

§111.22. Mathematics, Grade 6.

(a) Introduction.

(1) Within a well-balanced mathematics curriculum, the primary focal points at Grade 6 are using ratios to describe direct proportional relationships involving number, geometry, measurement, probability, and adding and subtracting decimals and fractions.

(2) Throughout mathematics in Grades 6-8, students build a foundation of basic understandings in number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry and spatial reasoning; measurement; and probability and statistics. Students use concepts, algorithms, and properties of rational numbers to explore mathematical relationships and to describe increasingly complex situations. Students use algebraic thinking to describe how a change in one quantity in a relationship results in a change in the other; and they connect verbal, numeric, graphic, and symbolic representations of relationships. Students use geometric properties and relationships, as well as spatial reasoning, to model and analyze situations and solve problems. Students communicate information about geometric figures or situations by quantifying attributes, generalize procedures from measurement experiences, and use the procedures to solve problems. Students use appropriate statistics, representations of data, reasoning, and concepts of probability to draw conclusions, evaluate arguments, and make recommendations.

(3) Problem solving in meaningful contexts, language and communication, connections within and outside mathematics, and formal and informal reasoning underlie all content areas in mathematics. Throughout mathematics in Grades 6-8, students use these processes together with graphing technology and other mathematical tools such as manipulative materials to develop conceptual understanding and solve problems as they do mathematics.

(b) Knowledge and skills.

(6.1) Number, operation, and quantitative reasoning. The student represents and uses rational numbers in a variety of equivalent forms.

The student is expected to:

- (A) compare and order non-negative rational numbers;
- (B) generate equivalent forms of rational numbers including whole numbers, fractions, and decimals;
- (C) use integers to represent real-life situations;

- (D) write prime factorizations using exponents;
- (E) identify factors of a positive integer, common factors, and the greatest common factor of a set of positive integers; and
- (F) identify multiples of a positive integer and common multiples and the least common multiple of a set of positive integers.

(6.2) Number, operation, and quantitative reasoning. The student adds, subtracts, multiplies, and divides to solve problems and justify solutions.

The student is expected to:

- (A) model addition and subtraction situations involving fractions with objects, pictures, words, and numbers;
- (B) use addition and subtraction to solve problems involving fractions and decimals;
- (C) use multiplication and division of whole numbers to solve problems including situations involving equivalent ratios and rates;
- (D) estimate and round to approximate reasonable results and to solve problems where exact answers are not required; and
- (E) use order of operations to simplify whole number expressions (without exponents) in problem solving situations.

(6.3) Patterns, relationships, and algebraic thinking. The student solves problems involving direct proportional relationships.

The student is expected to:

- (A) use ratios to describe proportional situations;
- (B) represent ratios and percents with concrete models, fractions, and decimals; and
- (C) use ratios to make predictions in proportional situations.

(6.4) Patterns, relationships, and algebraic thinking. The student uses letters as variables in mathematical expressions to describe how one quantity changes when a related quantity changes.

The student is expected to:

- (A) use tables and symbols to represent and describe proportional and other relationships such as those involving conversions, arithmetic sequences (with a constant rate of change), perimeter and area; and
- (B) use tables of data to generate formulas representing relationships involving perimeter, area, volume of a rectangular prism, etc.

(6.5) Patterns, relationships, and algebraic thinking. The student uses letters to represent an unknown in an equation.

The student is expected to formulate equations from problem situations described by linear relationships.

(6.6) Geometry and spatial reasoning. The student uses geometric vocabulary to describe angles, polygons, and circles.

The student is expected to:

- (A) use angle measurements to classify angles as acute, obtuse, or right;
- (B) identify relationships involving angles in triangles and quadrilaterals; and
- (C) describe the relationship between radius, diameter, and circumference of a circle.

(6.7) Geometry and spatial reasoning. The student uses coordinate geometry to identify location in two dimensions.

The student is expected to locate and name points on a coordinate plane using ordered pairs of non-negative rational numbers.

(6.8) Measurement. The student solves application problems involving estimation and measurement of length, area, time, temperature, volume, weight, and angles.

The student is expected to:

- (A) estimate measurements (including circumference) and evaluate reasonableness of results;
- (B) select and use appropriate units, tools, or formulas to measure and to solve problems involving length (including perimeter), area, time, temperature, volume, and weight;
- (C) measure angles; and
- (D) convert measures within the same measurement system (customary and metric) based on relationships between units.

(6.9) Probability and statistics. The student uses experimental and theoretical probability to make predictions.

The student is expected to:

- (A) construct sample spaces using lists and tree diagrams; and
- (B) find the probabilities of a simple event and its complement and describe the relationship between the two.

(6.10) Probability and statistics. The student uses statistical representations to analyze data.

The student is expected to:

- (A) select and use an appropriate representation for presenting and displaying different graphical representations of the same data including line plot, line graph, bar graph, and stem and leaf plot;
- (B) identify mean (using concrete objects and pictorial models), median, mode, and range of a set of data;
- (C) sketch circle graphs to display data; and
- (D) solve problems by collecting, organizing, displaying, and interpreting data.

(6.11) Underlying processes and mathematical tools.

The student applies Grade 6 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school.

The student is expected to:

- (A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics;
- (B) use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness;
- (C) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem; and
- (D) select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.

(6.12) Underlying processes and mathematical tools.

The student communicates about Grade 6 mathematics through informal and mathematical language, representations, and models.

The student is expected to:

- (A) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models; and
- (B) evaluate the effectiveness of different representations to communicate ideas.

(6.13) Underlying processes and mathematical tools.

The student uses logical reasoning to make conjectures and verify conclusions.

The student is expected to:

- (A) make conjectures from patterns or sets of examples and nonexamples; and
- (B) validate his/her conclusions using mathematical properties and relationships.