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.

DoDEA Mathematics Standards: Grade 2

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

Standards: In Grade 2, all students should:

2.M.1a: use place value to represent whole numbers through 1000 using numerals, words, and physical models;

Example: Show 78 as a number, with words, and by drawing a picture.

2.M.1b: identify numbers as even or odd numbers and determine whether a set of objects has an odd or even number of elements;

Example: Identify odd and even numbers on the calendar.

2.M.1c: show equivalent representations for whole numbers by using addition and subtraction facts;

Example: Find three ways to represent 8 as a difference.

2.M.1d: explain and demonstrate addition and subtraction for two-digit numbers without regrouping, e.g., doubling, making jumps of ten, partial sums or differences, counting up or back;

Example: Explain different ways to find the sum of 23 and 11.

2.M.1e: explain and demonstrate addition and subtraction for two-digit numbers with regrouping, e.g., doubling, making jumps of ten, partial sums or differences, counting up or back;

Example: Explain different ways to find the sum of 52 and 29.

2.M.1f estimate and verify answers in addition and subtraction problems with two-digit numbers;

Example: Estimate which sum is larger. Explain your answer.

28 + 41 or 37 + 37

2.M.1g: solve multi-step problems involving addition and subtraction;

Example: Determine the largest number that can be subtracted from 58 and still have more than 35 left.

2.M.1h: count by twos, fives, and tens to 100;

Example: Count 54 pencils by groups of tens and twos.

2.M.1i: model and demonstrate multiplication and division problems;

Example: Demonstrate two ways to represent 4 x 3.

2.M.1j: use words, numerals, and physical models to represent fractions and their relationship to the whole;

Example: What is another way of representing three thirds? Explain your answer.

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

Standards: In Grade 2, all students should:

2.M.2a: create and describe patterns with multiple attributes;

Example: Create a geometric pattern in which at least two attributes change.

2.M.2b: identify and extend a linear pattern by its rules;

Example: A dog has four legs. Two dogs have eight legs and so on. Continue the pattern to determine how many legs five dogs have.

2.M.2c: use symbols to represent unknown quantities and identify values for symbols;

Example: What is the value of this symbol, ♥**,** if ♥ - 54 is 33.

2.M.2d: represent equivalence and extend the concept to situations involving symbols;

Example: Find two numbers that can replace the symbols to make an equivalence statement of the following: ▲ + ■ = 100.

2.M.2e: solve open sentences by representing an expression in more than one way using the associative property of addition;

Example: Find two ways to add 5, 17, and 13 in this order.

2.M.2f: model and describe a problem situation using symbols and operations;

Example: Write an open sentence using symbols to model the following: Determine the number of girls in a class, if 15 in the class of the 26 students are boys.

2.M.2g: describe qualitative changes;

Example: Describe what happens to the taste of a fruit punch if more water is added.

2.M.2h: describe quantitative changes, especially those involving addition and subtraction;

Example: Describe how two teams can be made to have equal representations of boys and girls if one team has 5 boys and 7 girls while the other team has 7 boys and 5 girls.

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

Standards: In Grade 2, all students should:

2.M.3a: predict the results of putting together and taking apart two-dimensional shapes;

Example: Use objects or drawings to find other shapes that can be made from a rectangle.

2.M.3b: find and name locations using simple relationships and in coordinate systems, e.g., grids, maps;

Example: If your house is located on a grid at A5 and the playground is located at C3, what directions could you give to get from your house to the playground?

2.M.3c: identify shapes that have been rotated (turned), reflected (flipped), and translated (slide). Describe direction of translations, e.g., left, right, down, up;

Example: Describe the attributes of a square. Rotate the square one quarter turn. Describe the attributes of the square now. Compare the two shapes.

2.M.3d: identify and create shapes with symmetry;

Example: Draw a triangle that has symmetry and then draw one that does not have symmetry. Describe differences between the two shapes.

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

Standards: In Grade 2, all students should:

2.M.4a: tell time in five-minute intervals;

Example: Using a demonstration clock, tell me when your favorite television program begins and ends.

2.M.4b: describe and compare relationships of time, e.g., minutes in an hour, hours in a day, days in a week, months in a year;

Example: How many months in a year?

2.M.4c: decide which unit of measure is appropriate in a given situation;

Example: Would you use yards or inches to measure the length of your classroom? Explain your answer.

2.M.4d: make and use estimates of measurement, including time volume, weight, and area. Verify results;

Example: How many linker cubes would you need to put on one side of a balance scale to balance with ten pencils? Explain the results of your estimation and weighing.

2.M.4e: use repetition of a single unit to measure something larger than the unit;

Example: How many 1 gram units would you have to place on a pan scale to balance a stapler placed on the other side?

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

Standards: In Grade 2, all students should:

2.M.5a: develop categories for sorting a collection of materials;

Example: How many different ways can you sort a collection of buttons?

2.M.5b: collect, organize, represent, and interpret data using pictographs, bar graphs, and tables;

Example: Make a table showing one of the ways you sorted your button collection. Select and make the best type of graph to represent your data.

2.M.5c: generate questions, collect and organize data to address the questions, and draw conclusions;

Example: Demonstrate a different way to organize your button collection. Explain the differences in data organization.

2.M.5d: read and interpret graphs and tables to identify main ideas, draw conclusions, and make predictions;

Example: If the following table shows the temperatures throughout the day, what temperature would you estimate for 6 p.m. and why?

10 a.m.	Noon	2:00 p.m.	4:00 p.m.	6:00 p.m.
65 degrees	72 degrees	76 degrees	74 degrees	? degrees

2.M.5e: describe events that are more likely, least likely, or equally likely to happen;

Example: Are you more likely to spin an odd or an even number on a spinner that has 6 equal sections with number 1, 2, 3, 4, 5, 6?

2.M.5f: use physical models and pictures to represent possible arrangements of two or three objects;

Example: Make pictures to show the possible types of two-topping pizzas that could be created from a list of 5 toppings.

2.M.5g: identify events that can have more than one outcome, e.g., predicting weather, tossing coins;

Example: What are the possible outcomes from rolling two dice?