DINWIDDIE COUNTY Public Schools

Math 6

Math Curriculum

Dinwiddie County Public Schools provides each student the opportunity to become a productive citizen, engaging the entire community in the educational needs of our children.

Math 6 Curriculum Guide

- The DCPS Curriculum Guide contains key concepts and SOL numbers for each week. These skill areas must be cross referenced with the DOE Enhanced Scope and Sequence and DOE Curriculum Framework.
- Grade Level(s): 6
- Prerequisite: none
- Course Description: The sixth-grade standards are a transition from the emphasis placed on whole number arithmetic in the elementary grades to foundations of algebra. The standards emphasize rational numbers. Students will use ratios to compare data sets; recognize decimals, fractions, and percents as ratios; solve single-step and multistep problems, using rational numbers; and gain a foundation in the understanding of integers. Students will solve linear equations and use algebraic terminology. Students will solve problems involving area, perimeter, and surface area, work with π (pi), and focus on the relationships among the properties of quadrilaterals. In addition, students will focus on applications of probability and statistics.

Virginia Department of Education Mathematics SOL Curriculum 2009 Framework

Virginia Department of Education Mathematics 2009 SOL Standards

Virginia Department of Education Mathematics 2016 SOL Standards - Effective 2018-2019

Mathematical Instructional Resources

Nine Weeks	Approximate # of Days Taught	Topic (New Information)	Targeted SOL (2016 SOL Standards)
1	7	**Integers** Identify, represent, order, compare and compute integers	6.3abc (6.6ab)
1	4	**Exponents** Investigate, compute and recognize patterns of positive exponents	6.5 (6.4)
1	2	**Sequences** Identify and extend geometric and arithmetic sequences	6.17 (AFDA.1/All.5)
1	5	**Order of Operations** Evaluate whole number numerical expressions, using the order of operations	6.8 (6.6)
1	6	**Number Properties** Investigate and recognize identity, multiplicative of zero, and inverse properties	6.19abc (EKS 6.6/6.13/6.14)
1	2	**Modeling Fractions** Demonstrate multiple representations of multiplication and division of fractions	6.4 (EKS 6.5)
1	10	**Fractions and decimals** Multiply, divide, add, and subtract fractions including mixed numbers and compute practical problems involving decimals	6.6ab (6.5abc)
1	9	**Equations** Solve one step equations	6.18 (6.13)

Nine Weeks	Approximate # of Days Taught	Topic	Targeted SOL
2	2	**Ratios** Describe and compare data using appropriate notations	6.1
2	6	**Proportions** *Represent and determine proportional relationships, determine the unit rate, and make connections proportional representations	*(NEW) 6.12*
2	7	**Inequalities** Solve and graph one step inequalities	6.20 (6.14)
1st Cumulative Assessment November 28			
2	10	**Fractions, Decimals, and Percentages** Investigate, identify, demonstrate, compare and order fractions, decimals and percents	6.2abc (6.2ab)
2	8	**Graphs** Construct, draw conclusions from data, compare and contrast graphs	6.14abc (6.10abc)
3	6	**Data Analysis** Describe mean as balance point and decide which measure of center is appropriate for a given purpose	6.15ab (6.11ab)
3	5	**Probability** Compare and contrast independent and dependent events; determine the probabilities for independent and dependent events	6.16ab (8.11ab)
3	5	**Metric vs. Customary** Make ballpark comparisons between Metric and Customary	6.9 (EKS 7.3)

*Crosswalk (Summary of Revisions): 2016 Mathematics Standards of Learning and Curriculum Framework

Nine Weeks	Approximate # of Days Taught	Topic	Targeted SOL
2nd Cumulative Assessment February 13			
3	6	**Polygons** Describe and identify properties of quadrilaterals	6.13 (7.6)
3	3	**Congruence** Determine congruence of line segments, angles, and polygons	6.12 (6.9)
3	8	**Circumference and Area of a Circle** Define pi; Solve for circumference and area of a circle given a radius or diameter	6.10ab (6.7ab)
4	7	**Area Perimeter, Volume, and Surface Area** Solve area and perimeter of rectangles and triangles; Determine volume and surface area of rectangular prisms	6.10cd (6.7c/7.4a)
4	6	**Coordinate Plane Graphing** Identify the coordinates of a point on a coordinate plane and graph ordered pairs	6.11 (6.8)
Mock SOL Assessment April 6th			
4	15	**SOL Preparation and Remediation**	ALL
4	ongoing	**Cumulative Review / Remediation/Extensions / STEAM**	ALL

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.1** The student will describe and compare data, using ratios, and will use appropriate notations, such as , *a* to *b*, and *a*:*b*.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Describe** a relationship within a set by comparing part of the set to the entire set. ● **Describe** a relationship between two sets by comparing part of one set to a corresponding part of the other set. ● **Describe** a relationship between two sets by comparing all of one set to all of the other set. ● **Describe** a relationship within a set by comparing one part of the set to another part of the same set. ● **Represent** a relationship in words that makes a comparison by using the notations $\frac{a}{b}$, *a*:*b*, and *a* to *b*. ● **Determine** a ratio from a pictorial representation. ● **Create** a relationship in words for a given ratio expressed symbolically. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Describe **Apply** – Represent **Create -** Create **Key Vocabulary** rate ratio	**Essential Questions and Understandings** ● What is a ratio? A *ratio* is a comparison of any two quantities. A ratio is used to represent relationships within a set and between two sets. A ratio can be written using fraction form , a colon (2:3), or the word *to* (2 to 3). **Teacher Notes and Elaborations** A *ratio* is a comparison of any two quantities. A ratio is used to represent relationships within and between sets. A ratio can compare: 1. part of a set to the entire set, (part-whole comparison), 2. part of a set to another part of the same set, (part-part comparison), 3. part of a set to a corresponding part of another set, (part-part comparison) 4. all of a set to all of another set, (whole-whole comparison); and 5. two parts of a whole (part-part comparison). The order of the quantities in a ratio is directly related to the order of the quantities expressed in the relationship. For example, if asked for the ratio of the number of cats to dogs in a park, the ratio must be expressed as the number of cats to the number of dogs, in that order. All fractions are ratios and vice versa. Like fractions, ratios may or may not be written in simplest form (e.g., $\frac{4}{6}$ may be simplified to $\frac{2}{3}$, 4:6 may be simplified to 2:3, or 4 to 6 may be simplified to 2 to 3). A ratio is a multiplicative comparison of two numbers, measures, or quantities. Equal ratios may be found by multiplying or dividing both quantities in a ratio by the same non-zero number. A *rate* is a comparison of two quantities with different units. Rates can be expressed as ratios. A percent is a ratio that compares a quantity to the number 100.

		In words the ratio $\frac{3}{5}$ could represent a relationship between 3 cups of concentrate and 5 cups of water needed to make orange juice. *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.1** The student will describe and compare data, using ratios, and will use appropriate notations such as $\frac{a}{b}$, *a* to *b*, and *a*:*b*.	**Teacher Notes and Elaborations** *(continued)* Other examples of creating a relationship in words for a given ratio expressed symbolically are: The ratio of hearts to stars is 3:5 or 3 to 5 or .  The ratio of stars to hearts is 5:3 or 5 to 3 or $\frac{5}{3}$. The ratio of hearts to stars using numbers other than 3 and 5 could be 6 to 10, 9:15, or . Practice with multiple representations of equivalent ratios includes identifying each picture in a series that represents the same ratio. Example: Given the following, identify each picture that has a ratio of 1:4 for the number of circles to triangles.  (The correct answer is the first, second, and fourth picture.)

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.1** **Foundational Objectives**	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	● Use students in the classroom to collect and compare data. For example: boys to girls or students to teachers ● Survey classmates on favorite color and write ratios from results. ● Use different manipulatives to design ratio situations to be recorded and discussed.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.2** The student will a. investigate and describe fractions, decimals and percents as ratios; b. identify a given fraction, decimal or percent from a representation; c. demonstrate equivalent relationships among fractions, decimals, and percents;* and d. compare and order fractions, decimals, and percents.* *SOL test items measuring Objective 6.2c-d will be completed **without** the use of a calculator.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Identify** the decimal and percent equivalents for numbers written in fraction form including repeating decimals. ● **Represent** fractions, decimals, and percents on a number line. ● **Describe** orally and in writing the equivalent relationships among decimals, percents, and fractions that have denominators that are factors of 100. ● **Represent** by shading a grid, a fraction, decimal, and percent. ● **Represent** in fraction, decimal, and percent form a given shaded region of a grid. ● **Compare** two fractions with denominators of 12 or less using manipulatives, pictorial representations, number lines, and symbols (<, ≤, ≥, >, =). ● **Compare** two decimals, through thousandths, using manipulatives, pictorial representations, number lines, and symbols (<, ≤, ≥, >, =). ● **Compare** two percents using pictorial representations and symbols (<, ≤, ≥, >, =). ● **Order** no more than 3 fractions, decimals, and percents (decimals through thousandths, fractions with denominators of 12 or less), in ascending or descending order. *(continued)*	**Essential Questions and Understandings** ● What is the relationship among fractions, decimals and percents? Fractions, decimals, and percents are three different ways to express the same number. A ratio can be written using fraction form $\left(\frac{2}{3}\right)$, a colon (2:3), or the word *to* (2 to 3). Any number that can be written as a fraction can be expressed as a terminating or repeating decimal or a percent. **Teacher Notes and Elaborations** Fractions, decimals and percents are equivalent forms representing a given number. A *fraction* is a number that can be expressed in the form , where $b \neq 0$. *Percent* means "per 100" or how many "out of 100"; percent is another name for hundredths. A number followed by a percent symbol (%) is *equivalent* (equal) to that number with a denominator of 100 (e.g.,). Percents can be expressed as fractions with a denominator of 100 (e.g., $75\% = \frac{75}{100}$ or $\frac{3}{4}$,). Percents can be expressed as *decimals* (a system for writing names of numbers based on the number 10) (e.g., ,). Some fractions can be rewritten as equivalent fractions with denominators of powers of 10, and can be represented as decimals or percents (e.g., $\frac{3}{5} = \frac{6}{10}$, , $\frac{60}{100} = 0.60$, 0.60 = 60%). One example of an equivalent ratio for the decimal 3.6 is $\frac{18}{5}$, . Decimals, fractions, and percents, can be represented using concrete materials (e.g., Base-10 blocks, number lines, decimal squares, or grid paper).

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.2** The student will a. investigate and describe fractions, decimals and percents as ratios; b. identify a given fraction, decimal or percent from a representation; c. demonstrate equivalent relationships among fractions, decimals, and percents;* and d. compare and order fractions, decimals, and percents.* *SOL test items measuring Objective 6.2c-d will be completed **without** the use of a calculator.	**Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Describe, Identify **Apply** – Represent, Order **Analyze -** Compare **Key Vocabulary** benchmark composite number decimal equivalent factor fraction greatest common factor inequality least common multiple multiple percent prime number prime factorization repeating decimal terminating decimal	**Teacher Notes and Elaborations** *(continued)* The grid above has been shaded to represent the fraction $\frac{12}{16}$ which can be simplified to $\frac{3}{4}$. This also represents 75% or 0.75. Experiences with grids should not be limited to 100's grids. Percents can be represented by drawing shaded regions on grids or by finding a location on number lines. Percents are used in the real-life, for taxes, sales, data description, and data comparison. Fractions can be ordered, compared, and interpreted by using the relationship between the numerator and denominator. Some fractions with unlike denominators may also be expressed as decimals or percents in order to compare them easily. The decimal point is a symbol that separates the whole number part from the fractional part of a number. The decimal point separates the whole number amount from the part of a number that is less than one. The symbol • can be used in Grade 6 in place of × to indicate multiplication. Whole numbers, fractions, decimals, and percents may be positioned along a conventional number line. A number to the left has a lesser value than a number to its right. Example: Which number could represent point C on the number line? 0.34, , 0.75%, or  (The correct choice is) 0 C 1 *(continued)*

		Comparison between fractions, decimals, or whole numbers can be described using the mathematical symbols: < (“is less than”), ≤ (“is less than or equal to”), > (“is greater than”), ≥ (“is greater than or equal to”), or = (“is equal to”). The symbols >, ≥, <, and ≤ are called inequality symbols. An *inequality* is a statement formed by placing an inequality symbol between two expressions. A *benchmark* is a standard measurement that can be used as a reference especially when making comparisons.

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.2** The student will a. investigate and describe fractions, decimals and percents as ratios; b. identify a given fraction, decimal or percent from a representation; c. demonstrate equivalent relationships among fractions, decimals, and percents;* and d. compare and order fractions, decimals, and percents.* *SOL test items measuring Objective 6.2c-d will be completed **without** the use of a calculator.	**Teacher Notes and Elaborations** *(continued)* Strategies using 0, $\frac{1}{2}$, and 1 as benchmarks can be used to compare fractions. When comparing two fractions, use $\frac{1}{2}$ as a benchmark. Example: Which is greater, or $\frac{3}{9}$? is greater than $\frac{1}{2}$ because 4, the numerator, represents more than half of 7, the denominator. The denominator tells the number of parts that make the whole. $\frac{3}{9}$ is less than because 3, the numerator, is less than half of 9, the denominator, which tells the number of parts that make the whole. Therefore, $\frac{4}{7}$ > . When comparing two fractions close to 1, use distance from 1 as your benchmark. Example: Which is greater, or ? $\frac{6}{7}$ is away from 1 whole. $\frac{8}{9}$ is away from 1 whole. Since $\frac{1}{7} > \frac{1}{9}$, then is a greater distance away from 1 whole than so $\frac{8}{9}$ > . Students should have experience with fractions such as , whose decimal representation is a *terminating decimal* (e.g., $\frac{1}{8}$ = 0.125) and with fractions such as $\frac{2}{9}$, whose decimal representation does not end but continues to repeat (e.g., $\frac{2}{9} = 0.222...$). The *repeating decimal* can be written with ellipses (three dots) as in 0.222… or denoted with a bar above the digits that repeat as in $0.\overline{2}$. *continued*

	A *prime number* is a natural number that has exactly two different factors, 1 and the number itself. A *composite number* is a natural number that has more than two different factors. The number 1 is neither prime nor composite because it has only one factor, itself. Although it has an infinite number of factors, zero is neither prime nor composite. Zero is not a natural number. The *prime factorization* of a number is a representation of the number as the product of its prime factors. For example, the prime factorization of 18 is $2 \cdot 3 \cdot 3$. A *factor* of a number is an integer that divides evenly into that number. In other words, it is a divisor of the number. A common factor of two or more numbers is a divisor that all of the numbers share. The *greatest common factor* of two or more numbers is the largest of the common factors that all the numbers share. A *multiple* of a number is the product of the number and any natural number. The *least common multiple* of two or more numbers is the smallest common multiple of two or more numbers (other than 0).

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.2** **Foundational Objectives** **5.2** The student will a. recognize and name fractions in decimal form and vice versa; and b. compare and order fractions and decimals in a given set from least to greatest and greatest to least. **5.3** The student will identify and describe the characteristics of prime and composite numbers; and even and odd numbers. **4.1b** The student will compare two whole numbers through millions, using symbols (>, <, or =). **4.2** The student will a. compare and order fractions and mixed numbers; b. represent equivalent fractions; and c. identify the division statement that represents a fraction. **4.3c, d** The student will c. compare and order decimals; and d. given a model, write the decimal and fraction equivalents. **4.5a** The student will determine common multiples and factors, including least common multiple and greatest common factor. **3.1c** The student will compare whole numbers between 0 and 9,999 using >, <, or =.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml **Foundational Objectives** *(continued)* **3.3a, c** The student will a. name and write fractions (including mixed numbers) represented by a model; and **c.** compare fractions having like and unlike denominators, using words and symbols (>, <, or =).	• Use grid paper to illustrate the relationship between decimals, fractions and percents ( ). • Students will start with 2 fraction circles of different colors. Cut a slit to the center of each circle. Insert one into the other so that they can be rotated. Require the student to: Rotate the circles to show different fractions, in tenths, from 0 to 1. Rotate to show percents. Set the fraction circle to a specific fraction. Express the fraction in simplest form. Find a corresponding percent. Turn the circles to the unmarked side. Estimate for a specific fraction the corresponding decimal and percent. • Students will be given questions such as: What percent of the states within the United States are west of the Mississippi River? What percent of the states in the United States are east of the Rockies? • The students will construct as many true fraction sentences as possible using four digits. For example: Using 5, 6, 7, and 8, a student can construct the fraction sentence < . • Students work in groups of four. Deal out four cards after removing the A's, K's, Q's, J's, and 10's. Have the students place the cards in order from the highest value to the least value or vice versa. Students read the decimal number that they created. The winner can be either the student with the highest number or the lowest number. • Students will use grid paper to show the value of decimals by coloring fractional parts. • Students will use pictorial representations to show the value of fractions, decimals, and percents by coloring appropriate parts. • Students create a place value chart and insert representations of decimals (For example, place 9 tiles in the tenths place and add one more. What happens?). • "Highest Number Wins" Randomly call out the numbers 0 – 9. Each student decides where to place that digit on his paper to make the number with the highest value. • Have students look at several bars of music. Cover a note in each measure. Students must use fractional values to discover whether the missing note is a whole, half, quarter, or eighth note. • Tangrams may be used to develop understanding of fractional values. Choose a tangram piece to be the whole and then have students find the value of other pieces based on the whole. Students can physically manipulate the pieces to compare sizes.

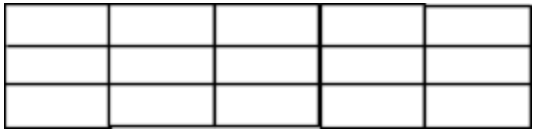
Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.3** The student will a. identify and represent integers; b. order and compare integers; and c. identify and describe absolute value of integers.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Identify** an integer represented by a point on a number line. ● **Represent** integers on a number line. ● **Order** and **compare** integers using a number line. ● **Compare** integers using mathematical symbols (<, >, =, ≠). ● **Identify** and **describe** the absolute value of an integer. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Describe **Understand** – Identify, Order **Analyze –** Represent, Compare **Key Vocabulary** absolute value inequality integer opposites	**Essential Questions and Understandings** ● What role do negative integers play in practical situations? Some examples of the use of negative integers are found in temperature (below 0), finance (owing money), and below sea level. There are many other examples. ● How does the absolute value of an integer compare to the absolute value of its opposite? They are the same because an integer and its opposite are the same distance from zero on a number line. **Teacher Notes and Elaborations** *Integers* are the set of whole numbers, their opposites and zero. Positive integers are greater than zero. Negative integers are less than zero. Zero is an integer that is neither positive nor negative. A negative integer is always less than a positive integer. The following are examples of integers represented in different forms: . Comparison between integers can be made by using the mathematical symbols: < (less than), > (greater than), = (equal to), or ≠ (not equal to). When comparing two negative integers, the negative integer that is closer to zero is greater. The symbols >, ≥, <, ≤, and ≠ are called inequality symbols. An *inequality* is a statement formed by placing an inequality symbol between two expressions. An integer and its *opposite* are the same distance from zero on a number line. For example, the opposite of 3 is -3 and the opposite of is 6. On a conventional number line, a number of lesser value is always located to the left of a number of greater value (e.g., -7 lies to the left of -3, thus < -3; 5 lies to the left of 8 thus 5 is less than 8). The following integers can be represented on a number line: 5, , 1, -3. (Note: The points must be plotted on the number line, not above the number line.) The *absolute value* of a number is the distance of a number from zero on the number line regardless of direction. The absolute value of 6 is 6 and the absolute value of -6 is also 6. Absolute value is represented as and is read as "The absolute value of negative six equals 6."

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.3** **Foundational Objectives**	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml How to create a number line in Word 2007 http://www.ehow.com/how_4963682_create-number-line-microsoft-word.html	• Use a number line to show the relationship between positive and negative integers.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.4** The student will demonstrate multiple representations of multiplication and division of fractions.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Demonstrate** multiplication and division of fractions using multiple representations. ● **Model** algorithms for multiplying and dividing with fractions using appropriate representations. **Cognitive Level (Bloom's Taxonomy, Revised)** **Apply** – Demonstrate **Analyze** - Model **Key Vocabulary** dividend divisor improper fraction mixed number product proper fraction quotient	**Essential Questions and Understandings** ● When multiplying fractions, what is the meaning of the operation? When multiplying a whole by a fraction such as $3 \cdot \frac{1}{2}$, the meaning is the same as with multiplication of whole numbers: 3 groups the size of of the whole. When multiplying a fraction by a fraction such as , we are asking for part of a part. When multiplying a fraction by a whole number such as · 6, we are trying to find a part of the whole. ● What does it mean to divide with fractions? For measurement division, the divisor is the number of groups and the quotient will be the number of groups in the dividend. Division of fractions can be explained as how many of a given divisor are needed to equal the given dividend. In other words, for the question is, "How many $\frac{2}{3}$ make $\frac{1}{4}$?" For partition division the divisor is the size of the group, so the quotient answers the question, "How much is the whole?" or "How much for one?" **Teacher Notes and Elaborations** In a multiplication problem, the *product* is the result of multiplying factors. In the operation of division, a *dividend* is a number or quantity to be divided by another number or quantity called the *divisor*. A *quotient* is the result of division; the number of times one quantity is contained in another .

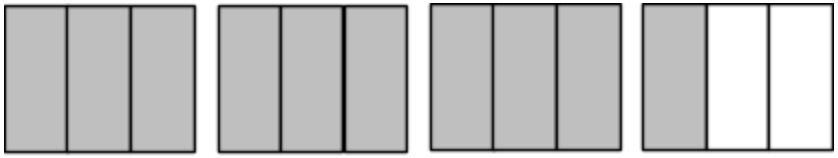
continued

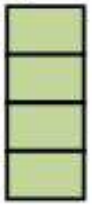
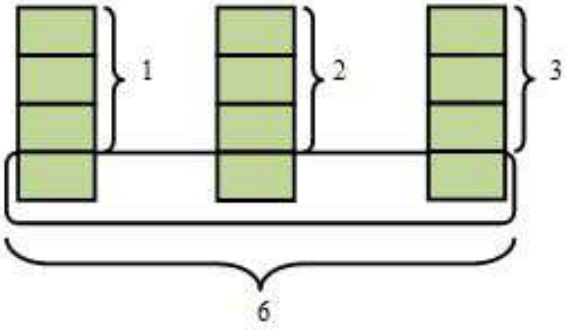
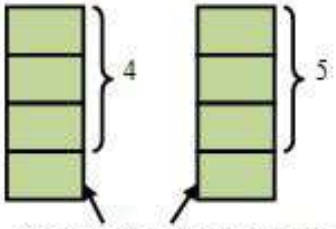
		Using manipulatives to build conceptual understanding and using pictures and sketches to link concrete examples to the symbolic enhance students' understanding of operations with fractions and helps students connect the meaning of whole number computation to fraction computation. Multiplication and division of fractions can be represented with arrays, paper folding, repeated addition, repeated subtraction, fraction strips, pattern blocks and area models. Multiplication and division are inverse operations.

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.4** The student will demonstrate multiple representations of multiplication and division of fractions.	**Teacher Notes and Elaborations** *(continued)* A *proper fraction* is one in which the numerator is less than the denominator. An *improper fraction* is one in which the numerator is greater than or equal to the denominator, such as and . A *mixed number* is a whole number and a fraction, such as $1\frac{2}{3}$. When multiplying a whole number by a fraction such as , the meaning is the same as with multiplication of whole numbers: 3 groups the size of $\frac{1}{2}$ of the whole. The following is a model of  + + = When multiplying a fraction by a fraction such as , **part of a part** is asked for. Scooter sales made up of the total sales of a sporting goods store. Anzio, a salesperson at the store, made of the scooter sales. Anzio's sales are **of** of the total sales. The following model can be used to illustrate this problem. Draw a 3 by 5 grid to represent a common denominator of 3 and 5.  Shade of the whole rectangle  *continued*

Select $\frac{2}{3}$ of the shaded rectangle to represent $\frac{2}{3}$ **of**

$$\frac{2}{3} \cdot \frac{1}{5} = \frac{2}{15}$$

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.4** The student will demonstrate multiple representations of multiplication and division of fractions.	**Teacher Notes and Elaborations** *(continued)* For partition division the divisor is the size of the group, so the quotient answers the question, "How much is the whole?" or "How much for one?" To find the quotient of $3\frac{1}{3} \div \frac{2}{3}$ begin by drawing a model for . Then divide the model into groups of $\frac{2}{3}$.  $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ There are 5 groups of $\frac{2}{3}$. So . Models such as the above example help students to see the relationship between the mixed number , and the improper fraction $\frac{10}{3}$. This example can also be thought of as how many are in ? Or how many groups of 2 pieces make up 10 pieces? $3\frac{1}{3} \div \frac{2}{3} =$ $10 \div 2 = 5$ This is referred to as the Common-Denominator process of dividing fractions. *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.4** The student will demonstrate multiple representations of multiplication and division of fractions.	**Teacher Notes and Elaborations** *(continued)* To determine the number of fractional parts in a given number such as how many $\frac{3}{4}$ are in 5, draw a figure to represent one whole divided into four equal parts.  Exactly how many $\frac{3}{4}$ are in 5? It takes 3 parts of the whole to make one $\frac{3}{4}$.   Since it takes 3 parts to make one $\frac{3}{4}$, what remains is 2 out of 3 parts or $\frac{2}{3}$. Exactly how many $\frac{3}{4}$ are in 5? There are $6\frac{2}{3}$.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.4** **Foundational Objectives** **3.3b** The student will model fractions (including mixed numbers). **3.6** The student will represent multiplication and division of whole numbers, using area, set and number line models.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml Teaching Student Centered Mathematics, Grades 5-8, John Van de Walle and LouAnn Lovin, Pearson, 2006, pages 98-106. *Modeling strategies, various algorithms and activities for dividing fractions are presented.*	• Find the LCD and LCM using prime factorization. • Use the prime factorizations of numbers to multiply and divide fractions. For example (Common factors are divided to equal 1) Note: Remind students to replace common factors with 1 (not zero) to avoid error. • Through teacher-orchestrated discussions of problems in context, students can develop useful methods to compute with fractions in ways that make sense. Students' understanding of computation can be enhanced by developing their own methods and sharing them with one another, explaining why their methods work and are reasonable to use, and then comparing their methods with the algorithms traditionally taught in school. In this way, students can appreciate the power and efficiency of the traditional algorithms and also connect them to student-invented methods that may sometimes be less powerful or efficient but are often easier to understand. • Using an area model assists with students' developing understanding of multiplication and division of fractions. • "Measurement and Fair-Sharing Models for Dividing Fractions", by Jeff Gregg and Diana Underwood Gregg, *Mathematics Teaching in the Middle School*, Vol. 12, No. 9, May, 2007, pages 490-496.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.5** The student will investigate and describe concepts of positive exponents and perfect squares.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Recognize** and describe patterns with exponents that are natural numbers, by using a calculator. ● **Recognize** and describe patterns of perfect squares not to exceed 20^2, by using grid paper, square tiles, tables, and calculators. ● **Recognize** powers of ten by examining patterns in a place value chart: $10^4 = 10{,}000$ $10^3 = 1000$ $10^2 = 100$ $10^1 = 10$ $10^0 = 1$ **Cognitive Level (Bloom's Taxonomy, Revised)** **Understand** – Use, Identify **Key Vocabulary** base exponent perfect square power of a number	**Essential Questions and Understandings** ● What does exponential form represent? Exponential form is a short way to write repeated multiplication of a common factor such as . ● What is the relationship between perfect squares and a geometric square? A perfect square is the area of a geometric square whose side length is a whole number. **Teacher Notes and Elaborations** Patterns in place value charts provide visual meaning of exponents. $10^4 = 10{,}000$ $10^3 = 1000$ $10^2 = 100$ $10^1 = 10$ $10^0 = 1$ In exponential notation, the *base* is the number that is multiplied, and the *exponent* represents the number of times the base is used as a factor. In 8^3, 8 is the base and 3 is the exponent. A *power of a number* represents repeated multiplication of the number by itself (e.g., $8^3 = 8 \cdot 8 \cdot 8$ and is read "8 to the third power"). When reading powers, if a base number has an exponent of 2, the base is "squared" (e.g., 4^2 can be read as 4 squared). When powers have an exponent of 3, the base is "cubed" (e.g., 4^3 can be read as 4 cubed). Any real number other than zero raised to the zero power is 1. Zero to the zero power (0) is undefined. *Perfect squares* are the numbers that result from multiplying any whole number by itself (e.g.,). Perfect squares can be represented geometrically as the areas of squares the length of whose sides are whole numbers (e.g., $1 \cdot 1$, $2 \cdot 2$, or $3 \cdot 3$). This can be modeled with grid paper, tiles, geoboards and virtual manipulatives. *continued* A square root of a number is a number which, when multiplied by itself, produces the given number (e.g., the square root of 49 is 7 because $7 \cdot 7 = 49$). Squaring a number and taking a square root of a number are inverse operations.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Number and Number Sense **Focus** Relationships among Fractions, Decimals, and Percents **Virginia SOL 6.5** **Foundational Objectives**	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Use the exponent key, the x key of the calculator, to explore patterns of perfect squares. • Use area models to illustrate perfect squares.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.6** The student will a. multiply and divide fractions and mixed numbers; and* b. estimate solutions and then solve single-step and multi-step practical problems involving addition, subtraction, multiplication, and division of fractions. *SOL test items measuring Objective 6.6a will be completed **without** the use of a calculator.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Multiply** and **divide** with fractions and mixed numbers. Answers are expressed in simplest form. ● **Estimate** solutions and **solve** single-step and multi-step practical problems that involve addition and subtraction with fractions and mixed numbers, with and without regrouping, that include like and unlike denominators of 12 or less. Answers are expressed in simplest form. Compare actual answers with estimates to check for reasonableness of results. ● **Estimate** solutions and **solve** single-step and multi-step practical problems that involve multiplication and division with fractions and mixed numbers that include denominators of 12 or less. Answers are expressed in simplest form. **Compare** actual answers with estimates to check for reasonableness of results. **Cognitive Level (Bloom's Taxonomy, Revised)** **Apply** – Estimate, Solve **Analyze –** Compare **Key Vocabulary** Benchmark compatible numbers difference estimation improper fraction mixed number product proper fraction reciprocal simplest form simplify sum quotient	**Essential Questions and Understandings** ● How are multiplication and division of fractions and multiplication and division of whole numbers alike? Fraction computation can be approached in the same way as whole number computation, applying those concepts to fractional parts. ● What is the role of estimation in solving problems? Estimation helps determine the reasonableness of answers. **Teacher Notes and Elaborations** *Simplify* means to make something as simple as possible. Students should understand that simplifying a fraction and writing it as a mixed number is not the same thing. is in *simplest form* because the numerator and denominator do not have any common factor other than 1. The term "reduce" should not be used because it causes confusion for some students. When a fraction is renamed in simplest form, it does not become smaller as the word "reduce" implies. Simplifying fractions to simplest form assists with uniformity of answers. Addition and subtraction are inverse operations as are multiplication and division. The sum is the result in an addition problem; the difference is the result in a subtraction problem. In a multiplication problem the *product* is the result of multiplying factors. A *quotient* is the result of division; the number of times one quantity is contained in another. A *proper fraction* is one in which the numerator is less than the denominator. An *improper fraction* is one in which the numerator is greater than or equal to the denominator, such as and $\frac{5}{5}$. A *mixed number* is a whole number and a fraction, such as . There is implied addition of the whole number part and the fractional part in mixed numerals (e.g.,). Experiences in problem solving should not be limited to calculator computation. Paper and pencil, mental math, and modeling should also be utilized.

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.6** The student will a. multiply and divide fractions and mixed numbers; and* b. estimate solutions and then solve single-step and multi-step practical problems involving addition, subtraction, multiplication, and division of fractions. *SOL test items measuring Objective 6.6a will be completed **without** the use of a calculator.	**Teacher Notes and Elaborations** *(continued)* It is helpful to use estimation to develop computational strategies. Estimation is an approximation and is generally a mental math computation. Students apply different strategies to determine an estimate. Estimation should not be confused with rounding numbers. Rounding numbers is an estimation strategy. For example, is about $\frac{3}{4}$ of 3, so the answer is between 2 and 3. Different estimation strategies such as compatible numbers and benchmarking are effective for different operations and different situations. Students should recognize estimation strategies that are most effective for different situations. *Compatible numbers* are two numbers that form a basic division fact such as 12 ÷ 4 = 3. Compatible numbers can be used to estimate quotients. Example: To estimate $12\frac{2}{3} \div 4\frac{1}{4}$, think 12 ÷ 4 = 3. A *benchmark* is a standard measurement that can be used as a reference especially when making comparisons. Strategies using 0, $\frac{1}{2}$, and 1 as benchmarks can be used to compare fractions. When comparing two fractions, use as a benchmark. Example: Which is greater, or $\frac{3}{9}$? $\frac{4}{7}$ is greater than because 4, the numerator, represents more than half of 7, the denominator. The denominator tells the number of parts that make the whole. is less than because 3, the numerator, is less than half of 9, the denominator, which tells the number of parts that make the whole. Therefore, > . When comparing two fractions close to 1, use distance from 1 as the benchmark. Example: Which is greater, or ? is $\frac{1}{7}$ away from 1 whole. is $\frac{1}{9}$ away from 1 whole. Since > , then is a greater distance away from 1 whole than so $\frac{8}{9}$ > . Solving multi-step problems in the context of real life situations enhances interconnectedness and proficiency with estimation strategies. Examples of practical situations solved by using estimation strategies include shopping for groceries, buying school supplies, budgeting an allowance, deciding what time to leave for school or the movies, and sharing a pizza or prize money from a contest. *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.6** The student will a. multiply and divide fractions and mixed numbers; and* b. estimate solutions and then solve single-step and multi-step practical problems involving addition, subtraction, multiplication, and division of fractions. *SOL test items measuring Objective 6.6a will be completed **without** the use of a calculator.	**Teacher Notes and Elaborations** *(continued)* Students need to become fluent with renaming fractional numbers in other forms and recognizing numbers written in different forms (e.g., is the same as or or). This flexibility with numbers allows students to be able to perform operations on the numbers more easily. When multiplying a whole by a fraction such as $3 \cdot \frac{1}{2}$, the meaning is the same as with multiplication of whole numbers: 3 groups the size of of the whole. When multiplying a fraction by a fraction such as , we are asking for part of a part. When multiplying a fraction by a whole number such as , we are trying to find a part of the whole. *Reciprocals* are two numbers whose product is 1 (e.g., is the reciprocal of 3 because and vice versa). (Students will investigate and recognize the multiplicative inverse property in Unit 7.)

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.6** **Foundational Objectives** **5.6** The student will solve single-step and multi-step practical problems involving addition and subtraction with fractions and mixed numbers and express answers in simplest form. **4.5b, d** The student will b. add and subtract fractions having like and unlike denominators that are limited to 2, 3, 4, 5, 6, 8, 10, and 12, and simplify the resulting fractions, using common multiples and factors; and d. solve single-step and multi-step practical problems involving addition and subtraction with fractions. **3.1b** The student will round whole numbers, 9,999 or less, to the nearest ten, hundred, and thousand. **3.7** The student will add and subtract proper fractions having like denominators of 12 or less.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Find the LCD and LCM using prime factorization. • Use the prime factorizations of numbers to multiply and divide fractions. For example $\frac{12}{5} \cdot \frac{25}{27} = \frac{2 \cdot 2 \cdot \cancel{3}}{\cancel{5}} \cdot \frac{\cancel{5} \cdot 5}{3 \cdot 3 \cdot \cancel{3}}$ • NCTM Principals and Standards: In grades 6 – 8, students should acquire computational fluency—the ability to compute efficiently and accurately—with fractions, and decimals. Teachers should help students learn how to decide when an exact answer or an estimate would be more appropriate, how to choose the computational method that would be best to use, and how to evaluate the reasonableness of answers to computations. Most calculations should arise as students solve problems in context. Students should consider the features of the problem and the likely use of an answer to a calculation in deciding whether an exact answer or an estimate is needed, and then select an appropriate mode of calculation from among mental calculation, paper-and-pencil methods, or calculator use. For example, the cost of $1\frac{1}{4}$ pounds of cheese at $2.40 a pound can be found mentally, whereas the cost of 1.37 pounds of cheese at $2.95 a pound might be estimated, although a calculator would probably be the preferred tool if an exact answer were needed. Students should remember to analyze the answers to their calculations to evaluate their reasonableness. • Through teacher-orchestrated discussions of problems in context, students can develop useful methods to compute with fractions in ways that make sense. Students' understanding of computation can be enhanced by developing their own methods and sharing them with one another, explaining why their methods work and are reasonable to use, and then comparing their methods with the algorithms traditionally taught in school. In this way, students can appreciate the power and efficiency of the traditional algorithms and also connect them to student-invented methods that may sometimes be less powerful or efficient but are often easier to understand.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.7** The student will solve single-step and multi-step practical problems involving addition, subtraction, multiplication, and division of decimals.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Solve** single-step and multi-step practical problems involving addition, subtraction, multiplication and division with decimals expressed to thousandths with no more than two operations. ● **Solve** single-step and multi-step practical problems involving decimals using estimation strategies and checking for the reasonableness of results. **Cognitive Level (Bloom's Taxonomy, Revised)** **Apply** – Solve **Key Vocabulary** compatible numbers estimation front-end estimation rounding	**Essential Questions and Understandings** ● What is the role of estimation in solving problems? Estimation gives a reasonable solution to a problem when an exact answer is not required. If an exact answer is required, estimation allows you to know if the calculated answer is reasonable. **Teacher Notes and Elaborations** Different strategies can be used to estimate the result of computations and judge the reasonableness of the result. For example: What is an approximate answer for $2.19 \div 0.8$? The answer is approximately 2 because $2 \div 1 = 2$. It is helpful to use estimation to develop computational strategies. *Estimation* is an approximation. Different estimation strategies such as *front-end*, *compatible numbers*, or *rounding* are effective for different operations and different situations. Students should recognize estimation strategies that are most effective for different situations (e.g., when multiplying numbers where both are about halfway between two multiples, such as the example $3.6 \cdot 7.5$, it is best to round one up and the other down ($4 \cdot 7$) to get the most reasonable estimate.) Rounding is used to approximate an answer such as $28.7 \cdot 2.05$ may be rounded to $29 \cdot 2$ or $30 \cdot 2$. Front-end estimation may be used when adding or subtracting. Add or subtract the leftmost digits and adjust by looking at the sum or difference of what is left. For example: 3.47 Front-end: $3 + 8 + 6 + 5 = 22$ 8.74 Adjust: $0.47 + 0.51 \approx 1$ and $0.74 + 0.27 \approx 1$ 6.27 $22 + 1 + 1 = 24$ + 5.51 The sum is about 24. Understanding the placement of the decimal point is very important when finding quotients of decimals. Examining patterns with successive decimals provides meaning, such as dividing the dividend by 6, by 0.6, by 0.06, and by 0.006. Solving multi-step problems in the context of real life situations enhances interconnectedness and proficiency with estimation strategies. Examples of practical situations solved by using estimation strategies include shopping for groceries, buying school supplies, budgeting an allowance, deciding what time to leave for school or the movies, and sharing a pizza or prize money from a contest. Experiences in problem solving should not be limited to calculator computation. Paper and pencil, mental math, and modeling should also be utilized.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.7** **Foundational Objectives** **5.1** The student, given a decimal through thousandths, will round to the nearest whole number, tenth, or hundredth. **5.5** The student will a. find the sum, difference, product, and quotient of two numbers expressed as decimals through thousandths (divisors with only one non-zero digit); and b. create and solve single-step and multi-step practical problems involving decimals. **4.3b** The student will round decimals to the nearest whole number, tenth, and hundredth. **4.5c, d** The student will c. add and subtract with decimals; and d. solve single-step and multi-step practical problems involving addition and subtraction with decimals.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Help students see that there are various ways to estimate and that the choice of strategy depends on the task. To underscore that estimation is a problem-solving process, prompt students to consider first the goal of a task and the level of accuracy needed. Encourage students to invent their own estimation strategies. Encourage students to justify their estimation strategies.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.8** The student will evaluate whole number numerical expressions, using the order of operations.* *SOL test items measuring Objective 6.8 will be completed **without** the use of a calculator.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Simplify** expressions by using the order of operations in a demonstrated step-by-step approach. The expressions should be limited to positive values and not include braces { } or absolute value $\lvert\ \rvert$. ● **Find** the value of numerical expressions, using order of operations, mental mathematics, and appropriate tools. Exponents are limited to positive values. **Cognitive Level (Bloom's Taxonomy, Revised)** **Apply** – Simply, Find **Key Vocabulary** base exponent expression grouping symbols order of operations rational number	**Essential Questions and Understandings** ● What is the significance of the order of operations? The order of operations prescribes the order to use to simplify expressions containing more than one operation. It ensures that there is only one correct answer. **Teacher Notes and Elaborations** A *rational number* is any number that may be expressed as the quotient $\left(\frac{a}{b}\right)$ of two integers (Note: The denominator cannot equal zero.). The *order of operations* is a convention that defines the computation order to follow in simplifying an expression. The order of operations is as follows: - First, complete all operations within grouping symbols**. If there are grouping symbols within other grouping symbols, do the innermost operation first. - Second, evaluate all exponential expressions. - Third, multiply and/or divide in order from left to right. - Fourth, add and/or subtract in order from left to right. **Parentheses ( ), brackets [ ], braces {}, and the division bar – as in should be treated as *grouping symbols*. The overuse of the acronym *PEMDAS* tends to reinforce inaccurate use of the order of operations. Students frequently multiply before dividing and add before subtracting because they do not understand the correct order of operations. The power of a number represents repeated multiplication of the number (e.g., $8^3 = 8 \cdot 8 \cdot 8$). The *base* is the number that is multiplied, and the *exponent* represents the number of times the base is used as a factor. In the example, 8 is the base, and 3 is the exponent. Any number, except 0, raised to the zero power is 1. Zero to the zero power is undefined. An *expression* is like a phrase. An expression has **no** equal sign and cannot be solved. Expressions are simplified by using the order of operations. *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.8** The student will evaluate whole number numerical expressions, using the order of operations.* *SOL test items measuring Objective 6.8 will be completed **without** the use of a calculator.	**Teacher Notes and Elaborations** *(continued)* Example 1: An expression can be simplified as follows: $\frac{2+18}{9-4}\cdot(2^0+3)$ Evaluate exponents first. $\frac{20}{5}\cdot 4$ Evaluate within grouping symbols next. Multiply. 16 Example 2: Students also need to recognize which operation should be used first. When simplifying the following, using order of operations, which operation should be performed first? A $8-4$ B $4\div 2$ C $2+3$ D $3\cdot 5$ Example 3: Sometimes the simplified value of an expression is in the form of an improper fraction. The value of is .

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Computation and Estimation **Focus** Applications of Operations with Rational Numbers **Virginia SOL 6.8** **Foundational Objective** **5.7** The student will evaluate whole number numerical expressions using the order of operations limited to parentheses, addition, subtraction, multiplication, and division.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• One player tosses the number cubes twice and all players record the numbers. The object of the game is to write an expression that uses all four numbers and all four operations to make a specified number, such as, the greatest number or the number closest to twenty-five. There is a time limit (e.g., two minutes). When time is called, players check each other's expressions. The player with the winning answer scores a point. After a few rounds, vary the rules (e.g., using parentheses or omitting multiplication). • Write a long string of numbers and operations on the chalkboard. Give the students time to compute. Explore all the different answers to this single problem. Discuss the one correct answer and how the answer was obtained. • Use a several different calculators to examine differences among calculators (e.g., answers). Students enter $6 + 2 \cdot 4 =$ on their calculators and compare each other's calculator displays. Some of the displays show 32 and others show 14. The students are asked: "Why", "Which is right?", "Are the other calculators broken?" • Students work in pairs. They will select an index card containing an expression with a given value, missing the operations and/or grouping symbols. In order to arrive at the given value, the students will arrange the operations in correct order. For example: Expression: 6 7 5 12 6 2 Value is 38 Answer: $6 + 7 \cdot 5 - 12 \div (6 - 2)$

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.9** The student will make ballpark comparisons between measurements in the U.S. Customary System of measurement and measurements in the metric system.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Estimate** the conversion of units of length, weight/mass, volume, and temperature between the U.S. Customary system and the metric system by using ballpark comparisons. Ex: 1L ≈ 1qt. Ex: 4L ≈ 4qts. ● **Estimate** measurements by comparing the object to be measured against a benchmark. **Cognitive Level (Bloom's Taxonomy, Revised)** **Apply** – Estimate **Key Vocabulary** Capacity Centimeter cup foot gallon gram inch kilogram kilometer liter mass meter metric system mile milliliter millimeter ounce pint pound quart ton weight yard U.S. Customary System	**Essential Questions and Understandings** ● What is the difference between weight and mass? Weight and mass are different. Mass is the amount of matter in an object. Weight is the pull of gravity on the mass of an object. The mass of an object remains the same regardless of its location. The weight of an object changes dependent on the gravitational pull at its location. ● How do you determine which units to use at different times? Units of measure are determined by the attributes of the object being measured. Measures of length are expressed in linear units, measures of area are expressed in square units, and measures of volume are expressed in cubic units. ● Why are there two different measurement systems? Measurement systems are conventions invented by different cultures to meet their needs. The U.S. Customary System is the preferred method in the United States. The metric system is the preferred system worldwide. **Teacher Notes and Elaborations** Making sense of various units of measure is an essential life skill, requiring reasonable estimates of what measurements mean particularly in relation to other units of measure. 1 inch is about 2.5 centimeters. 1 foot is about 30 centimeters. 1 meter is a little longer than a yard, or about 40 inches. 1 mile is slightly farther than 1.5 kilometers. 1 kilometer is slightly farther than half a mile. 1 ounce is about 28 grams. 1 nickel has the mass of about 5 grams. 1 kilogram is a little more than 2 pounds. 1 quart is a little less than 1 liter. 1 liter is a little more than 1 quart. Water freezes at 0°C and 32°F. Water boils at 100°C and 212°F. Normal body temperature is about 37°C and 98°F. Room temperature is about 20°C and 70°F. Measures of length are expressed in linear units. *Capacity* is the volume of a container given in units of liquid measure. *Mass* is the amount of matter in an object. *Weight* is the pull of gravity on the mass of an object. The mass of an object remains the same regardless of its location. The weight of an object changes dependent on the gravitational pull at its location. In everyday life, most people are actually interested in determining an object's mass, although they use the term *weight*, as shown by the questions: "How much does it weigh?" versus "What is its mass?

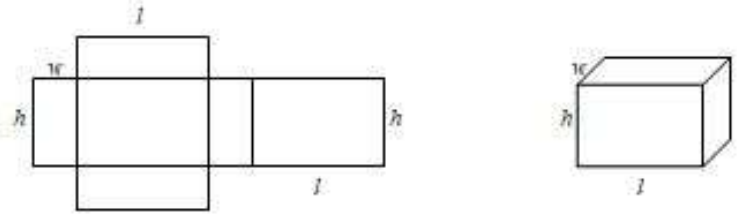
Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.9** The student will make ballpark comparisons between measurements in the U.S. Customary System of measurement and measurements in the metric system.	**Teacher Notes and Elaborations** (*continued*) The degree of accuracy of measurement required is determined by the situation. Whether to use an underestimate or an overestimate is determined by the situation. Physically measuring objects along with using visual and symbolic representations improves student understanding of both the concepts and the processes of measurement. The symbol "≈" is read as "approximately equal to" (e.g., 6.9 ≈ 7) and may be used to express a relationship. Using benchmarks is a strategy used to make measurement estimates. Benchmarks such as the two-meter height of a standard doorway can be used to estimate height of a room.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.9** **Foundational Objectives** **5.8c, d, e** The student will c. identify equivalent measurements within the metric system; d. estimate and then measure to solve problems, using U.S. Customary and metric units; and e. choose an appropriate unit of measure for a given situation involving measurement using U.S. Customary and metric units. **4.6** The student will a. estimate and measure weight/mass and describe the results in U.S. Customary and metric units as appropriate; and b. identify equivalent measurements between units within U.S. Customary system (ounces, pounds, and tons) and between units within the metric system (grams and kilograms). **4.7** The student will a. estimate and measure length, and describe the result in both metric and U.S. Customary units; and	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Place common objects around the room marked with their approximate measurements so that students can occasionally lift and inspect them and reinforce the idea of these measurements.

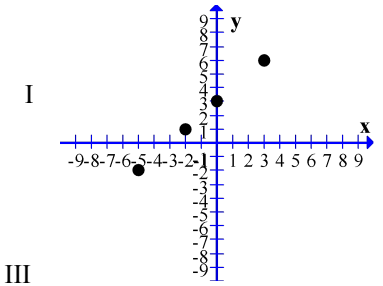
Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.9** **Foundational Objectives** *(continued)* **4.7** b. identify equivalent measurements between units within the U.S. Customary system (inches and feet; feet and yards; inches and yards; yards and miles) and between units within the metric system (millimeters and centimeters; centimeters and meters; and millimeters and meters). **4.8** The student will a. estimate and measure liquid volume and describe the results in U.S. Customary units; and b. identify equivalent measurements between units with the U.S. Customary system (cups, pints, quarts, and gallons). **3.9** The student will estimate and use U.S. Customary and metric units to measure a. length to the nearest half inch, inch, foot, yard, centimeter, and meter; b. liquid volume in cups, pints, quarts, gallons, and liters; c. weight/mass in ounces, pounds, grams, and kilograms; and d. area and perimeter.		

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.10** The student will a. define pi (π) as the ratio of the circumference of a circle to its diameter; b. solve practical problems involving circumference and area of a circle, given the diameter or radius; c. solve practical problems involving area and perimeter; and d. describe and determine the volume and surface area of a rectangular prism.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Derive** an approximation for pi (3.14 or) by gathering data and comparing the circumference to the diameter of various circles, using concrete materials or computer models. ● **Find** the circumference of a circle by substituting a value for the diameter or the radius into the formula $C = \pi d$ or $C = 2\pi r$. ● **Find** the area of a circle by using the formula $A = \pi r^2$. ● **Create** and solve problems that involve finding the circumference and area of a circle when given the diameter or radius. ● **Derive** formulas for area and perimeter of triangles, parallelograms, and trapezoids. ● **Apply** formulas to solve practical problems involving area and perimeter of triangles, rectangles, parallelograms, and trapezoids. ● **Develop** a procedure and formula for finding the surface area of a rectangular prism using concrete objects, nets, diagrams, and computation methods. ● **Develop** a procedure and formula for finding the volume of a rectangular prism using concrete objects, nets, diagrams, and computation methods. ● **Solve** problems that require finding the surface area of a rectangular prism, given a diagram of the prism with the necessary dimensions labeled.	**Essential Questions and Understandings** ● What is the relationship between the circumference and diameter of a circle? The circumference of a circle is about 3 times the measure of the diameter. ● What is the difference between area and perimeter? Perimeter is the distance around the outside of a figure while area is the measure of the amount of space enclosed by the perimeter. ● What is the relationship between area and surface area? Surface area is calculated for a three-dimensional figure. It is the sum of the areas of the two-dimensional surfaces that make up the three-dimensional figure. ● What is the relationship between area and volume of a rectangular prism? Volume is calculated for a three-dimensional figure. For a rectangular prism, it is the product of the area of the base times the height of the three-dimensional figure. **Teacher Notes and Elaborations** A *formula* is an equation that shows a mathematical relationship. Experiences in deriving the formulas for area, perimeter, and volume using manipulatives such as tiles, one-inch cubes, adding machine tape, graph paper, geoboards, or tracing paper, promote an understanding of the formulas and facility in their use. The *perimeter* of a polygon is the measure of the distance around the polygon. The *area* of a closed curve is the number of non-overlapping square units required to fill the region enclosed by the curve. The perimeter of a square whose side measures s is 4 times s ($P = 4s$), and its area is side times side ($A = s^2$). The perimeter of a rectangle is the sum of twice the length and twice the width [$P = 2l + 2w$, or $P = 2(l + w)$], and its area is the product of the length and the width ($A = lw$). The perimeter of a parallelogram is the sum of its sides and the area is the product of the base and the height (a perpendicular drawn from base one to base two). The perimeter of a trapezoid is the sum of its sides and the area is one half times its height times the sum of base one and base two.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.10** The student will a. define pi (π) as the ratio of the circumference of a circle to its diameter; b. solve practical problems involving circumference and area of a circle, given the diameter or radius; c. solve practical problems involving area and perimeter; and d. describe and determine the volume and surface area of a rectangular prism. **Pacing** **Unit 8:** Measurement **Time:** 17 Blocks	*(continued)* ● **Solve** problems that require finding the volume of a rectangular prism given a diagram of the prism with the necessary dimensions labeled. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Find **Understand** – Derive **Apply** – Apply, Solve **Create –** Create, Develop **Key Vocabulary** area base chord circumference cube diameter face formula height length net parallelogram perimeter pi plane figure (two-dimensional) radius ratio rectangle rectangular prism side solid figure (three-dimensional) square surface area trapezoid triangle volume width	**Teacher Notes and Elaborations** *(continued)* The following is a list of traditional formulas. Area of a rectangle: $A = lw$ Perimeter of a rectangle: Area of a square: Perimeter of a square: $p = 4s$ Area of a triangle: $A = \frac{1}{2}bh$ Area of a parallelogram: Area of a trapezoid: Area of a circle: Circumference of a circle: The value of *pi* (π) is the *ratio* (comparison) of the circumference of a circle to its diameter. The ratio of the circumference to the diameter of a circle is a constant value *pi* (π) which can be approximated by measuring various sizes of circles. The fractional approximation of pi (π) generally used is $\frac{22}{7}$. The decimal approximation of pi (π) generally used is 3.14. For example, if the diameter of a circle is 10.7 meters and the circumference is approximately 33.6 meters, then could be used to estimate the value of π. The *base* of a solid figure is the bottom, side or face of the solid figure. In a prism the two parallel congruent faces are called bases. A *chord* is a line segment connecting any two points on a circle but does not need to pass through the center of the circle. The *diameter* of a circle is a special chord that connects two points on the circle and passes through the center of the circle. The *radius* is the length of a segment connecting the center of the circle with any point on the circle. The *circumference* of a circle is the distance around the circle or the perimeter of the circle. The circumference of a circle is computed using $C = \pi d$ or $C = 2\pi r$, where d is the diameter and r is the radius of the circle. The area of a circle is computed using the formula $A = \pi r^2$ where r is the radius of the circle. Practical problems do not always have figures included. When figures are not included, drawing a representation will aid in solving the problem. *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.10** The student will a. define pi (π) as the ratio of the circumference of a circle to its diameter; b. solve practical problems involving circumference and area of a circle, given the diameter or radius; c. solve practical problems involving area and perimeter; and d. describe and determine the volume and surface area of a rectangular prism.	**Teacher Notes and Elaborations** *(continued)* A *face* is a flat *side* of a solid figure. *Surface area* is the total area of the surface of a solid. The *surface area* of a rectangular prism is the sum of the areas of all six faces ($SA=2lw+2lh+2wh$). *Nets* are *plane figure* (*two-dimensional*) drawings of *solid figures* (*three-dimensional*) that can be used to help students find surface area. A net of a solid is a two dimensional figure that can be folded into a three dimensional shape. A *rectangular prism* can be represented on a flat surface as a net that contains rectangles. Two rectangles that have the measures of the length and width of the base, two others that have measures of the length and height, and two others that have measures of width and height. Surface area of a rectangular prism is the total area of all six of the faces ($SA=2lw + 2lh + 2wh$).  The *volume* of a solid is the total amount of space inside a three-dimensional object. A unit for measuring volume is the cubic unit. Many formulas use B to represent the area of the base of the solid figure. The volume of a rectangular prism is computed by multiplying the area of the base, B, (length times width) by the height of the prism ($V = lwh$ or $V = Bh$). A *cube* is a rectangular prism in which every face is a square and every edge is the same length.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Measurement and Geometry **Focus** Problem Solving with Area, Perimeter, Volume, and Surface Area **Virginia SOL 6.10** **Foundational Objectives** **5.8a, b** The student will a. find perimeter, area, and volume in standard units of measure; and b. differentiate among perimeter, area, and volume and identify whether the application of the concept of perimeter, area, or volume is appropriate for a given situation. **5.9** The student will identify and describe the diameter, radius, chord, and circumference of a circle. **3.10** The student will a. measure the distance around a polygon in order to determine perimeter; and b. count the number of square units needed to cover a given surface in order to determine area.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml Looking at Geometry, Grades 6-9, Aims Education Foundation, 2009, pages 31-54. *Activities are designed to develop and use formulas for area of rectangles, parallelograms, triangles, and trapezoids.* Teaching Student Centered Mathematics, Grades 5-8, John Van de Walle and LouAnn Lovin, Pearson Education, 2006, Pages 251–256. *Activities are designed to develop and use formulas for area of rectangles, parallelograms, triangles, and trapezoids.*	● Give the students a circular object (e.g., plastic lids, cups, etc.), two different colors of strings, and a centimeter ruler. Students work in groups of two. The pair will measure the distance around the object and the diameter. Regardless of the lid size used, if the students have been careful wrapping the string, they should get three diameters out of the string length with a little string left over. After all partners have finished their measurements and calculations for the circles, write the ratios (e.g., circumference/diameter), including repeats, that they found in decimal form on the chalkboard. Ask the students to find the average (e.g., mean) of all ratios found. When students have measured carefully and 20 or more ratios are averaged together, the mean is usually quite close to 3.14. ● Ask students to write a sentence that describes a diameter's relationship to its circumference (e.g., a circumference equals about 3.14 of the diameter). ● Draw a rectangle, 7 units long and 5 units wide. Find the perimeter. Draw as many rectangles that you can find with perimeters of 24 units. ● Use geoboards or dot paper to explore area and perimeter. ● Demonstrate a number of different polygons with a given area and/or perimeter. ● Students bring in cereal and oatmeal boxes from home and cut them apart to more easily determine the surface area. ● Students stack unit cubes in various ways and find the surface areas of the structures they have built. They sketch their figures and discuss which figure has the largest surface area and which has the smallest surface area. ● Create models with concrete objects: string, ribbon, strips of paper to measure perimeter, and develop formulas. ● Use squares of paper, tiles, cardboard, and carpet to develop the concept of area. ● Use geoboards to model figures and to determine area and perimeter. ● Using pattern blocks, construct two different size parallelograms, triangles, and trapezoids. Next, measure their bases and heights. Using pencil and paper or calculator, find the area of each shape and compare the answers. ● Using wooden cubes and grid paper, have students draw a 3x4 rectangle on the paper and place 12 cubes on the original layer. Have students arrive at the formula for the volume of a rectangular prism by multiplying the area of the base (number of cubes in each layer) times the number of layers (height).

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.11** The student will a. identify the coordinates of a point in a coordinate plane; and b. graph ordered pairs in a coordinate plane.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Identify** and label the axes of a coordinate plane. ● **Identify** and label the quadrants of a coordinate plane. ● **Identify** the quadrant or the axis on which a point is positioned by examining the coordinates (ordered pair) of the point. ● **Graph** ordered pairs in the four quadrants and on the axes of a coordinate plane. ● **Identify** ordered pairs represented by points in the four quadrants and on the axes of the coordinate plane. ● **Relate** the coordinate of a point to the distance from each axis and relate the coordinates of a single point to another point on the same horizontal or vertical line. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Graph, Identify **Analyze** – Relate **Key Vocabulary** coordinate plane ordered pair origin plane quadrants *x*-axis *x*-coordinate *y*-axis *y*-coordinate	**Essential Questions and Understandings** ● Can any given point be represented by more than one ordered pair? The coordinates of a point define its unique location in a coordinate plane. Any given point is defined by only one ordered pair. ● In naming a point in the plane, does the order of the two coordinates matter? Yes. The first coordinate tells the location of the point to the left or right of the *y*-axis and the second coordinate tells the location of the point above or below the *x*-axis. Point (0, 0) is at the origin. **Teacher Notes and Elaborations** A *plane* can be represented as a flat surface that extends without end in all directions. In a *coordinate plane*, the coordinates of a point are typically represented by the *ordered pair* (*x*, *y*), where *x* is the first coordinate and *y* is the second coordinate. However, any letters may be used to label the axes and the corresponding ordered pairs. The *x-coordinate* is the distance from the origin along the *x*-axis (horizontal axis). The (*y-coordinate*) is the distance along the *y*-axis (vertical axis). The *quadrants* of a coordinate plane are the four regions created by the two intersecting perpendicular number lines. Quadrants are named in counterclockwise order. The signs on the ordered pairs for quadrant I are (+,+); for quadrant II, (–,+); for quadrant III, (–, –); and for quadrant IV, (+,–). The points graphed in this coordinate plane are: 

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.11** The student will a. identify the coordinates of a point in a coordinate plane; and b. graph ordered pairs in a coordinate plane.	**Teacher Notes and Elaborations** *(continued)* In a coordinate plane, the *origin* is the point at the intersection of the *x*-axis and *y*-axis; the coordinates of this point are (0, 0). For all points on the *x*-axis, the *y*-coordinate is 0 (e.g.. (2, 0), (–4, 0), (7, 0), and (–23, 0) are located on the *x*-axis.).For all points on the *y*-axis, the *x*-coordinate is 0. (e.g., (0, 2), (0, –7), (0, 14) and (0, –2) are located on the *y*-axis.). The coordinates may be used to name the point (e.g., the point (2, 7)). It is not necessary to say "the point whose coordinates are (2, 7)". The coordinates may also be used to describe the distance (using absolute value) from both the *x*- and *y*-axis. Example 1: The point (3, –7) is 3 units from the *y*-axis and 7 units from the *x*-axis. The coordinates may also be used to determine the distance from another point on the same horizontal or vertical line. Example 2: Given two points on the same vertical line, (4, 8) and (4, 5), the distance between these points is the distance between 5 units and 8 units or 3 units. Example 3: Given two points on the same vertical line, (2, 3) and (2, –7), the distance between these points can be found by determining the distance each point is from the *x*-axis. (2, 3) is 3 units from the *x*-axis. (2, –7) is 7 units from the *x*-axis. The distance from (2, 3) to (2, –7) on the vertical line is 10 units.

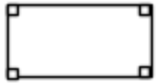
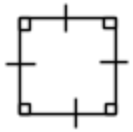
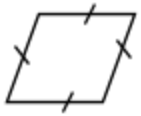
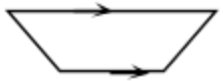
Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.11** **Foundational Objectives**	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Have students find and identify the missing coordinates of a vertex of a polygon on a coordinate plane. • Using the board game, *Battleship*, students will learn the concept of ordered pairs as positions on a grid. • Students will be given graph paper and ordered pairs will be called out orally. If the students have plotted the points correctly, a picture will be evident on the graph paper. • Students will draw a picture on a coordinate graph and label their coordinates. • Have students sit shoulder to shoulder one facing forward and the other facing backward. The first student will be given a picture on a coordinate plane. The other student will have a blank coordinate plane. The first student will describe the picture by calling out points on the coordinate plane and the second student will plot those points on their blank grid. When all the points have been given, students compare their coordinate planes to see if they are the same.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.12** The student will determine congruence of segments, angles, and polygons.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Characterize** polygons as congruent or non-congruent according to the measures of their sides and angles. ● **Determine** the congruence of segments, angles, and polygons, given their attributes. ● **Draw** polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving practical and mathematical problems. **Cognitive Level (Bloom's Taxonomy, Revised)** **Analyze** - Characterize **Evaluate** – Determine **Key Vocabulary** acute angle angle congruent correspondence hatch mark line segment noncongruent obtuse angle polygon ray right angle straight angle vertex	**Essential Questions and Understandings** ● Given two congruent figures, what inferences can be drawn about how the figures are related? The congruent figures will have exactly the same size and shape. ● Given two congruent polygons, what inferences can be drawn about how the polygons are related? Corresponding angles of congruent polygons will have the same measure. Corresponding sides of congruent polygons will have the same measure. **Teacher Notes and Elaborations** A *polygon* is a closed plane figure constructed of three or more straight-line segments. Sides are congruent if they have the same length. Angles are congruent if they have the same measure (the same number of degrees). *Congruent* figures have exactly the same size and the same shape. *Noncongruent* figures may have the same shape but not the same size. The symbol for congruency is "≅". *Correspondence* is the matching of members in one set with members in another set. The corresponding angles of congruent polygons have the same measure, and the corresponding sides of congruent polygons have the same measure. The determination of the congruence or non-congruence of two figures can be accomplished by placing one figure on top of the other or by comparing the measurements of all sides and all angles. A *line segment* is a part of a line that has two endpoints. A *ray* is a set of points that is a subset of a line; it extends indefinitely in one direction and has one endpoint. *Angles* are constructed from two rays that share a common endpoint (*vertex*). Construction of congruent line segments, angles, and polygons helps students understand congruency. A geometric construction can be made with a compass and a straightedge. The straightedge is used to draw line segments and the compass is used to transfer equal distances and draw arcs and circles. *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.12** The student will determine congruence of segments, angles, and polygons.	**Teacher Notes and Elaborations** *(continued)*

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.12** **Foundational Objectives** **5.11** The student will measure right, acute, obtuse, and straight angles. **4.10** The student will a. identify and describe representations of points, lines, line segments, rays, and angles, including endpoints and vertices; and b. identify representations of lines that illustrate intersection, parallelism, and perpendicularity. **4.11** The student will investigate congruence of plane figures. **3.15** The student will identify and draw representations of points, line segments, rays, angles, and lines. **3.16** The student will identify and describe congruent and noncongruent plane figures.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Students look for examples of congruent figures within the environment. • Play the "Congruent" Game. Cut out shapes of two each. Glue one of each shape on a circle with a spinner. Place all other pieces on another table. Divide class into two teams. Have a student come to the spinner and spin. Next, the student must go to the table and pick out the matching piece (e.g., visual memory), bring it back to the spinner, and see if it is a match. If the piece matches, the student's team receives a point. Continue rotating members and team turns until all students have had a turn. • Use patty paper to compare figures to determine congruence or noncongruence.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.13** The student will describe and identify properties of quadrilaterals.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Sort** and **classify** polygons as quadrilaterals, parallelograms, rectangles, trapezoids, kites, rhombi, and squares based on their properties. Properties include number of parallel sides, angle measures and number of congruent sides. ● **Identify** the sum of the measures of the angles of a quadrilateral as 360°. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Identify **Understand** – Classify **Analyze** – Sort **Key Vocabulary** bisect congruent diagonal intersect isosceles trapezoid kite parallel parallelogram perpendicular perpendicular bisector plane figure quadrilateral rectangle rhombus square trapezoid	**Essential Questions and Understandings** ● Can a figure belong to more than one subset of quadrilaterals? Any figure that has the attributes of more than one subset of quadrilaterals can belong to more than one subset. For example, rectangles have opposite sides of equal length. Squares have all 4 sides of equal length thereby meeting the attributes of both subsets. **Teacher Notes and Elaborations** *Plane figures* are 2-dimensional figures that lie entirely in a single plane. A *quadrilateral* is a closed planar (two-dimensional) figure with four sides that are line segments. If geometric figures *intersect* they have points in common. *Parallel* lines do not intersect; they are everywhere the same distance from each other and have no points in common. *Perpendicular lines* are two lines that intersect to form right angles. To *bisect* means to divide into two equal parts. A *perpendicular bisector* is a line, ray, or line segment that divides a segment into two congruent segments forming right angles and is perpendicular to the segment. *Congruent* figures have exactly the same size and the same shape. Noncongruent figures may have the same shape but not the same size. Quadrilaterals can be classified by the number of parallel sides. A parallelogram, a rectangle, a rhombus, and a square, each have two pairs of parallel sides. A trapezoid has only one pair of parallel sides. Other quadrilaterals have no parallel sides. Quadrilaterals can be classified by the measures of their angles. The sum of the measures of the angles of a quadrilateral is 360°. A rectangle has four 90° angles. A trapezoid may have zero or two 90° angles. Quadrilaterals can be classified by the number of congruent sides: a rhombus has four congruent sides; a square, which is a rhombus with four right angles, also has four congruent sides; a parallelogram and a rectangle each have two pairs of opposite sides congruent. A square is a special type of both a rectangle and a rhombus, which are special types of parallelograms, which are special types of quadrilaterals.

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.13** The student will describe and identify properties of quadrilaterals.	**Teacher Notes and Elaborations** *(continued)* Denote which angles are congruent with the same number of curved lines. Congruent sides are denoted with the same number of *hatch marks* on each congruent side. Arrows are used in diagrams to indicate that lines are parallel. A *diagonal* of a polygon is a line segment which connects two non-consecutive vertices. A *parallelogram* is a quadrilateral whose opposite sides are parallel and congruent. Opposite angles are congruent. A diagonal divides the parallelogram into two congruent triangles. The diagonals of a parallelogram bisect each other.  A *rectangle* is a parallelogram with four right angles. Rectangles have special characteristics (such as diagonals are congruent and they bisect each other) that are true for any rectangle. Since a rectangle is a parallelogram, a rectangle has the same properties as those of a parallelogram.  A *square* is a rectangle with four congruent sides and a rhombus with four right angles. Squares have special characteristics that are true for all squares, such as diagonals are perpendicular bisectors and diagonals bisect opposite angles. Since a square is a rectangle, a square has all the properties of a rectangle and of a parallelogram.  A *rhombus* is a parallelogram with four congruent sides.  A *trapezoid* is a quadrilateral with exactly one pair of parallel sides. The parallel sides are called bases, and the nonparallel sides are called legs. If the legs have the same length, then the trapezoid is an *isosceles trapezoid*.  A *kite* is a quadrilateral with two pairs of adjacent congruent sides. One pair of opposite angles is congruent. *(continued)* 

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.13** The student will describe and identify properties of quadrilaterals.	**Teacher Notes and Elaborations** *(continued)* Quadrilaterals can be sorted according to common attributes, using a variety of materials. A chart, graphic organizer, or Venn Diagram can be made to organize quadrilaterals according to attributes such as sides and/or angles.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Measurement and Geometry **Focus** Properties and Relationships **Virginia SOL 6.13** **Foundational Objectives** **5.13a** The student, using plane figures (square, rectangle, triangle, parallelogram, rhombus, and trapezoid), will develop definitions of these plane figures. **4.10b** The student will identify representations of lines that illustrate intersection, parallelism, and perpendicularity. **4.12** The student will a. define polygon; and b. identify polygons with 10 or fewer sides. **3.14** The student will identify, describe, compare, and contrast characteristics of plane and solid geometric figures (circle, square, rectangle, triangle, cube, rectangular prism, square pyramid, sphere, cone, and cylinder) by identifying relevant characteristics, including the number of angles, vertices, and edges, and the number and shape of faces, using concrete models.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Given a set of different quadrilaterals, students will classify them according to common attributes, which are determined by the students. Following a discussion by the students about their classifications, the teacher will refine their definitions. • Cooperative Activity: Each group is given a large loop of yarn. Without talking each student in the group must have both hands on the yarn and must make a shape specified by the teach

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.14** The student, given a problem situation, will a. construct circle graphs; b. draw conclusions and make predictions, using circle graphs; and c. compare and contrast graphs that present information from the same data set.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Collect, organize** and **display** data in circle graphs by depicting information as fractional parts. ● **Draw** conclusions and make **predictions** about data presented in a circle graph. ● **Compare** and **contrast** data presented in a circle graph with the same data represented in other graphical forms. ● **Decide** which type of graph is appropriate for a given situation. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Decide, Draw **Understand** – Predict **Analyze –** Compare, Contrast **Evaluate** – **Create** – Collect, Organize, Display **Key Vocabulary** bar graph circle graph data line graph survey	**Essential Questions and Understandings** ● What types of data are best presented in a circle graph? Circle graphs are best used for data showing a relationship of the parts to the whole. **Teacher Notes and Elaborations** To collect *data* (items of information) for any problem situation, an experiment can be designed, a survey can be conducted, or other data gathering strategies can be used. The data can be organized, displayed, analyzed, and interpreted to answer the problem. A stem-and-leaf plot displays data from least to greatest using the digits of the greatest place value to group data. A *survey* is a sampling, or partial collection, of facts, figures, or opinions taken and used to approximate or indicate what a complete collection and analysis might reveal. Different types of graphs are used to display different types of data. - *Bar graphs* use categorical (discrete) data (e.g., months or eye color). - *Line graphs* use continuous data (e.g., temperature and time). - *Circle graphs* show a relationship of the parts to a whole. All graphs include a title, and data categories should have labels. A scale should be chosen that is appropriate for the data. A key is essential to explain how to read the graph. A title is essential to explain what the graph represents. *Bar graphs* should be utilized to compare counts of different categories (categorical or discrete data). A bar graph uses parallel bars; either horizontal or vertical, to represent counts for several categories. One bar is used for each category with the length of the bar representing the count for that category. There is space before, between, and after the bars. The axis displaying the scale representing the count for the categories should extend one increment above the greatest recorded piece of data. The values should represent equal increments. Each axis should be labeled, and the graph should have a title. Statements representing an analysis and interpretation of the characteristics of the data in the graph should be included (e.g., similarities and differences, mode, least and greatest). *(continued)*

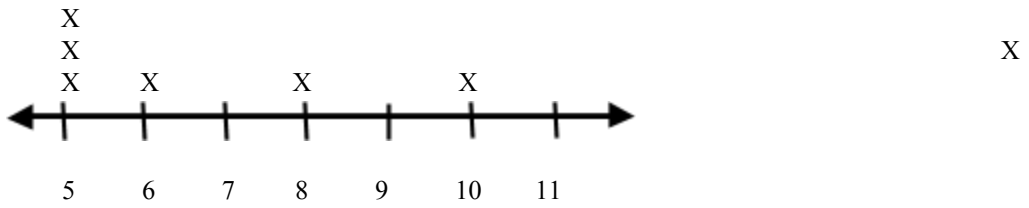
Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.14** The student, given a problem situation, will a. construct circle graphs; b. draw conclusions and make predictions, using circle graphs; and c. compare and contrast graphs that present information from the same data set.	**Teacher Notes and Elaborations** *(continued)* A double bar graph is similar to a bar graph but gives two counts for each category. It enables us to compare the same data over multiple periods of time. In the last example, instead of just comparing the temperature on one day a double bar could be used to compare the temperature on two days. A *line graph* is used when there is a numeric value associated with equally spaced points along a continuous number scale. Points are plotted to represent two related pieces of data, and a line is drawn to connect the points. (Teaching Student-Centered Mathematics, Grades 5-8, 2006, John Van de Walle and LouAnn Lovin). By looking at a single line graph, it can be determined whether the variable is increasing, decreasing, or staying the same. The values along the horizontal axis represent continuous data on a given variable, usually some measure of time, (e.g., time in years, months, or days). The data represented on a line graph is referred to as continuous data as it represents data collected over a continuous period of time. If one variable is not continuous, then a broken line is used. The values along the vertical axis represent the frequency with which those values occur in the data set. The values should represent equal increments of multiples of whole numbers, fractions, or decimals depending upon the data being collected. The scale should extend one increment above the greatest recorded piece of data. Each axis should be labeled and the graph should have a title. Statements representing an analysis and interpretation of the characteristics of the data in the graph should be included (e.g., trends of increase and /or decrease, least and greatest). A broken line is used if the data collected is not continuous data (such as test scores); a solid line is used if the data is continuous (such as height of a plant). Growth of Greta's CD Collection Jan Feb Mar Apr Time in Months *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.14** The student, given a problem situation, will a. construct circle graphs; b. draw conclusions and make predictions, using circle graphs; and c. compare and contrast graphs that present information from the same data set.	**Teacher Notes and Elaborations** *(continued)* *Circle graphs* are best used for data showing a relationship of the parts to the whole. The focus at this level is to use fractional parts to draw the circle graph. Benchmark measurements should be halves, thirds, fourths, sixths, eighths, twelfths, and any combination of these measurements. All experiences are not limited to these measurements.  Extension: The tools needed to construct a circle graph are a compass and a protractor. To construct a circle graph find the fractional part of the whole. Multiply each fractional part by 360 (the number of degrees in a circle). Draw a circle using a compass. Using a protractor, make central angles (angles whose vertex is the center of the circle) based on the products of the fractional parts times 360. Data are analyzed by describing the various features and elements of a graph. Conclusions and predictions are based on data analysis.

Sport	Number	Fractional part of circle	Measure of central angle
Football	10	$\frac{10}{40}=\frac{1}{4}$	$\frac{1}{4}\times 360=90°$
Soccer	20	$\frac{20}{40}=\frac{1}{2}$	$\frac{1}{2}\times 360=180°$
Baseball	4	$\frac{4}{40}=\frac{1}{10}$	$\frac{1}{10}\times 360=36°$
Basketball	6	$\frac{6}{40}=\frac{3}{20}$	$\frac{3}{20}\times 360=54°$
Total	40	$\frac{40}{40}=1$	360°

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.14** **Foundational Objectives** **5.15** The student, given a problem situation, will collect, organize, and interpret data in a variety of forms, using stem-and-leaf plots and line graphs. **4.14** The student will collect, organize, display, and interpret data from a variety of graphs. **3.17** The student will a. collect and organize data, using observations, measurements, surveys, or experiments; b. construct a line plot, picture graph, or a bar graph to represent the data; and c. read and interpret the data represented in line plots, bar graphs, and picture graphs and write a sentence analyzing the data.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	● Have students collect data by generating their own survey. Students should determine the similarities and differences in each of the graph formats and determine the most appropriate graph for the collected data. Students will then create an appropriate graph using their data. Discuss and interpret results. ● Have students compare data presented in a circle graph to the same data presented in a line graph and a bar graph.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.15** The student will a. describe mean as balance point; and b. decide which measure of center is appropriate for a given purpose.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Find** the mean for a set of data. ● **Describe** the three measures of center and a situation in which each would best represent a set of data. ● **Identify** and draw a number line that demonstrates the concept of mean as balance point for a set of data. **Key Vocabulary** balance point bimodal mean measures of center median mode	**Essential Questions and Understandings** ● What does the phrase "measure of center" mean? This is a collective term for the 3 types of averages for a set of data – mean, median, and mode. ● What is meant by mean as balance point? Mean can be defined as the point on a number line where the data distribution is balanced. This means that the sum of the distances from the mean of all the points above the mean is equal to the sum of the distances of all the data points below the mean. This is the concept of mean as the balance point. **Teacher Notes and Elaborations** *Measures of center* are types of averages for a data set. They represent numbers that describe a data set. Mean, median, and mode are the measures of center that are useful for describing the average for different situations. Mean works well for sets of data with no very high or very low numbers. (e.g., The average age in years of students at Center Middle School is 12. Mean is a better measure of the average because the set of data has no very high or very low numbers.) Median is a good choice when data sets have a couple of values much higher or much lower than most of the others. (e.g., The president of a small company has a salary of $320,000. The rest of the employees have salaries less than $100,000. Median is a better measure for the average salary of this company because one value is so much higher than the others.) Mode is a good descriptor to use when the set of data has some identical values or when data are not conducive to computation of other measures of central tendency, as when working with data in a yes or no survey. (e.g., Mode can be used to determine the average shoe size of students in a class. Shoe sizes are standardized and not conducive to computation.) The mean is the numerical average of the data set and is found by adding the numbers in the data set together and dividing the sum by the number of data pieces in the set. In grade 5 mathematics, mean is defined as fairshare. *Mean* can be defined as the point on a number line where the data distribution is balanced. This means that the sum of the distances from the mean of all the points above the mean is equal to the sum of the distances of all the data points below the mean. This is the concept of mean as the *balance point*. Defining mean as balance point is a prerequisite for understanding standard deviation, which is introduced in Algebra I. *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.15** The student will a. describe mean as balance point; and b. decide which measure of center is appropriate for a given purpose.	**Teacher Notes and Elaborations** *(continued)* This line plot shows the number of letters in the names of 7 students. Letters in Names  Each X represents 1 student. The balance point for this set of data is 7. The sum of the distances from the mean of all the points above the mean is equal to the sum of the distances of all the points below the mean. The *median* is the middle value of a data set in ranked order. If there are an odd number of pieces of data, the median is the middle value in ranked order. If there is an even number of pieces of data, the median is the numerical average of the two middle values. The *mode* is the piece of data that occurs most frequently. If no value occurs more often than any other, there is no mode. If there is more than one value that occurs most often, all these most-frequently-occurring values are modes. When there are exactly two modes, the data set is *bimodal*.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.15** **Foundational Objective** **5.16** The student will a. describe the mean, median, and mode as measures of center; b. describe mean as fair share; c. find the mean, median, mode, and range of a set of data; and d. describe the range of a set of data as a measure of variation.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml Connected Math 2; Grade 6; Data About Us; Pearson, Prentice Hall; 2006, Pages 52–62. *Many problems and activities comparing measures of center are presented. Line plots/number lines are used to demonstrate mean.* Teaching Student Centered Mathematics, Grades 5-8, John Van de Walle and LouAnn Lovin, Pearson Education, 2006, Pages 311–319. *Activities involving descriptive statistics are presented.*	• Draw a number line from 0 to 15 with about an inch between the numbers. Use 8 small sticky notes to represent the prices of 8 toys and place them on the number line. Have students place a light pencil mark on the line where they think the mean may be (Avoid the add up and divide computation.). The task is to determine the actual mean by moving the sticky notes in toward the "center". That is, the students are finding out what price or point on the number line balances out the eight prices on the line. For each move of a sticky one space to the left (a toy with a lower price), a different sticky must be moved one space to the right (a toy with a higher price). Eventually, all stickies should be stacked above the same number, the balance point or mean. (Teaching Student Centered Mathematics, Grades 5-8, John Van de Walle and LouAnn Lovin, 2006, p. 316). • Connected Math 2; Grade 6; Data About Us: Pearson, Prentice Hall; 2006, Page 59, problem 17, Town Election Today in Slugville. Three candidates are running for mayor. Each has determined the typical income for the people in Slugville using the mean, median, and mode. They are using this information to help in their campaigns.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.16** The student will a. compare and contrast dependent and independent events; and b. determine probabilities for dependent and independent events.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Determine** whether two events are dependent or independent. ● **Compare** and **contrast** dependent and independent events. ● **Determine** the probability of two dependent events. ● **Determine** the probability of two independent events. **Cognitive Level (Bloom's Taxonomy, Revised)** **Analyze –** Compare, Contrast **Evaluate** - Determine **Key Vocabulary** compound event dependent event independent event outcome probability simple event	**Essential Questions and Understandings** ● How can you determine if a situation involves dependent or independent events? Events are independent when the outcome of one has no effect on the outcome of the other. Events are dependent when the outcome of one event is influenced by the outcome of the other. **Teacher Notes and Elaborations** *Probability* is the chance of an event occurring. In probability the *outcome* is any of the possible results in an experiment. The probability of an event occurring is equal to the ratio of desired outcomes to the total number of possible outcomes (sample space). The probability of an event occurring can be represented as a ratio or the equivalent fraction, decimal, or a percent. The probability of an event occurring is a ratio between 0 and 1. A probability of 0 means the event will never occur. A probability of 1 means the event will always occur. A *simple event* is one event (e.g., pulling one sock out of a drawer and examining the probability of getting one color). A *compound event* combines two or more simple events (dependent or independent). A sample space is the set of all possible outcomes of an experiment. A sample space may be organized by using a list, chart, picture, or tree diagram. The sample space for tossing 2 coins is (H, H), (H, T), (T, H) and (T, T). *Events are independent* when the outcome of one has no effect on the outcome of the other. For example, rolling a number cube and flipping a coin are independent events. The probability of two independent events is found by using the following formula: $P(A \text{ and } B) = P(A) \cdot P(B)$ Example: When rolling two number cubes simultaneously, what is the probability of rolling a 3 on one cube and a 4 on the other? $P(3 \text{ and } 4) =$ *(continued)*

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Practical Applications of Statistics **Virginia SOL 6.16** The student will a. compare and contrast dependent and independent events; and b. determine probabilities for dependent and independent events.	**Teacher Notes and Elaborations** *(continued)* *Events are dependent* when the outcome of one event is influenced by the outcome of the other. For example, when drawing two marbles from a bag, ***not* replacing** the first after it is drawn affects the outcome of the second draw. The probability of two dependent events is found by using the following formula: Example: If a bag holds a blue ball, a red ball, and a yellow ball, what is the probability of picking a blue ball out of the bag on the first pick and then ***without* replacing** the blue ball in the bag, picking a red ball on the second pick? $P(\text{blue } \textit{and } \text{red}) = P(\text{blue}) \cdot P(\text{red } \textit{after } \text{blue}) = \frac{1}{3} \cdot \frac{1}{2} = \frac{1}{6}$ or approximately 16.7% The value of this probability can also be plotted on a number line. 

<table>
<tr><th>Curriculum Information</th><th>Resources</th><th>Sample Instructional Strategies and Activities</th></tr>
<tr>
<td><u>SOL Reporting Category</u>
Probability, Statistics, Patterns, Functions, and Algebra

<u>Focus</u>
Practical Applications of Statistics

<u>Virginia SOL 6.16</u>

<u>Foundational Objectives</u>
5.14
The student will make predictions and determine the probability of an outcome by constructing a sample space.
4.13
The student will
a. predict the likelihood of an outcome of a simple event; and
b. represent probability as a number between zero and one, inclusive.
3.18
The student will investigate and describe the concept of probability as chance and list possible results of a given situation.</td>
<td>Text:
Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education

VDOE Enhanced Scope and Sequence Sample Lesson Plans
http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php

Virginia Department of Education website
http://www.doe.virginia.gov/instruction/mathematics/index.shtml</td>
<td>● Assemble the following materials based on the number of pairs of students in your class (classes) first and then follow directions for activity.
Prepare bags for each pair of students by using a variety of color tiles. Each bag should contain only two colors and be different from the others both in total number of tiles and in quantity of colors one and two.
Prepare an answer key by numbering each bag and recording the contents of each bag.
Prepare an answer sheet for each pair of students something like this.

<table>
<tr><th>Bag #</th><th># of Color 1 Tiles</th><th># of Color 2 Tiles</th><th>Total # of Tiles</th><th>Probability of picking Color 1 Tile</th><th>Probability of picking Color 2 Tile With Replacement</th><th>Probability of picking Color 2 Tile Without Replacement</th></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2 - ?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Divide students into pairs. Have each pair complete the table for their bag number. Students should exchange bags until they have completed all bags.
Discuss results.
● Have students create experiments that illustrate dependent and independent events. Present their ideas and have class determine which is the dependent and which is the independent event.</td>
</tr>
</table>

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.17** The student will identify and extend geometric and arithmetic sequences.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Investigate** and **apply** strategies to **recognize** and **describe** the change between terms in arithmetic patterns. ● **Investigate** and **apply** strategies to **recognize** and **describe** geometric patterns. ● **Describe** verbally and in writing the relationships between consecutive terms in an arithmetic or geometric sequence. ● **Extend** and **apply** arithmetic and geometric sequences to similar situations. ● **Extend** arithmetic and geometric sequences in a table by using a given rule or mathematical relationship. ● **Compare** and **contrast** arithmetic and geometric sequences. ● **Identify** the common difference for a given arithmetic sequence. ● **Identify** the common ratio for a given geometric sequence. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Describe **Understand** – Recognize **Apply** – Apply **Analyze** – Extend, Contrast, Compare **Evaluate** – Investigate **Key Vocabulary** arithmetic sequence common difference common ratio geometric sequence	**Essential Questions and Understandings** ● What is the difference between an arithmetic and a geometric sequence? While both are numerical patterns, arithmetic sequences are additive and geometric sequences are multiplicative. **Teacher Notes and Elaborations** *Arithmetic and geometric sequences* are types of numerical patterns. In a sequence, numbers or figures are arranged according to some pattern. Each member of the pattern is called a term of the sequence. Numerical patterns may include linear and exponential growth, perfect squares, triangular and other polygonal numbers, or Fibonacci numbers**.** In the numerical pattern of an arithmetic sequence, students must determine the difference, called the *common difference*, between each succeeding number in order to determine what is added to each previous number to obtain the next number. Sample numeric patterns are 6, 9, 12, 15, 18, …; and 5, 7, 9, 11, 13,…. In geometric number patterns, students must determine what each number is multiplied by to obtain the next number in the geometric sequence. This multiplier is called the *common ratio*. Sample geometric number patterns include 2, 4, 8, 16, 32, …; 1, 5, 25, 125, 625, …; and 80, 20, 5, 1.25, …. Strategies to recognize and describe the differences between terms in numerical patterns include, but are not limited to, examining the change between consecutive terms, and finding common factors. An example is the pattern 1, 2, 4, 7, 11, 16, …. Classroom experiences should include building patterns and describing how the patterns can be extended in a logical manner. Building the patterns with physical materials such as tiles, counters, or flat toothpicks allows students to make changes if necessary and to build on to one step to make a new step. (Teaching Student-Centered Mathematics, Grades 5-8, 2006, John Van de Walle and LouAnn Lovin). A rule is an explanation of how to extend the pattern.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.17** **Foundational Objectives** **5.17** The student will describe the relationship found in a number pattern and express the relationship. **4.15** The student will recognize, create, and extend numerical and geometric patterns. **3.19** The student will recognize and describe a variety of patterns formed using numbers, tables, and pictures, and extend the patterns, using the same or different forms.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Given a list of numbers, have the students determine which numbers would be next. Have them determine if there is a common difference or common ratio thus determining if it is an arithmetic or geometric sequence. • Given pictorial models of the first three figures in a pattern, have the students create the next 4 figures in the pattern. Have the students explain orally and in writing how the pattern grows. • Explore and explain arithmetic and geometric patterns using manipulatives, (such as snap cubes, blocks, pattern blocks, and grid paper), number lines, and tables. • Create numerical and geometric patterns by using a given rule or mathematical relationship.

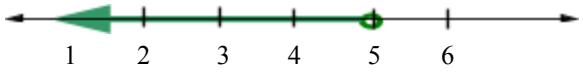
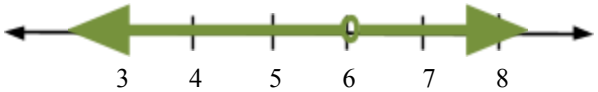
Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.18** The student will solve one-step linear equations in one variable involving whole number coefficients and positive rational solutions.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Represent** and solve a one-step equation, using a variety of concrete materials such as colored chips, algebra tiles, or weights on a balance scale. ● **Solve** a one-step equation by demonstrating the steps algebraically. ● **Identify** and use the following algebraic terms appropriately: *expression, equation*, *variable*, *term*, and *coefficient*. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Identify **Understand** – Represent **Apply** – Solve **Key Vocabulary** coefficient equation expression numerical expression term variable variable expression	**Essential Questions and Understandings** ● When solving an equation, why is it necessary to perform the same operation on both sides of an equal sign? To maintain equality, an operation performed on one side of an equation must be performed on the other side. **Teacher Notes and Elaborations** A *term* is a number, variable, product, or quotient in an expression of sums and/or differences. In , there are three terms $7x^2$, $5x$, and 3. A *coefficient* is the numerical factor in a term. For example, in the term , 3 is the coefficient; in the term z, 1 is the coefficient. A *variable* is a symbol (placeholder) used to represent an unspecified member of a set. A mathematical *expression* contains a variable or a combination of variables, numbers, and/or operation symbols and represents a mathematical relationship. An expression is like a phrase and does not have a verb, so an expression does not have an equal sign (=). An expression cannot be solved. A *numerical expression* is an expression that contains only numbers (e.g., 7 + 4). A *variable expression* contains a variable (e.g., n + 12). An *equation* is a mathematical sentence stating that **two** expressions are equal (An equation has only one equal sign. A series of equivalent equations can be written to solve an equation.). A one step linear equation is an equation that requires one operation to solve. Solutions to equations should be checked using substitution. Positive rational solutions are limited to the whole numbers and positive fractions and decimals. To solve a one-step equation algebraically students must maintain equality by performing the same operation on both sides of the equation. For example: If $a = b$ then If $a = b$ then If $a = b$ then $a \cdot c = b \cdot c$ If $a = b$ then $\frac{a}{c} = \frac{b}{c}$ $(c \neq 0)$

Curriculum Information	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.18** The student will solve one-step linear equations in one variable involving whole number coefficients and positive rational solutions.	**Teacher Notes and Elaborations** *(continued)* A variety of representations of equations should be used to demonstrate maintaining equality.

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.18** **Foundational Objectives** **5.18** The student will a. investigate and describe the concept of variable; b. write an open sentence to represent a given mathematical relationship using a variable; c. model one-step linear equations in one variable using addition and subtraction; and d. create a problem situation based on a given open sentence, using a single variable. **4.16a** The student will recognize and demonstrate the meaning of equality in an equation.	Text: Virginia Math Connects, Course 1, ©2012, Price, et al, McGraw-Hill School Education Group PWC Mathematics website http://pwcs.math.schoolfusion.us Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	● Demonstrate the use of a pan balance (e.g., scale) by showing how equal numbers of like objects balance each other. ● Play game of "Guess my Number" – or similar idea to demonstrate an unknown. "When you add 5 to me I become 12. Who Am I?" Use this to set the stage for unknowns. "How could we write this equation?"

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.19** The student will investigate and recognize a. the identity properties for addition and multiplication; b. the multiplicative property of zero; and c. the inverse property for multiplication.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Identify** the real number equation that represents each property of operations with real numbers, when given several real number equations. ● **Test** the validity of properties by using examples of the properties of operations on real numbers. ● **Identify** the property of operations with real numbers that is illustrated by a real number equation. ***NOTE: The commutative, associative and distributive properties are taught in previous grades***. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Identify **Analyze** - Test **Key Vocabulary** additive identity property (identity property of addition) associative property of addition associative property of multiplication commutative property of addition commutative property of multiplication distributive property identity elements inverses multiplicative identity property (identity property of multiplication) multiplicative inverse property (inverse property of multiplication) multiplicative property of zero reciprocal	**Essential Questions and Understandings** ● How are the identity properties for multiplication and addition the same? Different? For each operation the identity elements are numbers that combine with other numbers without changing the value of the other numbers. The additive identity is zero (0). The multiplicative identity is one (1). ● What is the result of multiplying any real number by zero? The product is always zero. ● Do all real numbers have a multiplicative inverse? No. Zero has no multiplicative inverse because there is no real number that can be multiplied by zero resulting in a product of one. **Teacher Notes and Elaborations** *Identity elements* are numbers that combine with other numbers without changing the other numbers. The additive identity is zero (0). The multiplicative identity is one (1). There are no identity elements for subtraction and division. The *additive identity property* states that the sum of any real number and zero is equal to the given real number (e.g., $5 + 0 = 5$). The *multiplicative identity property* states that the product of any real number and one is equal to the given real number (e.g., $8 \cdot 1 = 8$). *Inverses* are numbers that combine with other numbers and result in identity elements. The *multiplicative inverse property* states that the product of a number and its multiplicative inverse (or *reciprocal*) always equals one (e.g.,). Zero has no multiplicative inverse. The *multiplicative property of zero* states that the product of any real number and zero is zero. Division by zero is not a possible arithmetic operation. Division by zero is undefined. The *commutative property of addition* states that changing the order of the addends does not change the sum (e.g., $5 + 4 = 4 + 5$). The *commutative property of multiplication* states that changing the order of the factors does not change the product (e.g., $5 \cdot 4 = 4 \cdot 5$). The *associative property of addition* states that regrouping the addends does not change the sum [e.g., $5 + (4 + 3) = (5 + 4) + 3$]. The *associative property of multiplication* states that regrouping the factors does not change the product [e.g., $5 \cdot (4 \cdot 3) = (5 \cdot 4) \cdot 3$]. Subtraction and division are neither commutative nor associative. The *distributive property* states that the product of a number and the sum (or difference) of two other numbers equals the sum (or difference) of the products of the number and each other number [e.g., $5 \cdot (3 + 7) = (5 \cdot 3) + (5 \cdot 7)$, or $5 \cdot (3 – 7) = (5 \cdot 3) – (5 \cdot 7)$].

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.19** **Foundational Objectives** **5.19** The student will investigate and recognize the distributive property of multiplication over addition. **4.16b** The student will investigate and describe the associative property for addition and multiplication. **3.20** The student will a. investigate the identity and the commutative properties for addition and multiplication; and b. identify examples of the identity and commutative properties for addition and multiplication.	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• The class is divided into two teams of students. Each team is given 15 seconds to recognize the property of real numbers displayed on index cards. Each correct answer is worth one point. The team with the greatest number of points wins the game.

Curriculum Information	Essential Knowledge and Skills Key Vocabulary	Essential Questions and Understandings Teacher Notes and Elaborations
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.20** The student will graph inequalities on a number line.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections and representations to:** ● **Given** a simple inequality with integers, **graph** the relationship on a number line. ● **Given** the graph of a simple inequality with integers, **represent** the inequality two different ways using the symbols <, >, ≤ and ≥. **Cognitive Level (Bloom's Taxonomy, Revised)** **Remember** – Graph **Analyze** – Represent **Key Vocabulary** inequality solution set	**Essential Questions and Understandings** ● In an inequality, does the order of the expressions matter? Yes, the order does matter. For example, $x > 5$ is not the same relationship as $5 > x$. However, $x > 5$ is the same relationship as $5 < x$. **Teacher Notes and Elaborations** An *inequality* is a mathematical sentence that states that one quantity is less than, greater than, or not equal to another quantity. An inequality is a mathematical sentence that compares two expressions using one of the symbols <, >, ≤, ≥, or ≠. It is important for students to see inequalities written with the variable before the inequality symbol and after the inequality symbol. For example $x > -6$ and $7 > y$. Inequalities using the < or > symbols are represented on a number line with an open circle on the number and a shaded line over the solution set. Ex: $x < 5$ or $5 > x$. Graphing can be used to demonstrate that both inequalities represent the same solution set.  The *solution set* to an inequality is the set of all numbers that make the inequality true. Inequalities using the ≤ or ≥ symbols are represented on a number line with a closed circle on the number and shaded line in the direction of the solution set. When graphing $x \leq 5$ fill in the circle on the number line above the 5 to indicate that the 5 is included. (Note: The graph must be drawn on the number line not above the number line.) When graphing the inequality $x \neq 6$ the solution set includes all points except 6. This graph can be represented on a number line with an open circle on the number 6 and shaded lines extending in both directions. 

Curriculum Information	Resources	Sample Instructional Strategies and Activities
SOL Reporting Category Probability, Statistics, Patterns, Functions, and Algebra **Focus** Variable Equations and Properties **Virginia SOL 6.20** **Foundational Objectives**	Text: Mathematics Course 1 VA Grade 6, ©2012, Prentice Hall, Pearson Education VDOE Enhanced Scope and Sequence Sample Lesson Plans http://www.doe.virginia.gov/testing/sol/scope_sequence/mathematics_2009/index.php Virginia Department of Education website http://www.doe.virginia.gov/instruction/mathematics/index.shtml	• Place copies of integer number lines in sheet protectors. Give each student a dry erase marker, eraser, and sheet protector with number line. Write an inequality on the board for students to see, and then have them graph the inequality on their number line.

NOTES

Grade 6 – Crosswalk (Summary of Revisions): 2016 *Mathematics Standards of Learning and Curriculum Framework*

Additions (2016 SOL)	Deletions from Grade 6 (2009 SOL)
• 6.6a, b – Operations with two integers and solve practical problems [Moved from 7.3] • 6.9 EKS – Identify regular polygons; draw lines of symmetry for regular polygons • 6.11b –Determine the effect on measures of center when a value is added, removed, or changed [Moved from 5.16 EKS] • 6.12 – Represent proportional relationships between two quantities; determine unit rates and complete ratio tables; determine whether a proportional relationship exists; and make connections among representations of proportional relationships • 6.13 – Solve practical problems with one-step linear equations • 6.13 EKS – Write verbal expressions and sentences as algebraic expressions and equations; write algebraic expressions and equations as verbal expressions and sentences • 6.14 – Represent practical situations with inequalities; solve one-step inequalities involving addition and subtraction, and graph solutions on a number line • 6.14 EKS – Identify a value that is a solution to an inequality	• 6.9 – Ballpark comparisons between U.S. Customary system and metric system of measurements [Included in 7.3 EKS] • 6.10d – Describe and determine the volume and surface area of a rectangular prism [Included in 7.4a] • 6.13 – Properties of quadrilaterals [Included in 7.6a] • 6.15b – Decide which measure of center is appropriate for a given purpose • 6.16 – Dependent and independent events [Moved to 8.11a] • 6.16b – Determine probabilities [Included in 8.11b] • 6.17 – Arithmetic and geometric sequences [Included in AFDA.1 EKS, AII.5]
Parameter Changes/Clarifications (2016 SOL)	**Moves within Grade 6 (2009 SOL to 2016 SOL)**
• 6.2a EKS– Equivalencies limited to fractions with denominators of 12 or less or factors of 100 • 6.2b – Compare and order fractions, decimals, and percents extended to positive rational numbers; EKS limited to no more than four; EKS limited to fractions with denominators of 12 or less or factors of 100 to include proper, improper and mixed numbers • 6.4 EKS – Limitation changed to whole number exponents, versus natural number exponents • 6.5c EKS – Divisors limited to 3 digit number and decimal divisors limited to hundredths • 6.6c – Simplify numerical expressions [Moved and modified from 6.8] extended to include integers [EKS extended to include absolute value; exponents limited to 1, 2, and 3 and bases limited to whole numbers; expression may have no more than 3 operations] • 6.8b EKS - Coordinate values limited to integers • 6.10a EKS – Number of data values represented in a circle graph limited in order to make comparisons that have denominators of 12 or less or those that are factors of 100 • 6.10c – Compare circle graphs with other graphs now specified as bar graphs, pictographs, and line plots • 6.11a EKS – Represent mean as a balance point graphically on a line plot • 6.13 EKS – Solve a one-step equation in one variable. Coefficients are limited to integers and unit fractions. Numeric terms are limited to integers. • 6.6, 6.13, 6.14 EKS and US – apply properties of real numbers and properties of equality/inequality	• 6.2a – [Moved to 6.2 EKS] • 6.2 b, c – [Included in 6.2a] • 6.2d – Compare and order fractions, mixed numbers, decimals and percents [Included in 6.2b] • 6.4 – [Moved to 6.5a EKS] • 6.5 – [Moved to 6.4] • 6.6 – [Moved to 6.5a, b] • 6.7 – [Moved to 6.5c] • 6.8 – [Moved to 6.6c and modified] • 6.10a, b, c – [Moved to 6.7a, b, c] • 6.11 – [Moved to 6.8] • 6.12 – [Moved to 6.9]; Draw polygons in the coordinate plane and find side lengths using the coordinates [Moved to 6.8] • 6.13 – [Moved to 6.12] • 6.14 – [Moved to 6.10] • 6.15a – [Moved to 6.11a] • 6.18 – [Moved to 6.13] • 6.19 – Investigate and recognize properties [Incorporated into EKS and US for 6.6, 6.13, and 6.14] • 6.20 – [Moved to 6.14]

EKS = Essential Knowledge and Skills, referring to the column on the right side of the Curriculum Framework
US = Understanding the Standard, referring to the column on the left side of the Curriculum Framework

Comparison of Mathematics Standards of Learning – 2009 to 2016

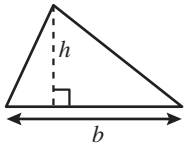
2009 SOL	2016 SOL
Number and Number Sense *On the state assessment, items measuring this objective are assessed without the use of a calculator.	
6.1 The student will describe and compare data, using ratios, and will use appropriate notations, such as $\frac{a}{b}$, *a* to *b*, and *a*:*b*.	6.1 The student will represent relationships between quantities using ratios, and will use appropriate notations, such as $\frac{a}{b}$, *a* to *b*, and *a*:*b*.
6.2 The student will a) investigate and describe fractions, decimals, and percents as ratios; [Moved to 6.2 EKS] b) identify a given fraction, decimal, or percent from a representation; [Included in 6.2a] c) demonstrate equivalent relationships among fractions, decimals, and percents;* and [Included in 6.2a] d) compare and order fractions, decimals, and percents.* [Included in 6.2b]	6.2 The student will a) represent and determine equivalencies among fractions, mixed numbers, decimals, and percents; and * b) compare and order positive rational numbers.*
6.3 The student will a) identify and represent integers; b) order and compare integers; and c) identify and describe absolute value of integers.	6.3 The student will a) identify and represent integers; b) compare and order integers; and c) identify and describe absolute value of integers.
6.4 The student will demonstrate multiple representations of multiplication and division of fractions. [Moved to 6.5 EKS]	
6.5 The student will investigate and describe concepts of positive exponents and perfect squares.	6.4 The student will recognize and represent patterns with whole number exponents and perfect squares.
Computation and Estimation *On the state assessment, items measuring this objective are assessed without the use of a calculator.	
6.6 The student will a) multiply and divide fractions and mixed numbers;* and b) estimate solutions and then solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of fractions.	6.5 The student will a) multiply and divide fractions and mixed numbers;* b) solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of fractions and mixed numbers; and c) solve multistep practical problems involving addition, subtraction, multiplication, and division of decimals. [Moved from 6.7]
6.7 The student will solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of decimals. [Moved to 6.5c]	

2009 SOL	2016 SOL
	6.6 The student will a) add, subtract, multiply, and divide integers;* [Moved from 7.3] b) solve practical problems involving operations with integers; and [Moved from 7.3 EKS] c) simplify numerical expressions involving integers.*[Moved and modified from 6.8]
6.8 The student will evaluate whole number numerical expressions, using the order of operations.* [Combined with 6.6]	
Measurement and Geometry	
6.9 The student will make ballpark comparisons between measurements in the U.S. Customary System of measurement and measurements in the metric system. [Included in 7.3 EKS]	
6.10 The student will a) define π (pi) as the ratio of the circumference of a circle to its diameter; b) solve practical problems involving circumference and area of a circle, given the diameter or radius; c) solve practical problems involving area and perimeter; and d) describe and determine the volume and surface area of a rectangular prism. [Included in 7.4a]	6.7 The student will a) derive π (pi); b) solve problems, including practical problems, involving circumference and area of a circle; and c) solve problems, including practical problems, involving area and perimeter of triangles and rectangles.
6.11 The student will a) identify the coordinates of a point in a coordinate plane; and [Included in 6.8b] b) graph ordered pairs in a coordinate plane.	6.8 The student will a) identify the components of the coordinate plane; and [Moved from 6.11 EKS bullet] b) identify the coordinates of a point and graph ordered pairs in a coordinate plane.
6.12 The student will determine congruence of segments, angles, and polygons.	6.9 The student will determine congruence of segments, angles, and polygons.
6.13 The student will describe and identify properties of quadrilaterals. [Included in 7.6]	
Probability and Statistics	
6.14 The student, given a problem situation, will a) construct circle graphs; b) draw conclusions and make predictions, using circle graphs; and c) compare and contrast graphs that present information from the same data set.	6.10 The student, given a practical situation, will a) represent data in a circle graph; b) make observations and inferences about data represented in a circle graph; and c) compare circle graphs with the same data represented in bar graphs, pictographs, and line plots.

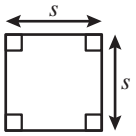
2009 SOL	2016 SOL
6.15 The student will a) describe mean as balance point; and b) decide which measure of center is appropriate for a given purpose.	6.11 The student will a) represent the mean of a data set graphically as the balance point; and b) determine the effect on measures of center when a single value of a data set is added, removed, or changed. [Moved from 5.16 EKS]
6.16 The student will a) compare and contrast dependent and independent events; [Moved to 8.11a] and b) determine probabilities for dependent and independent events. [Included in 8.11b]	
Patterns, Functions, and Algebra	
6.17 The student will identify and extend geometric and arithmetic sequences. [Included in AFDA.1 and AII.5]	
	6.12 The student will a) represent a proportional relationship between two quantities, including those arising from practical situations; b) determine the unit rate of a proportional relationship and use it to find a missing value in a ratio table; c) determine whether a proportional relationship exists between two quantities; and d) make connections between and among representations of a proportional relationship between two quantities using verbal descriptions, ratio tables, and graphs.
6.18 The student will solve one-step linear equations in one variable involving whole number coefficients and positive rational solutions.	6.13 The student will solve one-step linear equations in one variable, including practical problems that require the solution of a one-step linear equation in one variable.
6.19 The student will investigate and recognize a) the identity properties for addition and multiplication; b) the multiplicative property of zero; and c) the inverse property for multiplication. [Included in EKS and US for 6.6, 6.13, and 6.14]	
6.20 The student will graph inequalities on a number line.	6.14 The student will a) represent a practical situation with a linear inequality in one variable; and b) solve one-step linear inequalities in one variable, involving addition or subtraction, and graph the solution on a number line.

Grade 6 Mathematics Formula Sheet
2009 *Mathematics Standards of Learning*

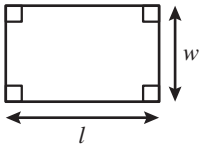
Geometric Formulas



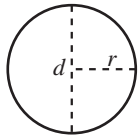
$$A = \frac{1}{2}bh$$



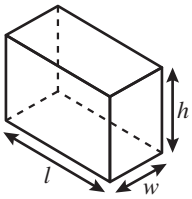
$$p = 4s$$
$$A = s^2$$



$$p = 2l + 2w$$
$$A = lw$$



$$C = 2\pi r$$
$$C = \pi d$$
$$A = \pi r^2$$



$$V = lwh$$
$$S.A. = 2lw + 2lh + 2wh$$

Pi

$$\pi \approx 3.14$$
$$\pi \approx \frac{22}{7}$$

Abbreviations

milligram	mg
gram	g
kilogram	kg
milliliter	mL
liter	L
kiloliter	kL
millimeter	mm
centimeter	cm
meter	m
kilometer	km
square centimeter	cm^2
cubic centimeter	cm^3

ounce	oz
pound	lb
quart	qt
gallon	gal.
inch	in.
foot	ft
yard	yd
mile	mi.
square inch	sq in.
square foot	sq ft
cubic inch	cu in.
cubic foot	cu ft

Area	A
Circumference	C
Perimeter	p
Surface Area	$S.A.$
Volume	V

DMS Algebra Readiness Push-in Tutoring Sheet

Date: _____ **Tutor Name: _____**

_____ Period	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:
_____ Period	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:

DMS Algebra Readiness Push-in Tutoring Sheet

_____ Period	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:	Teacher_____Time_____ SOL_____ Signature_____ Students: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ Activity:
Extra Work Times	WIN Teacher_____ Time_____ Signature_____ Students/SOL/activity: _____ _____ _____ _____	**Lunch and Learn** Time: _____ Students/SOL/activity: _____ _____ _____	***NOTES FOR THE DAY***

Tutor Signature: _____ Date: _____

Principal Signature: _____ Date: _____