FAIRFIELD PUBLIC SCHOOLS
FAIRFIELD, CONNECTICUT

ALGEBRA 12

Board of Education Approved February 28, 2006

ALGEBRA 12

Statement of Purpose
This first course in algebra establishes the foundation for all future mathematics. Students will be introduced to the language and concepts of algebra while building on the skills and knowledge from earlier courses. Emphasis will be placed on communicating, developing, and promoting understanding of and proficiency with the properties that govern the manipulation of symbols in expressions, equations, and the concept of function. This course will be supplemented with technology as a tool to enhance many of the concepts taught. Algebra 12 will focus on student learning with respect to the many uses of algebra as a problem solving tool to model real world situations mathematically.

Audience
The course is intended for all students who have successfully completed the pre-requisites listed below. It is expected that students taking this course will go on to study geometry and a second year of algebra.

Prerequisites
The prerequisites are the successful completion of Pre-Algebra and a teacher recommendation. Students should have mastery of computation with and applications of real numbers (integers, fractions, decimals, and percents), estimation, and measurement. They should be familiar with concepts in geometry, statistics, probability, patterns, and working with unknowns.

Course Description
This first course in algebra furthers the students' skills in operating with real numbers, variables and algebraic properties. Algebra 12 also develops the concept of function. Major topics include: number properties, operations with real numbers, solutions of linear and quadratic equations, graphing functions, data analysis, radicals, exponents, factoring, solutions of systems of linear equations. Throughout the course, there will be an integration of problem solving techniques, communication skills, computing and estimating, the use of technology, and real life applications.

Course Objectives
Students will be able to:
- collect, analyze, interpret and display data and statistics both manually and with technology.
- write and evaluate expressions
- compute using the order of operations
- use algebraic models to represent real-life situations
- organize data and represent functions
- identify and apply properties of equality and algebraic axioms.
- solve algebraic equations and inequalities.
- compute with real numbers and apply their properties
- solve equations and inequalities with real numbers
- determine probability and odds of an event
- graph on a number line

- solve real –life problems using ratios and presents
- create, manipulate, and model using equations, which may include, linear, quadratic and literal functions (formulas) and relations.
- graph linear equations
- recognize functions by its equations and/or graphs
- create and interpret graphs with functions and relations (manually and with technology).
- create, solve and interpret systems of equations and inequalities graphically and algebraically.
- graph linear and quadratic equations
- display, organize, and interpret data
- make predictions based on graphs
- apply properties of, and perform operations with, exponents and radicals.
- multiply and Divide expressions with exponents
- solve real-life problems with exponents and radicals
- perform operations on, manipulations with, and factoring of polynomials.
- do computations with polynomials (add, subtract, and multiply)
- factor polynomials with the purpose of solving equations

Skill Objectives
Students will:
- perform operations on the real numbers using fractions, decimals, percents, absolute value and exponents.
- apply the order of operations to evaluate an expression.
- graph numbers on a number line.
- manipulate and demonstrate the interconnection between fractions, decimals and percents.
- find the mean, median and mode of data.
- define and apply properties of algebra, including commutative, associative, distributive, identity, and inverse.
- define, simplify, and evaluate variable expressions and equations.
- solve proportions and use them to model real world problems.
- solve equations and inequalities with variables on one or both sides using one or more operations (including linear, absolute value, quadratic, exponential and rational).
- evaluate and transform literal equations (formulas).
- create models using inequalities and equations.
- solve absolute value equations and inequalities.
- identify when a relation is a function and use function notation.
- evaluate a function for a given value.
- make a table for a function and identify the domain and range.
- write a linear function in standard, slope-intercept and point-slope form and convert between forms.
- determine the slope and x and y intercepts of a linear function.
- explain the slope as a rate of change with units and the y intercept as an initial value within a real world context.

- model a real world situation with a constant rate of change using a linear function in order to make predictions.
- find the line of best fit given a set of data that appears to have a linear relationship.
- solve systems of equations by graphing, substitution and linear combination.
- graph real numbers on a number line.
- graph simple and compound inequalities.
- graph solutions of absolute value equations and inequalities in one variable.
- graph ordered pairs and data using appropriate coordinate axes and labels.
- graph linear functions and inequalities.
- graph systems of linear functions.
- graph quadratic functions.
- make and use a scatter plot.
- make and use a stem and leaf plot to organize data.
- draw a box and whisker plot to organize and interpret real-life data.
- define power, base and exponent.
- use scientific notation when working with large and small numbers.
- evaluate power terms, with positive and negative bases, with and without the calculator.
- apply properties of exponents to simplify exponential expressions including positive, negative and zero exponents.
- evaluate expressions and equations using properties of exponents.
- write and use models for exponential growth and decay.
- use properties of radicals to express radicals in simplest form.
- identify coefficient, term, monomial, binomial, trinomial and polynomial.
- add, subtract and multiply polynomial expressions.
- factor polynomials by finding the greatest common factor.
- factor binomials that have a difference of two squares.
- factor any factorable trinomial with a leading coefficient of 1.
- solve quadratic equations by factoring, applying the quadratic formula, and graphing.

Math Standards
Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.
1.1 Students should understand and describe patterns and functional relationships.
Core
1.1a Students should describe relationships and make generalizations about patterns and functions.
Extended
1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.
1.2 Students should represent and analyze quantitative relationships in a variety of ways.
Core
1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.
1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.

Core
1.3a Students should manipulate equations, inequalities, and functions to solve problems.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.
2.1 Students should understand that a variety of numerical representations can be used to describe quantitative relationships.
Core
2.1a Students should extend the understanding of number to include integers, rational numbers, and real numbers.
2.1b Students should interpret and represent large sets of numbers with the aid of technology.
2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.
Core
2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.
2.2b Students should solve proportional reasoning problems.

Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
Core
4.1a Students should create the appropriate visual or graphical representation of real data.
4.2 Students should analyze data sets to form hypotheses and make predictions.
Core
4.2a Students should analyze real world problems using statistical techniques.
4.3 Students should understand and apply basic concepts of probability.
Core
4.3a Students should understand and apply the principles of probability in a variety of situations.

Information and Technology Standards (to be added)

Essential Questions
- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- What is algebra and what role does it play in the world of mathematics? (i.e. Its importance as a foundation and tool in higher mathematics and the real world.)
- Given a real-world situation or set of data how can an algebraic model be created and applied?

- How can we employ technology to create and interpret models and enhance student learning?
- What are the properties* of algebra and how are they applied to numeric expressions, algebraic expressions, equations, inequalities, relations, and functions?

*(Equality, inequality, exponents, order of operations, axioms such as identity, inverse, distributive, associative and commutative)

- How can the order of operations help to evaluate expressions?
- How can data be represented?
- How can you make an educated prediction?
- What is slope and how is it related to the real world?
- What are the properties of a function and how can you recognize a function?
- How can data be organized and graphed in order to solve real-world situations?
- What are the properties of exponents and how are they applied to numeric expressions, algebraic expressions, and equations?
- What is a polynomial?
- How can you do computations and simplify a polynomial?
- How can a polynomial be factored?

UNITS OF STUDY

1. Foundations of Algebra

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.
1.1 Students should understand and describe patterns and functional relationships.
Core
1.1a Students should describe relationships and make generalizations about patterns and functions.
Extended
1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.
2.1 Students should understand that a variety of numerical representations can be used to describe quantitative relationships.
Core
2.1a Students should extend the understanding of number to include integers, rational numbers, and real numbers.
2.1b Students should interpret and represent large sets of numbers with the aid of technology.
2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.
Core
2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
Core
4.1a Students should create the appropriate visual or graphical representation of real data.
4.2 Students should analyze data sets to form hypotheses and make predictions.
Core
4.2a Students should analyze real world problems using statistical techniques.

Essential Questions
- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- What is algebra and what role does it play in the world of mathematics? (i.e. Its importance as a foundation and tool in higher mathematics and the real world.)
- Given a real-world situation or set of data how can an algebraic model be created and applied?
- How can the order of operations help to evaluate expressions?
- How can data be represented?

Core Topics
- Introduction to algebra
- Algebraic expressions
- Order of Operations
- Mean, median, and mode

Unit Objectives
Students will be able to:
- collect, analyze, interpret and display data and statistics both manually and with technology.
- write and evaluate expressions
- compute using the order of operations
- use algebraic models to represent real-life situations
- organize data and represent functions

Skill Objectives
Students will:
- perform operations on the real numbers using fractions, decimals, percents, absolute value and exponents.
- apply the order of operations to evaluate an expression.
- graph numbers on a number line.
- manipulate and demonstrate the interconnection between fractions, decimals and percents.
- find the mean, median and mode of data.

Sample Assessment
Amazing Algebra Amusement Park Adventure

Pacing
2 weeks

2. Algebraic expressions and equations

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.
1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.
Core
1.3a Students should manipulate equations, inequalities, and functions to solve problems.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.
2.1 Students should understand that a variety of numerical representations can be used to describe quantitative relationships.
Core
2.1a Students should extend the understanding of number to include integers, rational numbers, and real numbers.
2.1b Students should interpret and represent large sets of numbers with the aid of technology.
2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.
Core
2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.
2.2b Students should solve proportional reasoning problems.

Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.
4.3 Students should understand and apply basic concepts of probability.
Core
4.3a Students should understand and apply the principles of probability in a variety of situations.

Essential Questions
- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- What is algebra and what role does it play in the world of mathematics? (i.e. Its importance as a foundation and tool in higher mathematics and the real world.)
- How can we employ technology to create and interpret models and enhance student learning?
- What are the properties* of algebra and how are they applied to numeric expressions, algebraic expressions, equations, inequalities, relations, and functions?

*(Equality, inequality, exponents, order of operations, axioms such as identity, inverse, distributive, associative and commutative)

- How can you make an educated prediction?

Core Topics
- Properties of real numbers
- The number line
- Probability of an event

Unit Objectives
Students will be able to:
- identify and apply properties of equality and algebraic axioms.
- solve algebraic equations and inequalities.
- compute with real numbers and apply their properties
- solve equations and inequalities with real numbers
- determine probability and odds of an event
- graph on a number line
- solve real –life problems using ratios and presents

Skill Objectives
Students will:
- define and apply properties of algebra, including commutative, associative, distributive, identity, and inverse.
- define, simplify, and evaluate variable expressions and equations.
- solve proportions and use them to model real world problems.
- solve equations and inequalities with variables on one or both sides using one or more operations (including linear, absolute value, quadratic, exponential and rational).
- evaluate and transform literal equations (formulas).
- create models using inequalities and equations.
- solve absolute value equations and inequalities.

Sample Assessments
Fairfield Extra Curricular Budget Predictions

Pacing
7 weeks

3. Functions and Relations

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Core

1.1a Students should describe relationships and make generalizations about patterns and functions.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.2 Students should represent and analyze quantitative relationships in a variety of ways.

Core

1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.

Core

1.3a Students should manipulate equations, inequalities, and functions to solve problems.

Essential Question
- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?

Focus Questions
- How can we employ technology to create and interpret models and enhance student learning?
- What is slope and how is it related to the real world?
- What are the properties of a function and how can you recognize a function?

Core Topics
- Functions
- Slope as a rate of change

Unit Objectives

Students will be able to:
- create, manipulate, and model using equations, which may include, linear, quadratic and literal functions (formulas) and relations.
- graph linear equations.
- recognize functions by its equations and/or graphs.

Skill Objectives

Students will:
- identify when a relation is a function and use function notation.
- evaluate a function for a given value.
- make a table for a function and identify the domain and range.

- write a linear function in standard, slope-intercept and point-slope form and convert between forms.
- determine the slope and x and y intercepts of a linear function.
- explain the slope as a rate of change with units and the y intercept as an initial value within a real world context.
- model a real world situation with a constant rate of change using a linear function in order to make predictions.
- find the line of best fit given a set of data that appears to have a linear relationship.
- solve systems of equations by graphing, substitution and linear combination.

<u>Sample Assessments</u>

The Human Chain

<u>Pacing</u>

6 weeks

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.
1.1 Students should understand and describe patterns and functional relationships.
Core
1.1a Students should describe relationships and make generalizations about patterns and functions.
1.2 Students should represent and analyze quantitative relationships in a variety of ways.
Core
1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.
2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.
Core
2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.
2.2b Students should solve proportional reasoning problems.

Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
Core
4.1a Students should create the appropriate visual or graphical representation of real data.

Essential Questions
- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- What is algebra and what role does it play in the world of mathematics? (i.e. Its importance as a foundation and tool in higher mathematics and the real world.)
- Given a real-world situation or set of data how can an algebraic model be created and applied?
- How can we employ technology to create and interpret models and enhance student learning?
- How can data be organized and graphed in order to solve real-world situations?

Core Topics
- Graphing equations from data
- Displaying data

Unit Objectives
Students will be able to:
- create and interpret graphs with functions and relations (manually and with technology).
- create, solve and interpret systems of equations and inequalities graphically and algebraically.
- graph linear and quadratic equations.
- display, organize, and interpret data.
- make predictions based on graphs.

Skill Objectives
Students will:
- graph real numbers on a number line.
- graph simple and compound inequalities.
- graph solutions of absolute value equations and inequalities in one variable.
- graph ordered pairs and data using appropriate coordinate axes and labels.
- graph linear functions and inequalities.
- graph systems of linear functions.
- graph quadratic functions.
- make and use a scatter plot.
- make and use a stem and leaf plot to organize data.
- draw a box and whisker plot to organize and interpret real-life data.

Sample Assessments
Algebra Phone-tastic Giveaway

Pacing
7 ½ weeks

<center>**5. Exponents and Radicals**</center>

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Core

1.1a Students should describe relationships and make generalizations about patterns and functions.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.2 Students should represent and analyze quantitative relationships in a variety of ways.

Core

1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.

Core

1.3a Students should manipulate equations, inequalities, and functions to solve problems.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.1 Students should understand that a variety of numerical representations can be used to describe quantitative relationships.

Core

2.1a Students should extend the understanding of number to include integers, rational numbers, and real numbers.

2.1b Students should interpret and represent large sets of numbers with the aid of technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Essential Questions
- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?

Focus Questions
- What is algebra and what role does it play in the world of mathematics? (i.e. Its importance as a foundation and tool in higher mathematics and the real world.)
- Given a real-world situation or set of data how can an algebraic model be created and applied?

- What are the properties of exponents and how are they applied to numeric expressions, algebraic expressions, and equations?

Core Topics
- Properties of exponents
- Computing with exponents and radicals
- Real-life problems with growth and decay

Unit Objectives
Students will be able to:
- apply properties of, and perform operations with, exponents and radicals.
- multiply and Divide expressions with exponents.
- solve real-life problems with exponents and radicals.

Skill Objectives
Students will:
- define power, base and exponent.
- use scientific notation when working with large and small numbers.
- evaluate power terms, with positive and negative bases, with and without the calculator.
- apply properties of exponents to simplify exponential expressions including positive, negative and zero exponents.
- evaluate expressions and equations using properties of exponents.
- write and use models for exponential growth and decay.
- use properties of radicals to express radicals in simplest form.

Sample Assessments
Classic Vs. New

Pacing
6 weeks

<p style="text-align:center"><u>**6. Polynomials**</u></p>

<u>**Math Standards**</u>
Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.
1.1 Students should understand and describe patterns and functional relationships.
Core
1.1a Students should describe relationships and make generalizations about patterns and functions.
Extended
1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.
1.2 Students should represent and analyze quantitative relationships in a variety of ways.
Core
1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

<u>**Essential Question**</u>
- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?

<u>**Focus Questions**</u>
- What is algebra and what role does it play in the world of mathematics? (i.e. Its importance as a foundation and tool in higher mathematics and the real world.)
- What is a polynomial?
- How can you do computations and simplify a polynomial?
- How can a polynomial be factored?

<u>**Core Topics**</u>
- Polynomials
- Factoring

<u>**Unit Objectives**</u>
Students will be able to:
- perform operations on, manipulations with, and factoring of polynomials.
- do computations with polynomials (add, subtract, and multiply).
- factor polynomials with the purpose of solving equations.

<u>**Skill Objectives**</u>
Students will:
- identify coefficient, term, monomial, binomial, trinomial and polynomial.
- add, subtract and multiply polynomial expressions.
- factor polynomials by finding the greatest common factor.
- factor binomials that have a difference of two squares.
- factor any factorable trinomial with a leading coefficient of 1.
- solve quadratic equations by factoring, applying the quadratic formula, and graphing.

<u>Sample Assessments</u>
Polynomial Crossword Puzzle

<u>Pacing</u>
3 ½ weeks