FAIRFIELD PUBLIC SCHOOLS
FAIRFIELD, CONNECTICUT

GRADE 8 MATH

PREALGEBRA

Board of Education Approved February 28, 2006

GRADE 8 PREALGEBRA

Statement of Purpose
The grade 8 curriculum will firmly establish all skills needed in Algebra 1 and all future mathematics by working at the eighth grade level in the four content strands – number sense, probability, algebra, and geometry. Students will use the language and concepts that align with the NCTM and Connecticut State standards for eighth grade. Emphasis will be on problem solving and real world applications. This course will be supplemented with manipulatives and technology as tools to enhance many of the concepts taught.

Audience
The course is intended for all students who have successfully completed the seventh grade curriculum. It is expected that students taking this course will go on to study Algebra 1 at the high school level.

Prerequisite
The prerequisites are the successful completion of the seventh grade curriculum and a teacher recommendation. Students should have mastery of computation with whole numbers, decimals, fractions, and percents.

Course Description
The four areas of Pre-Algebra are: algebraic reasoning with an emphasis on solving equations with variables and algebraic properties, numerical and proportional reasoning with an emphasis on operations with real numbers, geometry and measurement with an emphasis on Pythagorean Theorem, surface area and volume, and probability and statistics with an emphasis on graphic models as predictive tools for real life situations.

Course Objectives
Students will be able to:
- model and describe patterns and functional relationships.
- model and analyze quantitative data.
- use algebraic symbols to represent and interpret data and physical phenomena.
- develop and apply units, systems, formulas, and appropriate tools to estimate and measure.
- use a variety of numerical representations in the base ten system to describe quantitative relationships.
- use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.
- apply units, systems, formulas, and appropriate tools to estimate and measure.
- use special reasoning, location, and geometric relationships to solve problems.
- use attributes of two and three dimensional shapes and geometric theorems to describe relationships, communicate ideas, and solve problems.
- collect, organize, and display data using appropriate statistical and graphical methods.
- understand and apply basic concepts of probability.

- analyze data sets to form hypotheses and make predictions.

Skill Objectives
Students will:
- use tables, graphs and equations to represent mathematical relationships and solve real-world equations.
- given a system of linear equations with one point of intersection, recognize that a variety of methods may be used to find the solution, including algebraic and graphical methods.
- identify functions as linear and nonlinear and compare and contrast their properties using tables, graphs and equations.
- investigate solving problems involving direct variation.
- use a graphing calculator to represent and to describe a linear function with tables, patterns, graphs and equations.
- recognize that on the coordinate plane, lines with the same slope are parallel and lines with different slopes intersect.
- given a system of two linear equations, identify whether they represent pairs of lines that have none, one or infinitely many points of intersection.
- solve problems that involve repetitive patterns and iterations, such as compound interest, using tables, spreadsheets and calculators.
- use order of operations, the distributive, associative, and commutative properties, identities and inverses to simplify computations with rational numbers and to write and solve multi-step problems in a variety of contexts.
- estimate reasonable answers and solve a variety of problems involving multi-step operations with rational numbers in various notation forms.
- solve a variety of problems involving integers, powers, roots, absolute value and scientific notation.
- use the rules for exponents to multiply and divide with powers of ten, including negative exponents.
- locate, label and order rational numbers on number lines, scales, coordinate grids and measurement tools.
- write a rational number in equivalent notation forms as a fraction, mixed number, improper fraction, decimal, ratio, percent, expanded form, powers of ten and scientific notation.
- use and describe methods for estimating and judging the reasonableness of computations with rational numbers.
- recognize the value and limitations of estimates and assess the amount of error resulting from estimates.
- identify, locate on number lines and grids, compare, order and use integers, powers and roots.
- develop, describe and use a variety of methods to estimate and calculate mentally with very large and very small numbers.
- make and test conjectures about relationships among sides, angles, perimeters, areas, surface areas and volumes of congruent and similar polygons and solids.

- explain the effect of scale factors on the length, area, and volume ratios of similar polygons and solids.
- investigate the diameter and height relationships among the volumes of cylinders, cones and spheres.
- estimate, measure, derive and use formulas and strategies to find the perimeter, area, surface area and volume of various regular and irregular polygons and solids.
- represent the numerical and geometrical relationships of surface area and volume of solids using nets and formulas.
- describe the accuracy of estimates and measures and the precision of measurement tools.
- solve simple dimensional analysis problems involving rates as it applies to velocity and density.
- investigate the relationship of the sides of triangles and the area of squares constructed off each side. Deduce and apply the Pythagorean theorem to solve indirect measurement problems.
- use coordinate geometry to explore and test relationships of parallel and perpendicular lines, congruence, similarity and transformations.
- use reflection, rotation and translation of polygons with line and rotational symmetry to find a single transformation that will produce the same result as a series of transformations.
- describe relationships such as parallels, perpendiculars, bisections, medians and mid-segments and how the same relationships are related to the slope and intersection of lines on the coordinate grid.
- use technology to collect, organize, display, compare, make predictions and analyze the results of large data sets.
- construct scatter plots and evaluate the effects of variables using line-of-best-fit.
- make inferences, formulate and evaluate hypotheses and conclusions based on experimental data for independent and dependent events. Compare data to predictions and to theoretical expectations.
- construct a variety of data displays, including box-and-whisker plots, and identify where measures of central tendency and dispersion are found in graphical displays.
- analyze and interpret data using descriptive statistics including range, mode, median, quartiles, outliers and mean.
- describe the role of random sampling, random number generation and the effects of sample size in statistical claims.
- use combinations and permutations, trees, networks (counting strategies) in a variety of contexts, and identify when order is irrelevant in determining a solution.

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.

1.1a Students should analyze physical phenomena, functions and patterns to identify relationships and make generalizations.

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

1.2a Students should describe the affects of characteristics of linear relationships on the way the relationship is represented verbally and in tables, graphs and equations.

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

1.3a Students should solve problems using various algebraic methods and properties.

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.

2.1a Students should compare and order integers, powers, and roots using number lines and grids.

2.1b Students should extend the understanding of scientific notation to very small numbers.

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

2.2a Students should solve problems involving fractions, decimals, ratios and percents.

2.2b Students should make generalizations about operations with very large and very small numbers.

2.2c Students should connect the exponential growth and decay models to repeated multiplication by the same factor.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

3.1a Students should explore the relationships among sides, angles, perimeters, areas, surface areas and volumes of congruent and similar polygons and solids.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

3.2a Students should model geometric relationships in a variety of ways.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

3.3a Students should use a variety of concrete methods including displacement to find volumes of solids.

3.3b Students should solve problems involving measurement through the use of appropriate tools, techniques and strategies.

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.
4.1a Students should construct appropriate representations of data based on the size and kind of data set and the purpose for its use.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students should make and evaluate statistical claims and justify conclusions with evidence.
4.3 Students should understand and apply basic concepts of probability.
4.3a Students should determine possible outcomes using a variety of counting techniques.

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 do geometric relationship and measurements help us to solve problems and make sense of our world?
- How can collecting, organizing, and displaying data help us analyze information, and make reasonable predictions and informed decisions?

Focus Questions
- How are the base ten number system and fractions, decimals, percents and ratios related?
- How do you use patterns, relations, and functions to model real world situations?
- How do you represent and analyze mathematical situations and structures using algebraic symbols?
- How can you use algebraic models to represent and understand quantitative relationships?
- How do you analyze change in various contexts?
- How can fractions, decimals, percents and ratios be used to describe and model real world problems?
- How can you locate, label, and order numbers on number lines and scales?
- How do you use the properties of exponents to solve a variety of real world problems?
- How do you use visualization, spatial reasoning, and geometric modeling to solve problems?
- How do you find the area, perimeter, surface area, and volume of polygons and solids?
- How do you use the Pythagorean Theorem to solve real world problems?
- How do you apply transformations and use symmetry to analyze mathematical situations?
- How do you select the appropriate statistical method to analyze data?
- How do you evaluate inferences and predictions that are based on data?
- How do you apply basic concepts of probability in the real world?
- How do you collect and organize data and display it?

UNITS OF STUDY

1. Algebraic Reasoning: Patterns and Functions

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.
1.1a Students should analyze physical phenomena, functions and patterns to identify relationships and make generalizations.

1.2 Students should represent and analyze quantitative relationships in a variety of ways.
1.2a Students should describe the affects of characteristics of linear relationships on the way the relationship is represented verbally and in tables, graphs and equations.

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

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

Focus Questions
- How do you use patterns, relations, and functions to model real world situations?
- How do you represent and analyze mathematical situations and structures using algebraic symbols?
- How can you use algebraic models to represent and understand quantitative relationships?
- How do you analyze change in various contexts?

Core Topics
- Relations and functions
- Linear equations and inequalities
- Order of operations and properties of numbers
- Graphs and tables
- The coordinate plane
- Rational numbers and operations

Unit Objectives
Students will be able to:
- model and describe patterns and functional relationships.
- model and analyze quantitative data.
- use algebraic symbols to represent and interpret data and physical phenomena.
- develop and apply units, systems, formulas, and appropriate tools to estimate and measure.

- use a variety of numerical representations in the base ten system to describe quantitative relationships.

Skill Objectives
Students will:
- use tables, graphs and equations to represent mathematical relationships and solve real-world equations.
- given a system of linear equations with one point of intersection, recognize that a variety of methods may be used to find the solution, including algebraic and graphical methods.
- identify functions as linear and nonlinear and compare and contrast their properties using tables, graphs and equations.
- investigate solving problems involving direct variation.
- use a graphing calculator to represent and to describe a linear function with tables, patterns, graphs and equations.
- recognize that on the coordinate plane, lines with the same slope are parallel and lines with different slopes intersect.
- given a system of two linear equations, identify whether they represent pairs of lines that have none, one or infinitely many points of intersection.
- solve problems that involve repetitive patterns and iterations, such as compound interest, using tables, spreadsheets and calculators.
- use order of operations, the distributive, associative, and commutative properties, identities and inverses to simplify computations with rational numbers and to write and solve multi-step problems in a variety of contexts.
- estimate reasonable answers and solve a variety of problems involving multi-step operations with rational numbers in various notation forms.
- solve a variety of problems involving integers, powers, roots, absolute value and scientific notation.
- use the rules for exponents to multiply and divide with powers of ten, including negative exponents.

Sample Assessment
Mountain Bike

Pacing
12 weeks

2. Numerical and Proportional Reasoning

Math Standards

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.

2.1a Students should compare and order integers, powers, and roots using number lines and grids.

2.1b Students should extend the understanding of scientific notation to very small numbers.

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

2.2a Students should solve problems involving fractions, decimals, ratios and percents.

2.2b Students should make generalizations about operations with very large and very small numbers.

2.2c Students should connect the exponential growth and decay models to repeated multiplication by the same factor.

Essential Question
- How are quantitative relationships represented by numbers?

Focus Questions
- How are the base ten number system and fractions, decimals, percents and ratios related?
- How can fractions, decimals, percents and ratios be used to describe and model real world problems?
- How can you locate, label, and order numbers on number lines and scales?
- How do you use the properties of exponents to solve a variety of real world problems?

Core Topics
- Computation with real numbers
- Rational and irrational numbers
- Equivalence of fractions, decimals, percents, and ratios
- Number lines and grids
- Properties of exponents

Unit Objectives

Students will be able to:
- use a variety of numerical representations in the base ten system to describe quantitative relationships.
- use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.

Skill Objectives

Students will:

- locate, label and order rational numbers on number lines, scales, coordinate grids and measurement tools.
- write a rational number in equivalent notation forms as a fraction, mixed number, improper fraction, decimal, ratio, percent, expanded form, powers of ten and scientific notation.
- use order of operations, the distributive, associative, and commutative properties, identities and inverses to simplify computations with rational numbers and to write and solve multi-step problems in a variety of contexts.
- estimate reasonable answers and solve a variety of problems involving multi-step operations with rational numbers in various notation forms.
- use and describe methods for estimating and judging the reasonableness of computations with rational numbers.
- recognize the value and limitations of estimates and assess the amount of error resulting from estimates.
- identify, locate on number lines and grids, compare, order and use integers, powers and roots.
- solve a variety of problems involving integers, powers, roots, absolute value and scientific notation.
- use the rules for exponents to multiply and divide with powers of ten, including negative exponents.
- develop, describe and use a variety of methods to estimate and calculate mentally with very large and very small numbers.

Sample Assessment

Planning A Field Trip

Pacing

8.5 weeks

<p style="text-align:center">3. Geometry and Measurement</p>

Math Standards

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

3.1a Students should explore the relationships among sides, angles, perimeters, areas, surface areas and volumes of congruent and similar polygons and solids.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

3.2a Students should model geometric relationships in a variety of ways.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

3.3a Students should use a variety of concrete methods including displacement to find volumes of solids.

3.3b Students should solve problems involving measurement through the use of appropriate tools, techniques and strategies.

Essential Question
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions
- How do you use visualization, spatial reasoning, and geometric modeling to solve problems?
- How do you find the area, perimeter, surface area, and volume of polygons and solids?
- How do you use the Pythagorean Theorem to solve real world problems?
- How do you apply transformations and use symmetry to analyze mathematical situations?

Core Topics
- The Pythagorean Theorem
- Polygons and solids
- Transformations
- Surface area and volume

Unit Objectives

Students will be able to:
- apply units, systems, formulas, and appropriate tools to estimate and measure.
- use special reasoning, location, and geometric relationships to solve problems.
- use attributes of two and three dimensional shapes and geometric theorems to describe relationships, communicate ideas, and solve problems.

Skill Objectives

Students will:

- make and test conjectures about relationships among sides, angles, perimeters, areas, surface areas and volumes of congruent and similar polygons and solids.
- explain the effect of scale factors on the length, area, and volume ratios of similar polygons and solids.
- investigate the diameter and height relationships among the volumes of cylinders, cones and spheres.
- estimate, measure, derive and use formulas and strategies to find the perimeter, area, surface area and volume of various regular and irregular polygons and solids.
- represent the numerical and geometrical relationships of surface area and volume of solids using nets and formulas.
- describe the accuracy of estimates and measures and the precision of measurement tools.
- solve simple dimensional analysis problems involving rates as it applies to velocity and density.
- investigate the relationship of the sides of triangles and the area of squares constructed off each side. Deduce and apply the Pythagorean theorem to solve indirect measurement problems.
- use coordinate geometry to explore and test relationships of parallel and perpendicular lines, congruence, similarity and transformations.
- use reflection, rotation and translation of polygons with line and rotational symmetry to find a single transformation that will produce the same result as a series of transformations.
- describe relationships such as parallels, perpendiculars, bisections, medians and mid-segments and how the same relationships are related to the slope and intersection of lines on the coordinate grid.

Sample Assessment

Popping for Profits

Pacing

9 weeks

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4. Probability and Statistics

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Math Standards

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.

4.1a Students should construct appropriate representations of data based on the size and kind of data set and the purpose for its use.

4.2 Students should analyze data sets to form hypotheses and make predictions.

4.2a Students should make and evaluate statistical claims and justify conclusions with evidence.

4.3 Students should understand and apply basic concepts of probability.

4.3a Students should determine possible outcomes using a variety of counting techniques.

Essential Question
- How can collecting, organizing, and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- How do you select the appropriate statistical method to analyze data?
- How do you evaluate inferences and predictions that are based on data?
- How do you apply basic concepts of probability in the real world?
- How do you collect and organize data and display it?

Core Topics
- Data collections and displays
- Measures of central tendency
- Combinations and permutations
- Inferences and predictions

Unit Objectives

Students will be able to:
- collect, organize, and display data using appropriate statistical and graphical methods.
- understand and apply basic concepts of probability.
- analyze data sets to form hypotheses and make predictions.

Skill Objectives

Students will:
- use technology to collect, organize, display, compare, make predictions and analyze the results of large data sets.
- construct scatter plots and evaluate the effects of variables using line-of-best-fit.
- make inferences, formulate and evaluate hypotheses and conclusions based on experimental data for independent and dependent events. Compare data to predictions and to theoretical expectations.

- construct a variety of data displays, including box-and-whisker plots, and identify where measures of central tendency and dispersion are found in graphical displays.
- analyze and interpret data using descriptive statistics including range, mode, median, quartiles, outliers and mean.
- describe the role of random sampling, random number generation and the effects of sample size in statistical claims.
- use combinations and permutations, trees, networks (counting strategies) in a variety of contexts, and identify when order is irrelevant in determining a solution.

Sample Assessment
Mascot Problem

Pacing
9 weeks