SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Algebra 2	**Length of Course:** 30 cycles
Grade Level(s): 9-11	**Periods Per Cycle:** 6
Units of Credit: 1	**Length of Period:** 43 minutes
Classification: Elective	**Total Instructional Time:** 129 hours

Course Description

This is a rigorous approach to the second course in modern algebra, which stresses the structure of the real number system and complex numbers. The course is also designed to help students to do the following: Recognize the techniques of algebra; acquire facility in applying deductive reasoning in algebra; and appreciate the need for precision of language.

Instructional Strategies, Learning Practices, Activities, and Experiences

Anticipatory Sets	Flexible Groups	Projects
Assessments	Graphic Organizers	Teacher Demonstrations
Bell Ringers/Warm-up Problems	Guided Practice	Technology Integration
Class Discussions	Higher-Level Questioning	Videos/DVD's
Closure Activities	Homework/Independent Practice	Wait Time/Wait Time Extended
Critical Thinking	Posted Agendas and Objectives	

Assessments

Assessments (Quizzes, Unit, Teacher-Created)	Higher-Level Questioning	Classwork
Bell Ringers	Projects	

Materials/Resources

Big Ideas Math: A Bridge to Success Algebra 2, Larson 1st Edition	Internet Resources

Adopted: 4/20/88
Revised: 9/3/91; 8/19/92; 8/9/93; 9/17/03; 8/17/09; 5/19/14, 5/20/2019

Equations and Inequalities	
The Standards of Mathematical Practices	
Make sense of problems and persevere in solving them **Construct viable arguments and critique the reasoning of others.** **Use appropriate tools strategically.** **Look for and make use of structure.**	**Reason abstractly and quantitatively.** **Model with mathematics.** **Attend to precision.** **Look for and express regularity in repeated reasoning.**
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Equations and Inequalities
• Apply Properties of Real Numbers
  ○ Compare, order, and locate rational and irrational numbers on the number line
• Evaluate and Simplify Algebraic Expressions
  ○ Follow order of operations
  ○ Positive/negative exponents
  ○ Roots
  ○ Absolute value
• Solve Linear Equations
• Rewrite Formulas and Equations
• Use Problem Solving Strategies and Models
• Solve Linear Inequalities
  ○ Simple and compound inequalities
  ○ Graph simple and compound inequalities
• Solve and Graph Absolute Value Equations and Absolute Value Inequalities
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	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.7 - Create and graph equations or inequalities to describe numbers or relationships.
	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.
	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.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.

Linear Equations and Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Linear Equations and Functions
• Represent Relations and Functions
  ○ Use ordered pairs, tables, graphs, mapping diagram
  ○ Identify domain and range
• Find Slope and Rate of Change
  ○ On a graph
  ○ Between two points
  ○ In an equation
  ○ From given data
• Graph Equations of Lines
  ○ Use slope and y-intercept
  ○ Use x-intercept and y-intercept
  ○ Use an x/y chart
• Write Equations of Lines
  ○ Given a graph, two points, or a single point and a slope
  ○ Point-slope form
  ○ Standard form
  ○ Slope-intercept form
• Model Direct Variation
• Draw Scatter Plots and Best-Fitting Lines
• Graph Absolute Value Functions and Transformations
• Graph Linear Inequalities in Two Variables
	CC.2.1.HS.F.1 - Apply and extend the properties of exponents to solve problems with rational exponents.
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	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.7 - Create and graph equations or inequalities to describe numbers or relationships.
	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.
	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.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.

Linear Systems and Matrices	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Linear Systems and Matrices
• Solve Linear Systems by Graphing
• Solve Linear Systems Algebraically
  ○ Substitution method
  ○ Elimination method
• Graph Systems of Linear Inequalities
• Solve Systems of Linear Equations in Three Variables
• Perform Basic Matrix Operations
  ○ Add
  ○ Subtract
  ○ Multiply by a scalar
• Multiply Matrices
• Evaluate Determinants and Apply Cramer's Rule
• Use Inverse Matrices to Solve Linear Systems
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	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.7 - Create and graph equations or inequalities to describe numbers or relationships.
	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.
	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.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.

Quadratic Functions and Factoring	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Quadratic Functions and Factoring
• Graph Quadratic Functions in Standard Form
• Graph Quadratic Functions in Vertex or Intercept Form
• Zero Product Property
• Solve $x^2 + bx + c = 0$ and $ax^2 + bx + c = 0$ by Factoring
  ○ Factor common monomial
  ○ Difference of squares
  ○ Factor by grouping
  ○ Rainbow method
• Solve Quadratic Equations by Finding Square Roots
• Perform Operations with Complex Numbers
  ○ Add, subtract, multiply, and divide
• Complete the square
• Use the Quadratic Formula and the Discriminant
  ○ With two real solutions
  ○ With one real solution
  ○ With imaginary solutions
• Graph and Solve Quadratic Inequalities
• Write Quadratic Functions and Models
  ○ Vertex form
  ○ Intercept form
  ○ Standard form
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	CC.2.1.HS.F.6 - Extend the knowledge of arithmetic operations and apply to complex numbers.
	CC.2.1.HS.F.7 - Apply concepts of complex numbers in polynomial identities and quadratic equations to solve 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.4 - Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.
	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.
	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.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.

Polynomials and Polynomial Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Polynomials and Polynomial Functions
• Properties of Exponents
  ○ Use numerical values, variables, and scientific notation
  ○ Product of powers
  ○ Power of a power
  ○ Power of a product
  ○ Negative exponent
  ○ Zero exponent
  ○ Quotient of powers
  ○ Power of a quotient
• Evaluate and Graph Polynomial Functions
  ○ Study end behavior
  ○ Evaluate using direct and synthetic substitution
• Add, Subtract, and Multiply Polynomials
• Factor and Solve Polynomial Equations
  ○ Factor using sum or difference of two cubes
• Apply the Remainder and Factor Theorems
• Find Rational Zeros
• Apply the Fundamental Theorem of Algebra
• Analyze Graphs of Polynomial Functions
• Write Polynomial Functions and Models
	CC.2.1.HS.F.1 - Apply and extend the properties of exponents to solve problems with rational exponents.
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	CC.2.2.HS.D.2 - Write expressions in equivalent forms to solve problems.
	CC.2.2.HS.D.3 - Extend the knowledge of arithmetic operations and apply to polynomials.
	CC.2.2.HS.D.6 - Extend the knowledge of rational functions to rewrite in equivalent forms.
	CC.2.2.HS.D.7 - Create and graph equations or inequalities to describe numbers or relationships.
	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.
	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.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.

Rational Exponents and Radical Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Rational Exponents and Radical Functions
• Evaluate n^{th} Roots and Use Rational Exponents
  ○ Approximate roots with a calculator
  ○ Solve using n^{th} roots
• Apply Properties of Rational Exponents
  ○ Product of powers
  ○ Power of a power
  ○ Power of a product
  ○ Negative exponent
  ○ Zero exponent
  ○ Quotient of powers
  ○ Power of a quotient
• Perform Function Operations and Composition
  ○ Add, subtract, multiply, and divide
  ○ Simplify composite functions
• Use Inverse Functions
  ○ Define
  ○ Confirm functions are inverses
  ○ Calculate inverses
• Graph Square Root and Cube Root Functions
• Solve Radical Equations
	CC.2.1.HS.F.1 - Apply and extend the properties of exponents to solve problems with rational exponents.
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	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.4 - Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.
	CC.2.2.HS.D.6 - Extend the knowledge of rational functions to rewrite in equivalent forms.
	CC.2.2.HS.D.7 - Create and graph equations or inequalities to describe numbers or relationships.
	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.
	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.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.

Exponential and Logarithmic Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Exponential and Logarithmic Functions
• Graph Exponential Growth Functions
• Graph Exponential Decay Functions
• Use Functions Involving e
• Evaluate Logarithms and Graph Logarithmic Functions
  ○ Convert between logarithmic and exponential form
  ○ Change of base formula
• Apply Properties of Logarithms
  ○ Product property
  ○ Quotient property
  ○ Power property
• Solve Exponential and Logarithmic Equations
• Write and Apply Exponential and Power Functions
	CC.2.1.HS.F.1 - Apply and extend the properties of exponents to solve problems with rational exponents.
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	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.6 - Extend the knowledge of rational functions to rewrite in equivalent forms.
	CC.2.2.HS.D.7 - Create and graph equations or inequalities to describe numbers or relationships.
	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.
	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.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.

Rational Functions	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Rational Functions
• Model Inverse and Joint Variation
  ○ Inverse variation
  ○ Constant of variation
• Graph Simple Rational Functions
  ○ Vertical and horizontal asymptotes
• Graph General Rational Functions
• Multiply and Divide Rational Expressions
• Add and Subtract Rational Expressions
• Solve Rational Equations
  ○ Cross multiplication
  ○ Multiply by least common denominator (LCD)
	CC.2.1.HS.F.1 - Apply and extend the properties of exponents to solve problems with rational exponents.
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	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.3 - Extend the knowledge of arithmetic operations and apply to polynomials.
	CC.2.2.HS.D.4 - Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.
	CC.2.2.HS.D.6 - Extend the knowledge of rational functions to rewrite in equivalent forms.
	CC.2.2.HS.D.7 - Create and graph equations or inequalities to describe numbers or relationships.
	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.
	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.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.

Counting Methods and Probability	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Counting Methods and Probability • Apply the Counting Principle and Permutations • Use Combinations and Permutations • Define and Use Probability and Odds • Find Probabilities of Disjoint and Overlapping Events • Find Probabilities of Independent and Dependent Events • Construct and Interpret Binomial Distributions	**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.2.1.HS.F.5** - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **CC.2.2.HS.D.9** - Use reasoning to solve equations and justify the solution method. **CC.2.4.HS.B.1** - Summarize, represent, and interpret data on a single count or measurement variable. **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. **CC.2.4.HS.B.4** - Recognize and evaluate random processes underlying statistical experiments. **CC.2.4.HS.B.5** - Make inferences and justify conclusions based on sample surveys, experiments, and observational studies. **CC.2.4.HS.B.6** - Use the concepts of independence and conditional probability to interpret data. **CC.2.4.HS.B.7** - Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

Data Analysis and Statistics	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**

Data Analysis and Statistics
• Find Measures of Central Tendency and Dispersion
  ○ Mean, median, and mode
  ○ Standard deviation
• Apply Transformations to Data
• Normal Distributions
• Stem-and-Leaf
• Box and Whisker Plot
	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.2.1.HS.F.5 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	
	CC.2.2.HS.D.9 - Use reasoning to solve equations and justify the solution method.
	
	CC.2.4.HS.B.1 - Summarize, represent, and interpret data on a single count or measurement variable.
	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.
	CC.2.4.HS.B.4 - Recognize and evaluate random processes underlying statistical experiments.
	CC.2.4.HS.B.5 - Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.