

BILLINGS PUBLIC SCHOOLS
MATHEMATICS
PRE-CALCULUS
Learner 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 develop an understanding of number systems by relating, counting, grouping and place value concepts.

- a. Apply the laws of exponents and logarithms to simplify, evaluate expressions and to solve equations. (E, A)**
- b. Identify and apply properties for complex number systems. (E, A)**
- c. Recognize the limiting behavior of a basic algebraic expression. (E, A)**
- d. Use integer and rational exponents/roots. (E, A)**
- e. Use irrational and complex numbers. (E, A)**

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

2. The learner will compute fluently and make reasonable estimates.

- a. Use the properties of radicals to solve equations. (E, A)**
- b. Add, subtract, multiply, divide, simplify, and solve rational expressions. (E, A)**
- c. Apply long division and synthetic substitution/division to simplify rational expressions. (E, A)**
- d. Convert equations between exponential and logarithmic forms. (E, A)**
- e. Evaluate common and natural logarithms. (E, A)**
- f. Apply the laws of logarithms. (E, A)**
- g. Memorize and apply exact values for sine, cosine, and tangent for the unit circle. (E, A)**
- h. Find the number and value of real and complex roots from an equation and a graph. (E, A)**
- i. Identify characteristics from a graph or an equation (including end behaviors, asymptotes, zeros, and symmetries). (E, A)**

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

3. Analyze characteristics and properties of 2- and 3-dimensional geometric shapes and develop mathematical arguments about them.

- a. Define, graph, and determine values of the circular trigonometric functions. (E, A)**
- b. Convert between degree and radian measure. (A)**
- c. State the properties of the trigonometric functions and their graphs (including domain, range, amplitude, frequency and period). (E, A)**
- d. Solve triangles using trig ratios and law of cosine and sine. (A)**
- e. Recognize symmetrical properties of trigonometric functions when graphed. (D, E, A)**

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

3. Analyze characteristics and properties of 2- and 3-dimensional geometric shapes and develop mathematical arguments about them. (cont.)

f. Identify and apply transformations to trig functions. (D, E, A)

g. Identify and apply basic trig identities and theorems to solve equations.
(D, E, A)

h. Identify reciprocal trigonometric functions. (I, D, E)

i. Convert between polar and rectangular coordinates. (I, D, E)

j. Graph polar coordinates. (I, D, E)

k. Evaluate powers and roots of complex numbers using polar coordinates. (I, D)

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

4. Understand patterns, relations and functions.

a. Apply properties of and graph functions. (E, A)

5. Represent and analyze mathematical situations and structures using algebraic symbols.

a. Solve all types of compound interest problems. (E, A)

b. Fit the proper function models to data. (E, A)

c. Determine the composite of two functions. (E, A)

d. Determine and graph the inverse of a function. (E, A)

e. Apply properties to factor and solve polynomials. (E, A)

f. Apply the remainder and factor theorems for rational functions. (E, A)

g. Solve and graph exponential and logarithmic functions. (E, A)

h. Add, subtract multiply, and divide complex numbers. (E, A)

i. Find and use both the explicit and recursive formula for given sequences and series. (E, A)

j. Determine the transformational effects of an equation and its graph from a given function. (E, A)

k. Utilize Pascal's Triangle and the binomial theorem to expand polynomials.
(E, A)

l. Solve systems of equations. (D, E, A)

5. Represent and analyze mathematical situations and structures using algebraic symbols. (cont.)

m. Analyze function limits, ending behavior, and discontinuities. (D, E, A)

n. Prove and apply Trigonometric Identities. (I, D, E, A)

o. Apply the definition of derivative. (I, D, E)

p. Apply the properties of definite integrals. (I, D, E)

q. Demonstrate proofs using Mathematical Induction. (I, D, E)

r. Recognize and use parametric equations. (I, D, E, A)

s. Graph and solve absolute value equations and inequalities. (I, D, E, A)

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

- 6. The learner will understand and apply basic concepts of probability.**
- a. Determine probabilities using counting procedures, tables, trees, area models, and formulas for permutations and combinations. (E, A)**
 - b. Explain and use the concepts of independent and dependent events and their relationship to compound events and conditional probability. (E, A)**
 - c. Determine experimental and theoretical probabilities. (E, A)**
 - d. Use a physical or mathematical model to estimate the probability of real-world events. (E, A)**
 - e. Use and interpret the normal and binomial distributions and binomial probability theorem appropriately. (E, A)**
 - f. Collect, organize, analyze, and interpret statistical data. (E, A)**

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

- 7. The learner will understand and apply basic concepts of technological tools.**
- a. Use graphing technology to graph function. (E, A)**
 - b. Determine the appropriate window on a graphing calculator for a given relation. (E, A)**
 - c. Use graphing technology to plot raw data and calculate and display regressions. (E, A)**
 - d. Use appropriate technology to evaluate measures involving trigonometric ratios. (E, A)**
 - e. Use technology to analyze and model data. (E, A)**
 - f. Calculate logarithms including change of base. (E, A)**
 - g. Use technology to graph and solve n(th) degree equations and systems of equations. (E, A)**