

Virginia Standards of Learning – Mathematics

EducAide’s Coverage of Grades 1–8 and High School

This document shows EducAide’s coverage of the SOLs for mathematics (2009), grades 1–8 and High School. It is current as of April 30, 2015, though subject to change. The number of items in Problem-Attic is shown to the right. For information about the SOLs, please see Standards of Learning & Testing at www.doe.virginia.gov.

Note: For Probability and Statistics (PS) and Discrete Mathematics (DM), the standards marked with an asterisk (*) apply to a one-semester course.

Grade One

Number and Number Sense: Place Value and Fraction Concepts

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| 1.1 | The student will | |
| | a) count from 0 to 100 and write the corresponding numerals. | 40 |
| | b) group a collection of up to 100 objects into tens and ones and write the corresponding numeral to develop an understanding of place value. | 24 |
| 1.2 | The student will count forward by ones, twos, fives, and tens to 100 and backward by ones from 30. | 12 |
| 1.3 | The student will identify the parts of a set and/or region that represent fractions for halves, thirds, and fourths and write the fractions. | 8 |

Computation and Estimation: Whole Number Operations

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| 1.4 | The student, given a familiar problem situation involving magnitude, will | |
| | a) select a reasonable order of magnitude from three given quantities: a one-digit numeral, a two-digit numeral, and a three-digit numeral (e.g., 5, 50, 500). | |
| | b) explain the reasonableness of the choice. | |
| 1.5 | The student will recall basic addition facts with sums to 18 or less and the corresponding subtraction facts. | 70 |
| 1.6 | The student will create and solve one-step story and picture problems using basic addition facts with sums to 18 or less and the corresponding subtraction facts. | 198 |

Measurement: Time and Nonstandard Measurement

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| 1.7 | The student will | |
| | a) identify the number of pennies equivalent to a nickel, a dime, and a quarter. | 28 |
| | b) determine the value of a collection of pennies, nickels, and dimes whose total value is 100 cents or less. | 16 |
| 1.8 | The student will tell time to the half-hour, using analog and digital clocks. | 38 |
| 1.9 | The student will use nonstandard units to measure length, weight/mass, and volume. | 24 |

- 1.10 The student will compare, using the concepts of more, less, and equivalent,
- a) the volumes of two given containers.
 - b) the weight/mass of two objects, using a balance scale.
- 1.11 The student will use calendar language appropriately (e.g., names of the months, today, yesterday, next week, last week).

Geometry: Characteristics of Plane Figures

- 1.12 The student will identify and trace, describe, and sort plane geometric figures (triangle, square, rectangle, and circle) according to number of sides, vertices, and right angles. 8
- 1.13 The student will construct, model, and describe objects in the environment as geometric shapes (triangle, rectangle, square, and circle) and explain the reasonableness of each choice. 6

Probability and Statistics: Data Collection and Interpretation

- 1.14 The student will investigate, identify, and describe various forms of data collection (e.g., recording daily temperature, lunch count, attendance, favorite ice cream), using tables, picture graphs, and object graphs. 14
- 1.15 The student will interpret information displayed in a picture or object graph, using the vocabulary more, less, fewer, greater than, less than, and equal to. 16

Patterns, Functions, and Algebra: Patterning and Equivalence

- 1.16 The student will sort and classify concrete objects according to one or more attributes, including color, size, shape, and thickness.
- 1.17 The student will recognize, describe, extend, and create a wide variety of growing and repeating patterns. 16
- 1.18 The student will demonstrate an understanding of equality through the use of the equal sign. 16

Grade Two**Number and Number Sense: Place Value, Number Patterns, and Fraction Concepts**

- 2.1 The student will
- a) read, write, and identify the place value of each digit in a three-digit numeral, using numeration models. 144
 - b) round two-digit numbers to the nearest ten.
 - c) compare two whole numbers between 0 and 999, using symbols ($>$, $<$, or $=$) and words (greater than, less than, or equal to). 126
- 2.2 The student will
- a) identify the ordinal positions first through twentieth, using an ordered set of objects. 4
 - b) write the ordinal numbers.
- 2.3 The student will
- a) identify the parts of a set and/or region that represent fractions for halves, thirds, fourths, sixths, eighths, and tenths. 36
 - b) write the fractions. 8
 - c) compare the unit fractions for halves, thirds, fourths, sixths, eighths, and tenths.
- 2.4 The student will
- a) count forward by twos, fives, and tens to 100, starting at various multiples of 2, 5, or 10. 36
 - b) count backward by tens from 100.
 - c) recognize even and odd numbers. 26

Computation and Estimation: Number Relationships and Operations

- 2.5 The student will recall addition facts with sums to 20 or less and the corresponding subtraction facts. 24
- 2.6 The student, given two whole numbers whose sum is 99 or less, will
- a) estimate the sum.
 - b) find the sum, using various methods of calculation. 134
- 2.7 The student, given two whole numbers, each of which is 99 or less, will
- a) estimate the difference.
 - b) find the difference, using various methods of calculation. 134
- 2.8 The student will create and solve one- and two-step addition and subtraction problems, using data from simple tables, picture graphs, and bar graphs.
- 2.9 The student will recognize and describe the related facts that represent and describe the inverse relationship between addition and subtraction. 8

Measurement: Money, Linear Measurement, Weight/Mass, and Volume

- 2.10** The student will
- a) count and compare a collection of pennies, nickels, dimes, and quarters whose total value is \$2.00 or less. 20
 - b) correctly use the cent symbol (¢), dollar symbol (\$), and decimal point (.). 12
- 2.11** The student will estimate and measure
- a) length to the nearest centimeter and inch. 62
 - b) weight/mass of objects in pounds/ounces and kilograms/grams, using a scale. 6
 - c) liquid volume in cups, pints, quarts, gallons, and liters. 2
- 2.12** The student will tell and write time to the nearest five minutes, using analog and digital clocks. 40
- 2.13** The student will
- a) determine past and future days of the week.
 - b) identify specific days and dates on a given calendar.
- 2.14** The student will read the temperature on a Celsius and/or Fahrenheit thermometer to the nearest 10 degrees.

Geometry: Symmetry and Plane and Solid Figures

- 2.15** The student will
- a) draw a line of symmetry in a figure. 14
 - b) identify and create figures with at least one line of symmetry. 48
- 2.16** The student will identify, describe, compare, and contrast plane and solid geometric figures (circle/sphere, square/cube, and rectangle/rectangular prism). 34

Probability and Statistics: Applications of Data

- 2.17** The student will use data from experiments to construct picture graphs, pictographs, and bar graphs. 8
- 2.18** The student will use data from experiments to predict outcomes when the experiment is repeated.
- 2.19** The student will analyze data displayed in picture graphs, pictographs, and bar graphs. 30

Patterns, Functions, and Algebra: Patterning and Numerical Sentences

- 2.20** The student will identify, create, and extend a wide variety of patterns.
- 2.21** The student will solve problems by completing numerical sentences involving the basic facts for addition and subtraction. The student will create story problems, using the numerical sentences.
- 2.22** The student will demonstrate an understanding of equality by recognizing that the symbol = in an equation indicates equivalent quantities and the symbol \neq indicates that quantities are not equivalent. 6

Grade Three**Number and Number Sense: Place Value and Fractions**

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| 3.1 | The student will | |
| | a) read and write six-digit numerals and identify the place value and value of each digit. | 100 |
| | b) round whole numbers, 9,999 or less, to the nearest ten, hundred, and thousand. | 52 |
| | c) compare two whole numbers between 0 and 9,999, using symbols (>, <, or =) and words (greater than, less than, or equal to). | 10 |
| 3.2 | The student will recognize and use the inverse relationships between addition/subtraction and multiplication/division to complete basic fact sentences. The student will use these relationships to solve problems. | 78 |
| 3.3 | The student will | |
| | a) name and write fractions (including mixed numbers) represented by a model. | 136 |
| | b) model fractions (including mixed numbers) and write the fractions' names. | 86 |
| | c) compare fractions having like and unlike denominators, using words and symbols (>, <, or =). | 44 |

Computation and Estimation: Computation and Fraction Operations

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| 3.4 | The student will estimate solutions to and solve single-step and multistep problems involving the sum or difference of two whole numbers, each 9,999 or less, with or without regrouping. | 346 |
| 3.5 | The student will recall multiplication facts through the twelves table, and the corresponding division facts. | 74 |
| 3.6 | The student will represent multiplication and division, using area, set, and number line models, and create and solve problems that involve multiplication of two whole numbers, one factor 99 or less and the second factor 5 or less. | 330 |
| 3.7 | The student will add and subtract proper fractions having like denominators of 12 or less. | |

Measurement: U.S. Customary and Metric Units, Area and Perimeter, and Time

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| 3.8 | The student will determine, by counting, the value of a collection of bills and coins whose total value is \$5.00 or less, compare the value of the bills and coins, and make change. | 114 |
| 3.9 | The student will estimate and use U.S. Customary and metric units to measure | |
| | a) length to the nearest $\frac{1}{2}$ inch, foot, yard, centimeter, and meter. | 46 |
| | b) liquid volume in cups, pints, quarts, gallons, and liters. | |
| | c) weight/mass in ounces, pounds, grams, and kilograms. | |
| | d) area and perimeter. | 84 |
| 3.10 | The student will | |
| | a) measure the distance around a polygon in order to determine perimeter. | 40 |

b)	count the number of square units needed to cover a given surface in order to determine area.	66
3.11	The student will	
a)	tell time to the nearest minute, using analog and digital clocks.	44
b)	determine elapsed time in one-hour increments over a 12-hour period.	26
3.12	The student will identify equivalent periods of time, including relationships among days, months, and years, as well as minutes and hours.	26
3.13	The student will read temperature to the nearest degree from a Celsius thermometer and a Fahrenheit thermometer. Real thermometers and physical models of thermometers will be used.	18
Geometry: Properties and Congruence Characteristics of Plane and Solid Figures		
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.	114
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.	
Probability and Statistics: Applications of Data and Chance		
3.17	The student will	
a)	collect and organize data, using observations, measurements, surveys, or experiments.	12
b)	construct a line plot, a picture graph, or a bar graph to represent the data.	40
c)	read and interpret the data represented in line plots, bar graphs, and picture graphs and write a sentence analyzing the data.	48
3.18	The student will investigate and describe the concept of probability as chance and list possible results of a given situation.	
Patterns, Functions, and Algebra: Patterns and Property Concepts		
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.	58
3.20	The student will	
a)	investigate the identity and the commutative properties for addition and multiplication.	14
b)	identify examples of the identity and commutative properties for addition and multiplication.	18

Grade Four**Number and Number Sense: Place Value, Fractions, and Decimals**

- 4.1 The student will
- a) identify orally and in writing the place value for each digit in a whole number expressed through millions. 68
 - b) compare two whole numbers expressed through millions, using symbols ($>$, $<$, or $=$). 26
 - c) round whole numbers expressed through millions to the nearest thousand, ten thousand, and hundred thousand. 40
- 4.2 The student will
- a) compare and order fractions and mixed numbers. 148
 - b) represent equivalent fractions. 156
 - c) identify the division statement that represents a fraction. 70
- 4.3 The student will
- a) read, write, represent, and identify decimals expressed through thousandths. 128
 - b) round decimals to the nearest whole number, tenth, and hundredth. 46
 - c) compare and order decimals. 50
 - d) given a model, write the decimal and fraction equivalents. 58

Computation and Estimation: Factors and Multiples, and Fraction and Decimal Operations

- 4.4 The student will
- a) estimate sums, differences, products, and quotients of whole numbers. 112
 - b) add, subtract, and multiply whole numbers. 32
 - c) divide whole numbers, finding quotients with and without remainders. 170
 - d) solve single-step and multistep addition, subtraction, and multiplication problems with whole numbers. 218
- 4.5 The student will
- a) determine common multiples and factors, including least common multiple and greatest common factor. 104
 - 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. 44
 - c) add and subtract with decimals. 16
 - d) solve single-step and multistep practical problems involving addition and subtraction with fractions and with decimals. 46

Measurement: Equivalence within U.S. Customary and Metric Systems

- 4.6 The student will
- a) estimate and measure weight/mass and describe the results in U.S. Customary and metric units as appropriate. 12
 - b) identify equivalent measurements between units within the U.S. Customary system (ounces, pounds, and tons) and between units within the metric system (grams and kilograms). 66
- 4.7 The student will
- a) estimate and measure length, and describe the result in both metric and U.S. Customary units. 90
 - 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). 128
- 4.8 The student will
- a) estimate and measure liquid volume and describe the results in U.S. Customary units. 6
 - b) identify equivalent measurements between units within the U.S. Customary system (cups, pints, quarts, and gallons). 58
- 4.9 The student will determine elapsed time in hours and minutes within a 12-hour period. 66

Geometry: Representations and Polygons

- 4.10 The student will
- a) identify and describe representations of points, lines, line segments, rays, and angles, including endpoints and vertices. 46
 - b) identify representations of lines that illustrate intersection, parallelism, and perpendicularity. 40
- 4.11 The student will
- a) investigate congruence of plane figures after geometric transformations, such as reflection, translation, and rotation, using mirrors, paper folding, and tracing. 26
 - b) recognize the images of figures resulting from geometric transformations, such as translation, reflection, and rotation. 6
- 4.12 The student will
- a) define polygon. 12
 - b) identify polygons with 10 or fewer sides. 46

Probability and Statistics: Outcomes and Data

- 4.13 The student will
- a) predict the likelihood of an outcome of a simple event. 36
 - b) represent probability as a number between 0 and 1, inclusive. 6
- 4.14 The student will collect, organize, display, and interpret data from a variety of graphs. 30

Patterns, Functions, and Algebra: Geometric Patterns, Equality, and Properties

- 4.15 The student will recognize, create, and extend numerical and geometric patterns. 180
- 4.16 The student will
- a) recognize and demonstrate the meaning of equality in an equation. 12
 - b) investigate and describe the associative property for addition and multiplication. 16

Grade Five**Number and Number Sense: Prime and Composite Numbers and Rounding Decimals**

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| 5.1 | The student, given a decimal through thousandths, will round to the nearest whole number, tenth, or hundredth. | 102 |
| 5.2 | The student will | |
| | a) recognize and name fractions in their equivalent decimal form and vice versa. | 28 |
| | b) compare and order fractions and decimals in a given set from least to greatest and greatest to least. | 6 |
| 5.3 | The student will | |
| | a) identify and describe the characteristics of prime and composite numbers. | 64 |
| | b) identify and describe the characteristics of even and odd numbers. | 6 |

Computation and Estimation: Multistep Applications and Order of Operations

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| 5.4 | The student will create and solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division with and without remainders of whole numbers. | 256 |
| 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 nonzero digit). | 82 |
| | b) create and solve single-step and multistep practical problems involving decimals. | 204 |
| 5.6 | The student will solve single-step and multistep practical problems involving addition and subtraction with fractions and mixed numbers and express answers in simplest form. | 176 |
| 5.7 | The student will evaluate whole number numerical expressions, using the order of operations limited to parentheses, addition, subtraction, multiplication, and division. | 50 |

Measurement: Perimeter, Area, Volume, and Equivalent Measures

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| 5.8 | The student will | |
| | a) find perimeter, area, and volume in standard units of measure. | 218 |
| | 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. | 6 |
| | c) identify equivalent measurements within the metric system. | 72 |
| | d) estimate and then measure to solve problems, using U.S. Customary and metric units. | 34 |
| | e) choose an appropriate unit of measure for a given situation involving measurement using U.S. Customary and metric units. | 68 |
| 5.9 | The student will identify and describe the diameter, radius, chord, and circumference of a circle. | 40 |

5.10	The student will determine an amount of elapsed time in hours and minutes within a 24-hour period.	82
5.11	The student will measure right, acute, obtuse, and straight angles.	108
Geometry: Classification and Subdividing		
5.12	The student will classify	
	a) angles as right, acute, obtuse, or straight.	56
	b) triangles as right, acute, obtuse, equilateral, scalene, or isosceles.	40
5.13	The student, using plane figures (square, rectangle, triangle, parallelogram, rhombus, and trapezoid), will	
	a) develop definitions of these plane figures.	130
	b) investigate and describe the results of combining and subdividing plane figures.	18
Probability and Statistics: Outcomes and Measures of Center		
5.14	The student will make predictions and determine the probability of an outcome by constructing a sample space.	92
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.	56
5.16	The student will	
	a) describe mean, median, and mode as measures of center.	30
	b) describe mean as fair share.	
	c) find the mean, median, mode, and range of a set of data.	120
	d) describe the range of a set of data as a measure of variation.	10
Patterns, Functions, and Algebra: Equations and Properties		
5.17	The student will describe the relationship found in a number pattern and express the relationship.	90
5.18	The student will	
	a) investigate and describe the concept of variable.	4
	b) write an open sentence to represent a given mathematical relationship, using a variable.	62
	c) model one-step linear equations in one variable, using addition and subtraction.	6
	d) create a problem situation based on a given open sentence, using a single variable.	26
5.19	The student will investigate and recognize the distributive property of multiplication over addition.	42

Grade Six**Number and Number Sense: Relationships among Fractions, Decimals, and Percents**

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| 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 $a:b$. | 176 |
| 6.2 | The student will | |
| | a) investigate and describe fractions, decimals, and percents as ratios. | 10 |
| | b) identify a given fraction, decimal, or percent from a representation. | 128 |
| | c) demonstrate equivalent relationships among fractions, decimals, and percents. | 148 |
| | d) compare and order fractions, decimals, and percents. | 66 |
| 6.3 | The student will | |
| | a) identify and represent integers. | 50 |
| | b) order and compare integers. | 40 |
| | c) identify and describe absolute value of integers. | 28 |
| 6.4 | The student will demonstrate multiple representations of multiplication and division of fractions. | 112 |
| 6.5 | The student will investigate and describe concepts of positive exponents and perfect squares. | 94 |

Computation and Estimation: Applications of Operations with Rational Numbers

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| 6.6 | The student will | |
| | a) multiply and divide fractions and mixed numbers. | 110 |
| | b) estimate solutions and then solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of fractions. | 90 |
| 6.7 | The student will solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of decimals. | 82 |
| 6.8 | The student will evaluate whole number numerical expressions, using the order of operations. | 34 |

Measurement: Problem Solving with Area, Perimeter, Volume, and Surface Area

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| 6.9 | The student will make ballpark comparisons between measurements in the U.S. Customary System of measurement and measurements in the metric system. | 4 |
| 6.10 | The student will | |
| | a) define π as the ratio of the circumference of a circle to its diameter. | 10 |
| | b) solve practical problems involving circumference and area of a circle, given the diameter or radius. | 98 |
| | c) solve practical problems involving area and perimeter. | 162 |
| | d) describe and determine the volume and surface area of a rectangular prism. | 118 |

Geometry: Properties and Relationships

- 6.11 The student will
- a) identify the coordinates of a point in a coordinate plane. 96
 - b) graph ordered pairs in a coordinate plane. 100
- 6.12 The student will determine congruence of segments, angles, and polygons. 104
- 6.13 The student will describe and identify properties of quadrilaterals. 40

Probability and Statistics: Practical Applications of Statistics

- 6.14 The student, given a problem situation, will
- a) construct circle graphs.
 - b) draw conclusions and make predictions, using circle graphs. 20
 - c) compare and contrast graphs that present information from the same data set. 24
- 6.15 The student will
- a) describe mean as balance point.
 - b) decide which measure of center is appropriate for a given purpose. 104
- 6.16 The student will
- a) compare and contrast dependent and independent events. 4
 - b) determine probabilities for dependent and independent events. 36

Patterns, Functions, and Algebra: Variable Equations and Properties

- 6.17 The student will identify and extend geometric and arithmetic sequences. 82
- 6.18 The student will solve one-step linear equations in one variable involving whole number coefficients and positive rational solutions. 94
- 6.19 The student will investigate and recognize
- a) the identity properties for addition and multiplication. 2
 - b) the multiplicative property of zero.
 - c) the inverse property for multiplication.
- 6.20 The student will graph inequalities on a number line. 26

Grade Seven**Number and Number Sense: Proportional Reasoning**

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| 7.1 | The student will | |
| | a) investigate and describe the concept of negative exponents for powers of ten. | 32 |
| | b) determine scientific notation for numbers greater than zero. | 26 |
| | c) compare and order fractions, decimals, percents, and numbers written in scientific notation. | 32 |
| | d) determine square roots. | 10 |
| | e) identify and describe absolute value for rational numbers. | 12 |
| 7.2 | The student will describe and represent arithmetic and geometric sequences, using variable expressions. | 28 |

Computation and Estimation: Integer Operations and Proportional Reasoning

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| 7.3 | The student will | |
| | a) model addition, subtraction, multiplication, and division of integers. | 62 |
| | b) add, subtract, multiply, and divide integers. | 118 |
| 7.4 | The student will solve single-step and multistep practical problems, using proportional reasoning. | 630 |

Measurement: Proportional Reasoning

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| 7.5 | The student will | |
| | a) describe volume and surface area of cylinders. | |
| | b) solve practical problems involving the volume and surface area of rectangular prisms and cylinders. | 50 |
| | c) describe how changing one measured attribute of a rectangular prism affects its volume and surface area. | 8 |
| 7.6 | The student will determine whether plane figures—quadrilaterals and triangles—are similar and write proportions to express the relationships between corresponding sides of similar figures. | 108 |

Geometry: Relationships between Figures

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| 7.7 | The student will compare and contrast the following quadrilaterals based on properties: parallelogram, rectangle, square, rhombus, and trapezoid. | 10 |
| 7.8 | The student, given a polygon in the coordinate plane, will represent transformations (reflections, dilations, rotations, and translations) by graphing in the coordinate plane. | 16 |

Probability and Statistics: Applications of Statistics and Probability

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| 7.9 | The student will investigate and describe the difference between the experimental probability and theoretical probability of an event. | 400 |
| 7.10 | The student will determine the probability of compound events, using the Fundamental (Basic) Counting Principle. | 138 |
| 7.11 | The student, given data for a practical situation, will | |
| | a) construct and analyze histograms. | 50 |
| | b) compare and contrast histograms with other types of graphs presenting information from the same data set. | |

Patterns, Functions, and Algebra: Linear Equations

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| 7.12 | The student will represent relationships with tables, graphs, rules, and words. | 64 |
| 7.13 | The student will | |
| | a) write verbal expressions as algebraic expressions and sentences as equations and vice versa. | 402 |
| | b) evaluate algebraic expressions for given replacement values of the variables. | 92 |
| 7.14 | The student will | |
| | a) solve one- and two-step linear equations in one variable. | 130 |
| | b) solve practical problems requiring the solution of one- and two-step linear equations. | 34 |
| 7.15 | The student will | |
| | a) solve one-step inequalities in one variable. | 56 |
| | b) graph solutions to inequalities on the number line. | 20 |
| 7.16 | The student will apply the following properties of operations with real numbers: | |
| | a) the commutative and associative properties for addition and multiplication. | 60 |
| | b) the distributive property. | 22 |
| | c) the additive and multiplicative identity properties. | 8 |
| | d) the additive and multiplicative inverse properties. | 46 |
| | e) the multiplicative property of zero. | |

Grade Eight**Number and Number Sense: Relationships within the Real Number System**

- 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. 244
 - b) compare and order decimals, fractions, percents, and numbers written in scientific notation. 98
- 8.2 The student will describe orally and in writing the relationships between the subsets of the real number system. 126

Computation and Estimation: Practical Applications of Operations with Real Numbers

- 8.3 The student will
- a) solve practical problems involving rational numbers, percents, ratios, and proportions. 434
 - b) determine the percent increase or decrease for a given situation. 14
- 8.4 The student will apply the order of operations to evaluate algebraic expressions for given replacement values of the variables. 80
- 8.5 The student will
- a) determine whether a given number is a perfect square. 30
 - b) find the two consecutive whole numbers between which a square root lies. 84

Measurement: Problem Solving

- 8.6 The student will
- a) verify by measuring and describe the relationships among vertical angles, adjacent angles, supplementary angles, and complementary angles. 114
 - b) measure angles of less than 360° .
- 8.7 The student will
- a) investigate and solve practical problems involving volume and surface area of prisms, cylinders, cones, and pyramids. 152
 - b) describe how changing one measured attribute of a figure affects the volume and surface area. 6

Geometry: Problem Solving with 2- and 3-Dimensional Figures

- 8.8 The student will
- a) apply transformations to plane figures. 240
 - b) identify applications of transformations. 34
- 8.9 The student will construct a three-dimensional model, given the top or bottom, side, and front views. 104
- 8.10 The student will

a)	verify the Pythagorean Theorem.	24
b)	apply the Pythagorean Theorem.	134
8.11	The student will solve practical area and perimeter problems involving composite plane figures.	152
Probability and Statistics: Statistical Analysis of Graphs and Problem Situations		
8.12	The student will determine the probability of independent and dependent events with and without replacement.	36
8.13	The student will	
a)	make comparisons, predictions, and inferences, using information displayed in graphs.	120
b)	construct and analyze scatterplots.	144
Patterns, Functions, and Algebra: Linear Relationships		
8.14	The student will make connections between any two representations (tables, graphs, words, and rules) of a given relationship.	174
8.15	The student will	
a)	solve multistep linear equations in one variable with the variable on one and two sides of the equation.	160
b)	solve two-step linear inequalities and graph the results on a number line.	50
c)	identify properties of operations used to solve an equation.	2
8.16	The student will graph a linear equation in two variables.	102
8.17	The student will identify the domain, range, independent variable, or dependent variable in a given situation.	14

Algebra I

Expressions and Operations

- | | | |
|-----|---|-----|
| A.1 | The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables. | 58 |
| A.2 | The student will perform operations on polynomials, including | |
| | a) applying the laws of exponents to perform operations on expressions. | 184 |
| | b) adding, subtracting, multiplying, and dividing polynomials. | 270 |
| | c) factoring completely first- and second-degree binomials and trinomials in one or two variables. Graphing calculators will be used as a tool for factoring and for confirming algebraic factorizations. | 100 |
| A.3 | The student will express the square roots and cube roots of whole numbers and the square root of a monomial algebraic expression in simplest radical form. | 32 |

Equations and Inequalities

- | | | |
|-----|--|-----|
| A.4 | The student will solve multistep linear and quadratic equations in two variables, including | |
| | a) solving literal equations (formulas) for a given variable. | 78 |
| | b) justifying steps used in simplifying expressions and solving equations, using field properties and axioms of equality that are valid for the set of real numbers and its subsets. | 36 |
| | c) solving quadratic equations algebraically and graphically. | 216 |
| | d) solving multistep linear equations algebraically and graphically. | 32 |
| | e) solving systems of two linear equations in two variables algebraically and graphically. | 150 |
| | f) solving real-world problems involving equations and systems of equations. Graphing calculators will be used both as a primary tool in solving problems and to verify algebraic solutions. | 344 |
| A.5 | The student will solve multistep linear inequalities in two variables, including | |
| | a) solving multistep linear inequalities algebraically and graphically. | 58 |
| | b) justifying steps used in solving inequalities, using axioms of inequality and properties of order that are valid for the set of real numbers and its subsets. | |
| | c) solving real-world problems involving inequalities. | 24 |
| | d) solving systems of inequalities. | 44 |
| A.6 | The student will graph linear equations and linear inequalities in two variables, including | |
| | a) determining the slope of a line when given an equation of the line, the graph of the line, or two points on the line. Slope will be described as rate of change and will be positive, negative, zero, or undefined. | 82 |
| | b) writing the equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line. | 118 |

Functions

- A.7** The student will investigate and analyze function (linear and quadratic) families and their characteristics both algebraically and graphically, including
- a) determining whether a relation is a function. 54
 - b) domain and range. 44
 - c) zeros of a function. 36
 - d) x - and y -intercepts. 50
 - e) finding the values of a function for elements in its domain. 36
 - f) making connections between and among multiple representations of functions including concrete, verbal, numeric, graphic, and algebraic. 146
- A.8** The student, given a situation in a real-world context, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically. 66

Statistics

- A.9** The student, given a set of data, will interpret variation in real-world contexts and calculate and interpret mean absolute deviation, standard deviation, and z -scores. 34
- A.10** The student will compare and contrast multiple univariate data sets, using box-and-whisker plots. 62
- A.11** The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve real-world problems, using mathematical models. Mathematical models will include linear and quadratic functions. 170

Geometry

Reasoning, Lines, and Transformations

- G.1** The student will construct and judge the validity of a logical argument consisting of a set of premises and a conclusion. This will include
- a) identifying the converse, inverse, and contrapositive of a conditional statement. 20
 - b) translating a short verbal argument into symbolic form.
 - c) using Venn diagrams to represent set relationships. 20
 - d) using deductive reasoning. 36
- G.2** The student will use the relationships between angles formed by two lines cut by a transversal to
- a) determine whether two lines are parallel. 8
 - b) verify the parallelism, using algebraic and coordinate methods as well as deductive proofs. 28
 - c) solve real-world problems involving angles formed when parallel lines are cut by a transversal. 34
- G.3** The student will use pictorial representations, including computer software, constructions, and coordinate methods, to solve problems involving symmetry and transformation. This will include
- a) investigating and using formulas for finding distance, midpoint, and slope. 186
 - b) applying slope to verify and determine whether lines are parallel or perpendicular. 134
 - c) investigating symmetry and determining whether a figure is symmetric with respect to a line or a point. 58
 - d) determining whether a figure has been translated, reflected, rotated, or dilated, using coordinate methods. 58
- G.4** The student will construct and justify the constructions of
- a) a line segment congruent to a given line segment. 4
 - b) the perpendicular bisector of a line segment. 14
 - c) a perpendicular to a given line from a point not on the line. 10
 - d) a perpendicular to a given line at a given point on the line.
 - e) the bisector of a given angle,. 12
 - f) an angle congruent to a given angle. 2
 - g) a line parallel to a given line through a point not on the given line. 16

Triangles

- G.5** The student, given information concerning the lengths of sides and/or measures of angles in triangles, will
- a) order the sides by length, given the angle measures. 8
 - b) order the angles by degree measure, given the side lengths. 6
 - c) determine whether a triangle exists. 16

- d) determine the range in which the length of the third side must lie. These concepts will be considered in the context of real-world situations. 16
- G.6 The student, given information in the form of a figure or statement, will prove two triangles are congruent, using algebraic and coordinate methods as well as deductive proofs. 60
- G.7 The student, given information in the form of a figure or statement, will prove two triangles are similar, using algebraic and coordinate methods as well as deductive proofs. 28
- G.8 The student will solve real-world problems involving right triangles by using the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry. 188

Polygons and Circles

- G.9 The student will verify characteristics of quadrilaterals and use properties of quadrilaterals to solve real-world problems. 52
- G.10 The student will solve real-world problems involving angles of polygons. 42
- G.11 The student will use angles, arcs, chords, tangents, and secants to
- a) investigate, verify, and apply properties of circles. 128
 - b) solve real-world problems involving properties of circles. 24
 - c) find arc lengths and areas of sectors in circles. 48
- G.12 The student, given the coordinates of the center of a circle and a point on the circle, will write the equation of the circle. 88

Three-Dimensional Figures

- G.13 The student will use formulas for surface area and volume of three-dimensional objects to solve real-world problems. 58
- G.14 The student will use similar geometric objects in two- or three-dimensions to
- a) compare ratios between side lengths, perimeters, areas, and volumes. 90
 - b) determine how changes in one or more dimensions of an object affect area and/or volume of the object. 50
 - c) determine how changes in area and/or volume of an object affect one or more dimensions of the object. 8
 - d) solve real-world problems about similar geometric objects. 44

Algebra, Functions, and Data Analysis

Algebra and Functions

- AFDA.1** The student will investigate and analyze function (linear, quadratic, exponential, and logarithmic) families and their characteristics. Key concepts include a) continuity; b) local and absolute maxima and minima; c) domain and range; d) zeros; e) intercepts; f) intervals in which the function is increasing/decreasing; g) end behaviors; and h) asymptotes. 46
- AFDA.2** The student will use knowledge of transformations to write an equation, given the graph of a function (linear, quadratic, exponential, and logarithmic). 94
- AFDA.3** The student will collect data and generate an equation for the curve (linear, quadratic, exponential, and logarithmic) of best fit to model real-world problems or applications. Students will use the best fit equation to interpolate function values, make decisions, and justify conclusions with algebraic and/or graphical models.
- AFDA.4** The student will transfer between and analyze multiple representations of functions, including algebraic formulas, graphs, tables, and words. Students will select and use appropriate representations for analysis, interpretation, and prediction. 52
- AFDA.5** The student will determine optimal values in problem situations by identifying constraints and using linear programming techniques. 70

Data Analysis

- AFDA.6** The student will calculate probabilities. Key concepts include a) conditional probability; b) dependent and independent events; c) addition and multiplication rules; d) counting techniques (permutations and combinations); and e) Law of Large Numbers.
- AFDA.7** The student will analyze the normal distribution. Key concepts include a) characteristics of normally distributed data; b) percentiles; c) normalizing data, using z-scores; and d) area under the standard normal curve and probability.
- AFDA.8** The student will design and conduct an experiment/survey. Key concepts include a) sample size; b) sampling technique; c) controlling sources of bias and experimental error; d) data collection; and e) data analysis and reporting.

Algebra II

Expressions and Operations

AII.1	The student, given rational, radical, or polynomial expressions, will	
	a) add, subtract, multiply, divide, and simplify rational algebraic expressions.	152
	b) add, subtract, multiply, divide, and simplify radical expressions containing rational numbers and variables, and expressions containing rational exponents.	196
	c) write radical expressions as expressions containing rational exponents and vice versa.	18
	d) factor polynomials completely.	114
AII.2	*The student will investigate and apply the properties of arithmetic and geometric sequences and series to solve real-world problems, including writing the first n terms, finding the n^{th} term, and evaluating summation formulas. Notation will include \sum and a_n .	300
AII.3	The student will perform operations on complex numbers, express the results in simplest form using patterns of the powers of i , and identify field properties that are valid for the complex numbers.	154

Equations and Inequalities

AII.4	The student will solve, algebraically and graphically,	
	a) absolute value equations and inequalities.	98
	b) quadratic equations over the set of complex numbers.	62
	c) equations containing rational algebraic expressions.	96
	d) equations containing radical expressions. Graphing calculators will be used for solving and for confirming the algebraic solutions.	106
AII.5	The student will solve nonlinear systems of equations, including linear-quadratic and quadratic-quadratic, algebraically and graphically. Graphing calculators will be used as a tool to visualize graphs and predict the number of solutions.	122

Functions

AII.6	The student will recognize the general shape of function (absolute value, square root, cube root, rational, polynomial, exponential, and logarithmic) families and will convert between graphic and symbolic forms of functions. A transformational approach to graphing will be employed. Graphing calculators will be used as a tool to investigate the shapes and behaviors of these functions.	212
AII.7	The student will investigate and analyze functions algebraically and graphically. Key concepts include	
	a) domain and range, including limited and discontinuous domains and ranges.	66
	b) zeros.	10
	c) x - and y -intercepts.	14
	d) intervals in which a function is increasing or decreasing.	10

e) asymptotes.	18
f) end behavior.	2
g) inverse of a function.	80
h) composition of multiple functions. Graphing calculators will be used as a tool to assist in investigation of functions.	52
AII.8 The student will investigate and describe the relationships among solutions of an equation, zeros of a function, x -intercepts of a graph, and factors of a polynomial expression.	124
Statistics	
AII.9 The student will collect and analyze data, determine the equation of the curve of best fit, make predictions, and solve real-world problems, using mathematical models. Mathematical models will include polynomial, exponential, and logarithmic functions.	84
AII.10 The student will identify, create, and solve real-world problems involving inverse variation, joint variation, and a combination of direct and inverse variations.	24
AII.11 The student will identify properties of a normal distribution and apply those properties to determine probabilities associated with areas under the standard normal curve.	104
AII.12 The student will compute and distinguish between permutations and combinations and use technology for applications.	192

Trigonometry

T.1	The student, given a point other than the origin on the terminal side of an angle, will use the definitions of the six trigonometric functions to find the sine, cosine, tangent, cotangent, secant, and cosecant of the angle in standard position. Trigonometric functions defined on the unit circle will be related to trigonometric functions defined in right triangles.	50
T.2	The student, given the value of one trigonometric function, will find the values of the other trigonometric functions, using the definitions and properties of the trigonometric functions.	20
T.3	The student will find, without the aid of a calculator, the values of the trigonometric functions of the special angles and their related angles as found in the unit circle. This will include converting angle measures from radians to degrees and vice versa.	46
T.4	The student will find, with the aid of a calculator, the value of any trigonometric function and inverse trigonometric function.	60
T.5	The student will verify basic trigonometric identities and make substitutions, using the basic identities.	168
T.6	The student, given one of the six trigonometric functions in standard form, will	
	a) state the domain and the range of the function.	12
	b) determine the amplitude, period, phase shift, vertical shift, and asymptotes.	100
	c) sketch the graph of the function by using transformations for at least a two-period interval.	34
	d) investigate the effect of changing the parameters in a trigonometric function on the graph of the function.	34
T.7	The student will identify the domain and range of the inverse trigonometric functions and recognize the graphs of these functions. Restrictions on the domains of the inverse trigonometric functions will be included.	32
T.8	The student will solve trigonometric equations that include both infinite solutions and restricted domain solutions and solve basic trigonometric inequalities.	54
T.9	The student will identify, create, and solve real-world problems involving triangles. Techniques will include using the trigonometric functions, the Pythagorean Theorem, the Law of Sines, and the Law of Cosines.	164

Probability and Statistics

PS.1	*The student will analyze graphical displays of univariate data, including dotplots, stemplots, and histograms, to identify and describe patterns and departures from patterns, using central tendency, spread, clusters, gaps, and outliers. Appropriate technology will be used to create graphical displays.	14
PS.2	*The student will analyze numerical characteristics of univariate data sets to describe patterns and departures from patterns, using mean, median, mode, variance, standard deviation, interquartile range, range, and outliers.	32
PS.3	*The student will compare distributions of two or more univariate data sets, analyzing center and spread (within group and between group variations), clusters and gaps, shapes, outliers, or other unusual features.	56
PS.4	*The student will analyze scatterplots to identify and describe the relationship between two variables, using shape; strength of relationship; clusters; positive, negative, or no association; outliers; and influential points.	58
PS.5	The student will find and interpret linear correlation, use the method of least squares regression to model the linear relationship between two variables, and use the residual plots to assess linearity.	104
PS.6	The student will make logarithmic and power transformations to achieve linearity.	14
PS.7	The student, using two-way tables, will analyze categorical data to describe patterns and departure from patterns and to find marginal frequency and relative frequencies, including conditional frequencies.	36
PS.8	*The student will describe the methods of data collection in a census, sample survey, experiment, and observational study and identify an appropriate method of solution for a given problem setting.	90
PS.9	*The student will plan and conduct a survey. The plan will address sampling techniques (e.g., simple random, stratified) and methods to reduce bias.	180
PS.10	The student will plan and conduct an experiment. The plan will address control, randomization, and measurement of experimental error.	4
PS.11	*The student will identify and describe two or more events as complementary, dependent, independent, and/or mutually exclusive.	46
PS.12	*The student will find probabilities (relative frequency and theoretical), including conditional probabilities for events that are either dependent or independent, by applying the Law of Large Numbers concept, the addition rule, and the multiplication rule.	260
PS.13	*The student will develop, interpret, and apply the binomial probability distribution for discrete random variables, including computing the mean and standard deviation for the binomial variable.	14
PS.14	The student will simulate probability distributions, including binomial and geometric.	80
PS.15	The student will identify random variables as independent or dependent and find the mean and standard deviations for sums and differences of independent random variables.	

- PS.16** *The student will identify properties of a normal distribution and apply the normal distribution to determine probabilities, using a table or graphing calculator.
- PS.17** *The student, given data from a large sample, will find and interpret point estimates and confidence intervals for parameters. The parameters will include proportion and mean, difference between two proportions, and difference between two means (independent and paired). 40
- PS.18** The student will apply and interpret the logic of a hypothesis-testing procedure. Tests will include large sample tests for proportion, mean, difference between two proportions, and difference between two means (independent and paired) and Chi-squared tests for goodness of fit, homogeneity of proportions, and independence. 18
- PS.19** The student will identify the meaning of sampling distribution with reference to random variable, sampling statistic, and parameter and explain the Central Limit Theorem. This will include sampling distribution of a sample proportion, a sample mean, a difference between two sample proportions, and a difference between two sample means. 10
- PS.20** The student will identify properties of a t-distribution and apply t-distributions to single-sample and two-sample (independent and matched pairs) t-procedures, using tables or graphing calculators.

Discrete Mathematics

- DM.1** *The student will model problems, using vertex-edge graphs. The concepts of valence, connectedness, paths, planarity, and directed graphs will be investigated. Adjacency matrices and matrix operations will be used to solve problems (e.g., food chains, number of paths). **18**
- DM.2** *The student will solve problems through investigation and application of circuits, cycles, Euler Paths, Euler Circuits, Hamilton Paths, and Hamilton Circuits. Optimal solutions will be sought using existing algorithms and student-created algorithms.
- DM.3** *The student will apply graphs to conflict-resolution problems, such as map coloring, scheduling, matching, and optimization. Graph coloring and chromatic number will be used.
- DM.4** *The student will apply algorithms, such as Kruskal's, Prim's, or Dijkstra's, relating to trees, networks, and paths. Appropriate technology will be used to determine the number of possible solutions and generate solutions when a feasible number exists.
- DM.5** *The student will use algorithms to schedule tasks in order to determine a minimum project time. The algorithms will include critical path analysis, the list-processing algorithm, and student-created algorithms.
- DM.6** *The student will solve linear programming problems. Appropriate technology will be used to facilitate the use of matrices, graphing techniques, and the Simplex method of determining solutions.
- DM.7** The student will analyze and describe the issue of fair division (e.g., cake cutting, estate division). Algorithms for continuous and discrete cases will be applied.
- DM.8** The student will investigate and describe weighted voting and the results of various election methods. These may include approval and preference voting as well as plurality, majority, run-off, sequential run-off, Borda count, and Condorcet winners.
- DM.9** The student will identify apportionment inconsistencies that apply to issues such as salary caps in sports and allocation of representatives to Congress. Historical and current methods will be compared.
- DM.10** The student will use the recursive process and difference equations with the aid of appropriate technology to generate a) compound interest; b) sequences and series; c) fractals; d) population growth models; and e) the Fibonacci sequence.
- DM.11** The student will describe and apply sorting algorithms and coding algorithms used in sorting, processing, and communicating information. These will include a) bubble sort, merge sort, and network sort; and b) ISBN, UPC, zip, and banking codes.
- DM.12** The student will select, justify, and apply an appropriate technique to solve a logic problem. Techniques will include Venn diagrams, truth tables, and matrices. **22**
- DM.13** The student will apply the formulas of combinatorics in the areas of a) the Fundamental (Basic) Counting Principle; b) knapsack and bin-packing problems; c) permutations and combinations; and d) the pigeonhole principle.

Mathematical Analysis

MA.1	The student will investigate and identify the characteristics of polynomial and rational functions and use these to sketch the graphs of the functions. This will include determining zeros, upper and lower bounds, y -intercepts, symmetry, asymptotes, intervals for which the function is increasing or decreasing, and maximum or minimum points. Graphing utilities will be used to investigate and verify these characteristics.	14
MA.2	The student will apply compositions of functions and inverses of functions to real-world situations. Analytical methods and graphing utilities will be used to investigate and verify the domain and range of resulting functions.	20
MA.3	The student will investigate and describe the continuity of functions, using graphs and algebraic methods.	12
MA.4	The student will expand binomials having positive integral exponents through the use of the Binomial Theorem, the formula for combinations, and Pascal's Triangle.	74
MA.5	The student will find the sum (sigma notation included) of finite and infinite convergent series, which will lead to an intuitive approach to a limit.	42
MA.6	The student will use mathematical induction to prove formulas and mathematical statements.	38
MA.7	The student will find the limit of an algebraic function, if it exists, as the variable approaches either a finite number or infinity. A graphing utility will be used to verify intuitive reasoning, algebraic methods, and numerical substitution.	10
MA.8	The student will investigate and identify the characteristics of conic section equations in (h, k) and standard forms. Transformations in the coordinate plane will be used to graph conic sections.	200
MA.9	The student will investigate and identify the characteristics of exponential and logarithmic functions in order to graph these functions and solve equations and real-world problems. This will include the role of e , natural and common logarithms, laws of exponents and logarithms, and the solution of logarithmic and exponential equations.	348
MA.10	The student will investigate and identify the characteristics of the graphs of polar equations, using graphing utilities. This will include classification of polar equations, the effects of changes in the parameters in polar equations, conversion of complex numbers from rectangular form to polar form and vice versa, and the intersection of the graphs of polar equations.	104
MA.11	The student will perform operations with vectors in the coordinate plane and solve real-world problems, using vectors. This will include the following topics: operations of addition, subtraction, scalar multiplication, and inner (dot) product; norm of a vector; unit vector; graphing; properties; simple proofs; complex numbers (as vectors); and perpendicular components.	238
MA.12	The student will use parametric equations to model and solve application problems.	28

- MA.13** The student will identify, create, and solve real-world problems involving triangles. Techniques will include using the trigonometric functions, the Pythagorean Theorem, the Law of Sines, and the Law of Cosines.
- MA.14** The student will use matrices to organize data and will add and subtract matrices, multiply matrices, multiply matrices by a scalar, and use matrices to solve systems of equations. 416