

The process standards of **problem solving, reasoning and proof, connections communication, and representation** are interwoven and independent with the content standards and are necessary for the comprehensive understanding of mathematics.

Strand: **M1 Numbers and Operations**

Pre-Kindergarten through Grade 12 instructional programs should enable all students to:

- understand numbers, ways of representing numbers, relationships among numbers, and number systems;
- understand meanings of operations and how they relate to none another;
- understand how to compute fluently and make reasonable estimates.

In Grade 7, all students should:

- Standards:
- M1a:** use, interpret and compare numbers in several equivalent forms such as integers, fractions, decimals, and percents;
 - M1b:** develop meaning of percent greater than 100 or less than 1;
 - M1c:** understand and use ratio and proportion to represent quantitative relationships;
 - M1d:** describe the differences between rational and irrational numbers;
 - M1e:** explain the relationship, meaning and effects of arithmetic operations with the set of integers;
 - M1f:** use order of operations and properties to simplify numerical expressions involving integers, fractions, decimals and exponents;
 - M1g:** simplify numerical expressions and solve real-life problems using the set of integers;
 - M1h:** estimate and solve problems including ratios, proportions and percents, and justify reasoning.

Essential To Know: Students analyze and explain methods for solving problems involving fractions, decimals, percents, proportions and ratios.

Strand: **M2 Algebra**

Pre-Kindergarten through Grade 12 instructional programs should enable all students to:

- understand patterns, relations, and functions;
- represent and analyze mathematical situations and structures using algebraic symbols;
- use mathematical models to represent and understand quantitative relationships;
- analyze change in various contexts.

In Grade 7, all students should:

- Standards:
- M2a:** represent, analyze, and generalize relations and functions with tables, graphs, words, and when possible, algebraic expressions and equations;
 - M2b:** explain relationships between graphs of lines and their equations;
 - M2c:** generate equivalent forms of algebraic expressions by combining like terms;
 - M2d:** use variables and appropriate operations to write an expression, equation, or inequality that represents a verbal description;
 - M2e:** model and solve equations using inverse operations;

- M2f:** represent linear equations and inequalities by plotting points;
- M2g:** analyze functional relationships to explain how a change in one quantity results in a change in the other;
- M2h:** recognize a variety of uses for variables.

Essential To Know: Students represent, analyze, and generalize relations and functions with tables, graphs, words, and when possible, algebraic expressions and equations.

Strand: **M3 Geometry**

Pre-Kindergarten through Grade 12 instructional programs should enable all students to:

- analyze characteristics and properties of two- and three- dimensional geometric shapes and develop mathematical arguments about geometric relationships;
- specify locations and describe spatial relationships using coordinate geometry and other representational systems;
- apply transformations and use symmetry to analyze mathematical situations;
- use visualization, spatial reasoning, and geometric modeling to solve problems.

In Grade 7, all students should:

- Standards:
- M3a:** demonstrate an understanding of conditions that indicate two geometrical figures are congruent and what congruence means about the relationships between the sides and angles of the two figures;
 - M3b:** use proportional reasoning to describe and express relationships between similar and congruent figures;
 - M3c:** classify and identify triangles by side and angle measurement and polygons as regular or irregular and/or by the number of sides;
 - M3d:** recognize and explain the following attributes of a circle, i.e., radius, diameter, arc, chord, semicircle, and central angle;
 - M3d:** use coordinate geometry to examine special geometric shapes, such as regular polygons and polygons with pairs of parallel or perpendicular sides;
 - M3e:** determine the length of a side of a figure drawn on a coordinate plane with vertices having the same x or y coordinates;
 - M3f:** examine congruence, similarity, and line or rotational symmetry of an object using transformations.

Essential To Know: Students describe and apply the properties of similarity and congruent figures and justify conjectures involving similarity and congruence. Students graph points and identify coordinates of points in the coordinate plane.

Strand: **M4 Measurement**

Pre-Kindergarten through Grade 12 instructional programs should enable all students to:

- understand measurable attributes of objects and the units, systems, and processes of measurement;
- apply appropriate techniques and tools.

In Grade 7, all students should:

- Standards:
- M4a:** select and use appropriate tools and units of measure when measuring and calculating angles, surface areas, and volumes of rectangular prisms;
 - M4b:** Analyze the structure and uniformity of the metric system and contrast with the customary system;

- M4c:** Develop strategies to determine the surface area and volume of rectangular prisms using geometric models and materials;
- M4e:** Understand the difference between surface area and volume, and demonstrate that two objects may have the same surface area, but different volumes—or may have the same volume, but different surface areas;
- M4f:** use ratios and proportions to solve problems involving scale factors.

Essential To Know: Students use investigation to determine how geometric formulas were derived. Students understand the characteristics of a system of measurements.

Strand: **M5 Data Analysis and Probability**

Pre-Kindergarten through Grade 12 instructional programs should enable all students to:

- formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them;
- select and use appropriate statistical methods to analyze data;
- develop and evaluate inferences and predictions that are based on data;
- understand and apply basic concepts of probability.

In Grade 7, all students should:

- Standards:
- M5a:** Read, create and interpret box and whisker plots, stem and leaf plots, scatter plots, and other appropriate types of graphs;
 - M5b:** Analyze the effect of graphing decisions on graphical representation, e.g., scaling, types of graphs, etc.;
 - M5c:** Find, interpret, and appropriately use quartile, interquartile range, and outliers;
 - M5d:** Explain how measures of central tendency are affected by extremes;
 - M5e:** Find and make predictions based on the line of best fit;
 - M5f:** Identify possible misuses of measures of central tendency;
 - M5g:** Use proportionality and probability to make and test conjectures about the results of experiments and simulations;
 - M5h:** Describe multiple outcomes of compound independent events, i.e., using tree diagrams and organized lists.

Essential To Know: Students understand and apply the fundamental concepts of measures of central tendency. Students represent probabilities as ratios, proportions, decimals between 0 and 1 and percentages between 0 and 100.

Strand: **M6 Problem Solving**

- Standard:
- M6a:** Pre-Kindergarten through Grade 12 instructional programs should enable all students to:
 - build new mathematical knowledge through problem solving;
 - solve problems that arise in mathematics and in other contexts;
 - apply and adapt a variety of appropriate strategies to solve problems;
 - monitor and reflect on the process of mathematical problem solving.

Strand: **M7 Reasoning and Proof**

- Standard: **M7a:** Pre-Kindergarten through Grade 12 instructional programs should enable all students to:
- recognize reasoning and proof as fundamental aspects of mathematics;
 - make and investigate mathematical conjectures;
 - develop and evaluate mathematical arguments and proofs;
 - select and use various types of reasoning and methods of proof.

Strand: **M8 Communication**

- Standard: **M8a:** Pre-Kindergarten through Grade 12 instructional programs should enable all students to:
- organize and consolidate their mathematical thinking through communication;
 - communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
 - analyze and evaluate the mathematical thinking and strategies of others;
 - use the language of mathematics to express mathematical ideas precisely.

Strand: **M9 Connections**

- Standard: **M9a:** Pre-Kindergarten through Grade 12 instructional programs should enable all students to:
- recognize and use connections among mathematical ideas;
 - understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
 - recognize and apply mathematics in contexts outside of mathematics.

Strand: **M10 Representation**

- Standard: **M10a:** Pre-Kindergarten through Grade 12 instructional programs should enable all students to:
- create and use representations to organize, record, and communicate mathematical ideas;
 - select, apply, and translate among mathematical representations to solve problems;
 - use representations to model and interpret physical, social, and mathematical phenomena.