

Mathematics Curriculum

Salem City Schools

Grade 8

Revised Summer 2006

Time Allotted	Topic	SOL	Chapter(s)
First Six Weeks	Organizing Data Measures of Central Tendency Line Plots Stem and Leaf Diagrams Box and Whisker Plots Bar and Line Graphs Scatter Plots Integer Operations Absolute Value	8.1, 8.3, 8.12	Chapters 1, 2, 3, 7 and 10
Second Six Weeks	Order of Operations Coordinate System Exponential Notation Scientific Notation Formulas Variable and Algebraic Expressions One and Two Step Equations Inequalities	8.1, 8.4, 8.15, 8.17	Chapters 1, 3, 4, 5, 6, 8, and 10
Third Six Weeks	One and Two Step Equation/Inequalities Functions Relations Ratio and Proportions Unit Rates Scale Drawings	8.3, 8.14, 8.15, 8.16, 8.17, 8.18	Chapters 4, 5, 6, 7, and 8
Fourth Six Weeks	Decimals and Percents Number Sense Rational and Real Numbers Probability Perfect Squares Square Roots Pythagorean Theorem	8.1, 8.2, 8.5, 8.10	Chapters 1, 3, 9, and 10
Fifth Six Weeks	Geometry Area/Perimeter Surface Area Volume Three Dimensional Transformations	8.6, 8.7, 8.8, 8.9	Chapters 12
Sixth Six Weeks	More Functions Probability Matrices Polynomials SOL Review	8.11, 8.13, 8.14, 8.18, (all for SOL Review)	Chapters 6 and 8

These documents reflect alignment of the Mathematics curriculum in the Salem City Schools with the Standards of Learning for the Commonwealth of Virginia. Efforts have been made to include suggestions for:

- ◆ Use of manipulatives for classroom instruction.
- ◆ Applying technology to accomplish the goals of a standard.
- ◆ Integration of mathematics instruction with other curricular areas.
- ◆ Classroom assessments.

The format of these materials is similar to Mathematics Standards of Learning Curriculum Framework published by the Virginia Department of Education in 2002. Unit/Topic/Strand refers to the six basic learning strands adopted by Virginia in support of the National Council of Teachers of Mathematics Standards adopted in 1989. The strands are synonymous with the Blueprint Categories used for reporting purposes on Standard of Learning tests grades 3 and 5. These strands/categories are:

- ◆ Number and Number Sense
- ◆ Computation and Estimation
- ◆ Measurement
- ◆ Geometry
- ◆ Probability and Statistics
- ◆ Patterns, Functions and Algebra

Each objective has a recommended implementation schedule. Teacher notes and instructional pedagogy that are implied in the objective are included along with Essential Understandings, and student outcomes are listed under Essential Knowledge Skills. Notes for enrichment and extensions, particularly to other curricular areas, are included under Essential Understandings. The cover page for each grade level is a suggested teaching sequence for the standards. The standards are listed sequentially within the curriculum document. The instructor is reminded that the standards are implemented with close attention given to review or spiraling to former lessons. Math extensions are given by number (no SOL prefix).

The implementation of mathematics standards does not rest entirely on the mathematics content addressed at a grade level. Concepts become part of a student's knowledge when developed with the aid of real life applications taken from other curricular areas. The use of technology and hence the implementation of Computer/Technology Standards (C/T) enables access to and manipulation of data from all resources.

Sample assessments are placed under Student Check for Understanding. Efforts have been made to use multiple choice formats to support student practice for Standards of Learning tests. There are suggestions for alternative assessments. Resources include reference to the student text and other classroom resources that a teacher may have at their disposal.

The intent of these materials is to provide a teacher guide for a basic mathematics course for each grade in levels K-8. Suggestions for extending the mathematics or enriching the mathematics content are directed to the teacher who has students that are prepared to do more advanced work. Extensions and Connections were developed with the cooperation of the gifted program coordinator. Some of these additions may provide an alternative challenge for students who have demonstrated mastery of the material. Pretesting is recommended for assessing competence in a standard. Each standard must be addressed either as a new topic or pretested to assure concept mastery required by the Standards of Learning.

8.1 The student will

- a) simplify numerical expressions involving positive exponents, using rational numbers, order of operations, and properties of operations with real numbers;
- b) recognize, represent, compare, and order rational numbers expressed in scientific notation; and
- c) compare and order decimals, fractions, percents, and numbers written in scientific notation.

Time Allotted: 2 weeks

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • <i>Expression</i> is a word used to designate any symbolic mathematical phrase that may contain numbers and/or variables. Expressions do not contain an equal sign. • A numerical expression contains only numbers and the operations on those numbers. • Expressions are simplified using the order of operations and the properties for operations with real numbers, i.e., associative, commutative, and distributive properties. • The order of operations defines the order in which operations are performed to simplify an expression. • The order of operations is as follows: <ul style="list-style-type: none"> – Complete all operations within grouping symbols. If there are grouping symbols within other grouping symbols, do the innermost operation first. – Evaluate all exponential expressions. – Multiply and/or divide in order from left to right. – Add and/or subtract in order from left to right. <p>continued</p>	<p>All students should</p> <ul style="list-style-type: none"> • Understand that any real number can be shown on a number line. • Understand that integers, positive and negative fractions, and positive and negative decimals are rational numbers. • Understand that an expression is like a phrase in that it has no equal sign. • Understand that the order of operations describes the order to use to compute with rational numbers. • Understand that numbers can be represented as decimals, fractions, percents, and in scientific notation. • Understand and use strategies to simplify expressions and to compare and order numbers. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Simplify numerical expressions containing exponents where the base is a rational number and the exponent is a positive whole number, using the order of operations and properties of operations with real numbers. • Recognize, represent, compare, and order rational numbers expressed in scientific notation, using both positive and negative exponents. • Compare and order fractions, decimals, percents, and numbers written in scientific notation.

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<p>continued</p> <ul style="list-style-type: none"> • A power of a number represents repeated multiplication of the number. For example, $(-5)^3$ means $(-5) \cdot (-5) \cdot (-5)$. The base is the number that is multiplied, and the exponent represents the number of times the base is used as a factor. In this example, (-5) is the base, and 3 is the exponent. • Scientific notation is used to represent very large or very small numbers. • A number written in scientific notation is the product of two factors: a decimal greater than or equal to one but less than 10 multiplied by a power of 10 (e.g., $3.1 \times 10^5 = 310,000$ and $3.1 \times 10^{-5} = 0.000031$). • Any real number raised to the zero power is 1. The only exception to this rule is zero itself. • Scientific calculators, graphing calculators, and some four-function calculators follow the rules of order of operations. 		

Student Check for Understanding:

1. Find the value.

$$-42 + 37 - 6(9 + 7) \div 4$$

- A. -29
- B. -13
- C. -8
- D. -4.25

2. Simplify.

$$\frac{5^2 + 3}{4^2 - 3^2}$$

- A. $\frac{13}{2}$
- B. 4
- C. 196
- D. 2

3. Which of the following is an example of how the distributive property can be used to find the product of 4 and the sum of
- $-2 + 3$
- ?

- A. $4 \bullet (-2) + 3$
- B. $4 \bullet (-2) + 4 \bullet 3$
- C. $4 \bullet 1$
- D. $4 \bullet (3 + -2)$

4. Which of the following is NOT equivalent to 0.095?

- A. 0.95×10^{-1}
- B. 9.5×10^{-2}
- C. 9.5×10^2
- D. 0.00095×10^2

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORDE Communications, 2004. Chapter 1, 3, 10.

Punchline Bridge to Algebra, March Mathworks, 2002, pp. 11, 68, 69.

Virginia SOL Math Coach Grade 8, Educational Design, Lapinski, New York, 2000, pp. 5-8, 13-18.

Number Line

Algebra tiles

Centimeter graph paper.

8.2 The student will describe orally and in writing the relationship between the subsets of the real number system.

Time Allotted: 3 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • The set of natural numbers is the set of counting numbers (1, 2, 3, 4, ...). • The set of whole numbers is the set of all the natural numbers and zero. • The set of integers is the set of whole numbers and their opposites. • The set of rational numbers is the set of all numbers that can be expressed as fractions in the form $\frac{a}{b}$ where a and b are integers and b does not equal zero. • The set of irrational numbers is the set of all non-repeating, nonterminating decimals. • The set of real numbers is the set of all rational and irrational numbers. An irrational number cannot be expressed as an integer or the quotient of integers. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand the relationship between the subsets of the real number system. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Describe orally and in writing the relationships among the sets of Natural or Counting Numbers, Whole Numbers, Integers, Rational Numbers, Irrational Numbers, and Real Numbers. • Illustrate the relationships among the subsets of the real number system by using graphic organizers such as Venn diagrams. Subsets include real numbers, rational numbers, irrational numbers, integers, whole numbers, and natural numbers. • Identify the subsets of the real number system to which a given number belongs. • Determine whether a given number is a member of a particular subset of the real number system, and explain why. • Describe each subset of the set of real numbers.

Student Check for Understanding:

1. Which is not rational?
 - A. 3
 - B. 3.04982...
 - C. $4.\bar{7}$
 - D. 0.2

2. Which statement is true?
 - A. All integers are rational numbers.
 - B. A number can be both rational and irrational.
 - C. Every integer is a whole number.
 - D. All real numbers are rational.

3. Which statement is not true about the number -6 ?
 - A. The number is a rational number.
 - B. The number is an integer.
 - C. The number is a real number.
 - D. The number is an irrational number.

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORC Communications, 2004. Chapter 10.

Virginia SOL Math Coach Grade 8, Educational Design, Lapinski, New York, 2000, pp. 10-12.

Classroom calculator.

8.3 The student will solve practical problems involving rational numbers, percents, ratios, and proportions. Problems will be of varying complexities and will involve real-life data, such as finding a discount and discount prices and balancing a checkbook.

Personal Living and Finance: Compute and understand taxes; investigate the implications of an inheritance; prepare and balance a personal/family budget; judge the quality of a bank's services to open a bank account; balance a checkbook; investigate the basics for insurance policies; manage debt, including retail and credit card debt; compute simple/compound interest rates; identify consumer rights and responsibilities; analyze simple contracts; contest and incorrect bill.

Time Allotted: Taught in conjunction with other SOL's.

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • Practical problems may include, but not be limited to, those related to economics, sports, science, social sciences, transportation, and health. Some examples include problems involving the amount of a pay check per month, the discount price on a product, temperature, simple interest, sales tax, and installment buying. • A percent is a special ratio in which the denominator is 100. • A discount is a percentage of the original price. The discount price is the original price minus the discount. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand how mathematics relates to problems in daily life. • Select an appropriate method or methods for computing with rational numbers and percents according to the context of the problem. • Understand how to set up a proportion given the relationship between two items. <p><i>PLF Standards: Student will investigate some of the following topics:</i></p> <ul style="list-style-type: none"> • Taxes • Statement reconciliation • Overdrafts • Automobile, property, health, life, and disability insurance • Record-keeping for credit purchases • Penalties • Debt payment plan 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Solve practical problems by using computation procedures for whole numbers, integers, rational numbers, percents, ratios, and proportions. • Maintain a checkbook and check registry for five or fewer transactions. • Compute a discount and the resulting (sale) price for one discount.

Student Check for Understanding:

1. Sales tax at the beach is 10%. At a Chinese restaurant you order hot and sour soup for \$1.25 and beef with broccoli for \$7.25. What is the total of your bill including sales tax?
 - A. \$7.25
 - B. \$8.50
 - C. \$9.35
 - D. \$10.00

2. Solve for n .
principal: \$1,500.00
rate of interest: 9% (compounded semiannually)
time: 6 months
interest: n
 - A. $n = \$810.00$
 - B. $n = \$675.00$
 - C. $n = \$135.00$
 - D. $n = \$67.50$

3. Solve for n .
cost: n
markup: 50%
selling price: \$300
 - A. $n = \$150$
 - B. $n = \$200$
 - C. $n = \$350$
 - D. $n = \$400$

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 6, 7.

Punchline Bridge to Algebra, Marcy Mathworks, 2001, pp. 84-100.

Calculator

Spreadsheet software

Centimeter grid paper

Laptop computers

PLF: Real world applications are found throughout the text. Some examples, pp: 24, 28, 42, 45, 56, 62, 66, 68, 78, 86, 87, 138, 152, 199, 305, 308-312, 354.

*Connections: WG 10.1, WG 10.5, PS 1, PS 4, PS 5, PS 7, PS 8, PS 10.

- 8.4 The student will apply the order of operations to evaluate algebraic expressions for given replacement values of the variables. Problems will be limited to positive exponents.**

Time Allotted: 3 days and ongoing throughout the year.

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • Algebraic expressions use operations with algebraic symbols (variables). • Algebraic expressions are evaluated by replacing the variables with numbers and applying the order of operations to simplify the resulting expression. • The replacement values are the numbers that replace the variables in an algebraic expression. • The order of operations is as follows: <ul style="list-style-type: none"> – Complete all operations within grouping symbols. If there are grouping symbols within other grouping symbols, do the innermost operation first. – Evaluate all exponential expressions. – Multiply and/or divide in order from left to right. – Add and/or subtract in order from left to right. 	<p>All students should</p> <ul style="list-style-type: none"> • Evaluate an algebraic expression by substituting a number for each variable and then simplifying the result. • Understand how to apply the order of operations after substituting given values for variables in algebraic expressions. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Substitute numbers for variables in an algebraic expression and simplify the expression by using the order of operations. Exponents used are whole numbers less than 4. • Apply the order of operations to evaluate formulas.

Student Check for Understanding:

1. What is the value of $7a(a-1)$ when $a = 2$?
 - A. 20
 - B. 33
 - C. 54
 - D. 98
2. Which number represents the value of the expression?
 $4(9x + y)$ when $x = 6$ and $y = 1$
 - A. 217
 - B. 220
 - C. 252
 - D. 268
3. What is the value of $\frac{3x+2y}{.05}$ when $x = 3$ and $y = 8$?
 - A. 5
 - B. 6
 - C. 50
 - D. 60
4. A driver training school calculates the cost of training (c) for a course using the formula $c = 60 + 16.5h$, where h is the number of hours of training. Find the cost of 10 hours of driver training.
 - A. \$76.50
 - B. \$86.50
 - C. \$165
 - D. \$225

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 1, 10.

Punchline Bridge to Algebra, Marcy Mathworks, 2001, pp. 9, 12, 21, 22, 26, 36.

Virginia SOL Math Coach Grade 8, Educational Design, Lapinski, 2000, pp. 44-46.

Classroom calculator

Hands-On Equation Learning System, Borenson and Associates, Borenson, Allenton, PA, 1996.

SOL Algebra The Virginia SOL Mathematics Coach, Algebra 1, Educational Design, Edwards, New York, 2000, pp. 1-7.

*Extensions: SOL 8.19 "Create and Solve Problems Using Formulas"
SOL 8.15 "...Investigate and Describe Functional Relationship..."

*Connections: PS 1, PS 7, PS 10.

8.5 The student, given a whole number from 0 to 100, will identify it as a perfect square or find the two consecutive whole numbers between which the square root lies.

8.10 The student will
a) verify the Pythagorean Theorem, using diagrams, concrete materials, and measurement; and
b) apply the Pythagorean Theorem to find the missing length of a side of a right triangle when given the lengths of the other two sides.

Time Allotted: 6 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<p>8.5</p> <ul style="list-style-type: none"> A perfect square is a whole number whose square root is a whole number (e.g., $\sqrt{25}$ is 5; thus, 25 is a perfect square). The square root of a number is that number which when multiplied by itself equals the number. Any whole number other than a perfect square has a square root that lies between two consecutive whole numbers. The square root of a whole number that is not a perfect square is an irrational number (e.g., $\sqrt{2}$ is an irrational number). An irrational number cannot be expressed exactly as a ratio. <p>8.10</p> <ul style="list-style-type: none"> In a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the legs (altitude and base). This relationship is known as the Pythagorean Theorem: $a^2 + b^2 = c^2$. The Pythagorean Theorem is used to find the measure of any one of the three sides of a right triangle if the measures of the other two sides are known. 	<p>All students should</p> <p>8.5</p> <ul style="list-style-type: none"> Understand that a perfect square is the product of a number multiplied by itself. Develop strategies for finding the square root of a number. <p>8.10</p> <ul style="list-style-type: none"> Understand that, for a right triangle, the square of the measure of the hypotenuse equals the sum of the squares of the measures of the base and altitude. Understand that the Pythagorean Theorem is a tool to find the measure of any side of a right triangle, given the measures of the other two sides. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <p>8.5</p> <ul style="list-style-type: none"> Identify the perfect squares from 0 to 100. Identify the two consecutive whole numbers between which the square root of a given whole number from 0 to 100 lies (e.g., $\sqrt{57}$ lies between 7 and 8 since $7^2 = 49$ and $8^2 = 64$). <p>8.10</p> <ul style="list-style-type: none"> Identify the parts of a right triangle (the hypotenuse and the legs). Verify the Pythagorean Theorem, using diagrams, concrete materials, and measurement. Find the measure of a side of a right triangle, given the measures of the other two sides. The measures of the sides of the triangle may be whole numbers no larger than 15 or decimals in tenths. Solve real-life problems involving right triangles by using the Pythagorean Theorem.

STANDARD 8.5/8.10 (continued) STRAND: COMPUTATION & ESTIMATION AND GEOMETRY GRADE LEVEL 8

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<p>continued</p> <ul style="list-style-type: none">▪ Whole number triples that are the measures of the sides of right triangles, such as (3,4,5), (6,8,10), (9,12,15), and (5,12,13), are commonly known as Pythagorean triples.▪ Explore the relationship between the measures of the sides of a right triangle, and squares that have sides of the same measure as the sides of the right triangle, using concrete materials, diagrams, and measurement		

STANDARD 8.5/8.10 (continued) STRAND: COMPUTATION & ESTIMATION AND GEOMETRY GRADE LEVEL 8

Student Check for Understanding:

1. Which of the numbers is a perfect square?
 - A. 12
 - B. 24
 - C. 36
 - D. 48

2. Between which two consecutive whole numbers would you find the square root of 82?
 - A. 6 and 7
 - B. 7 and 8
 - C. 8 and 9
 - D. 9 and 10

3. Which set of three numbers could be the lengths of the sides of a right triangle?
 - A. 9, 12, 15
 - B. 5, 12, 14
 - C. 16, 30, 35
 - D. 10, 15, 20

4. What is the length of \overline{BC} ?
 - A. 3 cm
 - B. 7 cm
 - C. $\sqrt{17}cm$
 - D. $\sqrt{115}cm$

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORC Communications, 2004. Chapter 10.

Punchline Bridge to Algebra, Marcy Mathworks, 2001, pp. 113-116.

Virginia SOL Math Coach Grade 8, Educational Design, 2000, pp. 82-88.
Classroom calculator

Centimeter grid paper

Geoboards

*Extensions: Special Right Triangles

Use formula $A = s^2$ to find area of square.

Find the length of side of square given the area.

*Connections: PS 10.15.

8.6 The student will verify by measuring and describe the relationships among vertical angles, supplementary angles, and complementary angles and will measure and draw angles of less than 360° .

Time Allotted: 3 or 4 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • Vertical angles are the opposite angles formed by two intersecting lines. Vertical angles are congruent. • Complementary angles are any two angles such that the sum of their measures is 90°. • Supplementary angles are any two angles such that the sum of their measures is 180°. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand the meaning of the term <i>angle</i>. • Understand how to use angle-measuring tools. • Understand that pairs of angles are named by their defining attributes. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Measure angles of less than 360° to the nearest degree, using appropriate tools. • Identify and describe the relationships among the angles formed by two intersecting lines. • Identify and describe pairs of angles that are vertical. • Identify and describe pairs of angles that are supplementary. • Identify and describe pairs of angles that are complementary.

Student Check for Understanding:

1. In the diagram below, \overline{AD} is perpendicular to \overline{FC} .

Which pair is complementary?

- A. $\angle AFB$ and $\angle BFC$
 - B. $\angle AFB$ and $\angle BFD$
 - C. $\angle AFB$ and $\angle EFA$
 - D. $\angle BFC$ and $\angle CFD$
2. Which of the following is always true?
- A. If two angles are vertical angles, the sum of their measures is 90° .
 - B. If two angles are vertical angles, the sum of their measures is 180° .
 - C. If two angles are vertical angles, one measures more than 90° and one measures less than 90° .
 - D. If two angles are vertical angles, each has the same measure.
3. If $\square QRS$ and $\square XYZ$ are supplementary, which must be true?
- A. The sum of the measures of the angles is 90° .
 - B. The sum of the measures of the angles is 180° .
 - C. Both angles can measure between 90° and 180° .
 - D. Both angles must measure less than 90° .

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORC Communications, 2004. Chapter 9.

Virginia SOL Math Coach Grade 8, Educational Design, Lapinski, 2000, pp. 75-81.

Punchline Bridge to Algebra, Marcy Mathworks, 2001, pp. 137-141, 143.

Protractor, ruler, centimeter grid paper

Geo-strips or scissors as models for vertical angles

Sketch pad

*Connections: PS 10

8.7 The student will investigate and solve practical problems involving volume and surface area of rectangular solids (prisms), cylinders, cones, and pyramids.

8.9 The student will construct a three-dimensional model, given the top, side, and/or bottom views.


Time Allotted: 20 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<p>8.7</p> <ul style="list-style-type: none"> • A polyhedron is a solid figure whose faces are all polygons. • A pyramid is a polyhedron with a base that is a polygon and other faces that are triangles with a common vertex. <ul style="list-style-type: none"> – The lateral area of a pyramid is the sum of the areas of the triangular faces. – The area of the base of a pyramid is the area of the polygon which is the base. – The total surface area of a pyramid is the sum of the lateral area and the area of the base. – The volume of a pyramid is $\frac{1}{3}Bh$, where B is the area of the base and h is the height. • A circular cone is a geometric solid whose base is a circle and whose side is a surface composed of line segments connecting points on the base to a fixed point (the vertex) not on the base. <ul style="list-style-type: none"> – The lateral area of a circular cone is the area of the surface connecting the base with the vertex and is equal to πrl, where l is the slant height. – The area of the base of a circular cone is πr^2. – The total surface area of a circular cone is $\pi r^2 + \pi rl$. – The volume of a cone is $\frac{1}{3}\pi r^2 h$, where h is the height and πr^2 is the area of the base. <p>continued</p>	<p>All students should</p> <p>8.7</p> <ul style="list-style-type: none"> • Understand the derivation of formulas for volume and surface area of prisms, cylinders, cones, and pyramids. • Understand the differences between volume and surface area. <p>8.9</p> <ul style="list-style-type: none"> ▪ Understand that a three-dimensional object can be represented as a two-dimensional model that represents views of the object from different perspectives 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <p>8.7</p> <ul style="list-style-type: none"> • Compute the surface area of a pyramid by finding the sum of the areas of the triangular faces and the base. • Compute the surface area of a cone by calculating the sum of the areas of the side and the base, using formulas. • Compute the volume and surface area of rectangular solids (prisms), cylinders, cones, and square pyramids, using formulas. • Investigate and solve problems involving volume and surface area of rectangular solids (prisms), cylinders, cones and pyramids. <p>8.9</p> <ul style="list-style-type: none"> ▪ Construct three-dimensional models, given top, side, and bottom views.

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<p>continued</p> <p>8.9</p> <ul style="list-style-type: none">• Three-dimensional models of geometric solids can be used to understand perspective and provide tactile experiences in determining two-dimensional perspectives.▪ Three-dimensional models of geometric solids can be represented on isometric paper.		

Student Check for Understanding:

1. This shows 3 different views of a three-dimensional figure constructed from cubes. Which could be this figure?

- A.  B. 
- C.  D. 

2. What is the area of this figure?

- A. 18 cm^2
 B. 26 cm^2
 C. 28 cm^2
 D. 36 cm^2

3. What is the figure below called?

- A. a pentagon
 B. a hexagon
 C. a heptagon
 D. a duodecagon

continued

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 12.

Virginia SOL Math Coach Grade 8, Educational Design, 2000, pp. 50.

Punchline Bridge to Algebra, Marcy Mathworks, 2001, pp. 152-165.

Solid figures and volume demo set

Blocks

SOL Formula Sheet

Classroom calculator

Centimeter paper

Net patterns

Rulers

Protractors

*Extensions: icosagon = 20 sides
 dodecagon = 12 sides

*Connections: PS 1.

continued

4. What is the volume of the figure below?

- A. 16.75 cu. ft.
- B. 20.93 cu. ft.
- C. 83.73 cu. ft.
- D. not here

5. What is the volume of the rectangular-based pyramid shown below?

- A. 89.26 m^3
- B. 101.38 m^3
- C. 102.08 m^3
- D. 306.25 m^3

Use the figure below to answer the next two questions.

6. What is this figure?

- A. cone
- B. rectangular prism
- C. pyramid
- D. not here

continued

7. How many faces and edges does it have (including the base)?
- A. 3 faces, 3 edges
 - B. 4 faces, 3 edges
 - C. 4 faces, 6 edges
 - D. not here

- 8.8 The student will apply transformations (rotate or turn, reflect or flip, translate or slide, and dilate or scale) to geometric figures represented on graph paper. The student will identify applications of transformations, such as tiling, fabric design, art, and scaling.**

Time Allotted: 3 or 4 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • A rotation of a geometric figure is a turn of the figure around a fixed point. The point may or may not be on the figure. The fixed point is called the <i>center of rotation</i>. • The rotation of a figure can be made clockwise or counterclockwise around a fixed point. • A reflection of a geometric figure is a flip of the figure across a line. Each point on the reflected figure is the same distance from the line as the corresponding point in the original figure. • A translation of a geometric figure is a slide of the figure in which all the points on the figure move the same distance in the same direction. • A dilation of a geometric figure is a transformation that changes the size of a figure by a scale factor to create a similar figure. • Real-life applications may include the following: <ul style="list-style-type: none"> – A rotation of the hour hand of a clock from 2:00 to 3:00 shows a turn of 30° clockwise. – A reflection of a boat in water shows an image of the boat flipped upside down with the water line being the line of reflection. – A translation of a shape on a wallpaper pattern shows the same shape slid the same distance in the same direction. – A dilation of a model airplane is the production model of the airplane. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand the relationship between transformations in a coordinate plane and their application in real-life. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Identify the geometric transformations (rotation, reflection, translation, and dilation) by using a variety of real-life examples • Demonstrate the reflection of a figure over a vertical or horizontal line on a coordinate grid. • Demonstrate 90°, 180°, 270°, and 360° rotations of a figure on a coordinate grid. • Demonstrate the translation of a figure on a coordinate grid. • Demonstrate the dilation of a figure from a fixed point on a coordinate grid.

Student Check for Understanding:

- In which graph is the white figure a reflection of the dark figure over the x – axis?
A. B.

C. D.
- Which of the following shows a figure reflected about the y -axis?
- In the graph below, figure $A'B'C'D'$ is the image of figure $ABCD$. Which describes the movement of the figure in the graph?

A. a rotation 90° clockwise about the origin
B. a rotation 180° about the origin
C. a rotation 270° clockwise about the origin
D. a rotation 90° counterclockwise about the origin

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 9, 11.

Punchline Bridge to Algebra, March Mathworks, 2001, pp. 144-146.

Virginia SOL Math Coach Grade 8, Educational Design, 2000, pp. 90-98.

Tessellation patterns, index cards, glue, drawing paper, centimeter grid paper, scissors, rulers, patty paper, miras.

*Extensions: M.S. Escher tessellations

*Connections: WG 10.1, WG 10.11, PS 9

8.11 The student will analyze problem situations, including games of chance, board games, or grading scales, and make predictions, using knowledge of probability.

Time Allotted: 5 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • The probability of an event occurring is the ratio of the desired outcomes to the total number of possible outcomes. • Choices that involve chance are based on an understanding of the reasonableness of obtaining a specific outcome. • The probability that an event is likely to occur is close to one. • The probability that an event is not likely to occur is close to zero. • The probability that an event is as likely to occur as it is not to occur is close to one-half. • Knowledge of probability can be used to determine the likelihood of winning such events as a prize through a raffle or lottery ticket, earning a high score in a dart game, or winning a card game. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand how to make predictions based on knowledge of probability. • Understand that choices that involve chance are based on an understanding of the reasonableness of obtaining a specific outcome. • Understand that knowledge of probability can be used to determine the likelihood of winning such events as contests. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Analyze a problem situation, and determine the likelihood of an event occurring, using knowledge of probability. • Predict the outcome of an event by analyzing its probability. • Explain the consequences of making different choices, using knowledge of probability. • Make predictions about the outcomes of games of chance, board games, and grading scales by using knowledge of probability.

Student Check for Understanding:

1. The basket contains 30 apples, 20 pears, and 10 peaches. What is the probability that the first piece of fruit taken from the basket will be a peach?
 - A. $\frac{1}{2}$
 - B. $\frac{1}{3}$
 - C. $\frac{1}{5}$
 - D. $\frac{1}{6}$
2. When this spinner is spun, about what percent of the time should it land on the space labeled "Red"?
 - A. 45%
 - B. 40%
 - C. 35%
 - D. 25%
3. The cafeteria offers 3 different meats, 4 different vegetables, 5 different desserts and 2 different drinks for lunch. How many different meals consisting of 1 meat, 1 vegetable, 1 dessert, and 1 drink are offered?
 - A. 14
 - B. 49
 - C. 70
 - D. 120

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 6.

Punchline Bridge to Algebra, March Mathworks, 2001, pp. 144-146.

Virginia SOL Math Coach Grade 8, Educational Design, 2000, pp. 126-137.

Dice, spinners, coins.

8.12 The student will make comparisons, predictions, and inferences, using information displayed in frequency distributions; box-and-whisker plots; scattergrams; line, bar, circle, and picture graphs; and histograms.

Personal Living and Finance: Prepare and balance a personal/family budget; judge the quality of a bank's services to open a bank account; examine and compare various savings options.

Time Allotted: 3-5 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • Comparisons, predictions, and inferences are made by examining characteristics of a data set displayed in a variety of graphical representations to draw conclusions. • The information displayed in different graphs may be examined to determine how data are or are not related, ascertaining differences between characteristics (comparisons), trends that suggest what new data might be like (predictions), and/or “what could happen if” (inferences). • Scattergrams can be used to predict trends and estimate a line of best fit. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand that comparisons, predictions, and inferences are made by examining characteristics of a data set displayed in a variety of graphical representations in order to draw conclusions. <p><i>PLF Standards: Student will investigate some of the following:</i></p> <ul style="list-style-type: none"> • <i>Estimation of income/expenses</i> • <i>Construction of a budget</i> • <i>Financial management techniques for living within a budget</i> • <i>Interest rates of savings accounts/certificates of deposit</i> • <i>Checking and other services</i> • <i>Savings options</i> • <i>Penalties</i> • <i>Stocks, bonds, and mutual funds</i> • <i>Real estate</i> • <i>Retirement accounts</i> • <i>Passbook savings</i> 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Make comparisons, predictions, and inferences, given data sets of no more than 20 items that are displayed in frequency distributions; box-and-whisker plots; scattergrams; line, bar, circle, and picture graphs; and histograms.

Student Check for Understanding:

1. Each year the church youth group has a car wash and donates the earnings to the food pantry.

Which amount is closest to the mean earnings over this period?

- A. \$300
- B. \$500
- C. \$700
- D. \$800

2. The graph below shows the population growth of a city over a 20-year period.

Based on the graph, which is the most reasonable prediction of the city's population in the year 2005?

- A. 40,000
- B. 49,000
- C. 56,000
- D. 75,000

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 2.

Virginia SOL Math Coach Grade 8, Educational Design, 2000, pp. 106-125.

Centimeter grid paper

Ruler

Laptop computer

Graphing calculator

PLF: balance checkbook, pp. 42, 66, 78, 86, 87, 152, 311, 312, 24, 25, 28, 56, 45; Guided Problem, 4-5; Enrichment, 6-1 "Creating a Budget with Circle Graph"

*Connections: E 8.1, E 8.3, E8.6, PS 1

8.13 The student will use a matrix to organize and describe data.

Personal Living and Finance: Judge the quality of a bank's services to open a bank account.

Time Allotted: 2 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • Matrices are used to sort, list, and organize data, such as sorting by gender the number of soccer, football, basketball, and softball players in a set. • A matrix is a rectangular array of numbers in rows and columns that are enclosed with brackets. A matrix organizes a data set visually. • A matrix is identified by its dimensions, rows, and columns (e.g., a 2-by-3 matrix has two rows and three columns). 	<p>All students should</p> <ul style="list-style-type: none"> • Understand that a matrix is a rectangular array of numbers in rows and columns that organizes a data set visually. <p><i>PLF Standards: Student will investigate some of the following topics:</i></p> <ul style="list-style-type: none"> • <i>Interest rates of savings accounts/certificates of deposit</i> • <i>Checking and other services</i> • <i>Savings options</i> • <i>Penalties</i> 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Describe the characteristics of a matrix, including designating labels for rows and columns. • Use a matrix of no more than 12 entries to organize and describe a data set. • Identify the position of an element by row and column. • Transfer data from a chart to a matrix.

Student Check for Understanding:

1. State the dimensions of matrix A.
A.0
B. 2×3
C. A_{32}
D. 3×2
2. In matrix A, what element is in Row 1 Column 2?
A.0
B.6
C.1
D.-4
3. A pet store currently has German Shepherd, Husky, and Lab puppies of both sexes. The table below shows how many of each type are available.

Which matrix shows the data from the table?

Resources:

Virginia SOL Math Coach Grade 8, Educational Design, 2000, Lesson 13.

*Extensions: Scalar – multiplying a number with a matrix.
Adding and subtracting matrices of equal dimensions.
Finding a missing entry.

- 8.14 The student will**
- describe and represent relations and functions, using tables, graphs, and rules; and**
 - relate and compare tables, graphs, and rules as different forms of representation for relationships.**

Personal Living and Finance: Compute state and federal taxes; compute simple/compound interest rates.

- 8.18 The student will use the following algebraic terms appropriately: domain, range, independent variable, and dependent variable.**

Time Allotted: 10 – 15 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<p>8.14</p> <ul style="list-style-type: none"> A relation is any set of ordered pairs. For each first member (domain), there may be many second members (range). A function is a relation in which there is one and only one second member (range) for each first member (domain). As a graph, a function is any curve (including straight lines) such that any vertical line would pass through the curve only once. As a table of values, a function has a unique value assigned to the second variable (range) for each value of the first variable (domain). Some relations are functions; all functions are relations. <p>8.18</p> <ul style="list-style-type: none"> The domain is the possible set of all the input values for the independent variable in a given situation. The range is the possible set of all the output values for the dependent variable in a given situation. <p>continued</p>	<p>All students should</p> <p>8.14</p> <ul style="list-style-type: none"> Understand the difference between functions and relations. Understand that a function is a one-to-one relationship between the domain and range. <p><i>PLF Standards: Student will investigate some of the following topics:</i></p> <ul style="list-style-type: none"> <i>Income and sales tax</i> <i>Simple/compound interest calculation</i> <i>Manual vs. automated calculation</i> <p>8.18</p> <ul style="list-style-type: none"> Understand that the domain represents all the values for the independent variables and the range represents all the values for the dependent variables. Understand that the independent variable is the value that causes the change in the dependent variable and the dependent variable is affected by the independent variable. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <p>8.14</p> <ul style="list-style-type: none"> Graph in a coordinate plane ordered pairs that represent a relation. Write a rule that represents a relation from a table of values. Write a table of values from the rule that represents a relation. Write a table of values from the graph of ordered pairs of a relation. Describe and represent relations and functions, using tables, graphs, and rules. Relate and compare different representations of the same relation. <p>8.18</p> <ul style="list-style-type: none"> Apply the following algebraic terms appropriately: <i>domain, range, independent variable, and dependent variable.</i> Identify examples of domain, range, independent variable, and dependent variable. <p>continued</p>

<p>continued</p> <ul style="list-style-type: none">• The independent variable is the input value.• The dependent variable depends on the independent variable and is the output value.• Below is a table of values for finding the circumference of circles, $C = \pi d$, where the value of π is approximated as 3.14.• The independent variable, or input, is the diameter of the circle. The values for the diameter make up the domain.▪ The dependent variable, or output, is the circumference of the circle. The set of values for the circumference make up the range		<p>continued</p> <ul style="list-style-type: none">• Determine the domain of a function.• Determine the range of a function.• Determine the independent variable of a relationship.▪ Determine the dependent variable of a relationship.
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continued

3. Which table shows ordered pairs that satisfy the function $y = 3x + 1$?

A. C.

B. D.

4. Determine which relation is a function.

A. B.

C. D.

5. What is the range of the function $y = -2x^2 + x$ when the domain is $\{1, 3, 5\}$?

A. $\{-1, -15, -45\}$

B. $\{5, 21, 55\}$

C. $\{3, 9, 5\}$

D. $\{-3, -9, -5\}$

E. $\{1, 15, 45\}$

8.15 The student will solve two-step equations and inequalities in one variable, using concrete materials, pictorial representations, and paper and pencil.

Time Allotted: 20 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • A two-step equation is defined as an equation that requires the use of two different operations to solve (e.g., $2x + 3 = -4$). • A two-step inequality is defined as an inequality that requires the use of two different operations to solve (e.g., $3x - 4 > 9$). • In an equation, the equal sign indicates that the value on the left is the same as the value on the right. • To maintain equality, an operation that is performed on one side of an equation must be performed on the other side. • The same procedures that work for equations work for inequalities. When both expressions of an inequality are multiplied or divided by a negative number, the inequality sign reverses. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand that an operation that is performed on one side of an equation must be performed on the other side to maintain equality. • Understand the procedures for solving inequalities. • Understand that when both expressions are multiplied or divided by a negative number, the inequality symbol reverses. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Solve two-step linear equations by showing the steps and using algebraic sentences. • Solve two-step inequalities by showing the steps and using algebraic sentences.

Student Check for Understanding:

- Angie mows lawns in her neighborhood to make money. She charges \$25 per lawn and buys a new mower for \$200. If x is the number of lawns, and p is her profit, which of the following would you use to find Angie's profit?
 - $25x - 200 = p$
 - $200 = 25x + p$
 - $25x = p - 200$
 - $25x + 200 = p$
- Which means "6 times a number minus 7 is 5 more than 4 times that number"?
 - $6n - 7 = 4n + 5$
 - $6(n - 7) = 4(n + 5)$
 - $7 - 6n = 5 + 4n$
 - $6(4n + 5) = 7$
- If $3(w - 2) = -8$, what is the value of w ?
 - 6
 - $-4\frac{2}{3}$
 - 2
 - $\frac{-2}{3}$
- What value of y makes $y + (4 - 2y) = 2$ true?
 - 0
 - 2
 - 3
 - 4

continued

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 4, 5.

Virginia SOL Math Coach Grade 8, Educational Design, 2000, pp. 138-144.

Punchline Bridge to Algebra, Marcy Mathworks, 2001, pp. 37-48.

*Connections: PS 1, PS 5, PS 10, E 8.3, E 8.5

continued

5. Solve the inequality and determine the graph of that solution. $-\frac{x}{2} + 4 \geq 2$

A.

B.

C.

D.

6. Choose the letter that gives the solution to $x - 2 \geq 6$.

A. $x \geq 8$

B. $x > 4$

C. $x \geq 4$

D. $x > 8$

8.16 The student will graph a linear equation in two variables, in the coordinate plane, using a table of ordered pairs.

Time Allotted: 10 days

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • A linear equation is an equation in two variables whose graph is a line. • Graphing a linear equation requires determining a table of ordered pairs by substituting into the equation values for one variable and solving for the other variable, plotting the ordered pairs in the coordinate plane, and connecting the points to form a straight line. • The axes of a coordinate plane are generally labeled x and y; however, any letters may be used that are appropriate for the function. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand that the graph of a linear equation in two variables is the set of all ordered pairs that satisfy the equation. 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Construct a table of ordered pairs by substituting values for x in a linear equation to find values for y. • Plot in the coordinate plane ordered pairs (x, y) from a table. • Connect the ordered pairs to form a straight line.

continued

4. Which table could be used to graph $2x + y = 7$?

A.

C.

B.

D.

8.17 The student will create and solve problems, using proportions, formulas, and functions.

Personal Living and Finance: Manage debt, including retail and credit card debt; compute simple/compound interest rates; examine and compare various savings options.

Time Allotted: Included in time factors with related SOL's.

UNDERSTANDING THE STANDARD (Teacher Notes)	ESSENTIAL UNDERSTANDINGS	ESSENTIAL KNOWLEDGE AND SKILLS
<ul style="list-style-type: none"> • A proportion is a statement of equality between two ratios. • A formula is a statement based on logical mathematical conclusions or observation and experimental evidence (e.g., the volume of a circular cylinder, $V = \pi r^2 h$). • A function is a relation (any set of ordered pairs) in which there is one and only one second member (range) for each first member (domain). • Proportional situations are based on multiplicative relationships. Equal ratios result from multiplication or division, not from addition or subtraction. 	<p>All students should</p> <ul style="list-style-type: none"> • Understand that proportions, formulas, and functions are ways to express relationships mathematically and are tools for solving problems. <p><i>PLF Standards: Student will investigate some of the following topics:</i></p> <ul style="list-style-type: none"> • <i>Record-keeping for credit purchases</i> • <i>Interest and late payment penalties</i> • <i>Debt payment plan</i> • <i>Simple/compound interest calculation</i> • <i>Manual vs. automated calculation</i> 	<p>The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to</p> <ul style="list-style-type: none"> • Write problems that require establishing a relationship between ratios. • Solve problems by using proportions. • Create problems that require the use of a formula. • Substitute known values for variables in a formula. • Solve a formula by using algebraic procedures. • Create problems that involve a functional relationship. • Solve problems that involve functions.

Student Check for Understanding:

1. The maximum size for a package accepted by the US Postal Service is one that satisfies the condition:

$$L + 2W + 2H = 198 \text{ inches,}$$

where the length (L) the width(W) and the height (H) are all in inches. If you wish to mail a package with L=48 inches and W=22 inches, what is the maximum permitted height?

- A. 27 in.
B. 53 in.
C. 73 in.
D. not here
2. A science class took a hike around a pond. The number of ducks they saw was 4 less than three times the number of geese they saw. They saw 32 ducks and geese in all. How many geese did they see?
- A. 8
B. 9
C. 20
D. 23

Resources:

Bridges to Algebra & Geometry, and ancillary materials, CORD Communications, 2004. Chapter 6, 8.

Virginia SOL Math Coach Grade 8, Educational Design, 2000, Proportions – Lesson 3; Functions – Lesson 21; Formulas – various.

PLF: pp. 294, 295, 298, 299, 308-315, 517, 526, 540.