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 6

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

Standards: In Grade 6, all students should:

6.M.1a: decompose and recompose whole numbers using factors and exponents;

Example: Find 3 different factor pairs for 180.

6.M.1b: find and use prime factorization of composite numbers;

Example: Explain why the least common multiple for 144 and 180 is 720.

6.M.1c: use simple expressions involving integers to represent and solve problems;

Example: The temperature in Bavaria this morning was -6^0 and now it is 3^0. How much has the temperature risen? Explain your answer.

6.M.1d: compare and order positive and negative decimals and fractions and find their locations on a number line;

Example: Place the following numbers correctly on a number line: ¼, .17, - ¼, -.17.

6.M.1e: interpret and use ratios in to show relative sizes of two quantities, using accurate notations, e.g., a/b, a to b, a:b;

Example: If there are 3 feet in a yard, write a ratio that represents the relationship using F for feet and Y for yards.

6.M.1f: use order of operations, including exponents, decimals, rational numbers, to simplify numerical expressions;

Example: Find the value of the expression: $^1/_2\ (12.4 - 5.2)^2$

6.M.1g: explain the meaning and effects of arithmetic operations with positive numbers to include fractions, decimals, and percents;

Example: Explain how you can divide two fractions and get a number greater than 1.

6.M.1h: perform fraction and decimal computations and justify the solutions;

Example: Use pictures to illustrate the sum of $^2/_3$ and $^1/_4$.

6.M.1i: estimate solutions to problems involving fractions and decimals;

Example: Explain why you can or cannot purchase a toy that is on sale for ¾ of the original price of $21 if you have $15.

6.M.1j: select and use mathematical methods and tools for computing with fractions and decimals;

Example: Explain how can you compute a 15% tip for bill which totals $28?

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

Standards: In Grade 6, all students should:

6.M.2a: recognize and generate equivalent forms of algebraic expressions;

Example: In playing the game, "Thinking of a Number", Jill says that you end up with the same number if you follow either of the two directions. Use algebraic expressions to show that she is correct.
[1] Think of a number, subtract one, double the result, and add 6.
[2] Think of a number, add two, and double the result.

6.M.2b: explain how the commutative, associative and distributive properties generate equivalent forms;

Example: Use the commutative and distributive property to create an equivalent expression that may make the following computation a simple product: 29 ● 76 + 24 ● 29.

6.M.2c: solve simple linear equations and inequalities;

Example: John wants to buy candy bars for some of his friends. If candy bars are 75 ¢, what is the maximum number of friends he can buy candy bars for if he has $2.35?

6.M.2d: use symbolic algebra to represent situations, e.g., relationships found in geometry;

Example: A gallon of paint will cover 400 square feet of surface area. Write an inequality to determine the dimensions of a room for which the 4 walls can be painted using 1 gallon of paint. Use (W) to represent that width of a room, (L) to represent the length of a room, and (H) to represent the height of a room.

6.M.2e: evaluate simple expressions by replacing variables with given values, and use formulas in problem-solving situations;

Example: If 2WH + 2LH < 400 represents the dimensions of a room (width, length, height) and 400 is the surface area a gallon of paint can cover, determine if a room 15X12X9 can be painted with one gallon of paint.

6.M.2f: create and interpret tables and graphs to draw conclusions and make predictions;

Example: The following chart lists calories in a serving of chicken tenders based on how many pieces are eaten. How many calories are in 17 chicken tenders?

Calories	Number Eaten
168	4
210	5
252	6
336	8

6.M.2g: create and compare representations that display constant and varying rates of change.

Example: A frog is stuck at the bottom of a well. Each day, the frog can climb up five feet but each night he slides back down 2 feet. The table Below lists his distance from the bottom of the well.

Day 1	5 feet	Night 1	3 feet
Day 2	8 feet	Night 2	6 feet

and so on …

If the well is 65 feet deep, create a graph that will illustrate when the frog is out of the well.

Strand:	**M3**	**Geometry**
Standards:		In Grade 6, all students should:

6.M.3a: describe and classify two- dimensional and three-dimensional shapes using their defining properties;

Example: List all of the two-dimensional shapes can have all right angles.

6.M.3b: identify and plot points on a coordinate plane in all quadrants;

Example: Draw a square with two corners of a square located at the points (3,2) and (3,5).

6.M.3c: describe sizes, positions and orientations of shapes after rotations, reflections, and translations;

Example: Which capitol letters will retain their orientation when reflected across the Y axis?

6.M.3d: recognize, explain, and perform up to two transformations on two-dimensional shapes;

Example: Draw a trapezoid in with vertices at (1,3), (2,1), (4,1), and (5,3). Rotate the shape 45^0 clockwise and draw its reflections to the other 3 quadrants.

6.M.3e: draw and identify two-dimensional geometric figures with specific side length or angle measure;

Example: Draw a right triangle that has legs of length 3 and 4. Determine the length of the third side.

6.M.3f: describe and use properties of similarity and congruency with two-dimensional figures to solve problems;

Example: A photograph is enlarged from a 3”X 5” to a poster with width of 24”. What are the dimensions of the enlarged poster?

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

Standards: In Grade 6, all students should:

6.M.4a: explain the relationship between area and perimeter of a rectangle when one attribute is changed and the other remains constant;

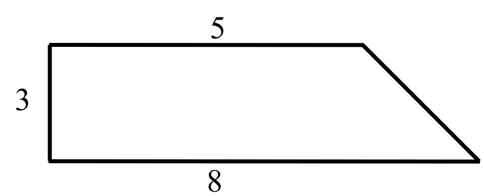
Example: A 6 X 3 rectangle has the same area and perimeter. What happens to the relationship between the area and perimeter when the width is increased to make it a square?

6.M.4b: select and use units of measurement to a given precision;

Example: Measure the segment to the nearest ⅛ of an inch.

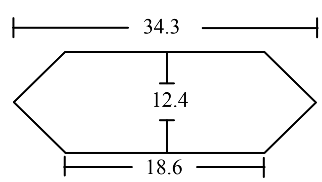
6.M.4c: create and use formulas to find the perimeters and areas of triangles and quadrilaterals, and to find the area and circumference of circles;

Example: Find the area of the following trapezoid:



6.M.4e: find the perimeter and area of irregular polygons;

Example: What is the area of a stained glass window with the dimensions shown?



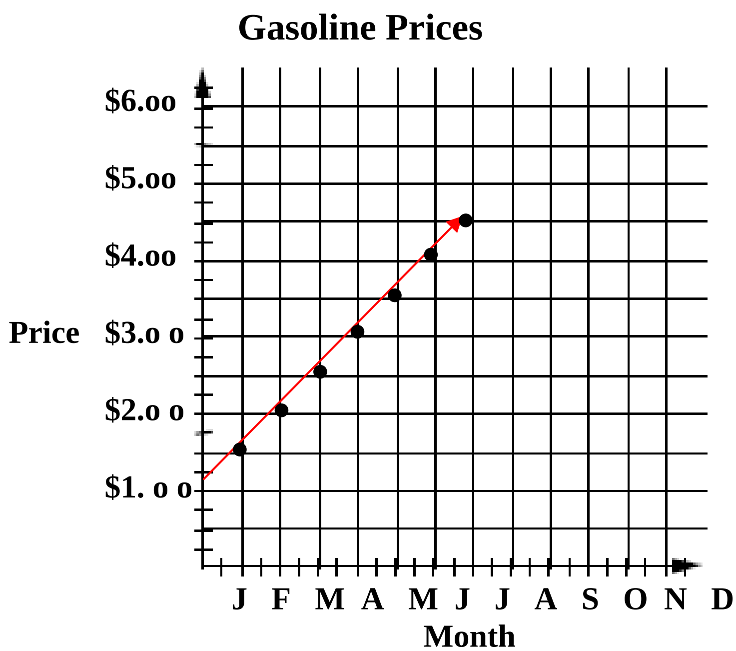
6.M.4f: identify rate as a form of measurement based on time, e.g., mph, rpm, cc/min.:

Example: Express the rate of a bicycle in km/hour if it has a tire with circumference of 2m that is making one revolution every second?

Strand:	**M5**	**Data Analysis and Probability**
Standards:		In Grade 6, all students should:

6.M.5a: read and use graphical representations to make predictions and/or draw conclusions;

Example: Use the graph below to predict the price of gasoline by December.



6.M.5b: formulate questions, design a study, and evaluate the data to reach a conclusion about characteristics shared by two populations or different characteristics that exist within a population;

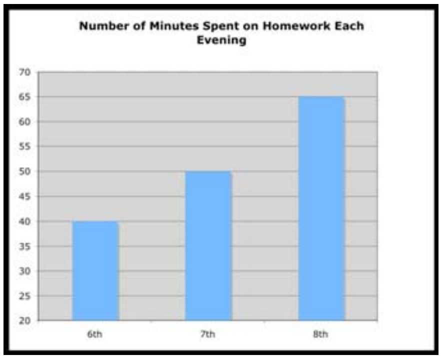
Example: Explain what you can do to determine the expected minimum wage by the time you graduate from high school?

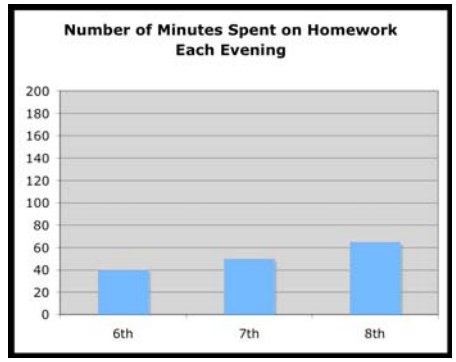
6.M.5c: identify the measures of central tendency and spread of a data set to describe the set;

Example: If a set of test scores range from 63 to 87 with a mean of 79, what statements can you make about the class grades as a whole?

6.M.5d: explain the effects of scale and/or interval changes in graphs that lead to misunderstandings;

Example: Leah, an 8th grader, wants to make a graph to show how much time typical middle school students at her school spend on homework. She wants to use one graph to show her teacher to convince him that he should not give 8th graders so much homework. Which of the following graphs would best suit her argument?





6.M.5e: select, construct, interpret, and justify the appropriate graphical representation of data;

Example: Explain which of the following sets of data would be best illustrated in a circle graph: Distance a paper airplane travels on 10 trials; Growth of a plant over 3 months; Color of eyes for the students in your classroom.

6.M.5f: use 0, 1, and ratios between 0 and 1 to represent the probability of outcomes for an event;

Example: Express the likelihood of being born in a month that ends in R as a ratio, if all the you are equally likely to be born in any one of the 12 months.

6.M.5g: describe and model all possible outcomes of simple events, e.g., tree diagrams, organized lists;

Example: The local sandwich shop has the following options: type of bread (white, wheat, rye), type of meat (turkey, ham, roast beef), and two options for addition (tomato, bacon). List all of the types of sandwiches that the sandwich shop will make.

6.M.5h: explain why the sum of the probabilities of all possible outcomes of a particular event is one;

Example: The probability of rolling a die and getting an odd number is $^{3}/_{6}$. What is the probability of rolling an even number? Why is the sum of these probabilities 1?