

## K – 12 MATHEMATICS UNIFYING STANDARDS

- 1.0 Number Sense and Operations** – Students understand ways of representing numbers, relationships among numbers, and number systems. They understand the meaning of and relationships between operations and strategies, and they can estimate appropriately.
- 2.0 Patterns, Functions, and Algebra** – Students know and understand various types of patterns and functional relationships. They use symbolic forms and models to represent and analyze mathematical structures in both real and abstract contexts.
- 3.0 Measurement** – Students know and understand attributes, units and systems of measurement. They apply a variety of techniques, tools, and formulas for determining measurements.
- 4.0 Geometry and Spatial Sense** – Students know how to analyze characteristics and properties of two- and three- dimensional objects. They select and use different representational systems, including coordinate and graph theory. They understand the usefulness of transformations and symmetry in analyzing mathematical situations. They know how to visualize and to use spatial reasoning to solve problems that cross disciplines.
- 5.0 Data Analysis, Statistics, and Probability** – Students know how to pose questions and collect, organize, represent and interpret data in order to answer those questions. They use methods of exploratory data analysis to develop and evaluate inferences, predictions, and arguments that are based on data. They understand and know how to apply the notions of chance and probability.
- 6.0 Problem Solving** – Students know that they learn basic skills and concepts in order to use them to solve problems in and out of school. They solve routine and complex problems by drawing from a variety of strategies, including technology, while demonstrating an attitude of persistence and reflection in their approaches.
- 7.0 Processes: Reasoning, Communication, and Connections** – Students use reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they recognize and understand multiple representations of the same concept. They see the interconnections among math ideas, as well as in other disciplines. They know how to communicate their math thinking clearly and coherently to others, orally, graphically, and in writing, using precise language and symbols.

**MATH STANDARDS  
LEVEL 7**

**1.0 Number Sense and Operations** – Students understand ways of representing numbers, relationships among numbers, and number systems. They understand the meaning of and relationships between operations and strategies, and they can estimate appropriately.

Focus Goals

- 1.1 Use the properties of, and compute with, rational numbers expressed in a variety of forms.
- 1.2 Use and apply knowledge of exponents, powers, and roots.

**2.0 Patterns, Functions and Algebra** – Students know and understand various types of patterns and functional relationships. They use symbolic forms and models to represent and analyze mathematical structures in both real and abstract contexts.

Focus Goals

- 2.1 Express quantitative relationships by using algebraic terminology, expressions, equations, inequalities, and graphs.
- 2.2 Interpret and evaluate expressions involving integer powers and simple roots.
- 2.3 Graph and interpret linear and nonlinear functions.
- 2.4 Solve simple linear equations and inequalities over the rational numbers.

**3.0 Measurement** – Students know and understand attributes, units, and systems of measurement. They apply a variety of techniques, tools, and formulas for determining measurements.

Focus Goals

- 3.1 Demonstrate depth of understanding in solving problems that require measurement of plane and solid shapes.
- 3.2 Select and use appropriate measurement tools to estimate, quantify proportions, and measure objects.
- 3.3 Know when and how to apply precision and accuracy.

**4.0 Geometry and Spatial Sense** – Students know how to analyze characteristics and properties of two- and three- dimensional objects. They select and use different representational systems, including coordinate and graph theory. They understand the usefulness of transformations and symmetry in analyzing mathematical situations. They know how to visualize and to use spatial reasoning to solve problems that cross disciplines.

Focus Goals

- 4.1 Identify, describe, draw, and classify properties of, and relationships between, plane and solid geometric figures.
- 4.2 Know and apply the Pythagorean theorem.
- 4.3 Deepen understanding of plane and solid geometric shapes by constructing figures that meet given conditions and by identifying attributes of figures.
- 4.4 Use spatial organization to solve problems.

**5.0 Data Analysis, Statistics, and Probability** – Students know how to pose questions and collect, organize, represent, and interpret data in order to answer those questions. They use methods of exploratory data analysis to develop and evaluate inferences, predictions, and arguments that are based on data. They understand and know how to apply the notions of chance and probability.

Focus Goal

- 5.1 Collect, organize, and represent data sets with one or more variables and identify any relationships using traditional or technological tools.
- 5.2 Identify and explain misuses of statistical data.

**6.0 Problem Solving** – Students know that they learn basic skills and concepts in order to use them to solve problems in and out of school. They solve routine and complex problems by drawing from a variety of strategies, including technology, and demonstrate an attitude of persistence and reflection in their approaches.

Focus Goals

- 6.1 Make decisions about how to approach problems.
- 6.2 Apply a variety of strategies, skills, and concepts in finding solutions.

**7.0 Reasoning, Communication, and Connections** – Students use reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they recognize and understand multiple representations of the same concept. They see the interconnections among math ideas, as well as in other disciplines. They know how to communicate their math thinking clearly and coherently to others, orally, graphically, and in writing, using precise language and symbols.

Focus Goals

- 7.1 Use math reasoning to develop, analyze, justify, and validate thinking and arguments.
- 7.2 Express math thinking orally, graphically, and in writing.
- 7.3 Understand multiple representations of the same concept.
- 7.4 Determine a solution is complete and move beyond a particular problem by generalizing to other situations.

**MATH STANDARDS  
LEVEL 7**

**1.0 Number Sense and Operations** - Students understand ways of representing numbers, relationships among numbers, and number systems. They understand the meaning of and relationships between operations and strategies, and they can estimate appropriately.

**1.1 Use the properties of, and compute with, rational numbers expressed in a variety of forms.**

- θ Read, write, and compare rational numbers using scientific notation (positive and negative powers of 10).
- θ Add, subtract, multiply, and divide rational numbers (integers, fractions, including integral fractions, and terminating decimals) and take rational numbers to whole-number powers.
- θ Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.
- θ Differentiate between rational and irrational numbers.
- θ Know that every rational number is either a terminating or repeating decimal and be able to convert terminating decimals into reduced fractions.
- θ Calculate the percentage of increases and decreases of a quantity.
- θ Solve percentage problems that involve discounts, markups, commissions, profit, and simple and compound interest.
- θ Solve problems involving numerical order of operations.

**1.2 Use and apply knowledge of exponents, powers, and roots.**

- θ Multiply and divide expressions involving integral whole-number exponents with a common base.
- θ Multiply, divide, and simplify rational numbers by using rules of exponents or other successful strategies.
- θ Use the inverse relationship between raising to a power and extracting the root of a perfect square integer; for an integer that is not square, determine without a calculator the two integers between which its square root lies and explain why.
- θ Interpret and find the absolute value of real numbers as the distance from zero on a number line.
- θ Identify and calculate numbers expressed in scientific notation

**2.0 Patterns, Functions, and Algebra** – Students know and understand various types of patterns and functional relationships. They use symbolic forms and models to represent and analyze mathematical structures in both real and abstract contexts.

**2.1 Express quantitative relationships by using algebraic terminology, expressions, equations, inequalities, and graphs.**

- θ Use variables and appropriate operations to write an expression, an equation, an inequality, or a system of equations or inequalities that represents a verbal description.
- θ Use the correct order of operations to evaluate algebraic expressions when given a value for the unknown.
- θ Simplify numerical expressions by applying properties of rational numbers (identity, inverse, distributive, associative, commutative) and identify the process used.
- θ Write number sentences with algebraic expressions to illustrate the following properties: associative, commutative, distributive, reflexive, and transitive.
- θ Use algebraic terminology: *variable, equation, term, coefficient, inequality, expression, and constant* correctly.

- θ Represent quantitative relationships graphically and interpret the meaning of a specific part of a graph in the situation represented, and find values not given.
- θ Understand a function as an extension of a pattern and write a rule that describes an arithmetic or geometric pattern, and use that pattern to determine the missing element.
- θ Identify an equivalent expression for a given expression.
- θ Determine and graph solutions for linear equations.

## 2.2 Interpret and evaluate expressions involving integer powers and simple roots.

- θ Represent positive whole-number powers as repeated multiplication and negative whole-number powers as repeated division or multiplication by the multiplicative inverse.
- θ Simplify and evaluate expressions that include exponents.
- θ Multiply and divide monomials.
- θ Factor common monomials.

## 2.3 Graph and interpret linear and nonlinear functions.

- θ Graph and use some nonlinear (quadratic, absolute values) functions.
- θ Graph linear functions and know that the ratio (“rise over run”) is called the slope of a graph.
- θ Plot the values of quantities whose ratios are always the same, and understand that the slope of the line equals the quantities.
- θ Estimate unknown quantities on a graph.

## 2.4 Solve simple linear equations and inequalities over the rational numbers.

- θ Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results.
- θ Graph inequalities on a number line.
- θ Solve multi-step problems involving rate, average speed, distance, and time or a direct variation.

**3.0 Measurement** – Students know and understand attributes, units, and systems of measurement. They apply a variety of techniques, tools, and formulas for determining measurements.

### 3.1 Demonstrate depth of understanding in solving problems that require measurement of plane and solid shapes

- θ Find the perimeter and area of basic two-dimensional figures and the surface area and volume of basic three-dimensional figures, (rectangles, parallelograms, trapezoids, squares, triangles, circles, prisms, and cylinders) using formulas routinely.
- θ Estimate and compute the area of more complex or irregular two- and three-dimensional figures by breaking them down into more basic figures.
- θ Understand that when the lengths of all dimensions of a three-dimensional rectangular solid are multiplied by a scale factor, the surface area is multiplied by the square of the scale factor and the volume is multiplied by the cube of the scale factor.

### 3.2 Select and use appropriate measurement tools to estimate, quantify proportions, and measure objects.

- θ Compare weights, capacities, geometric measures, times, and temperatures within and between measurement systems.
- θ Construct and read drawings and models made to scale.
- θ Use measures expressed as rates and measures expressed as products to solve problems; check the units of the solutions, and the reasonableness of the answers.

**3.3 Know when and how to apply precision and accuracy.**

- θ Use significant digits in meaningful contexts.
- θ Differentiate between accuracy (degree to which a measurement agrees to the actual value) and precision (degree to which measurements agree to each other).

**4.0 Geometry and Spatial Sense** – Students know how to analyze characteristics and properties of two- and three-dimensional objects. They select and use different representational systems, including coordinate and graph theory. They understand the usefulness of transformation and symmetry in analyzing mathematical situations. They know how to visualize and to use spatial reasoning to solve problems that cross disciplines.

**4.1 Identify, describe, draw, and classify properties of, and relationships between, plane and solid geometric figures.**

- θ Use basic geometric terminology and concepts accurately including: *altitude, midpoint, bisectors, both perpendicular and angular, chords, arcs, and skew lines.*
- θ Understand and use coordinate graphs to plot simple figures, determine lengths and areas related to them, determine and identify their image under translations, rotations, and reflections.
- θ Identify and apply properties of parallel and perpendicular lines.

**4.2 Know and apply the Pythagorean theorem.**

- θ Find the length of the missing side of a right triangle.

**4.3 Deepen understanding of plane and solid geometric shapes by constructing figures that meet given conditions and identify the attributes.**

- θ Identify and construct basic elements of two-dimensional geometric figures with altitudes, midpoints, diagonals, angle bisectors, perpendicular bisectors; central angles, radii, diameters, and chords of circles by using a compass and straightedge.
- θ Use relationships between two congruent figures to determine measures of missing sides and angles.
- θ Use relationships of similarity to find the missing side of a pair of similar polygons.
- θ Construct two-dimensional patterns for three-dimensional models, such as cylinders, prisms, and cones.
- θ Identify attributes of three-dimensional geometric objects and describe how two or more objects are related in space.
- θ Classify polyhedra.

**4.4 Use spatial organization to solve problems.**

- θ Use geometric representations (e.g., area, perimeter, volume) or make models to solve problems.
- θ Understand spatial dimension related to linear, square, and cubic units.
- θ Investigate and predict results of combining subdividing, and changing shapes (e.g., use pattern blocks, fold paper, dissect, tile, rearrange parts of solids).

**5.0 Data Analysis, Statistics and Probability** – Students know how to pose questions and collect, organize, represent, and interpret data in order to answer those questions. They use methods of exploratory data analysis to develop and evaluate inferences, predictions, and arguments that are based on data. They understand and know how to apply the notions of chance and probability.

**5.1 Collect, organize, and represent data sets with one or more variables and identify any relationships using traditional or technological tools.**

- θ Discover relationships using a spreadsheet.
- θ Use various forms to display a single set of data or to compare two sets of data including stem and leaf or box-and-whisker plots.
- θ Represent two numerical variables on a scatterplot, describe how the data points are distributed, and identify any apparent relationships.
- θ Understand and compute the minimum, the lower quartile, the median, mean, mode, the upper quartile, and the maximum of a data set.

**5.2 Identify and explain misuses of statistical data.**

- θ Identify faulty arguments or misleading presentations of data.
- θ Apply statistics appropriately to real-world situations.

**6.0 Problem Solving** - Students know that they learn basic math skills and concepts in order to use them to solve problems in and out of school. They solve routine and complex problems by drawing from a variety of strategies, including technology, and demonstrate an attitude of persistence and reflection in their approach.

**6.1 Make decisions about how to approach problems.**

- θ Analyze problems by identifying relationships, discriminating relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.
- θ Formulate and justify mathematical conjectures based upon a general description of the mathematical question or problem posed.
- θ Determine when and how to break a problem into simpler parts.

**6.2 Apply a variety of strategies, skills, and concepts in finding solutions.**

- θ Use technology to solve mathematical, real-world, and open-ended problems.
- θ Estimate and verify the reasonableness and/or the range of possible solutions
- θ Use strategies and results from simpler problems to solve more complex problems.
- θ Make and test conjectures using both inductive and deductive reasoning.

**7.0 Reasoning, Communication, and Connections** – Students use reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they recognize and understand multiple representations of the same concept. They see the interconnections among math ideas as well as in other disciplines. They know how to communicate their math thinking clearly and coherently to others, orally, graphically, and in writing, using precise language and symbols.

**7.1 Use math reasoning to develop, analyze, justify, and validate thinking and arguments.**

- θ Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.
- θ Make precise calculations and interpret the validity of the results from the context of the problem.
- θ Identify, evaluate, and present reasonable conclusions and justify the solution processes in the context of the original situation.
- θ Locate a flaw in a math argument.
- θ Estimate and solve unknown quantities on a graph using logical reasoning, arithmetic, and algebraic techniques.

**7.2 Express math thinking orally, graphically, and in writing.**

- θ Restate or summarize the problem.
- θ Ask clarifying and extending questions.
- θ Use a variety of methods such as words, numbers, symbols, charts, graphs, tables, diagrams, and models to explain math reasoning and use of processes.
- θ Express reasonable solutions clearly and logically using appropriate mathematical notation and terms, and support solutions with evidence, in both verbal and symbolic work.

**7.3 Understand multiple representations of the same concept.**

- θ Read and understand math in written form.
- θ Recognize the relationship between concrete models, math symbols, and written English.
- θ Translate written problems into math symbols, and math symbols into written English.
- θ Translate data from one representation to another (i.e., table to graph).

**7.4 Determine a solution is complete and move beyond a particular problem by generalizing to other situations.**

- θ Evaluate the reasonableness of a solution in the context of the original situation.
- θ Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
- θ Develop generalizations of the results and patterns and extend and apply them to new problem situations.