VALWOOD

GO BEYOND

Seventh Grade Math Curriculum

7th Grade Math Overview

Course Description

The goal of this course is to prepare the students for Algebra I or Algebra I Honors their final year of middle school. The class begins with a review of operations with rational numbers, and continues as the students master understanding expressions, solving multistep linear equations & inequalities, exploring exponents, and functions. Students will also explore rates, ratios, proportions, as well as geometry and probability.

Topics at a Glance

- Solve one and two-step linear equations
- Understanding linear relationships and solving linear equations and inequalities in one variable
- Application of rational numbers in problem-solving situations
- Proportional relationships
- Two and three-dimensional-Geometry
- Probability

Assessments

- Formative and summative classroom assessments
- Teacher created assessments
- Standardized test assessments

Grade Level Expectations

1. Proportional reasoning involves comparisons and multiplicative relationships among ratios
2. Formulate, represent, and use algorithms with rational numbers flexibly, accurately, and efficiently

1. Properties of arithmetic can be used to generate equivalent expressions
2. Equations and expressions model quantitative relationships and phenomena

1. Statistics can be used to gain information about populations by examining samples
2. Mathematical models are used to determine probability

1. Modeling geometric figures and relationships leads to informal spatial reasoning and proof
2. Linear measure, angle measure, area, and volume are fundamentally different and require different units of measure

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 - Seventh Grade

Standard: 1. Number Sense, Properties, and Operations

Valwood Graduates:

Make both relative (multiplicative) and absolute (arithmetic) comparisons between quantities. Multiplicative thinking underlies proportional reasoning.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. Proportional reasoning involves comparisons and multiplicative relationships among ratios.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Analyze proportional relationships and use them to solve real-world and mathematical problems. b. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. c. Identify and represent proportional relationships between quantities. i. Determine whether two quantities are in a proportional relationship. ii. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. iii. Represent proportional relationships by equations. iv. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate. d. Use proportional relationships to solve multistep ratio and percent problems.[4] i. Estimate and compute unit cost of consumables (to include unit conversions if necessary) sold in quantity	**Inquiry Questions:** 1. What information can be determined from a relative comparison that cannot be determined from an absolute comparison? 2. What comparisons can be made using ratios? 3. How do you know when a proportional relationship exists? 4. How can proportion be used to argue fairness? 5. When is it better to use an absolute comparison? 6. When is it better to use a relative comparison? **Relevance and Application:** 1. The use of ratios, rates, and proportions allows sound decision making in daily life such as determining best values when shopping, mixing cement or paint, adjusting recipes, calculating car mileage, using speed to determine travel time, or enlarging or shrinking copies. 2. Proportional reasoning is used extensively in the workplace. For example, determine dosages for medicine; develop scale models and drawings; adjust salaries and benefits; or prepare mixtures in laboratories. 3. Proportional reasoning is used extensively in geometry such as determining properties of similar figures, and comparing length, area, and volume of figures.

to make purchase decisions based on cost and practicality ii. Solve problems involving percent of a number, discounts, taxes, simple interest, percent increase, and percent decrease	**Nature of Discipline:** 1. Mathematicians look for relationships that can be described simply in mathematical language and applied to a myriad of situations. Proportions are a powerful mathematical tool because proportional relationships occur frequently in diverse settings. 2. Mathematicians reason abstractly and quantitatively. 3. Mathematicians construct viable arguments and critique the reasoning of others.

Content Area: Mathematics - Seventh Grade

Standard: 1. Number, Sense, Properties and Operations

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: Seventh Grade

Concepts and skills students master:

2. Formulate, represent, and use algorithms with rational numbers flexibly, accurately, and efficiently.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Apply understandings of addition and subtraction to add and subtract rational numbers including integers. i. Represent addition and subtraction on a horizontal or vertical number line diagram. ii. Describe situations in which opposite quantities combine to make 0. iii. Demonstrate p + q as the number located a distance q from p, in the positive or negative direction depending on whether q is positive or negative. iv. Show that a number and its opposite have a sum of 0 (are additive inverses). v. Interpret sums of rational numbers by describing real-world contexts. vi. Demonstrate subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). vii. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. viii. Apply properties of operations as strategies to add and subtract rational numbers. b. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers including integers. i. Apply properties of operations to multiplication of rational numbers. ii. Interpret products of rational numbers by describing real-world contexts. iii. Apply properties of operations to divide integers iv. Apply properties of operations as strategies to multiply and divide rational numbers. v. Convert a rational number to a decimal using long division.	**Inquiry Questions:** 1. How do operations with rational numbers compare to operations with integers? 2. How do you know if a computational strategy is sensible? 3. Is $0.\overline{9}$ equal to one? 4. How do you know whether a fraction can be represented as a repeating or terminating decimal? **Relevance and Application:** 1. The use and understanding algorithms help individuals spend money wisely. For example, compare discounts to determine best buys and compute sales tax. 2. Estimation with rational numbers enables individuals to make decisions quickly and flexibly in daily life such as estimating a total bill at a restaurant, the amount of money left on a gift card, and price markups and markdowns. 3. People use percentages to represent quantities in real-world situations such as amount and types of taxes paid, increases or decreases in population, and changes in company profits or worker wages). **Nature of Discipline:** 1. Mathematicians see algorithms as familiar tools in a tool chest. They combine algorithms in different ways and use them flexibly to accomplish various tasks. 2. Mathematicians make sense of problems and persevere in solving them. 3. Mathematicians construct viable arguments and critique the reasoning of others. 4. Mathematicians look for and make use of structure.

vi. Show that the decimal form of a rational number terminates in 0s or eventually repeats. c. Solve real-world and mathematical problems involving the four operations with rational numbers.	

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 - Seventh 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. Properties of arithmetic can be used to generate equivalent expressions.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Use properties of operations to generate equivalent expressions. i. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. ii. Demonstrate that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.	**Inquiry Questions:** 1. How do symbolic transformations affect an equation or expression? 2. How is it determined that two algebraic expressions are equivalent? **Relevance and Application:** 1. The ability to recognize and find equivalent forms of an equation allows the transformation of equations into the most useful form such as adjusting the density formula to calculate for volume or mass. **Nature of Discipline:** 1. Mathematicians abstract a problem by representing it as an equation. They travel between the concrete problem and the abstraction to gain insights and find solutions. 2. Mathematicians reason abstractly and quantitatively. 3. Mathematicians look for and express regularity in repeated reasoning.

Content Area: Mathematics - Seventh 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:

2. Equations and expressions model quantitative relationships and phenomena.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form,[2] using tools strategically. b. Apply properties of operations to calculate with numbers in any form, convert between forms as appropriate, and assess the reasonableness of answers using mental computation and estimation strategies. c. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. i. Fluently solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. ii. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. iii. Solve word problems[5] leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. iv. Graph the solution set of the inequality and interpret it in the context of the problem.	**Inquiry Questions:** 1. Do algebraic properties work with numbers or just symbols? Why? 2. Why are there different ways to solve equations? 3. How are properties applied in other fields of study? 4. Why might estimation be better than an exact answer? 5. When might an estimate be the only possible answer? **Relevance and Application:** 1. Procedural fluency with algebraic methods allows use of linear equations and inequalities to solve problems in fields such as banking, engineering, and insurance. For example, it helps to calculate the total value of assets or find the acceleration of an object moving at a linearly increasing speed. 2. Comprehension of the structure of equations allows one to use spreadsheets effectively to solve problems that matter such as showing how long it takes to pay off debt, or representing data collected from science experiments. 3. Estimation with rational numbers enables quick and flexible decision-making in daily life. For example, determining how many batches of a recipe can be made with given ingredients, how many floor tiles to buy with given dimensions, the amount of carpeting needed for a room, or fencing required for a backyard. **Nature of Discipline:** 1. Mathematicians model with mathematics.

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 - Seventh Grade

Standard: 3. Data Analysis, Statistics, and Probability

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:

1. Statistics can be used to gain information about populations by examining samples.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Use random sampling to draw inferences about a population. i. Explain that generalizations about a population from a sample are valid only if the sample is representative of that population. ii. Explain that random sampling tends to produce representative samples and support valid inferences. iii. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. iv. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. b. Draw informal comparative inferences about two populations. i. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. ii. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	**Inquiry Questions:** 1. How might the sample for a survey affect the results of the survey? 2. How do you distinguish between random and bias samples? 3. How can you declare a winner in an election before counting all the ballots? **Relevance and Application:** 1. The ability to recognize how data can be biased or misrepresented allows critical evaluation of claims and avoids being misled. For example, data can be used to evaluate products that promise effectiveness or show strong opinions. 2. Mathematical inferences allow us to make reliable predictions without accounting for every piece of data. **Nature of Discipline:** 1. Mathematicians are informed consumers of information. They evaluate the quality of data before using it to make decisions. 2. Mathematicians use appropriate tools strategically.

Content Area: Mathematics - Seventh Grade

Standard: 3. Data Analysis, Statistics, and Probability

Valwood Graduates:

Recognize and make sense of the many ways that variability, chance, and randomness appear in a variety of contexts.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. Mathematical models are used to determine probability.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Explain that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. b. Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. c. Develop a probability model and use it to find probabilities of events. i. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. ii. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. iii. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. d. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. i. Explain that the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.	**Inquiry Questions:** 1. Why is it important to consider all of the possible outcomes of an event? 2. Is it possible to predict the future? How? 3. What are situations in which probability cannot be used? **Relevance and Application:** 1. The ability to efficiently and accurately count outcomes allows systemic analysis of such situations as trying all possible combinations when you forgot the combination to your lock or deciding to find a different approach when there are too many combinations to try; or counting how many lottery tickets you would have to buy to play every possible combination of numbers. 2. The knowledge of theoretical probability allows the development of winning strategies in games involving chance such as knowing if your hand is likely to be the best hand or is likely to improve in a game of cards. **Nature of Discipline:** 1. Mathematicians approach problems systematically. When the number of possible outcomes is small, each outcome can be considered individually. When the number of outcomes is large, a mathematician will develop a strategy to consider the most important outcomes such as the most likely outcomes, or the most dangerous outcomes. 2. Mathematicians construct viable arguments and critique the reasoning of others. 3. Mathematicians model with mathematics.

ii. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. iii. For an event described in everyday language identify the outcomes in the sample space which compose the event. iv. Design and use a simulation to generate frequencies for compound events.	

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 - Seventh 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. Modeling geometric figures and relationships leads to informal spatial reasoning and proof.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: Draw construct, and describe geometrical figures and describe the relationships between them. i. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. ii. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. iii. Construct triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. iv. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	**Inquiry Questions:** 1. Is there a geometric figure for any given set of attributes? 2. How does scale factor affect length, perimeter, angle measure, area and volume? 3. How do you know when a proportional relationship exists? **Relevance and Application:** 1. The understanding of basic geometric relationships helps to use geometry to construct useful models of physical situations such as blueprints for construction, or maps for geography. 2. Proportional reasoning is used extensively in geometry such as determining properties of similar figures, and comparing length, area, and volume of figures. **Nature of Discipline:** 1. Mathematicians create visual representations of problems and ideas that reveal relationships and meaning. 2. The relationship between geometric figures can be modeled 3. Mathematicians look for relationships that can be described simply in mathematical language and applied to a myriad of situations. Proportions are a powerful mathematical tool because proportional relationships occur frequently in diverse settings. 4. Mathematicians use appropriate tools strategically. 5. Mathematicians attend to precision.

Content Area: Mathematics - Seventh Grade

Standard: 4. Shape, Dimension, and Geometric Relationships

Valwood Graduates:

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.

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. Linear measure, angle measure, area, and volume are fundamentally different and require different units of measure.

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. State the formulas for the area and circumference of a circle and use them to solve problems. b. Give an informal derivation of the relationship between the circumference and area of a circle. c. Use properties of supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. d. Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	**Inquiry Questions:** 1. How can geometric relationships among lines and angles be generalized, described, and quantified? 2. How do line relationships affect angle relationships? 3. Can two shapes have the same volume but different surface areas? Why? 4. Can two shapes have the same surface area but different volumes? Why? 5. How are surface area and volume like and unlike each other? 6. What do surface area and volume tell about an object? 7. How are one-, two-, and three-dimensional units of measure related? 8. Why is pi an important number?
	Relevance and Application: 1. The ability to find volume and surface area helps to answer important questions such as how to minimize waste by redesigning packaging, or understanding how the shape of a room affects its energy use.
	Nature of Discipline: 1. Geometric objects are abstracted and simplified versions of physical objects. 2. Geometers describe what is true about all cases by studying the most basic and essential aspects of objects and relationships between objects. 3. Mathematicians make sense of problems and persevere in solving them. 4. Mathematicians construct viable arguments and critique the reasoning of others.