THE CENTER FOR
Language in Learning

Mathematical Understanding Scale
Grades 6-8

Note: The descriptors for each level identify many of the key indicators that a student is developing mathematical understanding. Judgments about student placement on a level are to be based on overall attainment, not on a point-by-point check off.

Level 6	Level 7	Level 8	Level 9	Level 10
Developing understanding of the relationships among operations. Solves problems involving addition and subtraction of whole numbers. Uses place value and decomposition multi-digit numbers to solve multiplication and division problems. Uses models (e.g., number line), bench-marks, and equivalents to understand, represent, compare, and order common fractions and decimals.	Solves problems involving computation of whole numbers and knows which operation(s) makes sense for a situation. Developing understanding of primes/ composites, factors/multiples. Understands and uses the relationships among fractions, decimals, and percents, to solve simple problems involving rational numbers in a variety of ways (e.g., models, mentally).	Uses understanding of the number system to effectively and efficiently solve problems involving whole number computation. Becoming proficient solving problems involving computation with fractions, decimals, and percents. Developing understanding of positive and negative numbers and solves simple problems involving integers that arise in common situations and on the number line.	Understands and uses properties (e.g., closure, associative, distributive) and inverse relationships (e.g., multiplication/division, square/square roots) to solve problems. Solve problems involving fractions, decimals, and percents. Developing understanding of and uses proportional reasoning to solve a variety; of problems (e.g., rates, similarity, probability, scaling). Developing an understanding of large numbers, and their various representations (e.g., exponential, scientific, calculator notation).	Understands and uses concepts and properties of the real number system (e.g., factorization, irrational numbers, density, additive and multiplicative inverses.). Analyzes and compares algorithms for computing with rational numbers (including integers) and uses efficient and effective methods for solving problems. Uses proportional reasoning to solve a variety; of problems (e.g., rates, similarity, probability, scaling)
Identifies and describes numerical patterns and simple functions that emerge from a variety of situations, and represents them with tables and mathematical expressions. Plots points on a coordinate grid.	Beginning to identify and describe relationships between two quantities that vary together (functions) and represent them in tables as verbal rules, and as mathematical equations. Set up a coordinate grid, and plot data from a functional relationship.	Developing understanding of and ability to use variables in equations and expressions to model situations. Represents a simple functional relationship in a table, as a rule as an equations, and on a graph.	Represents functional relationships expressed in contexts, models, and/or symbolically in several ways and explains how different situations or models may represent the same function.	Developing understanding of and ability to represent and solve problems using algebraic expressions/ equations and their graphs. Flexibly moves between numerical, algebraic, and geometric representations of a problem situation.

Grades 6-8 (Continued)

Level 6	Level 7	Level 8	Level 9	Level 10
Identifies, names, and classifies common two and three dimensional geometric figures using distinguishing attributes (e.g., number of angles/vertices, sides/faces, symmetry). Visualizes and predicts the results of sliding, flipping and turning two dimensional figures. Estimates and measures lengths (in/ft or cm/m), Beginning to understand the concepts of area, and perimeter, and volume, by counting/measuring appropriate units.	Beginning to describe figures using geometric properties and relationships (e.g., congruence, size of angles, etc.). Visualizes and builds three dimensional shapes given two dimensional drawings (and vice versa). Develops, understands, and uses formulas for finding areas and perimeters of rectangles and figures made up of a combination of rectangles. Developing ability to choose appropriate units/tools to measure length, area, and volume.	Beginning to use mental visualizations and drawings to represent geometric phenomena (e.g., transformations, nets). Developing understanding of and beginning to solve problems involving geometric properties and relationships (e.g., parallelism, similarity.) Chooses appropriate units/tools to estimate and measure length, area, and volume.	Knows and/or derives appropriate formulas for area, perimeter, volume, and surface area and uses them, as well as mental visualizations, to solve problems. Uses a variety of tools to accurately measure and construct geometric figures.	Uses visualizations and/or other representations of geometric figures (e.g., geometric decompositions and transformations), and appropriate formulas to analyze, interpret and solve problems. Beginning to understand the difference between multiple observations of phenomena and a sound mathematical argument. Developing understanding of the approximate nature of measurement and the degree of accuracy needed for a situation.
Gathers data to answer a question, represents the data on a graph and makes justifiable conclusions based on the data. Conducts simple probability experiments and describes what happened verbally and numerically.	Gathers, organizes, and represents data accurately and appropriately in more than one way. Developing an understanding of the mean, median, mode, and range and how/when they are useful and appropriate to describe data sets. Represents possible outcomes for simple probability situations using tables, grids, and/or tree diagrams and expresses the outcomes in words and fractions.	Designs and conducts a survey, considering how to phrase the question, how the sample will be selected and whether it will be representative of the population, and whether the results might be valid beyond the sampled group. Developing an understanding of and ability to use experimental and theoretical probability to predict outcomes and solve problems.	Understands and uses simple tools of statistical analysis (e.g., range, measures of central tendency, box and whisker graphs) to interpret single variable data sets. Beginning to represent and interpret two variable data sets using scatter plots. Recognizes and explains the differences between theoretical probabilities and the results of experimental trials.	Analyzes and critiques data reports and explains how they might have been affected by considering possible sources of bias in the design, data collection and/or representation. Uses theoretical probability to predict and explain the outcomes of problems involving probability.