

## Sixth Grade Mathematics

**Description** The Appleton Area School District elementary mathematics program provides students opportunities to develop mathematical skills in thinking and applying problem-solving strategies. The framework of the program is based on providing students the knowledge of when and how to apply mathematical concepts and skills as well as an understanding of why the mathematical processes work.

### Credits

### Prerequisites

**Textbooks/Resources** Fuson, Dr. Karen C. *Math Expressions: Student Activity Book Volume 1&2*. Houghton Mifflin Harcourt, 2012. ISBN# 978-0-547-56739-6

**Required Assessments** District-wide, standards-based assessments identified

**Board Approved** April 1999

**Revised** September 2009

## AASD Mathematics Goals for K-12 Students

- *Become mathematical problem solvers.*
- *Learn to reason mathematically.*
- *Learn to communicate mathematically.*
- *Make mathematical connections.*
- *Develop conceptual understanding of mathematics.*
- *Develop procedural fluency.*
- *Learn to use technology appropriately.*

## AASD Mathematics Standards for Students in Grade Six

### Mathematical Practice Standards

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.

### Mathematics Content Standards

<u>Domain</u>	<u>Cluster</u>
<b>I. Ratios and Proportional Relationships</b>	A. Understand ratio concepts and use ratio reasoning to solve problems.
<b>II. The Number System</b>	A. Apply and extend previous understandings of multiplication and division to divide fractions by fractions. B. Compute fluently with multi-digit numbers and find common factors and multiples. C. Apply and extend previous understandings of numbers to the system of rational numbers.
<b>III. Expressions and Equations</b>	A. Apply and extend previous understandings of arithmetic to algebraic expressions. B. Reason about and solve one-variable equations and inequalities. C. Represent and analyze quantitative relationships between dependent and independent variables.
<b>IV. Geometry</b>	A. Solve real-world and mathematical problems involving area, surface area, and volume.
<b>V. Statistics and Probability</b>	A. Develop understanding of statistical variability. B. Summarize and describe distributions.

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>1. Develop deep conceptual understanding of mathematics by engaging in age-appropriate mathematical habits.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. makes Sense of problems and perseveres in solving them.</li> <li>b. reasons abstractly and quantitatively.</li> <li>c. constructs viable arguments and critiques the reasoning of others.</li> <li>d. models with mathematics.</li> <li>e. uses appropriate tools strategically.</li> <li>f. attends to precision.</li> <li>g. looks for and makes use of structure.</li> <li>h. looks for and expresses regularity in repeated reasoning.</li> </ul>	
<p><b>Objectives are linked to the Mathematical Practice Standards.</b></p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>2. Understand ratio concepts and use ratio reasoning to solve problems.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. understands the concept of a ratio and uses ratio language to describe a ratio relationship between two quantities. <i>For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.”</i></li> <li>b. understands the concept of a unit rate <math>a/b</math> associated with a ratio <math>a:b</math> with <math>b \neq 0</math>, and uses rate language in the context of a ratio relationship. <i>For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is <math>3/4</math> cup of flour for each cup of sugar.” “We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger.”</i></li> <li>c. uses ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.               <ul style="list-style-type: none"> <li>1. Makes tables of equivalent ratios relating quantities with whole-number measurements, finds missing values in the tables, and plots the pairs of values on the coordinate plane. Uses tables to compare ratios.</li> <li>2. Solves unit rate problems including those involving unit pricing and constant speed. <i>For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?</i></li> <li>3. Finds a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means <math>30/100</math> times the quantity); solves problems involving finding the whole, given a part and the percent.</li> <li>4. Uses ratio reasoning to convert measurement units; manipulates and transforms units appropriately when multiplying or dividing quantities.</li> </ul> </li> </ul>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b></p> <p>I. Ratios and Proportional Relationships</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>3. Apply and extend previous understandings of multiplication and division to divide fractions by fractions.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. interprets and computes quotients of fractions, and solves word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. <i>For example, create a story context for <math>(2/3) \div (3/4)</math> and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that <math>(2/3) \div (3/4) = 8/9</math> because <math>3/4</math> of <math>8/9</math> is <math>2/3</math>. (In general, <math>(a/b) \div (c/d) = ad/bc</math>.) How much chocolate will each person get if 3 people share <math>1/2</math> lb of chocolate equally? How many <math>3/4</math>-cup servings are in <math>2/3</math> of a cup of yogurt? How wide is a rectangular strip of land with length <math>3/4</math> mi and area <math>1/2</math> square mi?</i></p>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b> II. The Number System</p>		
<p><b>4. Compute fluently with multi-digit numbers and find common factors and multiples.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. fluently divides multi-digit numbers using the standard algorithm.</p> <p>b. fluently adds, subtracts, multiplies, and divides multi-digit decimals using the standard algorithm for each operation.</p> <p>c. finds the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Uses the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. <i>For example, express <math>36 + 8</math> as <math>4(9 + 2)</math>.</i></p>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b> II. The Number System</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>5. Apply and extend previous understandings of numbers to the system of rational numbers.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. understands that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); uses positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.</li> <li>b. understands a rational number as a point on the number line. Extends number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. <ul style="list-style-type: none"> <li>1. Recognizes opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognizes that the opposite of the opposite of a number is the number itself, e.g., <math>-(-3) = 3</math>, and that 0 is its own opposite.</li> <li>2. Understands signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognizes that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.</li> <li>3. Finds and positions integers and other rational numbers on a horizontal or vertical number line diagram; finds and positions pairs of integers and other rational numbers on a coordinate plane.</li> </ul> </li> <li>c. understands ordering and absolute value of rational numbers. <ul style="list-style-type: none"> <li>1. Interprets statements of inequality as statements about the relative position of two numbers on a number line diagram. <i>For example, interpret <math>-3 &gt; -7</math> as a statement that <math>-3</math> is located to the right of <math>-7</math> on a number line oriented from left to right.</i></li> <li>2. Writes, interprets, and explains statements of order for rational numbers in real-world contexts. <i>For example, write <math>-3^{\circ}\text{C} &gt; -7^{\circ}\text{C}</math> to express the fact that</i></li> </ul> </li> </ul>	

<b>5. Continued</b>	<p><i><math>-3^{\circ}\text{C}</math> is warmer than <math>-7^{\circ}\text{C}</math>.</i></p> <p>3. Understands the absolute value of a rational number as its distance from 0 on the number line; interprets absolute value as magnitude for a positive or negative quantity in a real-world situation. <i>For example, for an account balance of <math>-30</math> dollars, write <math> -30  = 30</math> to describe the size of the debt in dollars.</i></p> <p>4. Distinguishes comparisons of absolute value from statements about order. <i>For example, recognize that an account balance less than <math>-30</math> dollars represents a debt greater than 30 dollars.</i></p> <p>d. solves real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Includes use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.</p>	
<b>Objectives are linked to the following AASD Mathematics Domains:</b> II. The Number System		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>6. Apply and extend previous understandings of arithmetic to algebraic expressions.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. writes and evaluates numerical expressions involving whole-number exponents.</li> <li>b. writes, reads, and evaluates expressions in which letters stand for numbers.               <ul style="list-style-type: none"> <li>1. Writes expressions that record operations with numbers and with letters standing for numbers. <i>For example, express the calculation "Subtract y from 5" as <math>5 - y</math>.</i></li> <li>2. Identifies parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); views one or more parts of an expression as a single entity. <i>For example, describe the expression <math>2(8 + 7)</math> as a product of two factors; view <math>(8 + 7)</math> as both a single entity and a sum of two terms.</i></li> <li>3. Evaluates expressions at specific values of their variables. Includes expressions that arise from formulas used in real-world problems. Performs arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). <i>For example, use the formulas <math>V = s^3</math> and <math>A = 6s^2</math> to find the volume and surface area of a cube with sides of length <math>s = 1/2</math>.</i></li> </ul> </li> <li>c. applies the properties of operations to generate equivalent expressions. <i>For example, apply the distributive property to the expression <math>3(2 + x)</math> to produce the equivalent expression <math>6 + 3x</math>; apply the distributive property to the expression <math>24x + 18y</math> to produce the equivalent expression <math>6(4x + 3y)</math>; apply properties of operations to <math>y + y + y</math> to produce the equivalent expression <math>3y</math>.</i></li> <li>d. identifies when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). <i>For example, the expressions <math>y + y + y</math> and <math>3y</math> are equivalent because they name the same number regardless of which number <math>y</math> stands for.</i></li> </ul>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b> III. Expressions and Equations</p>		



Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>7. Reason about and solve one-variable equations and inequalities.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. understands solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Uses substitution to determine whether a given number in a specified set makes an equation or inequality true.</li> <li>b. uses variables to represent numbers and write expressions when solving a real-world or mathematical problem; understands that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.</li> <li>c. solves real-world and mathematical problems by writing and solving equations of the form <math>x + p = q</math> and <math>px = q</math> for cases in which <math>p</math>, <math>q</math> and <math>x</math> are all nonnegative rational numbers.</li> <li>d. writes an inequality of the form <math>x &gt; c</math> or <math>x &lt; c</math> to represent a constraint or condition in a real-world or mathematical problem. Recognizes that inequalities of the form <math>x &gt; c</math> or <math>x &lt; c</math> have infinitely many solutions; represents solutions of such inequalities on number line diagrams.</li> </ul>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b> III. Expressions and Equations</p>		
<p><b>8. Represent and analyze quantitative relationships between dependent and independent variables.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. uses variables to represent two quantities in a real-world problem that change in relationship to one another; writes an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyzes the relationship between the dependent and independent variables using graphs and tables, and relates these to the equation. <i>For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation <math>d = 65t</math> to represent the relationship between distance and time.</i></li> </ul>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b> III. Expressions and Equations</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>9. Solve real-world and mathematical problems involving area, surface area, and volume.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. finds the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; applies these techniques in the context of solving real-world and mathematical problems.</li> <li>b. finds the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and shows that the volume is the same as would be found by multiplying the edge lengths of the prism. Applies the formulas <math>V = l w h</math> and <math>V = b h</math> to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.</li> <li>c. draws polygons in the coordinate plane given coordinates for the vertices; uses coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Applies these techniques in the context of solving real-world and mathematical problems.</li> <li>d. represents three-dimensional figures using nets made up of rectangles and triangles, and uses the nets to find the surface area of these figures. Applies these techniques in the context of solving real-world and mathematical problems.</li> </ul>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b> IV. Geometry</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>10. Develop understanding of statistical variability.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. recognizes a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. <i>For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages.</i></li> <li>b. understands that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.</li> <li>c. recognizes that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.</li> </ul>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b>                      V. Statistics and Probability</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>11. Summarize and describe distributions.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. displays numerical data in plots on a number line, including dot plots, histograms, and box plots.</li> <li>b. summarizes numerical data sets in relation to their context, such as by:               <ul style="list-style-type: none"> <li>1. Reporting the number of observations.</li> <li>2. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</li> <li>3. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</li> <li>4. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</li> </ul> </li> </ul>	
<p><b>Objectives are linked to the following AASD Mathematics Domains:</b></p> <ul style="list-style-type: none"> <li>V. Statistics and Probability</li> </ul>		

**Resources and learning activities that address course objectives:**