VALWOOD

GO BEYOND

Eighth Grade Math Curriculum

8th Grade Algebra Mathematics Overview

Course Description

Algebra I covers many concepts that will build on previous math courses while preparing them to have a strong foundation for the rest of their math careers. Many topics will be discussed such as writing, solving, and graphing equations and inequalities, exponent rules, polynomials, rational and radical expressions, and functions. Fluency in these concepts is our goal in order to gain the skills students need to apply these concepts to the strong emphasis that is placed on problem solving skills. Students will know how to apply their knowledge of Algebra to aid them in real life applications. Students will be taught to use the graphing calculator as an aid in solving equations and problem solving.

Topics at a Glance

- Irrational numbers and radicals
- Positive and negative exponents
- Define functions and compare relations
- Write, graph and use linear equations
- Patterns of association in bivariate data
- Two and Three-dimensional Geometry
- Solve a given system of linear equations by graphing, simple substitution and simple elimination methods.

Assessments

- Formative and summative classroom assessments
- School level assessments
- State level assessment
- District high school transition assessment

Grade Level Expectations
1. In the real number system, rational and irrational numbers are in one to one correspondence on the number line.
1. Linear functions model situations with a constant rate of change and can be represented numerically, algebraically, and graphically 2. Properties of algebra and equality are used to solve linear equations and systems of equations 3. Graphs, tables and equations can be used to distinguish between linear and nonlinear functions
1. Visual displays and summary statistics of two-variable data condense the information in data sets into usable knowledge
1. Transformations of objects can be used to define the concepts of congruence and similarity 2. Direct and indirect measurement can be used to describe and make comparisons

Effective Components

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

1. Number Sense, Properties, and Operations

Number sense provides students with a firm foundation in mathematics. Students build a deep understanding of quantity, ways of representing numbers, relationships among numbers, and number systems. Students learn that numbers are governed by properties, and understanding these properties leads to fluency with operations.

Valwood Graduate Competencies

The Valwood graduate competencies are the preschool through twelfth-grade concepts and skills that all graduates will be able to demonstrate.

Valwood Graduate Competencies in the Number Sense, Properties, and Operations Standard are:

- Understand the structure and properties of our number system. At their most basic level numbers are abstract symbols that represent real-world quantities
- Understand quantity through estimation, precision, order of magnitude, and comparison. The reasonableness of answers relies on the ability to judge appropriateness, compare, estimate, and analyze error
- Are fluent with basic numerical and symbolic facts and algorithms, and are able to select and use appropriate (mental math, paper and pencil, and technology) methods based on an understanding of their efficiency, precision, and transparency
- Make both relative (multiplicative) and absolute (arithmetic) comparisons between quantities. Multiplicative thinking underlies proportional reasoning
- Understand that equivalence is a foundation of mathematics represented in numbers, shapes, measures, expressions, and equations
- Apply transformation to numbers, shapes, functional representations, and data

Content Area: Mathematics - Eighth Grade

Standard: 1. Number Sense, Properties, and Operations

Valwood Graduates:

Understand the structure and properties of our number system. At their most basic level numbers are abstract symbols that represent real-world quantities.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. In the real number system, rational and irrational numbers are in one to one correspondence to points on the number line.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Define irrational numbers. b. Demonstrate informally that every number has a decimal expansion. i. For rational numbers show that the decimal expansion repeats eventually. ii. Convert a decimal expansion which repeats eventually into a rational number. c. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions. d. Apply the properties of integer exponents to generate equivalent numerical expressions. e. Use square root and cube root symbols to represent solutions to equations of the form $x2=p$ and $x3=p$, where p is a positive rational number. f. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. g. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. h. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. i. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. ii. Interpret scientific notation that has been generated by technology.	**Inquiry Questions:** 1. Why are real numbers represented by a number line and why are the integers represented by points on the number line? 2. Why is there no real number closest to zero? 3. What is the difference between rational and irrational numbers? **Relevance and Application:** 1. Irrational numbers have applications in geometry such as the length of a diagonal of a one by one square, the height of an equilateral triangle, or the area of a circle. 2. Different representations of real numbers are used in contexts such as measurement (metric and customary units), business (profits, network down time, productivity), and community (voting rates, population density). 3. Technologies such as calculators and computers enable people to order and convert easily among fractions, decimals, and percents. **Nature of Discipline:** 1. Mathematics provides a precise language to describe objects and events and the relationships among them. 2. Mathematicians reason abstractly and quantitatively. 3. Mathematicians use appropriate tools strategically. 4. Mathematicians attend to precision.

2. Patterns, Functions, and Algebraic Structures

Pattern sense gives students a lens with which to understand trends and commonalities. Being a student of mathematics involves recognizing and representing mathematical relationships and analyzing change. Students learn that the structures of algebra allow complex ideas to be expressed succinctly.

Valwood Graduate Competencies
The Valwood graduate competencies are the preschool through twelfth-grade concepts and skills that all graduates will be able to demonstrate.

Valwood Graduate Competencies in the 2. Patterns, Functions, and Algebraic Structures Standard are:

- Are fluent with basic numerical and symbolic facts and algorithms, and are able to select and use appropriate (mental math, paper and pencil, and technology) methods based on an understanding of their efficiency, precision, and transparency
- Understand that equivalence is a foundation of mathematics represented in numbers, shapes, measures, expressions, and equations
- Make sound predictions and generalizations based on patterns and relationships that arise from numbers, shapes, symbols, and data
- Make claims about relationships among numbers, shapes, symbols, and data and defend those claims by relying on the properties that are the structure of mathematics
- Use critical thinking to recognize problematic aspects of situations, create mathematical models, and present and defend solutions

Content Area: Mathematics - Eighth Grade

Standard: 2. Patterns, Functions, and Algebraic Structures

Valwood Graduates:

Understand that equivalence is a foundation of mathematics represented in numbers, shapes, measures, expressions, and equations.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. Linear functions model situations with a constant rate of change and can be represented numerically, algebraically, and graphically.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Describe the connections between proportional relationships, lines, and linear equations. b. Graph proportional relationships, interpreting the unit rate as the slope of the graph. c. Compare two different proportional relationships represented in different ways. d. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. e. Derive the equation y = mx for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.	**Inquiry Questions:** 1. How can different representations of linear patterns present different perspectives of situations? 2. How can a relationship be analyzed with tables, graphs, and equations? 3. Why is one variable dependent upon the other in relationships? **Relevance and Application:** 1. Fluency with different representations of linear patterns allows comparison and contrast of linear situations such as service billing rates from competing companies or simple interest on savings or credit. 2. Understanding slope as rate of change allows individuals to develop and use a line of best fit for data that appears to be linearly related. 3. The ability to recognize slope and y-intercept of a linear function facilitates graphing the function or writing an equation that describes the function. **Nature of Discipline:** 1. Mathematicians represent functions in multiple ways to gain insights into the relationships they model. 2. Mathematicians model with mathematics.

Content Area: Mathematics - Eighth Grade

Standard: 2. Patterns, Functions, and Algebraic Structures

Valwood Graduates:

Are fluent with basic numerical and symbolic facts and algorithms, and are able to select and use appropriate (mental math, paper and pencil, and technology) methods based on an understanding of their efficiency, precision, and transparency.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. Properties of algebra and equality are used to solve linear equations and systems of equations.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Solve linear equations in one variable. i. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. ii. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. b. Analyze and solve pairs of simultaneous linear equations. i. Explain that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. ii. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. iii. Solve real-world and mathematical problems leading to two linear equations in two variables.	**Inquiry Questions:** 1. What makes a solution strategy both efficient and effective? 2. How is it determined if multiple solutions to an equation are valid? 3. How does the context of the problem affect the reasonableness of a solution? 4. Why can two equations be added together to get another true equation? **Relevance and Application:** 1. The understanding and use of equations, inequalities, and systems of equations allows for situational analysis and decision-making. For example, it helps people choose cell phone plans, calculate credit card interest and payments, and determine health insurance costs. 2. Recognition of the significance of the point of intersection for two linear equations helps to solve problems involving two linear rates such as determining when two vehicles traveling at constant speeds will be in the same place, when two calling plans cost the same, or the point when profits begin to exceed costs. **Nature of Discipline:** 1. Mathematics involves visualization. 2. Mathematicians use tools to create visual representations of problems and ideas that reveal relationships and meaning. 3. Mathematicians make sense of problems and persevere in solving them. 4. Mathematicians use appropriate tools strategically.

Content Area: Mathematics - Eighth Grade

Standard: 2. Patterns, Functions, and Algebraic Structures

Valwood Graduates:

Use critical thinking to recognize problematic aspects of situations, create mathematical models, and present and defend solutions.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

3. Graphs, tables and equations can be used to distinguish between linear and nonlinear functions.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Define, evaluate, and compare functions. i. Define a function as a rule that assigns to each input exactly one output. ii. Show that the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. iii. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). iv. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line. v. Give examples of functions that are not linear. b. Use functions to model relationships between quantities. i. Construct a function to model a linear relationship between two quantities. ii. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. iii. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. iv. Describe qualitatively the functional relationship between two quantities by analyzing a graph. v. Sketch a graph that exhibits the qualitative features of a function that has been described verbally. vi. Analyze how credit and debt impact personal financial goals.	**Inquiry Questions:** 1. How can change best be represented mathematically? 2. Why are patterns and relationships represented in multiple ways? 3. What properties of a function make it a linear function? **Relevance and Application:** 1. Recognition that non-linear situations is a clue to non-constant growth over time helps to understand such concepts as compound interest rates, population growth, appreciations, and depreciation. 2. Linear situations allow for describing and analyzing the situation mathematically such as using a line graph to represent the relationships of the circumference of circles based on diameters. **Nature of Discipline:** 1. Mathematics involves multiple points of view. 2. Mathematicians look at mathematical ideas arithmetically, geometrically, analytically, or through a combination of these approaches. 3. Mathematicians look for and make use of structure. 4. Mathematicians look for and express regularity in repeated reasoning.

3. Data Analysis, Statistics, and Probability

Data and probability sense provides students with tools to understand information and uncertainty. Students ask questions and gather and use data to answer them. Students use a variety of data analysis and statistics strategies to analyze, develop and evaluate inferences based on data. Probability provides the foundation for collecting, describing, and interpreting data.

Valwood Graduate Competencies
The Valwood graduate competencies are the preschool through twelfth-grade concepts and skills that all graduates will be able to demonstrate.

Valwood Graduate Competencies in the 3. Data Analysis, Statistics, and Probability Standard are:

- Recognize and make sense of the many ways that variability, chance, and randomness appear in a variety of contexts
- Solve problems and make decisions that depend on understanding, explaining, and quantifying the variability in data
- Communicate effective logical arguments using mathematical justification and proof. Mathematical argumentation involves making and testing conjectures, drawing valid conclusions, and justifying thinking
- Use critical thinking to recognize problematic aspects of situations, create mathematical models, and present and defend solutions

Content Area: Mathematics - Eighth Grade

Standard: 3. Data Analysis, Statistics, and Probability

Valwood Graduates:

Solve problems and make decisions that depend on understanding, explaining, and quantifying the variability in data.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. Visual displays and summary statistics of two-variable data condense the information in data sets into usable knowledge.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. b. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. c. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. d. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. e. Explain patterns of association seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. i. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. ii. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	**Inquiry Questions:** 1. How is it known that two variables are related to each other? 2. How is it known that an apparent trend is just a coincidence? 3. How can correct data lead to incorrect conclusions? 4. How do you know when a credible prediction can be made? **Relevance and Application:** 1. The ability to analyze and interpret data helps to distinguish between false relationships such as developing superstitions from seeing two events happen in close succession versus identifying a credible correlation. 2. Data analysis provides the tools to use data to model relationships, make predictions, and determine the reasonableness and limitations of those predictions. For example, predicting whether staying up late affects grades, or the relationships between education and income, between income and energy consumption, or between the unemployment rate and GDP. **Nature of Discipline:** 1. Mathematicians discover new relationship embedded in information. 2. Mathematicians construct viable arguments and critique the reasoning of others. 3. Mathematicians model with mathematics.

4. Shape, Dimension, and Geometric Relationships

Geometric sense allows students to comprehend space and shape. Students analyze the characteristics and relationships of shapes and structures, engage in logical reasoning, and use tools and techniques to determine measurement. Students learn that geometry and measurement are useful in representing and solving problems in the real world as well as in mathematics.

Valwood Graduate Competencies
The Valwood graduate competencies are the preschool through twelfth-grade concepts and skills that all graduates will be able to demonstrate.

Valwood Graduate Competencies in the 4. Shape, Dimension, and Geometric Relationships standard are:

- Understand quantity through estimation, precision, order of magnitude, and comparison. The reasonableness of answers relies on the ability to judge appropriateness, compare, estimate, and analyze error
- Make sound predictions and generalizations based on patterns and relationships that arise from numbers, shapes, symbols, and data
- Apply transformation to numbers, shapes, functional representations, and data
- Make claims about relationships among numbers, shapes, symbols, and data and defend those claims by relying on the properties that are the structure of mathematics
- Use critical thinking to recognize problematic aspects of situations, create mathematical models, and present and defend solutions

Content Area: Mathematics - Eighth Grade

Standard: 4. Shape, Dimension, and Geometric Relationships

Valwood Graduates:

Apply transformation to numbers, shapes, functional representations, and data.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. Transformations of objects can be used to define the concepts of congruence and similarity.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Verify experimentally the properties of rotations, reflections, and translations. b. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. c. Demonstrate that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations. d. Given two congruent figures, describe a sequence of transformations that exhibits the congruence between them. e. Demonstrate that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. f. Given two similar two-dimensional figures, describe a sequence of transformations that exhibits the similarity between them. g. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	**Inquiry Questions:** 1. What advantage, if any, is there to using the Cartesian coordinate system to analyze the properties of shapes? 2. How can you physically verify that two lines are really parallel? **Relevance and Application:** 1. Dilations are used to enlarge or shrink pictures. 2. Rigid motions can be used to make new patterns for clothing or architectural design. **Nature of Discipline:** 1. Geometry involves the investigation of invariants. Geometers examine how some things stay the same while other parts change to analyze situations and solve problems. 2. Mathematicians construct viable arguments and critique the reasoning of others. 3. Mathematicians model with mathematics.

Content Area: Mathematics - Eighth Grade

Standard: 4. Shape, Dimension, and Geometric Relationships

Valwood Graduates:

Use critical thinking to recognize problematic aspects of situations, create mathematical models, and present and defend solutions.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. Direct and indirect measurement can be used to describe and make comparisons.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Explain a proof of the Pythagorean Theorem and its converse. b. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. c. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. d. State the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	**Inquiry Questions:** 1. Why does the Pythagorean Theorem only apply to right triangles? 2. How can the Pythagorean Theorem be used for indirect measurement? 3. How are the distance formula and the Pythagorean theorem the same? Different? 4. How are the volume formulas for cones, cylinders, prisms and pyramids interrelated? 5. How is volume of an irregular figure measured? 6. How can cubic units be used to measure volume for curved surfaces?
	Relevance and Application: 1. The understanding of indirect measurement strategies allows measurement of features in the immediate environment such as playground structures, flagpoles, and buildings. 2. Knowledge of how to use right triangles and the Pythagorean Theorem enables design and construction of such structures as a properly pitched roof, handicap ramps to meet code, structurally stable bridges, and roads. 3. The ability to find volume helps to answer important questions such as how to minimize waste by redesigning packaging or maximizing volume by using a circular base.
	Nature of Discipline: 1. Mathematicians use geometry to model the physical world. Studying properties and relationships of geometric objects provides insights in to the physical world that would otherwise be hidden. 2. Geometric objects are abstracted and simplified versions of physical objects 3. Mathematicians make sense of problems and persevere in solving them.

	4. Mathematicians construct viable arguments and critique the reasoning of others.