

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 4, all students should:

- Standards:
- M1a:** explain the importance of place value in recognizing the magnitude of whole numbers up to a million and decimals through thousandths;
 - M1b:** identify and generate equivalent representations for the same number by decomposing and composing the number;
 - M1c:** judge the size of fractions in relation to benchmarks, i.e., 0, $\frac{1}{2}$, 1;
 - M1d:** identify and describe numbers according to their characteristics including primes, composites, and perfect squares;
 - M1e:** explore the relationships between fractions, mixed numbers, and decimals;
 - M1f:** model division problems and explore the meaning of remainders;
 - M1g:** use models, benchmarks, and equivalence to add and subtract fractions with like denominators;
 - M1h:** use models and benchmarks to add and subtract decimals;
 - M1i:** develop and apply strategies and methods for division of two-digit whole numbers by one-digit divisors;
 - M1j:** use the inverse relationships of addition and subtraction, and multiplication and division to solve problems and verify solutions;
 - M1k:** use estimation to make predictions and check the reasonableness of result;
 - M1l:** identify, compare and order the relative position of commonly used fractions and decimals on a number line;
 - M1m:** demonstrate proficiency in basic facts for all operations.

Essential to Know: Students explain and represent with models the relationship between whole numbers, common fractions, and decimals.
Students select and use estimation strategies and judge the reasonableness of the answer.

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 4, all students should:

- Standards:
- M2a:** use models and words to describe, extend, and generalize patterns and relationships;
 - M2b:** represent and analyze patterns and functions using words, tables, and graphs;
 - M2c:** describe mathematical relationships using expressions, equations or inequalities;
 - M2d:** apply order of operations and the commutative and associative properties to algebraic expressions, equations, and inequalities;
 - M2e:** use and interpret variables, mathematical symbols, and properties to write and simplify mathematical expressions and sentences;
 - M2f:** develop and solve equations or inequalities using variables that represent problem situations;
 - M2g:** identify and describe patterns of change to make predictions that identify the relationship represented in a table or graph.

Essential to Know: Students use relationships in patterns to make predictions by using tables, charts, physical objects, and symbols.

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;
- uses visualization, spatial reasoning, and geometric modeling to solve problems.

In Grade 4, all students should:

- Standards:
- M3a:** describe attributes of planes, points, and lines, i.e., parallel and perpendicular line segments;
 - M3b:** identify and draw right, obtuse, and acute angles;
 - M3c:** identify and draw congruent figures;
 - M3d:** investigate the results of subdividing, combining, and transforming shapes;
 - M3e:** make and use coordinate systems to specify locations and to describe paths;
 - M3f:** find the distance between points along horizontal and vertical lines of a coordinate system;
 - M3g:** predict and describe transformations to show that two shapes are congruent;
 - M3h:** identify and describe line and rotational symmetry in two-dimensional shapes and designs;
 - M3i:** identify geometric solids which could be composed of other solids.

Essential to Know: Students describe geometric properties and relationships using appropriate vocabulary.
Students use two-dimensional coordinate grids to represent points and to graph lines and simple figures.

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 4, all students should:

- Standards:
- M4a:** recognize that measurements are approximations;
 - M4b:** measure with accuracy using both customary and metric systems of measurement;
 - M4c:** extend recognition of measurable attributes to include area and angles;
 - M4d:** determine the possible dimensions of rectangles when the area is constant;
 - M4e:** estimate measurements of perimeter, area, and angle size;
 - M4f:** extend use of appropriate standard tools and units to include measure of perimeter and area;
 - M4g:** explore strategies to determine the perimeter and area of right triangles;
 - M4h:** develop strategies for estimating the area of irregular shapes;
 - M4i:** determine elapsed time;
 - M4j:** solve problems involving perimeter and areas of rectangles.

Essential to Know: Students carry simple unit conversions within a system of measurement.

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 4, all students should:

- Standards:
- M5a:** describe how data collection methods affect the information that is gathered to address a question;
 - M5b:** identify the median of a data set and describe what it indicates about the data set;
 - M5c:** use the median, mode, and range to compare and contrast the characteristics of related data sets;
 - M5d:** compare different representations of the same data to evaluate how each representation shows important aspects of the data;
 - M5e:** select the appropriate data representation form for a diverse set of investigations and justify the choice in each case;
 - M5f:** relate the concepts of impossible and certain events to the numerical values of 0 (impossible) and 1 (certain);
 - M5g:** investigate experimental probability;
 - M5h:** list and count all possible combinations using one member from each of several sets.

Essential to Know: Students appropriately represent and interpret data.

Strand: **M6 Problem Solving**

- Standard: **M6a:** Instructional programs from Pre-Kindergarten through Grade 12 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:** Instructional programs from Pre-Kindergarten through Grade 12 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:** Instructional programs from Pre-Kindergarten through Grade 12 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:** Instructional programs from Pre-Kindergarten through Grade 12 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:** Instructional programs from Pre-Kindergarten through Grade 12 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.