

MIDDLE GRADES 6-8

Number and Operations

Students in the middle grades represent real numbers using manipulatives, pictures, number lines, and symbols in a variety of contexts. Relationships among rational numbers are explored and equivalence among fractions, decimals, and percents is recognized and explained. Students extend their understanding of place value to decimal and scientific notation and use the properties of real numbers, including zero, one, and inverses. Numerical comparisons are expressed as ratios and rates and problems are solved using ratio, proportion, and percent.

Students develop fluency in computation with rational numbers as well as with relationships among numbers, including primes, composites, factors, and multiples. They explain exponents and square and cube roots of numbers, develop facility with estimation and mental computation, and use calculators appropriately.

Measurement

In the middle grades, the study of perimeter and area is expanded to include surface area and volume of prisms and cylinders and formulas are developed for computing these quantities. Relationships among length, perimeter, area, and volume are studied. Students draw objects to scale and use scale drawings to solve problems.

Geometry

Students use the properties and relationships among geometric figures to solve problems. Congruence, similarity using ratio and proportion, and the Pythagorean theorem are studied. Students continue to study symmetries and transformations and become proficient at visualizing and recognizing transformed figures in the coordinate plane. Three-dimensional figures are drawn and built using different views.

Data Analysis and Probability

Students investigate increasingly complex data sets and, with the appropriate statistical measures, solve problems involving multiple data sets. More sophisticated representations, such as histograms, box plots, and scatter plots, highlight an increased understanding of the spread and grouping of data and the relationships between variables. Students identify basic patterns and trends in tables and charts and use them to make predictions. They describe the distribution of data using measures of central tendency. Students explore extremes in data and the misuse of representations to communicate information.

With bivariate data, students learn to recognize relationships, estimate, and make predictions. In particular, linear relationships are identified and used to investigate bivariate data.

Students conduct experiments and simulations to investigate basic probability, including dependent and independent events. Experimental results are compared with theoretical probabilities and students learn that the level of agreement between the two often depends on the number of times an experiment is repeated. Students learn to make inferences and predictions based on the outcomes of their experiments and simulations.

Algebra

Students in the middle grades begin to use the language of function, identifying patterns and relationships in context and expressing them algebraically. Variables are used to describe the interdependence of quantities and build an understanding of slope as the rate of change between quantities. In order to solve problems, ordered pairs of data are generated and used to identify a linear relationship between quantities graphically and algebraically. From tables and graphs students recognize nonlinear relationships and functions. Linear equations and inequalities are solved using multiple strategies, including manipulatives, tables, guess-and-test, working backwards, and algebraic methods. Students simplify algebraic expressions involving real numbers and variables and apply algebraic methods to solve a variety of problems.

Grade 6

Major Concepts/Skills

- Negative rational numbers
- Percent
- Transformations in the coordinate plane
- Probability
- Equations and inequalities
- Multiplication and division of non-negative rational numbers
- Students will solve relevant and authentic problems using appropriate technology and apply these concepts as well as those developed in earlier years

Concepts/Skills to Maintain

- Addition and subtraction of non-negative rational numbers
- Number properties
- Perimeter and area
- Median, mode, and range
- Bar graphs and leaf plots

Strands: Number and Operations, Measurement, Geometry, Data Analysis and Probability, Algebra

COMPETENCY GOAL 1: The learner will understand and compute with rational numbers.

Objectives

- 1.01 Develop number sense for negative rational numbers.
 - a) Connect the model, number word, and number using a variety of representations, including the number line.
 - b) Compare and order.
 - c) Make estimates in appropriate situations.
- 1.02 Develop meaning for percents.
 - a) Connect the model, number word, and number using a variety of representations.
 - b) Make estimates in appropriate situations.
- 1.03 Compare and order rational numbers.

- 1.04 Develop fluency in addition, subtraction, multiplication, and division of non-negative rational numbers.
 - a) Analyze computational strategies.
 - b) Describe the effect of operations on size.
 - c) Estimate the results of computations.
 - d) Judge the reasonableness of solutions.
- 1.05 Develop fluency in the use of factors, multiples, exponential notation, and prime factorization.
- 1.06 Use exponential, scientific, and calculator notation to write very large and very small numbers.
- 1.07 Develop flexibility in solving problems by selecting strategies and using mental computation, estimation, calculators or computers, and paper and pencil.

COMPETENCY GOAL 2: The learner will select and use appropriate tools to measure two- and three-dimensional figures.

Objectives

- 2.01 Estimate and measure length, perimeter, area, angles, weight, and mass of two- and three-dimensional figures, using appropriate tools.
- 2.02 Solve problems involving perimeter/circumference and area of plane figures.

COMPETENCY GOAL 3: The learner will understand and use properties and relationships of geometric figures in the coordinate plane.

Objectives

- 3.01 Identify and describe the intersection of figures in a plane.
- 3.02 Identify the radius, diameter, chord, center, and circumference of a circle; determine the relationships among them.
- 3.03 Transform figures in the coordinate plane and describe the transformation.
- 3.04 Solve problems involving geometric figures in the coordinate plane.

COMPETENCY GOAL 4: The learner will understand and determine probabilities.

Objectives

- 4.01 Develop fluency with counting strategies to determine the sample space for an event. Include lists, tree diagrams, frequency distribution tables, permutations, combinations, and the Fundamental Counting Principle.
- 4.02 Use a sample space to determine the probability of an event.

- 4.03 Conduct experiments involving simple and compound events.
- 4.04 Determine and compare experimental and theoretical probabilities for simple and compound events.
- 4.05 Determine and compare experimental and theoretical probabilities for independent and dependent events.
- 4.06 Design and conduct experiments or surveys to solve problems; report and analyze results.

COMPETENCY GOAL 5: The learner will demonstrate an understanding of simple algebraic expressions.

Objectives

- 5.01 Simplify algebraic expressions and verify the results using the basic properties of rational numbers.
 - a) Identity.
 - b) Commutative.
 - c) Associative.
 - d) Distributive.
 - e) Order of operations.
- 5.02 Use and evaluate algebraic expressions.
- 5.03 Solve simple (one- and two-step) equations or inequalities.
- 5.04 Use graphs, tables, and symbols to model and solve problems involving rates of change and ratios.

Grade 7

Major Concepts/Skills

- Computation with rational numbers
- Ratio and proportion
- Factors and multiples
- Volume and surface area
- Measures of central tendency
- Box plots and histograms
- Equations and inequalities
- Students will solve relevant and authentic problems using appropriate technology and apply these concepts as well as those developed in earlier years

Concepts/Skills to Maintain

- Number properties
- Percent
- Transformations in the coordinate plane
- Probability

Strands: Number and Operations, Measurement, Geometry, Data Analysis and Probability, Algebra

COMPETENCY GOAL 1: The learner will understand and compute with rational numbers.

Objectives

- 1.01 Develop and use ratios, proportions, and percents to solve problems.
- 1.02 Develop fluency in addition, subtraction, multiplication, and division of rational numbers.
 - a) Analyze computational strategies.
 - b) Describe the effect of operations on size.
 - c) Estimate the results of computations.
 - d) Judge the reasonableness of solutions.
- 1.03 Develop flexibility in solving problems by selecting strategies and using mental computation, estimation, calculators or computers, and paper and pencil.

COMPETENCY GOAL 2: The learner will understand and use measurement involving two- and three-dimensional figures.

Objectives

- 2.01 Draw objects to scale and use scale drawings to solve problems.
- 2.02 Solve problems involving volume and surface area of cylinders, prisms, and composite shapes.

COMPETENCY GOAL 3: The learner will understand and use properties and relationships in geometry.

Objectives

- 3.01 Using three-dimensional figures:
 - a) Identify, describe, and draw from various views (top, side, front, corner).
 - b) Build from various views.
 - c) Describe cross-sectional views.
- 3.02 Identify, define, and describe similar and congruent polygons with respect to angle measures, length of sides, and proportionality of sides.
- 3.03 Use scaling and proportional reasoning to solve problems related to similar and congruent polygons.

COMPETENCY GOAL 4: The learner will understand and use graphs and data analysis.

Objectives

- 4.01 Collect, organize, analyze, and display data (including box plots and histograms) to solve problems.
- 4.02 Calculate, use, and interpret the mean, median, mode, range, frequency distribution, and inter-quartile range for a set of data.
- 4.03 Describe how the mean, median, mode, range, frequency distribution, and inter-quartile range of a set of data affect its graph.
- 4.04 Identify outliers and determine their effect on the mean, median, mode, and range of a set of data.
- 4.05 Solve problems involving two or more sets of data using appropriate statistical measures.

COMPETENCY GOAL 5: The learner will demonstrate an understanding of linear relations and fundamental algebraic concepts.

Objectives

- 5.01 Identify, analyze, and create linear relations, sequences, and functions using symbols, graphs, tables, diagrams, and written descriptions.
- 5.02 Translate among different representations of algebraic expressions, equations and inequalities.
- 5.03 Use and evaluate algebraic expressions, linear equations or inequalities to solve problems.
- 5.04 Develop fluency in the use of formulas to solve problems.

Grade 8

Major Concepts/Skills

- Real numbers
- Linear functions
- Pythagorean theorem, indirect measurement
- Scatterplots
- Slope
- Equations and inequalities
- Students will solve relevant and authentic problems using appropriate technology and apply these concepts as well as those developed in earlier years

Concepts/Skills to Maintain

- Ratio, proportion, and percent
- Factors and multiples
- Box plots and histograms
- Volume and surface area

Strands: Number and Operations, Measurement, Geometry, Data Analysis and Probability, Algebra

COMPETENCY GOAL 1: The learner will understand and compute with real numbers.

Objectives

- 1.01 Develop number sense for the real numbers.
 - a) Define and use irrational numbers.
 - b) Compare and order.
 - c) Use estimates of irrational numbers in appropriate situations.
- 1.02 Develop flexibility in solving problems by selecting strategies and using mental computation, estimation, calculators or computers, and paper and pencil.

COMPETENCY GOAL 2: The learner will understand and use measurement concepts.

Objectives

- 2.01 Determine the effect on perimeter, area or volume when one or more dimensions of two- and three-dimensional figures are changed.
- 2.02 Apply and use concepts of indirect measurement.

COMPETENCY GOAL 3: The learner will understand and use properties and relationships in geometry.

Objectives

- 3.01 Represent problem situations with geometric models.
- 3.02 Apply geometric properties and relationships, including the Pythagorean theorem, to solve problems.
- 3.03 Identify, predict, and describe dilations in the coordinate plane.

COMPETENCY GOAL 4: The learner will understand and use graphs and data analysis.

Objectives

- 4.01 Collect, organize, analyze, and display data (including scatterplots) to solve problems.
- 4.02 Approximate a line of best fit for a given scatterplot; explain the meaning of the line as it relates to the problem and make predictions.
- 4.03 Identify misuses of statistical and numerical data.

COMPETENCY GOAL 5: The learner will understand and use linear relations and functions.

Objectives

- 5.01 Develop an understanding of function.
 - a) Translate among verbal, tabular, graphic, and algebraic representations of functions.
 - b) Identify relations and functions as linear or nonlinear.
 - c) Find, identify, and interpret the slope (rate of change) and intercepts of a linear relation.
 - d) Interpret and compare properties of linear functions from tables, graphs, or equations.

- 5.02 Write an equation of a linear relationship given: two points, the slope and one point on the line, or the slope and y-intercept.
- 5.03 Solve problems using linear equations and inequalities; justify symbolically and graphically.
- 5.04 Solve equations using the inverse relationships of addition and subtraction, multiplication and division, squares and square roots, and cubes and cube roots.