CMP4 GRADE 6

Mathematical Focus: Generalizing patterns with a focus on algebra and number

Unit 1. Variables and Patterns: Introducing Algebraic Reasoning

Students develop the ability to recognize, describe, and analyze two kinds of relationships between variables: (1) change in the value of a single variable over time; and (2) change in the value of a dependent variable as it responds to change in the value of a related independent variable. Students are introduced to how to reason about those relationships using numeric, graphic, symbolic, and verbal representations. They continue to look for patterns and how to generalize these patterns throughout the 6th grade units.

This unit introduces finding solutions for equations and inequalities. Students continue to solve equations and inequalities both informally and symbolically throughout several Grade 6 units.

Mathematical Reflection
What are the advantages and disadvantages of using different representations to show the relationship between two variables? How is this information useful in solving problems?

Investigation 1. Organizing a Bike Tour: Variables, Tables, and Graphs
Investigation 2. Analyzing Relationships Among Variables
Investigation 3. Returning Home: Relating Variables with Equations
Total Problems: 10

Unit 2. Prime Time: Generalizing and Representing Factors and Multiples with Algebraic Expressions

Students study the structure of number to look more deeply at the structure and properties of numbers. Since it is now assumed that students come to 6th grade with some understanding of factors and multiples, this unit builds on and deepens students understanding of the structure of number and the power that comes with this understanding.

The exploration of the multiplicative and additive structure of number allows students to express important number properties more generally and hence continue their study of algebra. Whole numbers have interesting properties and structures. A major goal of this unit is to use algebra to study and represent important properties and structure of number.

Mathematical Reflection
How can you express the multiplicative patterns and relationships of numbers with words, numbers, and variables? How is this information useful in solving problems?

Investigation 1. Generalizing Factor and Multiple Patterns: Algebraic Reasoning
Investigation 2. Common Factors and Multiples: Least or Greatest?
Investigation 3. Using Exponents to Express the Multiplicative Structure of Numbers
Investigation 4. The Distributive Property: Writing and Evaluating Equivalent Expressions
Total Problems: 12

Unit 3. Comparing Quantities: Ratios, Rates, and Equivalence

This unit introduces ratios and reasoning with ratios, also called proportional reasoning. The main goal of this unit is to begin the process of recognizing a ratio situation and then applying an appropriate strategy for solving the problem.

CMP develops proportional reasoning over the course of several Units. This is the first. All subsequent units in 6th and 7th grade take advantage of the groundwork done here to apply this concept in different contexts, deepening and strengthening student understanding.

This Unit builds upon the concepts in *Prime Time* and equivalent fractions. Equivalence of ratios is introduced early and continues throughout the Unit. Students use rate tables as a way to express equivalent ratios and compute unit rates. Equivalent ratios are represented in tables, tape diagrams, double number line, grids, and bars. Percent is introduced as a ratio.

The development of algebraic reasoning continues as an opportunity to generalize patterns that occur in ratio tables.

Mathematical Reflection
What do you understand about ratios and reasoning with ratios? How is this information useful in solving problems?

Investigation 1. Making Comparisons
Investigation 2. Using Ratios to Solve Problems
Investigation 3. Using Unit Rates and Rate Tables
Investigation 4. For Every 100: Introducing Percent

Total Problems: 14

Unit 4. Bits of Rational: Extending Understanding of Fraction Operations and Solving Equations

The goal of this Unit is to deepen understanding and skill with computations involving fractions and use these skills to write and solve equations that involve fractions.

Students will have had some upper elementary experiences with fraction operations. Typically, however, students will not have developed a sense of which operation to use in a particular problem situation. Students can learn to carry out an algorithm as a procedure, but the real power of this Unit lies in the experiences that foster students' abilities to examine a problem situation and determine which operation or operations are needed to solve that problem.

Mathematical Reflection
What do you know about operations with rational numbers and using rational numbers to solve problems or equations? How is this information useful in solving problems?

Investigation 1. Extending Addition and Subtraction of Fractions
Investigation 2. Extending Multiplication with Fractions
Investigation 3. Making Sense of Fraction Division
Investigation 4. Wrapping Up the Operations: Equivalent Equations

Total Problems: 12

Unit 5. Covering and Surrounding: Two and Three-Dimensional Measurement

The Problems in this Unit are structured so that students can build a robust understanding of what it means to measure area, perimeter, surface area, and volume. They develop strategies for measuring perimeter and area of both rectangular and nonrectangular shapes.

Students use their understanding of rectangles and triangles to develop strategies for finding area and perimeter of other polygons by composing and decomposing these shapes into triangles or rectangles.

Students extend their understanding to three-dimensional objects. They find the area of individual faces of three-dimensional shapes to find total surface area. They use height and the area of the base to calculate the volume of rectangular prisms.
The Unit connects to and builds on all the preceding 6th grade Units. The connections to factors and multiples, fractions, and algebra are especially strong.

   Mathematical Reflection
What do you know about measurements of two-dimensional shapes? How is this information useful in solving problems?

Investigation 1. Designing Parks: Building on Area and Perimeter
Investigation 2. Measuring Polygons
Investigation 3. Designing Under Constraints
Investigation 4. Measuring Surface Area and Volume

Total Problems: 13

Unit 6. Points of Rational: A Focus on Decimals and Algebraic Reasoning

In this Unit, students broaden and extend their understanding of the rational number system by working with decimal numbers and negative numbers.

Students use the relationship between fractions and decimals, as well as the relationship between finite decimals and whole numbers to operate fluently with decimals.

Students extend their work of the rational numbers in the two-dimensional coordinate plane from the first quadrant to study rational numbers in all four quadrants.

While the development of the rational number system is a focus, algebraic reasoning is also strengthened. Students use equations and inequalities to communicate strategies and to solve problems requiring algebraic reasoning and sense making.

   Mathematical Reflection
What do you know about rational numbers? How is this information useful in solving problems?

Investigation 1. Fluency with Addition and Subtraction of Decimals
Investigation 2. Fluency with Multiplication and Division of Decimals
Investigation 3. Going Negative: Extending the Number Line
Investigation 4. Extending the Coordinate Plane

Total Problems: 10

Unit 7. Data About Us: Statistics and Data Analysis

Students learn about the process of statistical investigations. They also construct and analyze distributions of data. They compare data distributions by using measures of center and spread.

Students are introduced to some primary concepts in statistics and data analysis: attributes, observation, frequency table, line plot, and making statistical observations about the shapes of distributions of data.

Students study mode, median, and mean (measure of center) and range (measure of variability) including how to find the IQR. It also introduces the MAD.

Students use graphs to group data (i.e., histograms and box-and-whisker plots) and judge the measures of variability (IQR, MAD, and range, connecting to their related measures of center).

Tasks/questions related to proportional reasoning/algebra are included in all three problems.

Mathematical Reflection
What do you understand about using data in relation to a context to explore a statistical question? What role does measures of center, measures of spread, and charts/graphs) to describe and compare data play in answering the question?

Investigation 1. Organizing, Representing, and Describing Data
Investigation 2. Who's in Your Household? Making Sense of Measures of Center
Investigation 3. Making Sense of Variability
Investigation 4. Numbers that Describe Our Attributes: Using Graphs that Group Data

Total Problems: 13