

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.

FOCUS GOALS HONORS ALGEBRA 3-4

1.0 Number Sense and Operations

- 1.1 Identify and use the properties of complex numbers.
- 1.2 Understand the concept of absolute value.
- 1.3 Know the laws of rational exponents.
- 1.4 Understand and use the basic properties of matrices.
- 1.5 Understand basic number sense concepts in trigonometry.

2.0 Patterns, Functions, and Algebra

- 2.1 Simplify and evaluate algebraic expressions.
- 2.2 Solve a linear equation for any variable.
- 2.3 Analyze linear functions.
- 2.4 Solve and graph linear and quadratic inequalities.
- 2.5 Solve systems of linear equations and inequalities (in two or three variables) by substitution, with graphs, by elimination, or with matrices.
- 2.6 Solve and graph linear and quadratic equations.
- 2.7 Understand the concepts of a relation and a function.
- 2.8 Understand logarithmic and exponential functions.
- 2.9 Know and apply the six trigonometric functions and their characteristics.

3.0 Measurement

- 3.1 Apply formulas, tools, and techniques to determine measurements.
- 3.2 Understand trigonometric measurement scales.

4.0 Geometry and Spatial Sense

- 4.1 Understand and use coordinate geometry.
- 4.2 Understand triangle relationships.
- 4.3 Understand how to use conic sections.

5.0 Data Analysis, Statistics, and Probability

- 5.1 Organize, represent, and interpret data sets that have one or more variables.
- 5.2 Solve combination and permutation problems.
- 5.3 Apply a variety of strategies to determine probabilities.

6.0 Problem Solving

- 6.1 Make decisions about how to approach problems.
- 6.2 Apply a variety of strategies, skills, and concepts to find solutions.
- 6.3 Apply triangle trigonometry to solve real-world problems.

7.0 Processes: Reasoning, Communication, and Connections

- 7.1 Communicate algebraic thinking and conclusions using words, graphs, and charts.
- 7.2 Prove and explain trigonometric identities.
- 7.3 Apply literacy skills when making mathematical connections.

**MATH STANDARDS
HONORS ALGEBRA 3-4**

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 properties of complex numbers. (c/p)

- o Use order of operations to simplify algebraic expressions including rationalizing monomial and binomial denominators. (c7/p9/s)
- o Simplify radical expressions. (c15/s)
- o Simplify powers of i and $(a+bi)^n$ for $n < 4$. (c6,20/p11)
- o Simplify complex expressions including using the conjugate. (c6/p12)
- o Apply sequences and series. (s)

1.2 Understand the concept of absolute value. (c/p)

- o Relate absolute distance value on a number line to the formal definition. (c1/p9)
- o Solve equation and inequalities involving absolute value. (c1)
- o Solve enumerating problems. (s)

1.3 Know the laws of rational exponents. (c12/p11)

- o Apply exponential functions. (c12)

1.4 Understand and use the basic properties of matrices. (c/p)

- o Apply the inverse of a 2×2 . (c/la9/p)
- o Apply and compute determinants of 2×2 and 3×3 . (c/la10)
- o Solve simple matrix equations. (c2/p12)
- o Add, subtract, and multiply matrices. (c/la5)
- o Apply scalar multiplication. (c/la5)

1.5 Understand basic number sense concepts in trigonometry. (c)

- o Compute and graph the values of the trigonometric functions and the inverse trigonometric functions at various standard points. (c/t8)
- o Demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities. (c/t10)
- o Demonstrate an understanding of half-angle and double-angle formulas for sines and cosines and can use those formulas to prove and/or simplify other trigonometric identities. (c/t3.2)

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. (c/p)

- o Simplify expressions with rational exponents. (c7/p9)
- o Add, subtract, multiply, and divide polynomials (including long division and synthetic division). (c3/p12/s)
- o Factor higher degree polynomials, difference of two squares, perfect square trinomials, and sum/difference of two cubes. (c4/p11)
- o Add, subtract, multiply, divide, reduce, and evaluate rational expressions with monomial and polynomial denominators and simplify complicated rational expressions, including those with negative exponents in the denominator. (c7/p11/s)

2.2 Solve a linear equation for any variable. (c/s)

- o Use factoring. (c8/p12)
- o Use logs. (c11/p12)

2.3 Analyze linear functions. (p)

- o Make connections between a solution to a linear equation and a point on the graph. (c2/p9)
- o Graph linear equations from slope-intercept form, standard form, given a point and the slope. (p9)
- o Write a linear equation: (p10)
 - Given 2 points
 - Given 1 point and the slope
 - Given a graph
 - That is parallel or perpendicular to a given line through a given point

2.4 Solve and graph linear and quadratic inequalities.

- o Solve and graph inequalities in one and two variables. (c2/p9,10/s)
- o Solve and graph inequalities involving absolute value. (c1/p11/s)
- o Given an inequality on a graph, manipulate correctly. (s)
- o Solve a system of two linear and/or quadratic inequalities in two variables and sketch the solution sets. (c/p)

2.5 Solve systems of linear equations and inequalities (in two or three variables) by substitution, with graphs, by elimination, or with matrices. (c2/p11)

- o Solve a system of two linear and/or quadratic inequalities in two variables and sketch the solution sets. (c/p)
- o Recognize how points in the shaded region of the sketch represent solutions for the system of inequalities. (p11)

2.6 Solve and graph linear and quadratic equations. (c/p)

- o Know the quadratic formula. (c8/p9/s)
- o Use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations. (c8/p9)
- o Recognize quadratic form of higher order polynomials. (p)
- o Understand the role of quadratic form in reduction and factoring of higher level polynomials. (p)
- o Find the value of the discriminate and tell the nature of the roots.*
- o Demonstrate and explain the effect that changing a coefficient has on the graph of quadratic functions; that is, students can determine how the graph of a parabola changes as a , b , and c vary in the equation $y = a(x - b)^2 + c$. (c9/p12)
- o Graph quadratic functions and determine the maxima, minima, and zeros of the function. (c10/p11/s)

2.7 Understand the concepts of a relation and a function. (c)

- o Determine the domain of independent variables and the range of dependent variables defined by a graph, set of ordered pairs, or equation. (p)
- o Determine whether a relation defined by a graph, set of ordered pairs, or a symbolic expression is a function and justify the conclusion. (p)
- o Graph functions of the form $y = nx^2$, $y = nx^3$, $y = x$, and $y = a^x$ and their inverses. (p)
- o Graph a function and its inverse (if it exists) and determine the relationship between the domain and range of the function and its inverse. (p)
- o Solve problems involving functional concepts, such as composition, defining the inverse function and performing arithmetic operations on functions. (c24)

2.8 Understand logarithmic and exponential functions. (c)

- o Know and apply the laws of logs. (c11.1,11.2/p12)
- o Understand and use properties of logs to simplify logarithmic numeric expressions and solve logarithmic equations. (c14/p12)

2.9 Know and apply the six trigonometric functions and their characteristics.

- o Know the definition of sine and cosine as y - and x -coordinates of points on the unit circle and be familiar with the graphs of the sine and cosine functions. (c/t2)
- o Graph functions of the form $f(t) = A \sin(Bt + C) + D^*$ or $f(t) = A \cos(Bt + C) + D^*$ and interpret A , B , and C in terms of amplitude, frequency, period, and phase shift. (c/t4)
- o Know the definitions of the tangent and cotangent functions and graph them. (c/t5)
- o Know the definitions of the secant and cosecant functions and graph them. (c)
- o Know that the tangent of the angle that a line makes with the x -axis is equal to the slope of the line. (c/t9)
- o Know the definitions of the inverse trigonometric functions and graph the functions. (c/t8)

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 Apply formulas, tools, and techniques to determine measurements. (p)

- o Use formulas to find surface area and volume of prisms and cylinders, and area and perimeter of circles, polygons, and irregular figures. (p9,10/s)
- o Solve for a literal variable, such as solving for r when $V=(4/3)(nr^3)$.*

3.2 Understand trigonometric measurement scales. (c)

- o Understand the notion of angle and how to measure it, in both degrees and radians (convert between degrees and radians). (c/t1)
- o Understand the notion of conterminal and reference angle for a given angle.*
- o Understand how to convert between decimal degrees and degrees – minutes.*

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 Understand and use coordinate geometry. (p/s)

- o Use the distance and midpoint formulas. (p9/s)
- o Find the slope of a line.*
- o Determine congruence, similarity, and regularity of polygons. (s)

4.2 Understand triangle relationships. (c/p)

- o Use the Pythagorean Theorem to determine distance and find missing lengths of sides of right triangles. (p9/s)
- o Determine the measure of objects indirectly using similar and right triangles. (p9/s)

4.3 Understand how to use conic sections. (c/p)

- o Identify and explain how to graph conic sections centered at origin (e.g., asymptotes, foci, eccentricity). (c16/p12)
- o Given a quadratic equation of the form $ax^2 + by + cx^2 + dy + e = 0$, use the method of completing the square to put the equation into standard form and recognize whether the graph of the equation is a circle, ellipse, parabola, or hyperbola and graph the equation. (c17/p/a3-4)

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 Organize, represent and interpret data sets that have one or more variables. (p)

- o Identify relationships among variables within a data set using traditional and technological tools. (p)
- o Identify the independent and dependent variable. (p)
- o Display and interpret data in a scatter plot, frequency table, stem and leaf plot, and histogram. (p9)
- o Describe the correlation between, and predict outcomes of data. (p9)
- o Find the equations of trend lines or lines of best fit. (p10/s)

5.2 Solve combination and permutation problems. (c/p)

- o Use fundamental counting principles to compute combinations and permutations. (c18/p12)
- o Use combinations and permutations to compute probabilities. (c19/p12)

5.3 Apply a variety of strategies to determine probabilities.

- o Use distribution (binomial, geometric, etc.). (s)
- o Determine mean, median, and range when adding or omitting data. (s)

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.

6.1 Make decisions about how to approach problems. (p9-12)

- o Analyze problems by identifying relationships, discriminating relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns. (p)
- o Identify and utilize appropriate tools. (p)
- o Make generalizations based on prior knowledge and related examples. (p)

6.2 Apply a variety of strategies, skills, and concepts to find solutions. (c/p)

- o Apply algebraic techniques to solve rate, work and percent mixture problems. *
- o Apply quadratic equations to physical problems, (such as the motion of an object under the force of gravity) and determine the maxima and minima of a function. (c10/p11)
- o Use estimation to verify the reasonableness of calculated results. (c9/p12)
- o Make and test conjectures by using inductive and deductive reasoning. (c9/p12)
- o Find the general term and the sums of arithmetic series of both finite and infinite geometric series. (c22/p/a3-4)

6.3 Apply triangle trigonometry to solve real-world problems. (c)

- o Use trigonometry to determine unknown sides or angles in right triangles. (c/t12)
- o Know the law of sines and the law of cosines and apply those laws to solve problems. (c/t13)
- o Determine the area of a triangle, given one angle and the two adjacent sides. (c/t14)
- o Use trigonometry in a variety of applications and word problems. (c/t19)

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 algebraic thinking and conclusions using words, graphs, and charts. (p)**7.2 Prove and explain trigonometric identities. (c)**

- o Know how to prove that, $\cos^2(x) + \sin^2(x) = 1$ and that this identity is equivalent to the Pythagorean Theorem (i.e., students can prove this identity by using the Pythagorean Theorem and, conversely, they can prove the Pythagorean Theorem as a consequence of this identity). (c/t3.1)
- o Know how to prove other trigonometric identities and simplify others by using the identity $\cos^2(x) + \sin^2(x) = 1$. For example, students use this identity to prove that $\sec^2(x) + \tan^2(x) = 1$. (c/t3.2)

7.3 Apply literacy skills when making mathematical connections. (p-language arts)

- o Learn and use mathematics vocabulary encountered through reading. (R1.0)
- o Use strategies to comprehend, analyze, and evaluate mathematics reading materials. (R2.0)
- o Employ technology to organize, record, and interpret mathematics information. (R3.0)
- o Write about mathematics to convey ideas logically and correctly. (W2.0)