

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 8
FOCUS ON ALGEBRA**

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 Identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers.
- 1.2 Understand and use such operations as take the opposite, find the reciprocal, take the root, and raise to a fractional power.

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 Simplify and evaluate algebraic expressions using appropriate techniques.
- 2.2 Solve various forms of linear equations.
- 2.3 Graph and write the equation of a line.
- 2.4 Solve and graph inequalities.
- 2.5 Solve a system of two linear equations in two variables.
- 2.6 Solve a system of two linear inequalities in two variables and sketch the solution sets.
- 2.7 Solve and graph quadratic equations.
- 2.8 Understand the concepts of a relation and a function.

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 Apply given formulas in problem settings.

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 Deepen understanding of plan and solid geometric shapes.
- 4.2 Understand and use coordinate geometry.
- 4.3 Understand triangle relationships.

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 Goals

- 5.1 Organize, represent, and interpret data sets that have one or more variables and identify relationships among variables within a data set using traditional and technological tools.
- 5.2 Solve combination and permutation problems.

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.

Focus Goals

- 6.1 Make decisions about how to approach problems.
- 6.2 Apply 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 Communicate math thinking and conclusions using words, graphs, and charts.
- 7.2 Know and use simple aspects of a logical argument.
- 7.3 Use the properties of the number system to judge the validity of results, the next step of a procedure, and to prove or disprove statements.
- 7.4 Express math thinking orally, graphically, and in writing.

**MATH STANDARDS
LEVEL 8 - ALGEBRA**

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 Identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers. (c/p8-9)

- θ Use order of operations to determine arithmetic solutions. (s)
- θ Use properties of numbers to demonstrate whether assertions are true or false. (c)
- θ Simplify radical expressions. (p/c)
- θ Compare number sentences that include rational numbers. (s)
- θ Add, subtract, multiply, and divide rational numbers in the context of numerical problems. (s)

1.2 Use operations such as: take the opposite, find the reciprocal, take the root, and raise to a fractional power. (c/p9)

- θ Use scientific notation in meaningful contexts. (p9/s)
- θ Understand and use the rules of exponents. (c/p9)

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 Simplify and evaluate algebraic expressions using appropriate techniques. (c/p)

- θ Simplify expressions with rational coefficients and exponents. (s)
- θ Add, subtract, multiply, and divide polynomials. (c)
- θ Factor second- and simple third-degree polynomials, by finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. (c/p9)
- θ Factor both the numerator and denominator of polynomials in fractions to reduce to lowest terms. (c)
- θ Translate sentences into algebraic expressions. (s)

2.2 Solve various forms of linear equations. (c/p9)

- θ Solve linear equations involving absolute values. (c/p)
- θ Solve multi step problems, including word problems, involving linear equations. (s)
- θ Translate given sentences into equations. (s)

- 2.3 Graph and write the equation of a line.** (c/p9)
- θ Graph linear equations in slope-intercept form.
 - θ Graph linear equations in standard form.
 - θ Graph and write the equation of a line given two points.
 - θ Graph and write equations given a point and the slope.
 - θ Verify that a point lies on a line, given an equation of the line.
 - θ Find the equations of a line perpendicular to a given line that passes through a given point. (c/p9)
 - θ Understand the concepts of parallel lines and perpendicular lines and how those slopes are related.
- 2.4 Solve and graph inequalities.** (c/p-9)
- θ Solve and graph inequalities in one variable.
 - θ Solve and graph inequalities involving absolute value.
 - θ Solve linear inequalities and sketch the region defined by the linear inequality. (s)
- 2.5 Solve a system of two linear equations in two variables.** (c/p9)
- θ Solve by graphing.
 - θ Solve by substitution.
 - θ Solve by elimination.
- 2.6 Solve a system of two linear inequalities in two variables and sketch the solution sets.** (c)
- o Recognize how points in the shaded region of the sketch represent solutions for the system of inequalities.
- 2.7 Solve and graph quadratic equations.** (c/p9)
- θ Know the quadratic formula and be familiar with its proof by completing the square. (c)
 - θ Use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations. (c/p9)
 - θ Graph quadratic functions and know that their roots are the x-intercepts. (c)
 - θ Determine whether the graph of a quadratic function will intersect the x-axis in zero, one or two points. (c)
- 2.8 Understand the concepts of a relation and a function.** (c/p)
- θ Determine whether a given relation defines a function. (c/p9)
 - θ Determine the domain of independent variables and the range of dependent variables defined by a graph, a set of ordered pairs, or a symbolic expression. (c/p9)
 - θ Determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion. (c)
 - θ Substitute given values for the variable in a function to determine the resulting value. (s)
 - θ Graph functions of the form $y=nx^2$ and $y=nx^3$ and use in solving problems. (c7)

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 Solve problems that require measurement of plane and solid geometric shapes.

- θ Apply significant digits.
- θ Differentiate between precision, accuracy, and error.
- θ Convert a measurement within a system to solve a problem. (s)

3.2 Apply given formulas to solve problems.

- θ Use formulas to find surface area and volume of prisms and cylinders, and area and perimeter of circles, polygons, and irregular figures. (s)
- θ Solve for a literal variable, such as solving for d when $c = \pi d$. (*)

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.

4.1 Deepen understanding of plane and solid geometric shapes. (p8)

- θ Identify, understand, and apply terms and properties of geometric shapes: *center, diameter, radius, semicircle, perpendicular, and parallel lines*. (s)

4.2 Understand and use coordinate geometry. (p-9)

- θ Use the distance formula.
- θ Use the midpoint formula.
- θ Find the slope of a line.

4.3 Understand triangle relationships. (p-9)

- θ Use the Pythagorean Theorem to determine distance and find missing lengths of sides of right triangles.
- θ Determine the measure of objects indirectly using similar triangles. (s)

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 at the notions of chance and probability.

5.1 Organize, represent and interpret data sets that have one or more variables and identify relationships among variables within a data set using traditional and technological tools. (c)

- θ Identify the independent and dependent variable.
- θ Display and interpret data in a scatter plot, frequency table, stem and leaf plot, and histogram. (s)
- θ Describe the correlation between, and predict outcomes of data. (s)
- θ Find the equations of trend lines or lines of best fit. (s)

5.2 Solve combination and permutation problems.

- θ Count the number of possible arrangements that can be made when ordering a set of objects. (s)

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 approaches.

6.1 Make decisions about how to approach problems. (c)

- θ Analyze problems by identifying relationships, discriminating relevant from irrelevant information, identifying missing information, sequencing and prioritizing information and observing patterns. (c/p8/s)
- θ Determine the general description of the question or problem posed; understand the problem. (c/p8)
- θ Determine when and how to break a problem into simpler parts. (c/p7-8)
- θ Solve problems involving scale drawings, whole numbers, fractions, decimals and percents by applying proportions. (s)

6.2 Apply strategies, skills, and concepts in finding solutions. (c/p)

- θ Apply algebraic techniques to solve rate problems, work problems, and percent mixture problems. (c)
- θ Apply quadratic equations to physical problems, such as the motion of an object under the force of gravity. (c)
- θ Use estimation to verify the reasonableness of calculated results. (s)
- θ Make and test conjectures by using inductive and deductive reasoning. (c/p7-8)

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.

7.1 Communicate math thinking and conclusions using words, graphs, and charts. (p)

7.2 Know and use simple aspects of a logical argument. (c)

- θ Explain the difference between inductive and deductive reasoning and identify and provide examples of each. (c/p9)
- θ Identify and explain the hypothesis and conclusion in logical deduction. (c/p9)
- θ Use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion. (c/p9)
- θ Formulate and justify math conjectures. (c/p8)

7.3 Use the properties of the number system to judge the validity of results, the next step of a procedure, and to prove or disprove statements. (c)

- θ Construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions. (c/p9)
- θ Judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step. (c/p9)
- θ Determine whether the statement is true sometimes, always, or never given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities. (c/p9)

7.4 Express math thinking orally, graphically, and in writing. (p)

- θ Restate or summarize the problem. (p)
- θ Ask clarifying and extending questions. (p)
- 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. (c/p7-8)
- θ Express reasonable solutions clearly and logically using appropriate mathematical notation and terms, and support solutions with evidence, in both verbal and symbolic work. (c/p7-8)