Algebra 2 strengthens and builds on the concepts taught in Algebra 1, increasing a student's ability to think in abstract terms. The fundamentals of Algebra 1 are reviewed and expanded upon to increase the skill level needed for more advanced study in mathematics. Topics include solving linear equations and inequalities, graphing, writing, and applying linear functions, solving systems of equations, advanced factoring, solving quadratic and polynomial equations, working with exponents, radicals and complex numbers, and developing higher level graphing skills. Additionally, students will study probabilities and data analysis.

Algebra 2 is offered to students who earned less that a 75% in Algebra 1 and/or who were not proficient on the Keystone Exam. Keystone Algebra topics will be reviewed and expanded in preparation for Winter Keystone exam. It is also offered for students in 12th grade who have completed Algebra A, Algebra B, and Geometry, and wish to take a fourth elective math course. This course is not part of the college-preparatory program.

Credits 1.0

Prerequisites: Algebra 1 (70% or greater and Less than 1480 on the Keystone Algebra Exam)
or Algebra A, Algebra B, and Geometry.

Unit 1: Equations and Inequalities

Unit Outcomes:
Students will review evaluating and simplifying algebraic expressions, including those with exponents using order of operation. Students then use these properties and the properties of equality to review solving linear equations. They will also rewrite formulas and equations to solve for a specified variable. They will use verbal models and problem solving strategies to both write and solve linear equations stemming from real world scenarios. Students will also review solving and graphing linear inequalities in one variable.

State Standards:
A1.1.2.1.1. Write, solve, and/or apply a linear equation.
A1.1.2.1.3. Interpret solutions to problems in the context of the problem situation.
A1.1.3.1.1. Write or solve compound inequalities and/or graph their solution sets on the
                   number line.
A1.1.3.1.2. Identify or graph the solution set to a linear inequality on a number line.
A2.1.3.2.2. Use algebraic processes to solve a formula for a variable.

Essential Outcomes:
   A. Evaluate and simplify algebraic expressions.
   B. Solve linear equations including equations containing fractions.
   C. Rewrite equations and formulas for a specified variable.
   D. Use problem-solving strategies to model and solve linear equations.
   E. Solve linear inequalities in one variable and represent the solution set as a graph, an
       inequality, and using interval notation.

Key Vocabulary:

Numerical Expression	Variable Expression	Solve
Term	Coefficient	Compound Inequality
Like Terms	Simplify	

Content and Instructional Strategies:
Lecture
Visual Aids
Worksheets
Text-based questions
Real life problems/connections

Remediation:
Computer lessons
Re-teaching Activities
IWSS worksheets
SLOT
Pre-test study guides

Enrichment:
Enrichment/challenge worksheets
Computer lessons

Assessment Criteria:
Homework – book and worksheets
Teacher created quizzes, tests, essays and open-ended questions

Resources and Materials:
Textbook
Computer
Worksheets
Calculators
Interwrite board
Chromebook applications

Unit 2: Linear Equations and Functions

Unit Outcomes:
In this unit, students define functions, and relate to mapping values from the domain to the range. Students use slope to graph and write equations for linear functions. They also use slope to identify parallel and perpendicular lines. Students learn how many real world applications can be modeled by linear functions and rates of change. They will be able to identify types of correlation and write the equation of the line of best fit from a scatter plot. They will make predictions based on both algebraic equations and graphs.

State Standards:
A1.2.1.1.2. Determine whether a relation is a function given a set of points or a graph.
A1.2.1.2.2. Translate from one representation of a linear function to another (graph, table, equation).
A1.2.2.1.1. Identify, describe, and/or use constant rates of change.
A1.2.2.1.3. Write or identify a linear equation when given: graph of the line, two points on the line, slope and a point on the line.
A1.2.2.1.4. Determine the slope and/or y-intercept represented by a linear equation or graph.
A1.2.2.2.1. Draw, identify, find and/or write an equation for a line of best fit from a scatter plot.
A1.2.3.2.3. Make predictions using the equations or graphs of best-fit lines or scatter plots.
A2.2.1.1.1. Analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically.
A2.2.1.1.3. Determine the domain, range or inverse of a relation.
A2.2.2.2.1. Identify and describe the effect of changing parameters within a family of functions.

Essential Outcomes
    A. Represent relations and functions in different forms (mapping diagram, table, ordered pairs, graph, equation, and function notation) and determine the domain and range.
    B. Find slope or rate of change given a graph or two points on a line.
    C. Graph equations of lines using slope-intercept and standard form.
    D. Write equations of lines given slope and a point on the line, two points on the line, and lines parallel or perpendicular to a given line.
    E. Determine the line of best fit and its equation given a scatterplot.
    F. Use families of functions to describe translations and transformations of basic functions (linear, quadratic, square root, and absolute value)

Key Vocabulary:

Relation	Function notation	Parallel
Function	Slope	Perpendicular
Domain	y-intercept, x-intercept	Scatterplot
Range	Slope-intercept form,	Line of best fit
Vertical line test	Standard form	

Content and Instructional Strategies:

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Unit 3: Data Analysis and Probability

Unit Outcomes:
Students will be able to use measures of dispersion to describe a set of data. They will be able to use data displays in problem-solving settings to solve problems and make predictions based on the data. They will also review data displays including stem and leaf and box and whisker plots. Students will also be able to apply probability to practical situations.

State Standards:
A1.2.3.1.1. Calculate and/or interpret the range, quartiles, and interquartile range of data.
A1.2.3.2.1. Estimate or calculate to make predictions based on a circle, line, bar graph, measure of central tendency, or other representation.
A1.2.3.2.2. Analyze data, make predictions, and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, scatter plots, measures of central tendency, or other representations).
A1.2.3.3.1. Find probabilities for compound events (e.g. find the probability of red and blue, find probability of red or blue) and represent as a fraction, decimal, or percent.

Essential Outcomes:
   A. Analyze data displayed as a graph (circle, line, bar graph) or plot (scatter, box-and-whisker, stem and leaf plot).
   B. Calculate the quartiles, range and interquartile range given a set of data.
   C. Find the probability of a single event occurring and represent it in various ways (fraction, decimal, percent).
   D. Find the probability of a compound event occurring. This will include both and/or compound events. Probabilities will be represented as fractions, percents, and decimals.

Key Vocabulary:

Quartiles	Interquartile Range	Compound Probability
Range	Probability	

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Unit 4: Linear Systems

Unit Outcomes:
In this unit, students work with systems of equations and systems of inequalities. For equations, they will solve systems graphically and algebraically. This includes systems with many solutions and those with no solutions. Algebraic solving will include both substitution and elimination. With inequalities, students will graphically solve systems with two or more inequalities and be able to identify the solution region. Students will apply systems to real-life application problems.

State Standards:
A1.1.2.2.1. Write and/or solve a system of linear equations (including problem situations) using graphing, substitution, and/or elimination.
A1.1.2.2.2. Interpret solutions to problems in the context of the problem situation.
A1.1.3.2.1. Write and/or solve a system of linear inequalities using graphing.
A1.1.3.2.2. Interpret solutions to problems in the context of the problem situation.

Essential Outcomes:
    A. Identify the solution to a system of two linear equations using its graph.
    B. Solve linear systems algebraically using substitution and elimination.
    C. Graph systems of linear inequalities.

Vocabulary:
System   Solution to system

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Unit 5: Quadratic Functions and Factoring

Unit Outcomes:
Students will learn how to graph quadratic functions from both standard and vertex form. They will learn how to factor binomials and trinomials and use these skills to solve quadratic equations. Students will solve quadratic equations by factoring, finding square roots, and using the quadratic formula. In addition, students will review the properties of radicals and simplifying radicals. Students will learn how to calculate with the imaginary unit *i* and to perform operations with complex numbers.

State Standards:
A1.1.1.3.1. Simplify/evaluate expressions involving properties/laws of exponents, roots, and/or absolute values to solve problems.
A2.1.1.1.1. Simplify and write square roots in terms of the imaginary unit *i*.
A2.1.1.1.2. Simplify/evaluate expressions involving powers of *i.*
A2.2.1.1.4. Identify and/or determine characteristics of exponential quadratic, or polynomial functions.
A2.1.1.2.1. Add and subtract complex numbers.
A2.1.1.2.2. Multiply and divide complex numbers.
A2.1.2.2.1. Factor algebraic expressions including differences of squares and trinomials.
A2.1.3.1.1. Write and/or solve quadratic equations (including factoring and the Quadratic Formula).
A2.2.2.1.1. Create, interpret, and/or use the graph or table of a polynomial function.
A2.2.2.1.3. Determine, use and/or interpret the minimum and maximum values over a specified interval for polynomial, exponential, or logarithmic functions.
A2.2.2.1.4. Translate from one representation to another (graph, table, equation).

Essential Outcomes:
  A. Graph quadratic functions in standard and vertex forms.
  B. Factor quadratic expressions by removing common factors, difference of two squares, and trinomials of the form $x^2 + bx + c$ and $ax^2 + bx + c$.
  C. Perform operations with square roots. Answers will be simplified by removing perfect square factors and rationalizing the denominator (does not include multiplying by conjugate).
  D. Perform operations with complex numbers.
  E. Solve quadratic equations by factoring, taking square roots, and using the Quadratic Formula.
  F. Apply quadratic equations to real world applications.

Key Vocabulary:

Parabola	Axis of symmetry	Zeros of a function
Vertex	Simplified Radical Form	x-intercept, y-intercept
Vertex form	Rationalize denominator	Complex number
Standard form	Factor	Imaginary number
Minimum/maximum	Discriminant	

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Unit 6: Polynomials and Polynomial Functions

Unit Outcomes:
Students will review and apply properties of exponents to simplify expressions involving powers. They will also review how to add, subtract, and multiply polynomials. Students will then expand their knowledge and solve polynomial equations by factoring and applying theorems about polynomial roots.

State Standards:
A1.1.1.5.1. Add, subtract and/or multiply polynomial expressions (express answers in simplest form).
A2.1.2.1.1. Use exponents to represent rational numbers.
A2.1.2.1.3. Simplify/evaluate expressions involving multiplying exponents.
A2.1.2.2.1. Factor algebraic expressions including differences of squares and trinomials.
A2.1.3.1.1. Write /solve a quadratic equation.

Essential Outcomes:
   A. Use properties of exponents to evaluate and simplify expressions involving powers.
   B. Classify polynomials based on degree and number of terms
   C. Add, subtract, and multiply polynomials.
   D. Factor polynomial expressions by removing common factors, factoring sum and difference of cubes, difference of squares, and by grouping.
   E. Solve polynomials to find all real and imaginary solutions.
   F. Write a polynomial using its zeros, including imaginary and irrational roots (these will be given in conjugate pairs).

Key Vocabulary:
Polynomial	Linear	Quintic
Degree	Quadratic	Monomial
Leading coefficient	Cubic	Binomial
Constant	Quartic	Trinomial

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Unit 7: Radical Expressions and Equations

Unit Outcomes:
In this unit, students will learn the meaning of nth roots and rational exponents. They will be able to interchange between radical and rational exponent notation and simplify expressions in both forms. Students will also be able to find inverses, domains of functions, and combinations and compositions of functions.

State Standards:
A2.1.2.1.   Use exponents, roots and/or absolute value to represent equivalent forms.
A2.1.2.1.2. Simplify/evaluate expressions involving positive/negative exponent.
A2.1.2.1.3. Simplify/evaluate expressions involving multiplying exponents.
A2.1.3.1.2. Solve equations containing rational or radical expressions.
A2.2.1.1.3. Determine the domain, range or inverse of a relation.

Essential Outcomes:
   A. Evaluate the nth roots of real numbers using both radical and rational exponent notation.
   B. Simplify, add, subtract, multiply and divide radical expressions.
   C. Write radical expressions in equivalent form with rational exponents. Apply properties of rational exponents to simplify expressions.
   D. Solve equations containing radicals or rational exponents.
   E. Determine the domain of functions from an equation or graph.
   F. Find combinations and compositions of functions.
   G. Find inverses of functions from a chart, equation, or graph.

Key Vocabulary:

Radical	n^{th} root	Extraneous solution
Index	Rational exponent	Inverse
Radicand	Composition of functions	

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Resources and Materials:
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Unit 8: Rational Functions

Unit Outcomes:
Students will review how to add, subtract, multiply and divide rational expressions, and expand their skills to simplify complex fractions. Students will also solve rational equations.

Standards:
A2.1.2.2.1. Factor algebraic expressions, including difference of squares and trinomials.
A2.1.2.2.2. Simplify rational algebraic expressions.
A2.1.3.1.2. Solve equations involving rational and/or complex equations.

Essential Outcomes:
   A. Simplify, multiply and divide rational expressions and complex fractions.
   B. Add and subtract rational expressions with like and unlike denominators.
   C. Solve rational equations and proportions.

Key Vocabulary:
Rational expression   Complex fraction
Proportion

Content and Instructional Strategies:
Lecture
Visual Aids
Worksheets
Text-based questions
Real life problems/connections

Remediation:
Computer lessons
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Enrichment:
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Assessment Criteria:
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