Tunkhannock Area School District
Algebra 2
Curriculum Map 2014

Quarter 1
Targeted Standard(s): PA Core 2.1.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents. 2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical problems. 2.1.HS.F.3 Apply quantitative reasoning to choose and Interpret units and scales in formulas, graphs and data displays. 2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.A2.1.2.1.1 Use exponential expressions to represent rational numbers. 2.2.HS.D.3 Extend the knowledge of arithmetic operations and apply to polynomials. 2.2.HS.D.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs. 2.2.HS.D.5 Use polynomial identities to solve problems. 2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships. 2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable. 2.2.HS.D.9 Use reasoning to solve equations and justify the solution method. 2.2.HS.D.10 Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. 2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable. 2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables. 2.4.HS.B.3 Analyze linear models to make interpretations based on the data. **Keystone Algebra 2 Eligible Content** A2.1.2.1.2 Simplify/evaluate expressions involving positive and negative exponents and/or roots (may contain all types of real numbers—exponents should not exceed power of 10). A2.1.2.1.3 Simplify/evaluate expressions involving multiplying with exponents (e.g., $x^6 \bullet x^7 = x^{13}$), powers of powers (e.g., $(x^6)7 = x^{42}$) and powers of products (e.g., $(2x^2)3 = 8x^6$). A2.1.2.2.1 Factor algebraic expressions, including difference of squares and trinomials. A2.1.2.2.2 Simplify rational algebraic expressions. A2.2.3.1.1 Draw, identify, find, interpret, and/or write an equation for a regression model (lines and curves of best fit) for a scatter plot. A2.1.3.1.2 Solve equations involving rational and/or radical expressions (e.g., $10/(x + 3) + 12/(x – 2) = 1$ or $\sqrt{}(x^2 + 21x) = 14$). A2.1.3.1.4 Write, solve, and/or apply linear or exponential growth or decay (including problem situations). A2.1.3.2.1 Determine how a change in one variable relates to a change in a second variable (e.g., y = 4/x; if x doubles, what happens to y?). A2.1.3.2.2 Use algebraic processes to solve a formula for a given variable (e.g., solve d = rt for r). A2.2.3.1.2 Make predictions using the equations or graphs of regression models (lines and curves of best fit) of scatter plots.
Enduring Understandings: Work with radicals and integer exponents. Extend the properties of exponents to rational exponents. Interpret the structure of expressions.

Write expressions in equivalent forms to solve problems.
Use polynomial identities to solve problems.
Rewrite rational expressions.
Understand solving equations as a process of reasoning and explain the reasoning.
Create equations that describe numbers or relationships.
Build new functions from existing functions.
Understand the concept of a function and use function notation.
Summarize, represent, and interpret data on a single count or measurement variable.

Essential Questions:

How can you extend algebraic properties and processes to quadratic, exponential and polynomial expressions and equations and then apply them to solve real world problems?

What are the advantages/disadvantages of the various methods to represent exponential functions (table, graph, equation) and how do we choose the most appropriate representation?

How do quadratic equations and their graphs and/or tables help us interpret events that occur in the world around us?

How do you explain the benefits of multiple methods of representing polynomial functions (tables, graphs, equations, and contextual situations)?

How do you differentiate between two independent events and two dependent events and how do you calculate the probabilities for each situation?

How do you use lines and curves of best fit to model real world situations and to provide predictions based on a sample?

Core Content/Objectives		Instructional Actions	
Concepts What students will know	**Competencies** What students will be able to do	**Activities/Strategies/Materials** Learning Activities/Differentiation Interdisciplinary Connections	**Assessment** How learning will be assessed
I. Exponents A. Properties of Integer Exponents	A. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2x3^{-5} = 3^{-3} = 1/3^3 = 1/27$. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	Exponent Rules Game Exponent Tutorial	Formative Assessments -Daily Homework -Peer-teaching -Problem Solving Activities -Vocabulary Summative Assessments -Chapter Tests -Section Quizzes Quarter Projects Classroom Diagnostic Tool
B. Simplify Expressions with Scientific Notation	B. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	Working With Scientific Notation Scientific Notation Notes Practice Operations with Scientific Notation	

C. Rational Exponents	C. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2x3^{-5} = 3^{-3} = 1/3^3 = 1/27$. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1}/^3$ to be the cube root of 5 because we want $(5^1/^3)^3 = 5(^1/^3)^3$ to hold, so $(5^1/^3)^3$ must equal 5. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	Tutorial and Practice with Rational Exponents Lesson on Rational Exponents Tutorial with Video Examples and Practice Problems	
II. Radicals A. Simplify Radicals	A. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	Simplifying Radicals Notes	
B. Operations with Radicals	B. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	Operations with Radicals Tutorial on Radicals	
C. Solve Radical Equations	C. Rewrite expressions involving radicals and rational exponents	Steps to Solve Equations Involving Radicals	

	using the properties of exponents.		
III. Polynomials A. Factor Polynomials	A. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines.	Factoring Practice Tutorial and Practice Problems	
B. Algebraic Fractions	B. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	Notes on Simplifying Algebraic Fractions Examples for Factoring and Simplifying Rational Expressions	

	Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. 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.		
IV. Equations and Inequalities A. Solve Rational Equations	A. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	Rational Equation Solutions Steps to Solve Radical Equations with Examples	
B. Solve Formulas for a Variable	B. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	Solving Formulas Tutorial Formula Examples	

C. Effect of Variable Change	C. 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 andillustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.		
D. Apply Equations and Inequalities	D. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^x$, $y = (0.97)^x$, $y = (1.01)12^x$, $y = (1.2)^{x/1}$º, and classify them as representing exponential growth or decay.	Applying Equations Worksheet Tutorial with Applied Examples	

E. Write and Graph Linear Equations F. Apply Equations of Lines	E. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.	Linear Equations Tutorials Tutorial on Graphing Linear Equations from Different Forms Practice Problems Examples of Scatterplots and Lines of Best Fit	

G. Proportion and Variation	G. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x),f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	Proportion Practice Problems Tutorial with Problem Examples of Direct and Inverse Variation	

Quarter 2
Targeted Standard(s): PA Core 2.1.HS.F.3 Apply quantitative reasoning to choose and Interpret units and scales in formulas, graphs and data displays. 2.1.HS.F.6 Extend the knowledge of arithmetic operations and apply to complex numbers. 2.1.HS.F.7 Apply concepts of complex numbers in polynomial identities and quadratic equations to solve problems. 2.2.HS.D.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs. 2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships. 2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable. **Keystone Algebra 2 Eligible Content** A2.1.1.1.1 Simplify/write square roots in terms of i (e.g., √-24 = 2i√6). A2.1.1.1.2 Simplify/evaluate expressions involving powers of i (e.g., $i^6 + i^3 = -1 - i$). A2.1.1.2.1 Add and subtract complex numbers (e.g., (7 – 3i) – (2 + i) = 5 – 4i). A2.1.1.2.2 Multiply and divide complex numbers (e.g., (7 – 3i)(2 + i) = 17 + i). A2.1.3.1.1 Write and/or solve quadratic equations (including factoring and using the Quadratic Formula). A2.1.3.1.2 Solve equations involving rational and/or radical expressions (e.g., 10/(x + 3) + 12/(x – 2) = 1 or √(x^2 + 21x) = 14).
Enduring Understandings: Solve equations and inequalities in one variable. Create equations that describe numbers or relationships. Understand solving equations as a process of reasoning and explain the reasoning. Perform arithmetic operations with complex numbers.
Essential Questions: How can you extend algebraic properties and processes to quadratic, exponential and polynomial expressions and equations and then apply them to solve real world problems? What are the advantages/disadvantages of the various methods to represent exponential functions (table, graph, equation) and how do we choose the most appropriate representation? How do quadratic equations and their graphs and/or tables help us interpret events that occur in the world around us? How do you explain the benefits of multiple methods of representing polynomial functions (tables, graphs, equations, and contextual situations)? How do you differentiate between two independent events and two dependent events and how do you calculate the probabilities for each situation? How do you use lines and curves of best fit to model real world situations and to provide predictions based on a sample?

Core Content/Objectives		Instructional Actions	
Concepts What students will know	**Skills** What students will be able to do	**Activities/Strategies/Materials** Learning Activities/Differentiation Interdisciplinary Connections	**Assessment** How learning will be assessed
V. Quadratic Equations A. Graph Quadratic Equations	A. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	Graphing Quadratic Equations Tutorial Tutorial With Examples and Quizzes	Formative Assessments -Daily Homework -Peer-teaching -Problem Solving Activities -Vocabulary Summative Assessments -Chapter Tests -Section Quizzes Quarter Projects Classroom Diagnostic Tool
B. Solve by Square Root	B. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	Solving Quadratics by Square Root Practice Problems with Solutions	

	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		
C. Solve by Factoring	C. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an	Solve Quadratics by Factoring Self Check Use Different Factoring Methods	

	equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		
VI. Complex Number System A. Imaginary Numbers	A. Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	Introduction to Imaginary Numbers Definition, Applications and Patterns with Imaginary Numbers	
B. Simplify Radicals using Imaginary Numbers	B. 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.	Radicals and Imaginary Numbers Worksheets with Complex Numbers	

	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.		
C. Operations with Complex Numbers	C. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	Operations with Complex Numbers Overview of Complex Numbers, the Complex Plane and uses for Complex Numbers	
VII. Quadratic Equations with Complex Numbers A. Solve by Completing the Square	A. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	Method for Solving by Completing the Square Directions with Example Problems and Solutions	

	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		
B. Solve by Quadratic Formula	B. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2= 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	Demonstrate Use of Quadratic Formula Practice with Applications and Graphing	
C. Write Equations in Quadratic	C. Solve quadratic equations in	Writing Quadratic Equations	

Form	one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	Practice Standard and Vertex Form- Tutorial and Practice	
D. Apply Quadratic Equations	D. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$	Examples of Applications Method and Practice Sets	

	that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		

Quarter 3
Targeted Standard(s): PA Core 2.1.HS.C.1 Use the concept and notation of functions to interpret and apply them in terms of their context. 2.1.HS.C.2 Graph and analyze functions and use their properties to make connections between the different representations. 2.1.HS.C.4 Interpret the effects transformations have on functions and find the inverses of functions. 2.1.HS.C.5 Construct and compare linear, quadratic and exponential models to solve problems. 2.1.HS.C.6 Interpret functions in terms of the situation they model. 2.1.HS.C.7 Apply radian measure of an angle and the unit circle to analyze the trigonometric functions. 2.1.HS.C.8 Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs. 2.1.HS.C.9 Prove the Pythagorean identity and use it to calculate trigonometric ratios. 2.1.HS.F.3 Apply quantitative reasoning to choose and Interpret units and scales in formulas, graphs and data displays. 2.2.HS.D.4 Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs. 2.2.HS.D.6 Extend the knowledge of rational functions to rewrite in equivalent forms. 2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships. 2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable. **Keystone Algebra 2 Eligible Content** A2.1.2.1.4 Simplify or evaluate expressions involving logarithms and exponents (e.g., log28 = 3 or log42 = ½). A2.1.3.1.1 Write and/or solve quadratic equations (including factoring and using the Quadratic Formula). A2.1.3.1.2 Solve equations involving rational and/or radical expressions (e.g., $10/(x + 3) + 12/(x – 2) = 1$ or $\sqrt{(x^2 + 21x)} = 14$). A2.1.3.1.3 Write and/or solve a simple exponential or logarithmic equation (including common and natural logarithms). A2.1.3.1.4 Write, solve, and/or apply linear or exponential growth or decay (including problem situations). A2.2.1.1.3 Determine the domain, range, or inverse of a relation. A2.2.1.1.4 Identify and/or determine the characteristics of an exponential, quadratic, or polynomial function (e.g., intervals of increase/decrease, intercepts, zeros, and asymptotes). A2.2.2.1.1 Create, interpret, and/or use the equation, graph, or table of a polynomial function (including quadratics). A2.2.2.1.2 Create, interpret, and/or use the equation, graph, or table of an exponential or logarithmic function (including common and natural logarithms). A2.2.2.1.3 Determine, use, and/or interpret minimum and maximum values over a specified interval of a graph of a polynomial, exponential, or logarithmic function. A2.2.2.1.4 Translate a polynomial, exponential, or logarithmic function from one representation of a function to another (graph, table, and equation). A2.2.2.2.1 Identify or describe the effect of changing parameters within a family of functions (e.g., $y = x^2$ and $y = x^2 + 3$, or $y = x^2$ and $y = 3x^2$).
Enduring Understandings: Solve equations and inequalities in one variable. Create equations that describe numbers or relationships. Understand the concept of a function and use function notation.

Build new functions from existing functions.
Analyze functions using different representations.
Interpret functions that arise in applications in terms of the context.
Understand the relationship between zeros and factors of polynomials
Use polynomial identities to solve problems.
Extend the domain of trigonometric functions using the unit circle.
Model periodic phenomena with trigonometric functions.
Prove and apply trigonometric identities.
Construct and compare linear, quadratic, and exponential models and solve problems.
Write expressions in equivalent forms to solve problems.
Extend the properties of exponents to rational exponents.

Essential Questions:

How can you extend algebraic properties and processes to quadratic, exponential and polynomial expressions and equations and then apply them to solve real world problems?

What are the advantages/disadvantages of the various methods to represent exponential functions (table, graph, equation) and how do we choose the most appropriate representation?

How do quadratic equations and their graphs and/or tables help us interpret events that occur in the world around us?

How do you explain the benefits of multiple methods of representing polynomial functions (tables, graphs, equations, and contextual situations)?

How do you differentiate between two independent events and two dependent events and how do you calculate the probabilities for each situation?

How do you use lines and curves of best fit to model real world situations and to provide predictions based on a sample?

Core Content/Objectives		Instructional Actions	
Concepts What students will know	**Skills** What students will be able to do	**Activities/Strategies/Materials** Learning Activities/Differentiation Interdisciplinary Connections	**Assessment** How learning will be assessed
VIII. Polynomials and Radical Equations A. Solve Polynomial Equations	A. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	Polynomial Equations Examples Three Methods used to solve Polynomial Equations	Formative Assessments -Daily Homework -Peer-teaching -Problem Solving Activities -Vocabulary Summative Assessments -Chapter Tests -Section Quizzes Quarter Projects Classroom Diagnostic Tool
B. Solve Radical Equations	B. Solve quadratic equations in one variable. a. Use the method of completing	Demonstration Directions for Solving Radical Equations	

	the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	Solve Equation Written with Radicals or Rational Exponents	
IX. Functions A. Identify Functions	A. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the	Define and Evaluate Functions Introduction to Functions	

	equation y = f(x). Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x^3 or f(x) = (x+1)/(x–1) for x ≠ 1. b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain.		
B. Function Notation	B. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an	Evaluate Functions using Algebraic Substitutions Evaluate Functions with Graphs-Includes Examples and Games	

	expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$. b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain.		
C. Linear Functions	C. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$. b. (+) Verify by composition that one function is the inverse of	Linear Functions Practice Problems Lesson on Piecewise Defined Functions and Applications	

	another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.		
D. Quadratic Functions	D. For a function that models a	Quadratic Functions Notes	

	relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2= 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic	Graphs of Quadratic Functions with Tables	

	functions, and simple rational and exponential functions. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^x$, $y = (0.97)^x$, $y = (1.01)12^x$, $y = (1.2)^{x/10}$, and classify them as representing exponential growth or decay.		
E. Polynomial Functions	E. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the	Polynomial Functions Information End Behavior	

	function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2= 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02) ^{x}, y = (0.97) ^{x}, y = (1.01)12 ^{x}, y = (1.2) $^{x/1}$ º, and classify them as representing exponential growth or decay. 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). 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. Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity (x2 + y2)2 = (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples.		

F. Translate, Reflect, and Stretch Graphs	F. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2= 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations	Graph Shifting Techniques Common Graphs and Manipulations Tutorial	

	arising from linear and quadratic functions, and simple rational and exponential functions. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^x$, $y = (0.97)^x$, $y = (1.01)12^x$, $y = (1.2)^{x/1}$º, and classify them as representing exponential growth or decay. 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 andillustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions		

	for them.		
G. Rational Functions	G. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real	Tutorial on Graphing and Understanding Characteristics of Rational Functions Properties and Examples/Graphs of Rational Functions	

	numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^x$, $y = (0.97)^x$, $y = (1.01)12^x$, $y = (1.2)^{x/10}$, and classify them as representing exponential growth or decay.		
H. Trigonometric Functions	H. 1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.2. Explain how the unit circle in the coordinate plane	Tutorial on Using the Unit Circle to Determine the Trigonometric Functions Introduction to Trigonometric Functions and Graphs	

	enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. 8. Prove the Pythagorean identity sin2(θ) + cos2(θ) = 1 and use it to find		
X. Exponential and Logarithmic Functions A. Exponential Function and Their Graphs	A. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. 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. Create equations and inequalities	Tutorial on Exponential Functions Lesson with Graphs, Tables and Applications	

	in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		
B. Logarithmic Functions and Their Graphs	B. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as $(1.151/12)12t \approx 1.01212t$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. 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	Tutorial on Logarithmic Functions Introduction to Graphing	

	coefficients determined for example by Pascal's Triangle. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 x 3^{-5} = 3^{-3} = 1/3^3 = 1/27$. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1}/^3$ to be the cube root of 5 because we want $(5^1/^3)^3 = 5(^1/^3)^3$ to hold, so $(5^1/^3)^3$ must equal 5. Rewrite expressions involving radicals and rational exponents using the properties of exponents. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the		

	initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		
C. Properties of Logarithms	C. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is	Tutorial on Properties of Logarithms Properties of Logarithms Notes	

	15%. 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.		
D. Exponential and Logarithmic Equations	D. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. Know and apply the Binomial Theorem for the expansion of (x +	Tutorial on Solving Logarithmic and Exponential Equations	

	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. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 x 3^{-5} = 3^{-3} = 1/3^3 = 1/27$. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5. Rewrite expressions involving radicals and rational exponents using the properties of exponents. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking		

	square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		
E. Applying Exponential and Logarithmic Functions	E. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈	Examples and Tutorial on Applications Applying Functions	

	1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. 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. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2x3^{-5} = 3^{-3} = 1/3^3 = 1/27$. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1l}/^3$ to be the cube root of 5 because we want $(5^1/^3)^3 = 5(^1/^3)^3$ to hold, so $(5^1/^3)^3$ must equal 5. Rewrite expressions involving radicals and rational exponents using the properties of exponents. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an		

	equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		

Quarter 4
Targeted Standard(s): PA Core 2.1.HS.C.3 Write functions or sequences that model relationships between two quantities. 2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. 2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically. 2.3.HS.A.14 Apply geometric concepts to model and solve real world problems. 2.4.HS.B.4 Recognize and evaluate random processes underlying statistical experiments. 2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies. 2.4.HS.B.6 Use the concepts of independence and conditional probability to interpret data. 2.4.HS.B.7 Apply the rules of probability to compute probabilities of compound events in a uniform probability model. **Keystone Algebra 2 Eligible Content** A2.2.1.1.1 Analyze a set of data for the existence of a pattern and represent the pattern with a rule algebraically and/or graphically. A2.2.1.1.2 Identify and/or extend a pattern as either an arithmetic or geometric sequence (e.g., given a geometric sequence, find the 20th term). A2.2.3.2. Apply probability to practical situations. A2.2.3.2.2 Use odds to find probability and/or use probability to find odds. A2.2.3.2.3 Use probability for independent, dependent, or compound events to predict outcomes.
Enduring Understandings: Understand independent and conditional probability and use them to interpret data. Understand and evaluate random processes underlying statistical experiments. Make inferences and justify conclusions from sample surveys, experiments, and observational studies
Essential Questions: How can you extend algebraic properties and processes to quadratic, exponential and polynomial expressions and equations and then apply them to solve real world problems? What are the advantages/disadvantages of the various methods to represent exponential functions (table, graph, equation) and how do we choose the most appropriate representation? How do quadratic equations and their graphs and/or tables help us interpret events that occur in the world around us? How do you explain the benefits of multiple methods of representing polynomial functions (tables, graphs, equations, and contextual situations)? How do you differentiate between two independent events and two dependent events and how do you calculate the probabilities for each situation? How do you use lines and curves of best fit to model real world situations and to provide predictions based on a sample?

Core Content/Objectives		Instructional Actions	
Concepts What students will know	**Skills** What students will be able to do	**Activities/Strategies/Materials** Learning Activities/Differentiation Interdisciplinary Connections	**Assessment** How learning will be assessed
XI. Sequences A. Sequences, Series, and Summation Notation	A. Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Summarize categorical data for two categories in two-way	Sequences and Series Website Sequences and Series Practice	Formative Assessments -Daily Homework -Peer-teaching -Problem Solving Activities -Vocabulary Summative Assessments -Chapter Tests -Section Quizzes Quarter Projects Classroom Diagnostic Tool

	frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.		
B. Arithmetic Sequences	B. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The	Tutorial on Arithmetic Sequences Lesson with Definitions and Examples	

	graph of f is the graph of the equation y = f(x). Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$. b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.		
C. Geometric Sequences	C. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f	Geometric Sequence Tutorial Lesson on Characteristics of Geometric Sequences	

	corresponding to the input x. The graph of f is the graph of the equation y = f(x). Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$. b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.		
XII. Probability A. Permutations and Combinations	A. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this	Permutations and Combinations Combinations and Permutations Website	

	characterization to determine if they are independent. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.		

B. Probability	B. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.	Probability Practice Probability Applications and Games	

	(+) Use permutations and combinations to compute probabilities of compound events and solve problems.		
C. Apply Probability	C. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model? Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between	Probability Games Probability Theory Resources	

	parameters are significant. Evaluate reports based on data.		
D. Computation of Compound Probability	D. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. (+) Apply the general Multiplication Rule in a uniform	Compound Probability Tutorial and Practice	

	probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.		
E. Odds and Mathematical Expectation		Odds Tutorial	
XIII. Geometry A. Parallel and Perpendicular Lines		Parallel and Perpendicular Lines Tutorial and Resources Use Lines and Segments to Explore Concepts of Parallel and Perpendicular	
C. Points of Intersection		Intersection Tutorial	
D. Distance Between Points		Tutorial on Distance Formula	
E. Coordinate Geometry		Coordinate Geometry Websites	