By the end of sixth grade, students have mastered the four arithmetic operations with positive and negative numbers, whole numbers, fractions and decimals; they accurately compute and solve problems. They apply their knowledge to statistics and probability. Students understand the concept of and how to calculate the range, mean, median and mode of data sets. They analyze data and sampling processes for possible bias and misleading conclusions, and they use addition and multiplication of fractions routinely to calculate probabilities for compound events. Students conceptually understand and work with ratios and proportions; they compute percentages (e.g., tax, tips, interest). Students know about   and the formulas for the circumference and area of a circle. They use letters for numbers in formulas involving geometric shapes and in representing an unknown part of a ratio. They solve 1-step linear equations.

NUMBER SENSE

1. Students compare and order fractions, decimals, and mixed numbers. They solve problems involving fractions, ratios, proportions, and percentages.

1.1. compare and order positive and negative fractions, decimals, and mixed numbers and place them on a number line
1.2. interpret and use ratios in different contexts (e.g., batting averages, miles per hour) to show the relative sizes of two quantities using appropriate notations (a/b, a to b, a:b)
1.3. use proportions to solve problems (e.g., determine the value of N if $4/7 = N/21$, find the length of a side of a polygon similar to a known polygon). Use cross-multiplication as a method for solving such problems, understanding it as multiplication of both sides of an equation by a multiplicative inverse.
1.4. calculate given percentages of quantities and solve problems involving discounts at sales, interest earned and tips

2. Students calculate and solve problems involving addition, subtraction, multiplication and division of rational numbers.
2.1. solve problems involving addition, subtraction, multiplication and division of fractions and explain why a particular operation was used for a given situation
2.2. explain the meaning of multiplication and division of fractions and perform the calculations (e.g., $5/8$ divided by $15/16 = 5/8 \times 16/15 = 2/3$)

2.3. solve addition, subtraction, multiplication and division problems, including those arising in concrete situations that use positive and negative numbers and combinations of these operations

2.4. determine the least common multiple and greatest common divisor of whole numbers. Use them to solve problems with fractions (e.g., to find a common denominator in order to add two fractions or to find the reduced form for a fraction)

ALGEBRA AND FUNCTIONS
1. Students write verbal expressions and sentences as algebraic expressions and equations; they evaluate algebraic expressions, solve simple linear equations and graph and interpret their results.
1.1. write and solve one-step linear equations in one variable
1.2. write and evaluate an algebraic expression for a given situation using up to three variables commutative

1.3. apply algebraic order of operations and the, associative and distributive properties to evaluate expressions and justify each step in the process

1.4. solve problems using correct order of operations manually

2. Students analyze and use tables, graphs and rules to solve problems involving rates and proportions.
2.1. convert from one unit of measurement to another (e.g., from feet to miles, from centimeters to inches)
2.2. demonstrate understanding that rate is a measure of one quantity per unit value of another quantity
2.3. solve problems involving rates, average speed, distance and time

3. Students investigate geometric patterns and describe them algebraically.
3.1. use variables in expressions describing geometric quantities(e.g., $P = 2w + 2l$, $A = 1/2\, bh$, $C =$ d, which give the perimeter of a rectangle, area of a triangle, and circumference of a circle, respectively
3.2. express simple relationships arising from geometry in symbolic form

MEASUREMENT AND GEOMETRY
1. Students deepen their understanding of measurement of plane and solid shapes and use this understanding to solve problems.
1.1. understand the concept of a constant number like   . Know the formula for the circumference and area of a circle
1.2. know common estimates of   (3.14; 22/7) and use these values to estimate and calculate the circumference and the area of circles; compare with actual measurements

1.3. know and use the formulas for the volume of triangular prisms and cylinders (area of base x height); compare and explain the similarity between these formulas and the formula for the volume of a rectangular solid

2. Students identify and describe the properties of two-dimensional figures.
2.1. identify angles as vertical, adjacent, complementary and/or supplementary and provide descriptions of these terms
2.2. use the properties of complementary and supplementary angles and of the angles of a triangle to solve problems involving an unknown angle

2.3. draw quadrilaterals and triangles given information about them (e.g., a quadrilateral having equal sides but no right angles, a right isosceles triangle)

STATISTICS, DATA ANALYSIS and PROBABILITY
1. Students compute and analyze statistical measurement for data sets.

    1.1. compute the range, mean, median and mode of data sets

    1.2. understand how additional data added to data sets can effect these computations of measures of central tendency

    1.3. understand how the inclusion or exclusion of outliers affect measures of central tendency

    1.4. know why a specific measure of central tendency (mean, median, mode) provides the most useful information in a given context

2. Students use data samples of a population and describe the characteristics and limitations of the samples.

    2.1. compare different samples from a population with the data from the entire population and identify when it makes sense to use a sample

    2.2. identify different ways of selecting a sample (e.g., convenience sampling, those who respond to a survey, random sampling) and which makes a sample more representative for a population

    2.3. analyze data displays and explain how the way the question was asked might have influenced the results obtained, and/or how the way the results were displayed might have influenced the conclusions reached

    2.4. identify data that represent sampling and explain why the sample (and the display) may be biased

    2.5. identify claims based on statistical data and, in simple cases, evaluate the validity of the claims

3. Students determine theoretical and experimental probabilities and use these to make predictions about events.

3.1. represent all possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and express the theoretical probability of each outcome

    3.2. use data to estimate the probability for future events (e.g., batting averages or number of accidents per mile driven)

    3.3. represent probabilities as ratios, proportions, and decimals between 0 and 1, and percents between 0 and 100 and check that probabilities computed are reasonable; know how this is related to the probability of an event not occurring

    3.4. understand that the probability of either of two disjointed events occurring is the sum of the two individual probabilities and that the probability of one event following another, in independent trials, is the product of the two probabilities

    3.5. understand the difference between independent and dependent events and how this affects the results for specific probability situations

MATHEMATICAL REASONING
1. Students make decisions about how to approach problems.

    1.1. analyze problems by identifying relationships, discriminating relevant from irrelevant information,

identifying missing information, sequencing and prioritizing information and observing patterns

1.2. formulate and justify mathematical conjectures based upon a general description of the mathematical question or problem posed

1.3. determine when and how to break a problem into simpler parts

2. Students use strategies, skills and concepts in finding solutions

    2.1. use estimation to verify the reasonableness of calculated results

    2.2. apply strategies and results from simpler problems to more complex problems

    2.3. estimate unknown quantities graphically and solve for them using logical reasoning, and arithmetic and algebraic techniques

    2.4. use a variety of methods such as words, numbers, symbols, charts, graphs, tables, diagrams and models to explain mathematical reasoning

    2.5. 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

    2.6. indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy

    2.7. make precise calculations and check the validity of the results from the context of the problem

3. Students move beyond a particular problem by generalizing to other situations.

    3.1. evaluate the reasonableness of the solution in the context of the original situation

    3.2. note method of deriving the solution and demonstrate conceptual understanding of the derivation by solving similar problems

    3.3. develop generalizations of the results obtained and the strategies used and extend them to new problem situations