MATHEMATICS

Pre-Algebra

Grade 8		
NUMBER SENSE **1. Students know the properties of and compute with rational numbers expressed in a variety of forms.** 8.1.1 read, write and compare rational numbers in scientific notation (positive and negative powers of 10), approximate numbers using scientific notation 8.1.2 add, subtract, multiply and divide rational numbers, integers, fractions and decimals and take rational numbers to whole number powers 8.1.3 convert fractions to decimals and percents and use these representations in estimation, computation and applications 8.1.4 differentiate between rational and irrational numbers 8.1.5 know that every fraction is either a terminating or repeating decimal and be able to convert terminating decimals into reduced fractions 8.1.6 calculate percent of increases and decreases of a quantity 8.1.7 solve problems that involve discounts, markups, commissions, profit and simple compound interest	**2. Students use exponents, powers, and roots and use exponents in working with fractions.** 8.2.1 understand negative whole number exponents. Multiply and divide expressions involving exponents with a common base 8.2.2 add and subtract fractions using factoring to find common denominators 8. 2.3 multiply, divide, and simplify fractions using exponent rules 8.2.4 use the inverse relationship between raising to a power and root extraction for perfect square integers; and, for integers which are not square, determine without a calculator, the two integers between which its square root lies, and explain why 28.5 understand the meaning of the absolute value of a number, interpret it as the distance of the number from zero on a number line and determine the absolute value of real numbers	**3. Students understand and use such operations as taking the opposite, reciprocal, and raising to a power. This includes the understanding and use of the rules of exponents.** **4. Students convert numbers from common form into scientific notation and from scientific notation to common form, and manipulate numbers within scientific notation.**

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Grade 8		
ALGEBRA AND FUNCTIONS		
1. Students express quantitative relationships using algebraic terminology, expressions, equations, inequalities and their graphs. 8.1.1 use variables and appropriate operations to write an expression, equation, inequality, or system of equations or inequalities which represent a verbal description (e.g., three less than a number, half as large as area A) 8.1.2 use order of operations correctly to evaluate algebraic expressions such as $3(2x + 5)^2$ 8.1.3 simplify numerical expressions by applying properties of rational numbers (identity, inverse, distributive, associative, commutative), and justify the process used 8.1.4 use algebraic terminology correctly (e.g., variable, equation, term, coefficient, inequality, expression, constant) 8.1.5 represent quantitative relationships graphically and interpret the meaning of a specific part of a graph in terms of the situation represented by the graph	**2. Students interpret and evaluate expressions involving integer powers and simple roots.** 8.2.1 interpret positive whole number powers as repeated multiplication and negative whole numbers as repeated division or multiplication by the multiplicative inverse; Simplify and evaluate expressions that include exponents 8.2.2 multiply and divide monomials; extend the process of taking powers and extracting roots to monomials, when the latter results in a monomial with an integer exponent **4. Students solve simple linear equations and inequalities over the rational numbers.** 8.4.1 solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution(s) in terms of the context from which they arose and verify the reasonableness of the results 8.4.2 solve multi-step problems involving rate, average speed, distance and time, or direct variation	**3. Students graph and interpret linear and some non-linear functions.** 8.3.1 graph functions of the form $y = nx^2$ and $y = nx^3$ and use in solving problems 8.3.2 plot the values from the volumes of a 3-D shape for various values of its edge lengths (e.g., cubes with varying edge lengths or a triangle prism with a fixed height and a varying length equilateral triangle base) 8.3.3 graph linear functions, noting that the vertical change (change in y-value) per unit horizontal change (change in x-value) is always the same and know that the ratio ("rise over run") is called the slope of a graph **5. Students simplify expressions prior to solving linear equations and inequalities in one variable such as 3(2x-5) + 4(x-2) = 12.** **6. Students graph a linear equation, and compute the x- and y- intercepts (e.g., graph 2x + 6y = 4). They are also able to sketch the region defined by linear inequality (e.g., sketch the region defined by 2x + 6y < 4).**

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MEASUREMENT AND GEOMETRY		
1. Students choose appropriate units of measure and use ratios to convert within and between measurement systems to solve problems. 8.1.1 compare weights, capacities, geometric measures, times and temperatures within and between measurement systems (e.g., miles per hour and feet per second, cubic inches to cubic centimeters) 8.1.2 construct and read scale drawings and models 8.1.3 use measures expressed as rates (e.g., speed, density) and measures expressed as products (e.g., person-days) to solve problems, check units of the solutions, and use dimensional analysis to check the reasonableness of an answer	**2. Students compute the perimeter, area and volume of common geometric objects and use these to find measures of less common objects; know how perimeter, area, and volume are affected under changes of scale.** 8.2.1 routinely use formulas for finding the perimeter and areas of basic two-dimensional figures and for the surface area and volume of basic three-dimensional figures, including rectangles, parallelograms, trapezoids, squares, triangles, circles, prisms, and circular cylinders 8.2.2 estimate and compute the area of more complex or irregular two- and three-dimensional figures by breaking them up into more basic geometric objects 8.2.3 compute the length of the perimeter, the surface area of the faces, and the volume of a 3-D object built from rectangular solids. They understand that when the lengths of all dimensions are multiplied by a scale factor, the surface area is multiplied by the square of the scale factor and the volume is multiplied by the cube of the scale factor 8. 2.4 relate the changes in measurement under change of scale to the units used (e.g., square inches, cubic feet) and to conversions between units (1 square foot = 144 square inches, 1 cubic inch = 16.39 cubic centimeters)	**3. Students know the Pythagorean Theorem and deepen their understanding of plane and solid geometric shapes by constructing figures that meet given conditions and by identifying attributes of figures.** 8.3.1 identify and construct basic elements of geometric figures, (e.g., diagonals, angle bisectors and perpendicular bisectors; and central angles, radii, diameters and chords of circles) using compass and straight-edge 8.3.2 know and understand the Pythagorean Theorem and use it to find the length of the missing side of a right triangle and lengths of other line segments, and, in some situations, empirically verify the Pythagorean Theorem by direct measurement 8.3.3 demonstrate an understanding of when two geometrical figures are congruent and what congruence means about the relationships between the sides and angles of the two figures 8.3.4 construct two-dimensional patterns for three-dimensional models such as cylinders, prisms and cones 8.3.5 identify elements of three-dimensional geometric objects (e.g., diagonals of rectangular solids) and how two or more objects are related in space (e.g., skew lines, the possible ways three planes could intersect

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Grade 8		
STATISTICS, DATA ANALYSIS AND PROBABILITY **1. Students collect, organize and represent data sets that have one or more variables and identify relationships among variables within a data set both manually and by using an electronic spreadsheet program.** 8.1.1 know various forms of display for data sets, including a stem-and-leaf plot or box-and-whisker plot; use them to display a single set of data or compare two sets of data 8.1.2 represent two numerical variables on a scatter plot and informally describe how the data points are distributed and whether there is an apparent relationship between the two variables (e.g., time spent on homework and grade level) 8.1.3 understand the meaning of and be able to compute the minimum, the lower quartile, the median, the upper quartile and the maximum of a data set		

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Grade 8		
MATHEMATICAL REASONING **1. Students make decisions about how to approach problems.** 8.1.1 analyze problems by identifying relationships, discriminating relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns 8.1.2 formulate and justify mathematical conjectures based upon a general description of the mathematical question or problem posed 8.1.3 determine when and how to break a problem into simpler parts	**2. Students use strategies, skills and concepts in finding solutions.** 8.2.1 use estimation to verify the reasonableness of calculated results 8.2.2 apply strategies and results from simpler problems to more complex problems 8.2.3 use a variety of methods such as words, numbers, symbols, charts, graphs, tables, diagrams and models to explain mathematical reasoning 8.2.4 express the solution clearly and logically using appropriate mathematical notation and terms and clear language, and support solutions with evidence, in both verbal and symbolic work 8.2.5 indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy 8.2.6 make precise calculations and check the validity of the results from the context of the problem	**3. Students determine a solution is complete and move beyond a particular problem by generalizing to other situations.** 8.3.1 evaluate the reasonableness of the solution in the context of the original situation 8.3.2 note method of deriving the solution and demonstrate conceptual understanding of the derivation by solving similar problems 8.3.3 develop generalizations of the results obtained and the strategies used and extend them to new problem situations