PETERS TOWNSHIP HIGH SCHOOL
COURSE SYLLABUS: ALGEBRA 2 HONORS

Course Overview and Essential Skills

This course is an in-depth study of the language, concepts, and techniques of Algebra that will prepare students to approach and solve problems following a logical succession of steps. This course is the foundation for future high school mathematics courses such as precalculus and calculus. Topics include the study of functions (polynomial, exponential, logarithmic, rational, radical, and trigonometric), probability and statistics. Real world applications are presented within the course content and a function's approach is emphasized. Essential skills developed include: solving equations using multiple methods, analyzing graphs of functions, organizing and analyzing data, recognizing patterns, and identifying conic sections.

Course Textbook and Required Materials

- *Algebra 2*, Holt McDougal, ISBN# 978-0-030-99576-7
- Online textbook: my.hrw.com (Students given login and password during first week of course.)
- Required daily materials: Textbook, Three-Ring Binder, Pencil, Graphing Calculator (TI-83 Plus, TI-84, or TI-84 Plus)

Course Outline of Material Covered

Unit or Topic	Concepts/Skills/Resources	Timeframe
Foundations for Functions	• Real numbers must be classified as rational OR irrational, and can't be both rational and irrational. • Rational numbers can be classified into three subsets of the real number system - natural numbers, whole numbers and integers. • Ordering real numbers from least to greatest or greatest to least is an effective way to compare real numbers. • It is impossible to list out all real numbers, regardless of the subset. • Interval notation can be used to represent a set of numbers. • The real number properties can be applied to simplify numeric expressions and solve problems mentally (additive identity, multiplicative identity, additive	4 weeks

	inverse, multiplicative inverse, closure, commutative, associative, distributive). • Square roots can be estimated by using perfect squares. • Square roots have special properties that can be applied to simplify, multiply, and divide them (product property and quotient property). • Square roots can be simplified by rationalizing the denominator. • To evaluate an algebraic expression, substitute and use the order of operations. • Algebraic expressions are equivalent if they contain exactly the same terms when simplified. • Expressions involving exponents can be simplified using the properties of exponents (zero exponent, negative exponent, product of powers, quotient of powers, power of a power, power of a product, power of a quotient). • Scientific notation is a method of writing numbers by using powers of 10. • All functions are relations, but not all relations are functions. • The domain (x-values) and range (y-values) can be determined for a relation and function. • The vertical line test can be use to determine if the graph of a relation is a function. • When the set of ordered pairs described by an equation satisfies the definition of a function, the equation can be written in function notation. • Translations, reflections, compressions and stretches are transformations on functions. • A parent function is the simplest function with the defining characteristics of the family. Chapter 1	

Linear Functions	• Linear equations can be solved using a variety of methods (Distributive Property, Variables on Both Sides). • All real numbers or no solution may be the result of solving a linear equation. • Proportional relationships can be applied to rates, similarity, and scale. • Solving proportions requires cross-multiplication. • Linear functions have a constant rate of change and can be written in the form: y=mx+b. • The graph of a linear function is a straight line. • Linear functions can be graphed using the slope and a point on the line. • Linear functions can be graphed using the x-intercept and y-intercept. • Linear functions can be graphed in Slope-Intercept Form. • Vertical lines have an undefined slope and horizontal lines have a slope of zero. • In order to write the equation for a line in Slope-Intercept Form, the slope and y-intercept must be known. • The slope of a line can be found graphically by rising and running or by using the slope formula. • Linear equations can be written using Point-Slope Form. • Parallel lines have the same slope. • The slopes of perpendicular lines are opposite reciprocals. • When graphing linear inequalities, the coordinate plane is divided into two regions. • Linear functions can be transformed on the coordinate plane (translations, reflections, stretches and compressions). • Linear models can be represented with a scatter plot and line of best fit. • Correlation is the strength and direction of the linear relationship between two variables.	3 weeks

	• Linear models can be used to make predictions. • Absolute value measures the distance from zero on a number line. • Absolute value equations and inequalities can be solved using the same steps. • Absolute value functions can be graphed and transformed just like linear functions. Chapter 2	
Linear Systems of Equations	• A system of equations is a set of two or more equations containing two or more variables. • A linear system is a system of equations containing only linear equations. • A line is an infinite set of points that are solutions to a linear equation. • The solution of a system of equations is the set of all points that satisfy each equation. • On a graph of a system of two equations, the solution is the set of points where the lines intersect. • Substitution can be used to determine if a given ordered pair is an element of the solution set for the system of equations. • Tables and graphs can be used to solve a system of equations. • A consistent system is a set of equations or inequalities that has at least one solution. • An inconsistent system is a set of equations or inequalities that has no solutions (parallel lines). • An independent system has equations with different slopes. • A dependent system has equations with equal slopes and equal y-intercepts (same line). • Substitution and elimination are algebraic methods to solving systems of linear equations.	3 weeks

	• A set of linear inequalities is a set of two or more linear inequalities with the same variables. • The solution to a system of inequalities is often an infinite set of points that can be represented graphically by shading. • When graphing multiple inequalities on the same graph, the region where the shadings overlap is the solution region. • Linear programming is a method of finding a maximum or minimum value of a function that satisfies a given set of conditions called constraints. • A constraint is one the inequalities in a linear programming problem. • The solution to the set of constraints can be graphed as a feasible region. • The objective function is the best combination of values in order to minimize or maximize a certain function. Chapter 3	
Quadratic Functions	• Quadratic functions can be factored using the following methods: greatest common factor, difference of squares, trinomial (product/sum), grouping • The graph of a quadratic function is called a parabola and is "U" shaped. • A quadratic function can be graphed using a table of values. • Transformations (translations, reflections, stretches and compressions) can be applied to the parent function. • Quadratic functions can be written in vertex form to represent each transformation. • Quadratic functions are symmetric curves. • The axis of symmetry is the line through the vertex of a parabola that divides the parabola into two congruent halves. • Quadratic functions can be written in standard form.	4 weeks

	• There are four important properties of quadratic functions: how the graph opens, what the axis of symmetry is, where the vertex is located, and what the y-intercept is. • Quadratic functions have a maximum or minimum value at the vertex. • A zero of a function is a value of the input that makes the output zero. • The zeros of a function are the x-intercepts and quadratics can have at most two zeros. • The roots of an equation are the values of the variable that make the equation true. • The zero product property can be used to find the zeros of a function. • Projectile motion can be modeled by a quadratic function. • Quadratic equations can be solved by taking the square root. • Quadratic equations can be solved by completing the square. • An imaginary number is the square root of a negative number. • Square roots of negative numbers can be simplified. • A complex number is a number with both a real and imaginary part. • Complex conjugates have real parts that are equal and imaginary parts that are opposites. • The quadratic formula can be use to solve any quadratic equation. • The discriminant is a part of the quadratic formula that is used to determine the number of real roots of a quadratic equation. • A quadratic inequality can be graphed and its solution set is a set of ordered pairs. • The graphing calculator can fit a curve through a set of data and produce a quadratic model. • Complex numbers can be graphed.	

	• Complex numbers can be added, subtracted, multiplied and divided. Chapter 5	
Polynomial Functions	• Polynomial expressions can be simplified using addition, subtraction, multiplication, and division. • Polynomial addition and subtraction utilizes the concept of like terms. • Polynomial multiplication utilizes the distributive property. • A relationship exists between binomial expansion and Pascal's Triangle. • Polynomial division and arithmetic division follow the same procedure. • Synthetic division can be used to simplify the division process and applied to find zeros of polynomial functions. • The Remainder Theorem uses synthetic division as a method of evaluating a polynomial function. • Some polynomial expressions can be factored using various techniques (GCF, difference of perfect squares and cubes, trinomials, and grouping.) • Factoring is used to find zeros of polynomial functions. • Roots, zeros, and x-intercepts are equivalent terms. • The Rational Root Theorem determines possible real zeros of a polynomial function. • Multiplicity of zeros is directly related to the graphical representation of a polynomial function. • The Fundamental Theorem of Algebra states that the number of zeros of a polynomial function is equal to the degree of the function. • The lead coefficient of a polynomial dictates the left-right behavior of the graph of the function.	3 weeks

	• Polynomials can be used to represent real world situations and make future predictions based on the model. Chapter 6	
Rational and Radical Functions	• y = kx is direct variation • y = k/x is inverse variation • Common denominators are necessary to add and subtract rational expressions. • Rational expressions may be reduced before multiplying. • Dividing rational expressions involves multiplying by the reciprocal. • Rational functions have discontinuities. • Two functions can be identical except for a single point. • Rational equations may have extraneous solutions. • Radical expressions can be rewritten using rational exponents. • In a rational exponent, the numerator represents the power and the denominator represents the root. • Expressions with rational exponents follow the Laws of Exponents. • Radical functions with even indexes have restricted domains. • f(x) + c is a vertical translation. • f(x + c) is a horizontal translation. • -f(x) is a reflection about the x-axis. • f(-x) is a reflection about the y-axis. • af(x) is a vertical stretch/compression. • f(ax) is a horizontal stretch/compression. • Radical equations may have extraneous solutions. • Solving single radical equations involves isolating the radical. • Solving multiple radical equations involves separating the radicals. Chapter 8	4 weeks
Exponential and Logarithmic Functions	• Exponential functions have a numeric base and a variable exponent. • Exponential functions can represent growth and decay models.	4 weeks

	• Exponential functions have a horizontal asymptote. • There are two types of compound interest...compunded n times per year and continuously compounded. • Inverse functions only exist for one-to-one functions. • Domain restrictions can be applied to create an inverse function for functions that are not one-to-one. • The inverse of an exponential function is a logarithmic function. • Logarithms are exponents. • Logarithmic functions have positive, integer bases. • The domain of a y = log x is all x values, greater than 0. • Logarithmic functions have a vertical asymptote. • Logarithm expressions can be simplified using the properties of logarithms: product, quotient, power, and inverse properties. • Calculators are programmed to evaluate log and ln. • There are many methods used to solve exponential and logarithmic equations. • Logarithmic equations may have extraneous roots. • e is approximately equal to 2.71828... • Exponential and logarithmic functions can represent many real-world data models. Chapter 7	
Properties and Attributes of Functions	• There are multiple ways to represent a function. • Different representations of functions provide information that allows you to translate to another representation. • Piecewise functions provide opportunities to describe many real world scenarios. • Step functions are a subset of piecewise functions.	2 weeks

	• A horizontal translation is inside the function and it slides the graph right or left. • A vertical translation is outside the function and it slides the graph up or down. • A reflection across the y-axis is inside the function. • A reflection across the x-axis is outside the function. • X and Y intercepts are helpful in graphing. • One can perform operations on functions in much the same way that you perform operations on numbers or expressions. • Evaluating composition of functions starts inside and moves outward. • The horizontal-line test tells you whether a relation has an inverse. • Only one-to-one functions have inverses. • Modeling real-world data requires knowledge of the families of functions. Chapter 9	
Probability and Statistics	• The Fundamental Counting Principle is a useful principle to calculate permutations. • There is a difference between permutations and combinations. • Permutations and combinations are useful in problem solving. • Experimental probabilities help estimate difficult theoretical probabilities. • Independent events do not affect the probabilities of one another. • Given statements mean that you must compute conditional probabilities. • Inclusive events have one or more outcomes in common. • There are three measures of central tendency. • The mean of a probability distribution is known as the expected value.	3 weeks

	• Numbers outside of three standard deviations are considered outliers. • The Binomial Theorem allows us to quickly find expansion terms. • The are four characteristics of a binomial situation. • Binomial situations require us to compute probabilities using a specific formula. Chapter 11	
Sequences and Series	• The terms of a sequence can be found recursively or explicitly. • Writing rules for sequences allows for finding specific terms. • Sequences can model situations that can aid problem solving. • Adding the terms of a sequence yields a series. • Summation notation is a compact way of writing series. • There are specific formulas to sum constant, linear, and quadratic series. • Series can model situations than can aid problem solving. • Sequences and series can be labeled arithmetic or geometric. • Knowing the nature of a sequence can lead to finding missing terms. • There are general formulas for writing arithmetic and geometric sequences. • The geometric mean of two numbers is the square root of their product. • Geometric series either converge or diverge based on the ratio. • Repeating decimals can be written as a rational number. Chapter 12	3 weeks
Conics Sections	• Identify, distinguish, and graph Conic Sections, Circles, Ellipses, Hyperbolas, Parabolas • Create equations of conic sections given constraints Chapter 10	2 weeks

Matrices	• Determine the order of matrices • Add, subtract, multiply, and divide matrices Chapter 4	1 week

****Depending on the needs of the class or changes in the school year, the course outline is subject to change.***