Mathematics Content Strands

M1 Numbers and Operations

Number pervades all areas of mathematics. The other four Content Standards as well as all five Process Standards are grounded in understanding number. Central to this standard is the development of number sense, which allows students to naturally combine or decompose numbers, solve problems using the relationships among operations and knowledge of the base-ten system, and make a reasonable estimate for the answer to a problem.

Computational fluency – having and using efficient and accurate methods for computing – is essential. Students should be able to perform computations in different ways, including mental calculations, estimation, and paper-and-pencil calculations using mathematically sound algorithms. All students should use calculators at appropriate times, setting the calculator aside when the instructional focus is on developing computational algorithms.

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.

M2 Algebra

The ideas of algebra are a major component of the school mathematics curriculum and help to unify it. Mathematical investigations and discussions of arithmetic and its properties frequently include aspects of algebraic reasoning. Such experiences present rich contexts and opportunities for enhancing mathematical understanding and are an important precursor to the more formalized study of algebra in the middle and secondary grades. A strong foundation in algebra should be in place by the end of the eighth grade, and all high school students should pursue ambitious goals in 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.

M3 Geometry

Geometry and spatial sense are fundamental components of mathematics learning. They offer ways to interpret and reflect on our physical environment and can serve as tools for the study of other topics in mathematics and science. Geometry is a natural area of mathematics for the development of students' reasoning and justification skills that build across the grades.
Geometry should be learned using concrete models, drawings, and dynamic software. As the study of the relationships among shapes and their properties becomes more abstract, students should come to understand the role of definitions and theorems and be able to construct their own proofs.

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.

M4 Measurement

The study of measurement is crucial in the K-12 mathematics curriculum because of its practicality and pervasiveness in many aspects of everyday life. Measurement is possibly the area of mathematics that is most important when considering everyday applications of mathematics, and highlights connections between mathematics and areas outside of the school curriculum such as social studies, science, art, and physical education. The study of measurement helps students establish connections within mathematics and provides an opportunity for learning about and unifying ideas concerning number and operations, algebra, geometry, statistics, probability, and data analysis.

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.

Data Analysis and Probability

To analyze data and reason statistically are essential to be an informed citizen, employee, and consumer. The amount of statistical information available to help make decisions in business, politics, research, and everyday life is staggering. Through experiences with the collection and analysis of data, students can learn to make sense of and interpret information and allow them to make appropriate arguments and recognize inappropriate arguments as well.

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.

Mathematics Process Standards

The DoDEA PK-12 mathematics program includes the process standards: problem solving, reasoning and proof, communication, connections, and representation. Instruction in mathematics must focus on process standards in conjunction with all PK-12 content standards throughout the grade levels.

Problem Solving	Reasoning and Proof	Communication	Connections	Representation
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.	**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.	**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.	**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.	**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.

Strand: **M1** **Numbers and Operations**

Standards: In Grade 5, all students should:

5.M.1a: identify verbally and in writing the place value for each digit in decimals through millionths;

Example: Write the number 287.426271 in words.

5.M.1b: identify and represent equivalent forms of fractions with denominators of 12 or less, decimals, and percents;

Example: How can fractions and decimals which have different digits, such as 3/4 and 0.75, still have the same value?

5.M.1c: explain how decimals and percents are parts of a whole;

Example: If a 5^{th} grade class has 25 students and 15 are girls, represent the part of the class that is boys as a percentage.

5.M.1d: use models to show the ratio interpretation of a fraction as part-to-part and part-to-whole;

Example: Divide 25 muffins to represent the ratio 2:3.

5.M.1e: represent and compare numbers less than zero by extending the number line and using familiar applications (e.g., temperature), to demonstrate the usefulness of negative numbers;

Example: The temperature this morning was 18 degrees below zero and now it is 3 degrees below zero. Show on a number line how much has the temperature risen? Explain in your own words how you found your answer.

5.M.1f: identify and use the distributive property to simplify and/or perform computations;

Example: Explain how you know that 4(15 – 9) = 4 X 15 – 4 X 9.

5.M.1g: use order of operations, including the use of parentheses, to simplify numerical expressions;

Example: Simplify 5(6-2) + 4(8+2). Explain your strategy.

5.M.1h: explain why fractions need common denominators to be added or subtracted;

Example: If two medium pizzas are cut so that one has 4 equal slices and the other has 8 equal slices and you take one slice from each pizza, explain what portion of a pizza you have.

5.M.1i: use models to show an understanding of the concept of multiplication and division of fractions with denominators of 12 or less;

Example: If after a party you have ¾ of a pepperoni pizza and ½ of a cheese pizza left over, how much of a pizza would remain? Explain how you determined your answer.

5.M.1j: understand and compute positive integer powers of nonnegative integers as repeated multiplication;

Example: Sam asked the class: "What is the difference between the expression 4*3 and the expression 4^3?" How would you respond to Sam's question?

5.M.1k: divide whole numbers with two-digit divisors;

Example: Calculate 736 ÷ 23.

5.M.1l: use models and equivalent forms to add and subtract fractions with like and unlike denominators up to 12, expressing answers in simplest form;

Example: Draw a diagram to illustrate the sum ¼ + ⅝.

5.M.1m: use estimation strategies for the results of computations involving whole numbers, fractions with denominators of 12 or less, and decimals through millionths;

Example: What is an approximate value for ⅔ times 375. Explain how you arrived at your estimate.

5.M.1n: compute and perform multiplication and division of fractions with denominators of 12 or less and decimals;

Example: You have 3 ¾ pies left over from a dinner party. How many people can have ¼ of a pie each?

5.M.1o: understand and apply divisibility rules for 2, 3, 4, 5, 6, 9, and 10;

Example: The 82 members of the chorus stand in rows as they perform. Can singers stand in 3 equal rows?

Strand: **M2** **Algebra**

Standards: In Grade 5, all students should:

5.M.2a: express a general rule for a pattern by using visual representations, words, tables, graphs, or mathematical symbols;

Example: Using the table below, determine the late fee for a book that is 18 days overdue. Explain a rule that can be used to determine late fees.

Days overdue	2	4	6	…..	18
Fee	$0.30	$0.60	$0.90	…..	?

5.M.2b: explain the concept of variable (e.g., a letter standing for all numbers of a specific set, such as integers);

Example :Explain how variables are used in the formula for the area of a rectangle; A = L x W.

5.M.2c: use variables to represent unknown quantities in general rules when describing mathematical patterns and relationships;

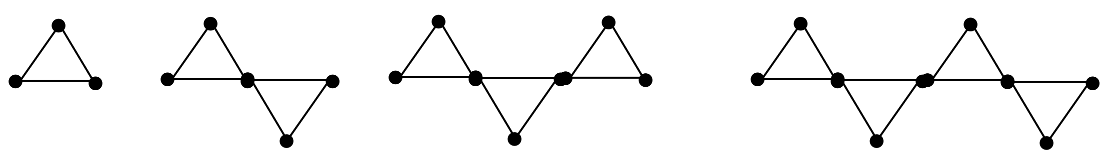
Example: If a library charges 30¢ per day for an overdue book, write an expression using variables to represent the charge for any given number of days late.

5.M.2d: apply order of operations and the commutative, associative properties for addition and multiplication and the distributive property to simplify algebraic expressions, equations, and inequalities;

Example: Simplify the expression 4X + 3(2X – 5).

5.M.2e: construct tables and graphs that accurately represent the relationship between two variables;

Example: Using the pattern below, construct a table that demonstrates the relationship between the number of triangles and the number of points needed to create the figure.



5.M.2f: identify, describe, and compare situations that represent constant or varying rates of change;

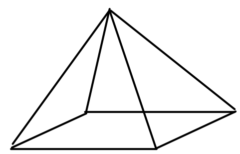
Example: Compare the two patterns below. Explain how they are the same and how are they different.
…4, 8, 12, 16, …
…4, 16, 64, 256, …

Strand: **M3** **Geometry**

Standard: In Grade 5, all students should:

5.M.3a: identify, describe and compare the properties of a three-dimensional objects (e.g., cylinder, cone, cube, square pyramid, and rectangular prism) by the number of faces, edges, or vertices;

Example: Tell how many face, edges, and vertices in the figure.



5.M.3b: identify and graph ordered pairs in the first quadrant of a coordinate system;

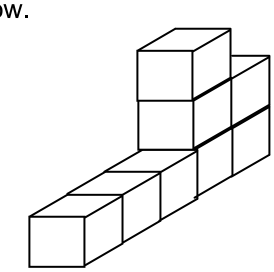
Example: Plot the points (2,1), (4,2), and (6,3). Describe what you notice about the graph of these ordered pairs.

5.M.3c: create patterns that result from drawing a combination of reflections (flips), rotations, and translations (slides) of geometric figures, including rotational symmetry;

Example: Draw a rectangle and then translate it 2 inches vertically across your paper. Draw the new rectangle in a different color.

5.M.3d: visualize and draw two-dimensional views of three-dimensional objects made from rectangular solids;

Example: Draw a picture to show the top, front, and right-hand side views of the picture below.



Strand: **M4** **Measurement**

Standards: In Grade 5, all students should:

5.M.4a: identify volume as the space inside a three-dimensional object as a measured in cubic units and use strategies to determine the surface areas and volumes of rectangular solids;

Example: Find the volume of a cereal box with length 36 cm, width 24 cm, height 9 cm.

5.M.4b: convert standard units of measurement within both customary and metric systems of measurement, e.g., inches to feet, centimeters to meters, etc.;

Example: Determine how many inches there are in 2 feet.

5.M.4c: develop and use strategies for estimating the volume of various three-dimensional objects;

Example: Jill wants to determine the volume of a box that contains Rubik's Cubes. If the cubes are 3 inches on a side and there are 3 rows of 4 cubes each on the top layer, explain how she can determine the volume.

5.M.4d: use standard measurement tools and units to measure volume;

Example: Measure the dimensions of a shoe box and determine its volume.

Strand: **M5** **Data Analysis and Probability**

Standard: In Grade 5, all students should:

5.M.5a: explain sampling techniques for gathering data;

Example: Describe how you would randomly survey shoppers in the mall to determine their preference in athletic shoe brands.

5.M.5b: select and use a graph that is appropriate for the type of data to be displayed;

Example: Conduct a survey to find the favorite magazines of the students in your class. Decide whether to use a bar, line, or picture graph to display the data. Describe how you decided which graph to use to display the results of your survey.

5.M.5c: describe the role of the mean as a balance point for the data set;

Example: Joey has an 85 average on his four mathematics tests. Describe what you know about Joey's mathematics test grades.

5.M.5d: recognize samples as subsets of larger populations;

Example: List 3 possible ways to divide your school population into distinct subsets.

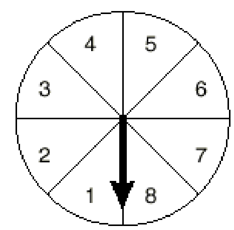
5.M.5e: use a sample to make projections for a larger population;

Example: The following information, gathered by 10 students in each class, reports the average amount of hours of watching television in a week. What projections can you make about the total school population?

Class	Ms. Jones	Mr. Smith	Mr. Bailey	Ms. Miles	Ms. Brown
Avg. Hrs of TV	18.5	21	16.7	19.8	22.1

5.M.5f: use common fractions to represent the probability of events that are neither certain nor impossible;

Example: The spinner shown is used to play a game. What is the probability that the arrow will land on a number greater than 5?



5.M.5h: compare theoretical and experimental outcomes in an experiment when the total number of possible outcomes is 12 or less;

Example: Bill rolled an even number on his die on 7 occasions. How does this relate to the theoretical probability of rolling an even number?

5.M.5i: make predictions based on experimental and theoretical probabilities.

Example: Marcie has 11 letter cards that spell the word MISSISSIPPI. If she picks 1 card without looking, what is the probability that it will have the letter S on it?