Pequea Valley School District
Math

Course: Honors Algebra 2 **Grade**: 8, 9, 10

Unit 1: Equations and Inequalities

Unit Essential Question: **How do we use equations and inequalities to represent and solve real world problems?**

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Real Numbers and Expressions	**Linear Equations**	**Linear Inequalities**	**Absolute Value Equations and Inequalities**
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
Opposite, Reciprocal, Evaluate Power, Variable, Term, Coefficient, Like Terms, Exponent, Base, Algebraic Expression, Equivalent Expression, Constant Term, PEMDAS, Distributive Property, Commutative Property, Associative Property, Inverse Property, Identity Property, Rational Number, Real Number, Irrational Number, Integer, Whole Number, Unit Rate, Conversion Factor, Absolute Value	Linear Equation, Solve for a Variable, Isolate, Equivalent Equations, Solution, Formula	Linear Inequality, Compound Inequality, Equivalent Inequalities	Absolute Value Equation, Absolute Value Inequality, Extraneous Solution, Tolerance, Absolute Deviation
KNOW	**KNOW**	**KNOW**	**KNOW**
• Subsets of real numbers • Unit analysis • Simplifying algebraic expressions • Order of operations • Combining like terms • Properties of real numbers • Evaluating expressions	• Solving linear equations • Properties of Equality • Reasonableness of answers • Rewriting formulas and equations • Problem solving strategies	• Solving linear inequalities • Graphing solutions to linear inequalities • Compound inequalities	• Solving absolute value equations • Solving absolute value inequalities

UNDERSTAND	UNDERSTAND	UNDERSTAND	UNDERSTAND
• Real numbers and their properties • Converting from one unit of measure to another • How to simplify expressions	• The process of solving linear equations • How to rewrite formulas and equations (i.e. Solve for y) • Methods of solving word problems	• How to solve inequalities and interpret the solutions • Compound inequalities and the differences between "and" and "or".	• Tolerance (abs. deviation) as an absolute value inequality • Solutions to absolute value equations
LEARNING OUTCOME	**LEARNING OUTCOME**	**LEARNING OUTCOME**	**LEARNING OUTCOME**
• Learners will be able to perform unit conversions and make sense of solutions • Learners will be able to utilize the properties of real numbers to justify work/solutions.	• Learners will be able to solve real-life situations involving linear equations • Learners will be able to rewrite formulas and equations	• Learners will be able to represent real-life situations with linear inequalities and interpret the solutions. • Learners will be able to graphically represent solutions to real-life linear inequalities	• Learners will be able to represent real-life situations with absolute value equations/inequalities and interpret the solutions.

Pa Core Standards:

CC.2.1.HS.F.2
Apply properties of rational and irrational numbers to solve real world or mathematical problems.
CC.2.1.HS.F.3
Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays.
CC.2.1.HS.F.4
Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.2.HS.D.1
Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.2
Write expressions in equivalent forms to solve problems.
CC.2.2.HS.D.8
Apply inverse operations to solve equations or formulas for a given variable.
CC.2.2.HS.D.9
Use reasoning to solve equations and justify the solution method.
CC.2.2.HS.D.10
Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Assessments: Unit Assessment_

Pacing: 14 days (including assessment)

Resources: Schoology, McDougal Littel Algebra 2

Pequea Valley School District
Math

Course: Honors Algebra 2 Grade: 8, 9, 10

Unit 2: Linear Equations and Functions

Unit Essential Question: How can algebraic and graphical representations of functions be used to solve real world problems?

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Relations, Functions, Slope and Rate of Change	**Graphing Linear Equations and Inequalities**	**Writing Linear Equations, Direct and Inverse Variation and Scatter Plots**	**Absolute Value Functions and Transformations**
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
Relation, Function, Domain, Range, Independent Variable, Dependent Variable, Linear Function, Function Notation, Ordered Pair, Graph, Vertical Line Test, Slope, Rate of Change, Parallel Lines, Perpendicular Lines, Undefined Slope	Parent Function, y-Intercept, Slope-Intercept Form, Standard Form, x-Intercept, Horizontal Line, Vertical Line	Direct Variation, Inverse Variation, Joint Variation, Constant of Variation, Scatter Plot, Positive Correlation, Negative Correlation, Correlation Coefficient, Best-fitting Line	Absolute Value Function, Vertex, Symmetry, Transformation, Translation, Reflection, Vertical Stretch, Vertical Shrink
KNOW	**KNOW**	**KNOW**	**KNOW**
• Definition of Function • Domain and range • Function notation • Slope and rate of change • Classification of lines by slope • Comparisons of slopes of parallel and perpendicular lines	• Graphing lines in standard and slope-intercept form • Graphing linear inequalities • Finding x and y intercepts graphically and algebraically	• Writing equations of lines given a graph, a point and the slope, two points, or a real-life scenario • The comparisons between graphs, data points and equations that model direct, inverse and joint variation. • Creating scatter plots and writing equations of best-fitting lines	• Graphing absolute value functions • Writing equations of absolute value functions • Transformations of graphs of absolute value and other functions
UNDERSTAND	**UNDERSTAND**	**UNDERSTAND**	**UNDERSTAND**
• What makes a relation a function • The concept of domain and range • Slope as rate of change	• Slope in the context of a graph • The x and y intercepts in the context of a problem • Graphs represent solutions to equations/inequalities	• The forms in which a linear equation may be written and when to use each form • Why and how variables show direct, inverse or joint variation	• Why absolute value graphs are in the shape of a v • The effects a, h, and k have on the graph of any function • Vertical stretches/shrinks

• How slopes affect the graph of a line	• Equations to horizontal and vertical lines	• The purpose of scatter plots and how to obtain useful information from the data represented	• The components of an absolute value equation
LEARNING OUTCOME	**LEARNING OUTCOME**	**LEARNING OUTCOME**	**LEARNING OUTCOME**
• Learners will be able to calculate slope/rate of change and identify lines based on slope/rate of change • Learners will be able to identify domain and range of real-life situations and use rate of change to solve the problem	• Learners will be able to solve real-life situations by graphing and interpreting linear models • Learners will be able to identify domain and range of real-life situations and explain slope and x and y intercepts in the context of the problem	• Learners will be able to represent real-life situations with scatter plots, model the data with an equation and interpret the solutions. • Learners will be able to write linear equations in slope-intercept and standard form that represent real-life situations and interpret the solutions. • Learners will be able to represent real-life situations with the proper variation model	• Learners will be able to model real-life situations with absolute value functions and utilize the graph to help solve problems • Learners will be able to transform the graph of any function given values for a, h, and k, and list the transformations that took place using proper vocabulary

Pa Core Standards:

CC.2.2.HS.D.7
Create and graph equations or inequalities to describe numbers or relationships.
CC.2.2.HS.D.10
Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
CC.2.2.HS.C.1
Use the concept and notation of functions to interpret and apply them in terms of their context.
CC.2.2.HS.C.2
Graph and analyze functions and use their properties to make connections between the different representations.
CC.2.2.HS.C.3
Write functions or sequences that model relationships between two quantities.
CC.2.2.HS.C.4
Interpret the effects transformations have on functions and find the inverses of functions.
CC.2.2.HS.C.5
Construct and compare linear, quadratic, and exponential models to solve problems.
CC.2.2.HS.C.6
Interpret functions in terms of the situations they model.
CC.2.4.HS.B.2
Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3
Analyze linear models to make interpretations based on the data.

Assessments: Formal Quiz, Variation Assessment, Unit 2 Assessment

<u>Pacing</u>: 20 days (including assessment)

<u>Resources</u>: Schoology, McDougal Littel Algebra 2

Pequea Valley School District
Math

Course: Honors Algebra 2 Grade: 8, 9, 10

Unit 3: Linear Systems and Matrices

Unit Essential Question: How can we use systems of linear equations to solve real world problems?

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Solve Systems of Linear Equations Graphically	**Solve Systems of Linear Equations Algebraically**	**Graph Systems of Linear Inequalities and Linear Programming**	**Perform Basic Matrix Operations**
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
System of Linear Equations, Solution to a System, Infinitely Many Solutions, No Solution	Elimination, Linear Combination, Substitution, Linear Equation in 3 Variables, Ordered Triple	System of Inequalities, Solution to a System of Inequalities, Graph of a System of Inequalities, Linear Programming, Objective Function, Constraints, Feasible Region, Unbounded Region, Bounded Region	Matrix, Dimensions, Elements, Equal Matrices, Scalar, Scalar Multiplication
KNOW	**KNOW**	**KNOW**	**KNOW**
• Definition of a system of equations • Graphic representations of systems with no solution, one solution and infinitely many solutions	• Substitution • Elimination/Linear Combination • System of 3 Equations • Z Coordinate	• The process of linear programming • How to graph a system of linear inequalities • Where a solution to a system of inequalities lies on a graph	• How to label, write and identify matrices • Whether or not operations can be completed between matrices
UNDERSTAND	**UNDERSTAND**	**UNDERSTAND**	**UNDERSTAND**
• Where the solution is visually on the graph of a system of linear equations • What it means to be a solution to a system of equations • Different possibilities for solutions to a system of linear equations	• Uses of systems of equations • What it means to be a solution to a system of equations • Different possibilities for solutions to a system of linear equations	• Why we use linear programming and in what situations • Graphical representations of systems of linear inequalities • Maximizing/minimizing objective functions • Feasible regions	• Operations with matrices • Multiplication is not commutative • Solving a matrix equation for an element

LEARNING OUTCOME	LEARNING OUTCOME	LEARNING OUTCOME	LEARNING OUTCOME
• Learners will be able to determine whether or not a given point is a solution to a given system of equations • Learners will be able to write, identify and interpret a solution(s) to a system of equations for a real-life situation	• Learners will be able to write, identify and interpret a solution(s) to a system of equations for a real-life situation (2 and 3 variables)	• Learners will be able to write objective functions and constraints, identify feasible regions, and interpret solutions to real world situations that involve linear programming • Learners will be able to graph systems of linear inequalities and interpret the solutions in relation to real world problems	• Learners will be able to use matrices for the purpose of organizing information and solving problems in a real world situation.

Pa Core Standards:

CC.2.2.HS.D.10

Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Assessments: Formal Quiz, Linear Programming Assessment, Unit 3 Assessment_

Pacing: 10 days (including assessment)

Resources: Schoology, McDougal Littel Algebra 2

Pequea Valley School District
Math

Course: Honors Algebra 2 Grade: 8, 9, 10

Unit 4: Quadratic Functions and Factoring

Unit Essential Question: How does writing and solving quadratic equations help us to solve real-life problems?

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Graph Quadratic Functions and Inequalities	**Solve Quadratic Functions by Factoring**	**Solve Quadratic Functions and Inequalities by Square Roots and Quadratic Formula, and Perform Operations with Complex Numbers**	**Write Quadratic Functions and Models**
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
Quadratic Function, Parabola, Standard Form, Vertex, Axis of Symmetry, Minimum Value, Maximum Value, Vertex Form, Intercept Form, Quadratic Inequality, Systems of Quadratic Inequalities	Monomial, Binomial, Trinomial, Quadratic Equation, Root, Zero, Zero Product Property, Difference of 2 Squares, Difference/Sum of 2 Cubes, Quadratic Equation	Square Root, Radical, Radicand, Rationalizing the Denominator, Conjugates, Simplifying a Square Root, Complex Number, Imaginary Number, Complex Conjugates, Complex Plane, Absolute Value of a Complex Number, Quadratic Formula, Discriminant, Critical Values	Best-fit Quadratic Model, Quadratic Regression
KNOW	**KNOW**	**KNOW**	**KNOW**
• How to identify quadratic functions • The vertex of a graph of a quadratic function • Parabolas are symmetrical • Standard Form vs Vertex Form vs Intercept Form and changing between forms • Solution regions for quadratic inequalities and systems of quadratic inequalities	• Factoring methods when a = 1 and when a ≠ 1 • The Zero Product Property • Special factoring patterns • Uses for the discriminant • The Quadratic Formula •	• All methods of simplifying square roots • When and how to solve quadratic equations and inequalities in one variable with square roots and the quadratic formula • All methods of simplifying complex numbers • When and why complex numbers are needed	• How to write a quadratic equation given a graph, the vertex and a point, or the x-intercepts • The process of writing a quadratic model given data that mimics a quadratic function

		• The Quadratic Formula and how to use it • The discriminant and how to use it	
UNDERSTAND	**UNDERSTAND**	**UNDERSTAND**	**UNDERSTAND**
• Graphical representations of quadratic functions, inequalities and systems of inequalities • The symmetrical characteristics of parabolas • Differences between the x-intercepts and the vertex in the context of the problem • All three forms of equivalent quadratic equations (standard, vertex, intercept) represent the same function/situation and will produce the same graph	• Factoring and the purposes of factoring • Solutions to quadratic equations • How and when to apply the Zero Product Property • Zeros, roots, solutions and x-intercepts versus linear factors • Graphic representations of zeros of quadratic functions	• When and how to use each method of solving quadratic equations and inequalities • Numbers and types of solutions to quadratic equations and inequalities • All real solutions have decimal equivalents and will be represented on the graph of a quadratic equation • Simplifying solutions in radical form versus evaluating to decimal equivalents • Representing solutions to quadratic inequalities in one variable on a number line versus graphing to find solutions	• The process of writing a quadratic model for various form of data
LEARNING OUTCOME	**LEARNING OUTCOME**	**LEARNING OUTCOME**	**LEARNING OUTCOME**
• Learners will be able to graphically represent real life quadratic situations in all three forms and interpret solutions. • Learners will be able to graph a quadratic function and identify the proper point on the graph that solves a real world situation.	• Learners will be able to solve real world situations by writing and solving quadratic equations through factoring.	• Learners will be able to write and solve quadratic equations as they relate to real world problems using factoring, square roots and the quadratic formula. • Learners will be able to interpret solutions to quadratic equations graphically and algebraically. • Learners will know when and how to use each method of solving quadratics and be able to apply this knowledge to real world quadratic equations.	• Learners will be able to write and use a quadratic model given data from a real-life situation.

Pa Core Standards:

Standard - CC.2.2.HS.C.5
Construct and compare linear, quadratic and exponential models to solve problems.
Standard - CC.2.2.HS.D.9
Use reasoning to solve equations and justify the solution method.
Standard - CC.2.2.HS.D.7
Create and graph equations or inequalities to describe numbers or relationships.
Standard - CC.2.2.HS.D.2
Write expressions in equivalent forms to solve problems.
Standard - CC.2.2.HS.C.6
Interpret functions in terms of the situation they model.
Standard - CC.2.2.HS.C.3
Write functions or sequences that model relationships between two quantities.

Assessments: Formal Quiz, Factoring Assessment, Unit 4 Assessment_

Pacing: 17 days (including assessment)

Resources: Schoology, McDougal Littel Algebra 2

Pequea Valley School District
Math

Course: Honors Algebra 2 Grade: 8, 9, 10

Unit 5: Polynomials and Polynomial Functions

Unit Essential Question: How do we use polynomials to represent and solve real-life situations?

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Properties of Exponents	**Evaluate and Graph Polynomial Functions and Analyze Graphs and End Behavior of Polynomial Functions**	**Add, Subtract and Multiply Polynomials and Factor to Solve Polynomial Equations**	**Apply the Remainder and Factor Theorems, Find Rational Zeros and Apply the Fundamental Theorem of Algebra**
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
Base, Exponent, Scientific Notation	Polynomial, Polynomial Function, Leading Coefficient, Degree, Constant Term, Cubic Function, Quartic Function, Direct Substitution, Synthetic Substitution, End Behavior, Local Maximum, Local Minimum	Like Terms, Factor Completely, Factor by Grouping, Common Monomial Factor, Sum of Two Cubes, Difference of Two Cubes, Factor to Solve	Remainder Theorem, Factor Theorem, Rational Zero Theorem, Fundamental Theorem of Algebra, Synthetic Substitution, Solutions, Zeros, Roots,
KNOW	**KNOW**	**KNOW**	**KNOW**
• Properties of Exponents • Scientific Notation	• Graphing polynomial functions • Writing the end behavior of a graph • Direct and synthetic substitution • Key components of the graph of a polynomial function	• The processes of factoring by all methods • Combining like terms • Exponent rules for the purpose of multiplying polynomials • Perfect cubes and perfect squares	• Polynomial long division • Synthetic division • List possible rational zeros • Factoring polynomials through synthetic division • Finding all zeros of polynomial functions

UNDERSTAND	UNDERSTAND	UNDERSTAND	UNDERSTAND
• How to use properties of exponents to simplify polynomials • Uses of and operations involving scientific notation	• End behavior as it relates to a polynomial function its degree, the leading coefficient and the graph • Polynomial graphs and their key components, including turning points and real vs imaginary numbers • Evaluating polynomials	• The process of solving polynomials through factoring • Operations with polynomials	• The process of solving polynomials for all solutions • The process of dividing polynomial functions
LEARNING OUTCOME	**LEARNING OUTCOME**	**LEARNING OUTCOME**	**LEARNING OUTCOME**
• Learners will be able to simplify expressions relating to real world situations using the properties of exponents. • Learners will be able to solve real world problems using data in scientific notation.	• Learners will be able to utilize the graph of a polynomial function and its key components to solve real world situations.		• Learners will be able to find all solutions to polynomial equations

Pa Core Standards:

Standard - CC.2.2.HS.C.5
Construct and compare linear, quadratic and exponential models to solve problems.
Standard - CC.2.2.HS.D.9
Use reasoning to solve equations and justify the solution method.
Standard - CC.2.2.HS.D.7
Create and graph equations or inequalities to describe numbers or relationships.
Standard - CC.2.2.HS.D.2
Write expressions in equivalent forms to solve problems.
Standard - CC.2.2.HS.C.6
Interpret functions in terms of the situation they model.
Standard - CC.2.2.HS.C.3
Write functions or sequences that model relationships between two quantities.

Assessments: Formal Quiz, Factoring Assessment, Unit 4 Assessment_
Pacing: 17 days (including assessment)
Resources: Schoology, McDougal Littel Algebra 2

Pequea Valley School District
Math

Course: Honors Algebra 2 Grade: 8, 9, 10

Unit 7: Exponential and Logarithmic Functions

Unit Essential Question: How do we use exponential and logarithmic functions to solve real-life problems?

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Exponential Growth and Decay Functions, The Euler Number	**Evaluate and Graph Logarithmic Functions**	**Properties of Logarithms**	**Solve Exponential and Logarithmic Equations**
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
Exponential function, Exponential growth, Exponential decay, Growth factor, Decay factor, Asymptote, Compound interest, Simple interest, Rate, Principal, Compounded, The Euler Number, Continuously compounded interest, Natural base	Logarithm, Common logarithm, Natural logarithm,	Product Property, Quotient Property, Power Property, Expanding logarithms, Condensing logarithms, Change of base formula	Exponential equation, Logarithmic equation, Extraneous solution
KNOW	**KNOW**	**KNOW**	**KNOW**
• Exponential growth function • Exponential decay function • The Euler Number • Compound interest formula • Continuously compounded interest formula • Translations of exponential graphs • Domain and range of exponential functions	• Definition of a logarithm • Translations of logarithmic graphs • Evaluating logarithmic functions • Logarithmic form and exponential form • Inverse of logarithmic functions	• Change of base formula • Properties of logarithms	• Steps for solving logarithmic equations • Steps for solving exponential equations

UNDERSTAND	UNDERSTAND	UNDERSTAND	UNDERSTAND
• The difference between exponential growth and decay • How to write exponential growth and decay functions to model real life situations • How to find compound, and continuously compounded interest • The Natural Base (The Euler Number) and applications of the number	• The relationship between exponential and logarithmic functions • Common logarithms and Natural logarithms • The inverse of a logarithmic function will be an exponential function • Graphs of logarithmic functions will be reflections of exponential functions	• How to expand/condense logarithms • When and how to use the change of base formula • How to apply properties of logarithms	• The inverse function is needed to solve exponential or logarithmic equations. • How to manipulate logarithmic and exponential equations for the purpose of solving them.
LEARNING OUTCOME	**LEARNING OUTCOME**	**LEARNING OUTCOME**	**LEARNING OUTCOME**
• Learners will be able to use exponential functions to model and solve real world situations.	• Learners will be able to convert between exponential and logarithmic forms. • Learners will be able to evaluate logarithmic functions. • Learners will be able to graph logarithmic functions.	• Learners will be able to use the properties of logarithms to simplify logarithmic expressions. • Learners will be able to evaluate logarithms using the change of base formula.	• Learners will be able to solve logarithmic and exponential equations as they relate to real world problems

Pa Core Standards:

CC.2.2.HS.C.5 Construct and compare linear, quadratic and exponential models to solve problems.

Assessments: Unit Assessment

Pacing: 20 days (including assessment)

Resources: Schoology, McDougal Littel Algebra 2

Pequea Valley School District
Math

Course: Honors Algebra 2 **Grade**: 8, 9, 10

Unit: Rational Functions

Unit Essential Question: How do we use exponential and logarithmic functions to solve real-life problems?

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Rational Functions and Their Graphs	**Multiplying and Dividing Rational Functions**	**Adding and Subtracting Rational Functions**	**Solving Rational Equations**
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
Rational function, Asymptote, End behavior,	Simplified form of a rational expression, reciprocal	Complex fractions	Cross multiplication, Extraneous solution
KNOW	**KNOW**	**KNOW**	**KNOW**
• Where vertical and horizontal asymptotes, and zeros occur • Definition of a rational function	• Factors can be reduced prior to multiplying and dividing rational expressions • Factoring of polynomials	• LCDs of rational expressions • Process for adding/subtracting fractions (rational expressions)	• Cross multiplication • LCD to solve rational equations
UNDERSTAND	**UNDERSTAND**	**UNDERSTAND**	**UNDERSTAND**
• How to solve for horizontal and vertical asymptotes, and zeros of rational functions • Why zeros, vertical and horizontal asymptotes occur	• How to multiply and divide rational expressions	• How to add/subtract rational expressions	• When to use cross multiplication and when to use LCD in order to solve rational equations.

LEARNING OUTCOME	LEARNING OUTCOME	LEARNING OUTCOME	LEARNING OUTCOME
• Learners will be able to identify zeros, vertical and horizontal asymptotes of rational functions.	• Learners will be able to multiply and divide rational expressions	• Learners will be able to add and subtract rational expressions for the purpose of simplifying rational expressions.	• Learners will be able to solve real life problems involving models of rational equations.

Pa Core Standards:

CC.2.2.HS.D.6 Extend the knowledge of rational functions to rewrite in equivalent forms.

Assessments: Unit Assessment

Pacing: 25 days (including assessment)

Resources: Schoology, McDougal Littel Algebra 2