

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 one another;
- understand how to compute fluently and make reasonable estimates

In Grade 8, all students should:

- Standards:
- M1a:** explain the meaning of exponents that are negative and zero;
  - M1b:** use scientific, exponential and calculator notation to express very large or small numbers;
  - M1c:** expand scientific notation to include negative exponents;
  - M1d:** explain and use the additive and multiplicative identities and the additive and multiplicative inverses;
  - M1e:** apply order of operations to simplify expressions and perform appropriate operation(s) involving numbers written in exponential notation or radical form;
  - M1f:** make reasonable estimates and then solve problems that include rational numbers, ratios, and proportions.

Essential To Know: Students represent and compare the magnitude of numbers appropriately using exponential, scientific, and calculator notation.

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 8, all students should:

- Standards:
- M2a:** generalize patterns and sequences by describing the way to find the  $n$ th term.
  - M2b:** identify functions as linear or nonlinear and contrast their properties using tables, graphs, or equations;
  - M2c:** analyze relationships between linear equations and their graphs by connecting the meaning of intercepts and slope to the context of the situation;
  - M2d:** use symbolic algebra to represent situations and to solve problems involving linear and nonlinear relationships;
  - M2e:** recognize, generate, and justify equivalent forms of algebraic expressions;
  - M2f:** solve linear equations and inequalities;

- M2g:** represent situations using systems of linear equations and solve graphically;
- M2h:** model and solve problems using various representations, i.e., graphs, tables, and equations;
- M2i:** connect the rate of change to the slope of a line;
- M2j:** analyze changes in linear relationships using graphs;
- M2k:** Describe and compare how changes in an equation affect the related graph.

Essential To Know: Students model and solve real world problems using various representations such as graphs, tables, 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 8, all students should:

- Standards:
- M3a:** understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
  - M3b:** verify the Pythagorean Theorem;
  - M3c:** apply the Pythagorean Theorem to determine if a triangle is a right triangle or to find a missing side of a right triangle;
  - M3d:** identify and describe angle relationships formed by parallel lines cut by a transversal using appropriate terminology, i.e., alternate interior, alternate exterior, supplementary, vertical angles, corresponding angles, complementary, consecutive interior;
  - M3e:** plot ordered pairs of rational numbers on the coordinate plane in all four quadrants;
  - M3f:** use geometric models to represent and explain numerical and algebraic relationships.

Essential To Know: Students apply the Pythagorean theorem by constructing figures that meet specific conditions.

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, tools, and formulas to determine measurements.

In Grade 8, all students should:

- Standards::
- M4a:** describe and demonstrate how perimeter, area, and volume are affected by changes of scale;
  - M4b:** develop strategies to determine the surface area and volume of selected prisms, pyramids and cylinders;

**M4c:** use formulas to a specified level of precision in finding the surface area and volume of prisms, pyramids and cylinders and the volume of spheres and cones;

**M4d:** find the sum of the interior and exterior angles of regular convex polygons with and without the use of a protractor;

**M4e:** solve simple rate problems.

Essential To Know: Students use strategies to determine the surface area and volume of prisms, pyramids and cylinders.

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 8, all students should:

- Standards:
- M5a:** Differentiate between discrete and continuous data and appropriate ways to represent each;
  - M5b:** Find, interpret and appropriately use measures of center, quartile, and interquartile range to compare two sets of data;
  - M5c:** Find the equation of a line of best fit for data represented as a scatter plot;
  - M5d:** Describe sampling methods and analyze effects of random versus biased sampling and justify conclusions;
  - M5e:** Construct convincing and appropriate arguments for a conclusion based on analysis of data presented;
  - M5f:** Recognize faulty arguments or common errors in data analysis;
  - M5g:** Compute the probability of the occurrence of independent and simple dependent events;
  - M5h:** Distinguish between permutations and combinations.

Essential To Know: Students construct convincing and appropriate arguments based on analysis of data and interpretation of graphs.  
Students explain the difference between independent and dependent events.

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.