. ● **Teach with Tech Document Camera** Assign several problems to the class, and give students time to work through them. Then choose several students to share and explain their work to the class. Be sure the students sketch a diagram and explain how they	

			decided whether to use the Law of Sines or the Law of Cosines to solve the problem. ● Choose students to show and explain to the class how to sketch the graph of a trigonometric function. Be sure each student explains how to create a table of values, choose a scale for the graph, and plot the points to draw the graph.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings. Make sure students use the reference angle that is formed by the terminal side and the x-axis, not the y-axis. Students might forget the signs of the trigonometric functions in all four quadrants. Suggest that drawing the angle in standard position can help them determine the quadrant of its terminal side. Students may sometimes make mistakes with the Law of Sines by using the ratio of the sine of an angle and the length of a side that is not opposite that angle. Suggest that students highlight the opposite side and angle pairs. For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan

Unit Title: Chapter 13: Trigonometric Identities and Equations

Targeted Standards: **F.TF.8 Prove** the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin (θ), cos (θ), or tan (θ) given sin (θ), cos (θ), or tan (θ) and the quadrant of the angle.

Unit Objectives/Conceptual Understandings: The students will be able to verify trig identities, apply Sum and Difference Formulas and Double Angle and Half Angle Formulas. The students will also solve trig equations.

Essential Questions: How can representing the same mathematical concept in different ways be helpful?

Unit Assessment: Teacher-generated assessments will be used.

	Core Content Objectives	**Instructional Actions**

Cumulative Progress Indicators	**Concepts** What students will know	**Skills** What students will be able to do	**Activities/Strategies**	**Assessment Check Points**
F.TF.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin (θ), cos (θ), or tan (θ) given sin (θ), cos (θ), or tan (θ) and the quadrant of the angle.	Unit vocabulary explored: a) trigonometric identity b) quotient identity c) reciprocal identity d) Pythagorean identity e) cofunction identity) f) negative angle identity g) trigonometric equation ● The fundamental trigonometric identities ● The sum and difference identities	● learn how to verify and use trigonometric identities ● prove trigonometric identities ● solve trigonometric equations using the ideas of factoring, the zero product property,	● Suggest to students that it is often easier to begin with the more complicated side of a trigonometric identity and match it to the simpler side. ● Converting all terms to sine and cosine may be a good strategy if	● Check for student understanding of concepts in Chapter 13.. ● Quiz 1, p. 37 ● Quiz 2, p. 37 ● Quiz 3, p. 38 ● Quiz 4, p. 38 ● **Ticket Out the Door** Have students make a list of angles between 0° and 360° for

	• Double-Angle and Half- Angle Identities • How to solve trigonometric equations	trigonometric inverses, and periodic behavior	students become stuck. • There may be more than one way to represent an angle when using the sum and difference formulas. • Do not perform operations to each side of the unverified identity because the properties of equality do not apply to identities as they do to equations. • When solving trigonometric equations, have students work in small groups to compare how they arrived at the solution. • Create a class Web page that includes all of the trigonometric identities and formulas from this chapter. Have students subscribe to an RSS feed so that	which the sum and difference formulas can easily be used. Then have them tell what the angles have in common. • **Ticket Out the Door** Have students write an equation involving $\sin^2 \theta$ that has exactly one solution for the interval $90° < \theta < 270°$.

			they can easily tell when you update the page. ● **Document Camera** Choose several students to work through examples and explain how to apply the sum and difference of angles formulas. ● Stress the Study Tip provided in the margin next to Example 3. Determining the proper sign for the answer at the beginning of the computation will help some students avoid forgetting this step at the end of their computations. ● **Blog** Have students write blog entries about how to solve trigonometric equations. Have them describe how the process is similar to and different from	

			solving other types of equations.	

Resources: Essential Materials, Supplementary Materials, Links to Best Practices **-E-Tool Kit** **-Personal Tutor** **-Interactive Classroom (PowerPoint)** **-Skills Practice Masters** **-Self-Check Quiz** **-Graphing Calculator**	**Instructional Adjustments:** For the approaching, on level, ELL, and beyond level student… ● Differentiated instruction, word problem practice, enrichment, study guide, skills practice, five-minute checks, and study notebook ● Individual accommodations will be made based on student's Individualized Education Plan or 504 Plan