

BILLINGS PUBLIC SCHOOLS
MATHEMATICS
HONORS ALGEBRA 3
Learning Objectives

MISSION STATEMENT

In a rapidly changing technological society, mathematics is a tool of great and growing importance. To achieve mathematical power one needs to become a problem solver, to value mathematics, to reason and communicate mathematically, and to be confident in applying mathematics to real world situations. The goal of mathematics education is to develop mathematically literate individuals who understand how mathematics, technology, and society influence one another.

PHILOSOPHY

We believe every student can understand the general nature and uses of mathematics necessary to solve problems, reason inductively and deductively and apply numerical concepts necessary to function in a technological society. We believe instructional strategies must include real world applications and the appropriate use of technology. We believe students must be able to use mathematics as a communications medium. Therefore, as an educational system we believe we can teach all children and all children can learn. We believe accessing knowledge, reasoning, questioning, and problem solving are the foundations for learning in an ever-changing world. We believe education enables student to recognize and strive for higher standards. Consequently, we will commit our efforts to help students acquire knowledge and attitudes considered valuable in order to develop their potential and/or their career and lifetime aspirations.

LEARNER DOMAINS

- I. The learner will develop an understanding of number sense and mathematical properties.**
- II. The learner will develop an understanding of estimation, computation and mental math.**
- III. The learner will develop an understanding of measurement and geometric concepts.**
- IV. The learner will develop an understanding of patterns, algebraic reasoning and logic.**
- V. The learner will develop an understanding of statistics, probability, and data analysis.**
- VI. The learner will develop an understanding of technological tools.**

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I. The learner will develop an understanding of number sense and mathematical properties. (I, D, E, A)

1. The learner will use and understand the real number system, its operations, notations, and the various subsystems.
 - a. Demonstrate the meaning of rational and real-number exponents. (A)
 - b. Identify and apply properties for matrices. (D, E, A)**
2. The learner will use definitions and basic operations of the complex number system.
- 3. Identify and apply properties and operations for the complex number systems. (E, A)**

II. The learner will develop an understanding of estimation, computation and mental math. (I, D, E, A)

1. The learner will compute fluently and make reasonable estimates.
 - a. Perform the basic operations on expressions involving fractions, mixed numbers, radicals, exponents, logarithms, or matrices. (D, E)**
 - b. Memorize exact values for sine, cosine, and tangent for the unit circle, including quadrantal, and multiples of 30° , 45° , 60° angles. (D, E, A)**
 - c. Estimate the number of real and complex roots from an equation and a graph. (A)

III. The learner will develop an understanding of measurement and geometric concepts. (I, D, E, A)

1. Analyze characteristics and properties of 2- and 3-dimensional geometric shapes and develop mathematical arguments about them.
 - a. Recognize symmetrical properties of functions when graphed. (I, D)
 - b. Determine the graph of an inverse function. (I, D, E)**
 - c. Convert between DMS and decimal degree systems. (I, D, E, A)**
 - d. Convert between degree and radian measure. (I, D, E)**
 - e. Define, graph, and determine values of the circular trigonometric functions and their inverses by using properties. (D, E)**
 - f. State the properties of the trigonometric functions and their graphs (including domain, range and period). (I, D, E)**
 - g. Determine period, amplitude, phase shift, and vertical shift of sinusoidal functions. (I, D, E, A)**
 - h. Plot points using polar coordinates. (I, D, E)**
 - i. Convert between polar and rectangular coordinates or equations. (I, D, E)**
 - j. Graph polar equations. (I, D, E)**
 - k. Determine characteristics of polar families. (I, D)
 - l. Convert complex numbers between rectangular and polar form. (I, D)
 - m. Graph polar equations of conics. (I, D)
 - n. Determine the characteristics of a conic section given its equation and graph. (I, D, E)**

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IV. The learner will develop an understanding of measurement and geometric concepts. (I, D, E, A) (cont.)

1. Analyze characteristics and properties of 2- and 3-dimensional geometric shapes and develop mathematical arguments about them.
 - o. Find an equation of a parabola, ellipse, or hyperbola given certain information about the conic section. (I, D, E)**
 - p. Identify a conic by its equation. (I, D, E)**
2. Apply appropriate techniques, tools, and formulas to determine measurements.
 - a. Use distance, midpoint, and slope formulas to solve problems. (A)
 - b. Test an equation for symmetry with respect to the x-axis, y-axis, and origin. (I, D, E, A)**
 - c. Write the standard form of the equation of a circle and graph the circle. (D, E, A)**
 - d. Translate between standard and general forms of a circle. (I, D, E, A)**
 - e. Graph functions using translations, scale changes, or reflections. (D, E, A)**
 - f. Solve triangles using trig ratios and Law of Cos/ Law of Sine. (D, E, A)**
 - g. Find areas of triangles. (D, E, A)**
 - h. Use rotation formulas to transform second degree equations so that no xy term is present. (I, D)**

V. The learner will develop an understanding of patterns, algebraic reasoning and logic. (I, D, E, A)

1. Understand patterns, relations and functions.
 - a. Recognize and use the standard forms for functions. (I, D, E)**
 - b. Apply properties of and graph functions (linear, quadratic, polynomial, rational, exponential, logarithmic, trigonometric, absolute value, step, and piece-wise. (I, D, E)**
 - c. Determine the transformational effects of an equation and its graph from its parent function. (D, E, A)**
2. Represent and analyze mathematical situations and structures using algebraic symbols.
 - a. Evaluate functions written in function notation. (I, D, E, A)**
 - b. Apply properties to solve equations involving quadratic, polynomial, radical, absolute, rational, exponential, logarithmic, or trigonometric expressions algebraically. (D, E, A)**
 - c. Solve simple and compound inequalities algebraically. (D, E, A)**
 - d. Apply the remainder and factor theorems for rational functions. (I, D, E)**
 - e. Solve systems of equations algebraically, with matrices, with augmented matrices in echelon form, and with Cramer's Rule. (I, D, E, A)**
 - f. Solve systems of inequalities algebraically and graphically. (I, D, E, A)**
 - g. Complete the square to change standard form of a quadratic equation to vertex form. (I, D)
 - h. Determine the equation, graph and characteristics of quadratic relations. (I, D, E)**

BILLINGS PUBLIC SCHOOLS
MATHEMATICS
HONORS ALGEBRA 3
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2. Represent and analyze mathematical situations and structures using algebraic symbols.
(cont.)

- i. Perform partial fraction decomposition. (I, D)
- j. Prove statements about natural numbers using mathematical induction. (I, D)
- k. Analyze motion in two dimensions using parametric equations using tables, equations, graphs, and circular trigonometric formulas. (I,D)
- 3. **Graph and interpret linear programming problems.** (D, E, A)
 - m. Analyze linear, quadratic, polynomial, rational, logarithmic, exponential, and trigonometric functions and their graphs.** (I, D, E, A)
 - n. Analyze conic sections and apply translation properties.** (I, D, E)
 - o. Find intercepts.** (I, D, E, A)
 - p. Find the equation of a line given two of its characteristics (points, slope, intercepts) and graph it. (A)
 - q. Find equations for parallel or perpendicular lines. (A)
 - r. Translate verbal descriptions into mathematical equations to solve problems.** (D, E)
 - s. Determine whether a relation is a function by table, ordered pairs, or graph. (A)
 - t. Identify the domain of a function from an equation or a graph.** (D, E, A)
 - u. Identify the range of a function by graph.** (D, E, A)
 - v. Find the average rate of change of a function. (I, D)
 - w. Determine where a function is increasing, decreasing, and constant answered in interval notation.** (I, D, E)
 - x. Identify local and absolute extreme.** (D, E, A)
 - y. Recognize and graph families of functions.** (D, E, A)
 - z. Determine even and odd functions by graph or equation.** (I, D, E, A)
 - aa. Form the sum, difference, product, quotient, and composite of two functions.** (I, D, E)
 - bb. Recognize patterns in linear, quadratic, power, or exponential functions. (I, D)
 - cc. Divide polynomials by long division and synthetic division.** (D, E, A)
 - dd. Solve polynomials for complex roots.** (D, E, A)
 - ee. Find an inverse of a function.** (D, E, A)
 - ff. Change between exponential and logarithmic forms.** (E, A)
 - gg. Use properties of logarithms to rewrite expressions.** (I, D, E, A)
 - hh. Establish trigonometric identities.** (I, D, E)
 - ii. Use trigonometric identities to find exact values and establish new identities.** (I, D, E, A)
 - jj. Find products and quotients of complex numbers in polar form. (I, D)
 - kk. Find powers and roots of complex numbers using DeMoivre's Theorem. (I, D)

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MATHEMATICS
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VI. The learner will develop an understanding of statistics, probability, and data analysis. (I, D, E, A)

1. The learner will understand and apply basic concepts of statistics.
 - a. Create scatter plots and interpret trends in the data. (E, A)**
 - b. Calculate numerical measures of central tendency (mean, median, mode). (A)
 - c. Calculate numerical measures of variability (range, variance, standard deviation). (I, D)
 - d. Use statistics to analyze data sets. (I, D)
 - e. Draw, interpret, and analyze stem-and-leaf plots. (I, D)
 - f. Draw, interpret, and analyze box-and-whisker plots. (I, D)
 - g. Use interquartile range to identify outliers. (I, D)
 - h. Given a set of data, find equations of “good”, “better”, and “best” fit. (I, D, E, A)**
 - i. Find and interpret the correlation coefficient of a linear relation. (I, D, E, A)**

VI. The learner will develop an understanding of technological tools. (I,D,E,A)

1. The learner will understand and apply basic concepts of technological tools.
 - a. Use graphing technology to graph functions. (D, E, A)**
 - b. Use graphing technology to perform matrix operations and solve matrix equations. (I, D, E, A)**
 - c. Determine the appropriate window on a graphing calculator for a given relation. (A)
 - d. Use appropriate technology to evaluate measures involving trigonometric ratios. (D, E, A)**
 - e. Use technology to analyze and model data. (I, D, E, A)
 - f. Use technology to solve equations graphically. (I, D, E)**
 - g. Understand appropriate use of and limitations of technology. (I, D)
 - h. Calculate logarithms including change of base. (I, D, E, A)**