

BILLINGS PUBLIC SCHOOLS
MATHEMATICS
HONORS GEOMETRY
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 proportions and percents to real-world problems and develop an understanding of percent change. (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. Approximate square roots and memorize the perfect squares up to and including 625. (A)

b. Solve problems involving rational numbers. (D, E, A)

c. Develop a deeper understanding of solutions that are not rational, such as simplified radicals, π , and trig functions. (D, E, A)

d. Determine whether it is appropriate to express an answer in exact or approximate form for a given situation. (I, D, E, A)

3. The learner will understand meanings of operations and how they relate to one another.

a. Identify and apply associative, commutative, distributive, identity, inverse and closure properties. (A)

III. The learner will develop an understanding of measurement and geometric concepts.

(I, D, E, A)

4. Understand measurable attributes of objects and the units, systems and processes of measurement.

a. Perform dimensional analysis. (D, E, A)

b. Analyze precision accuracy and approximate error in measuring length area and volume, and choose appropriate unit. (I, D, E, A)

5. Apply appropriate techniques, tools and formulas to determine measurements.

a. Identify, recognize, determine and solve problems using the measures of angle pairs associated with parallel, intersecting and perpendicular lines.

(I, D, E, A)

b. Develop and use formulas to determine the perimeter and area of planar figures. (I, D, E, A)

c. Estimate perimeter, area, and volume of irregular regions. (E, A)

d. Analyze changes in area and volume in relation to changes in linear measures of plane and space figures. (D, E, A)

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- 5. Apply appropriate techniques, tools and formulas to determine measurement. (cont.)**
- e. Develop and use formula to determine the volume and surface area of space figures including composite figures. (D, E, A)**
 - f. Solve problems involving the Pythagorean theorem. (E, A)**
 - g. Recognize and identify the ratio of sides in 45-45-90 and 30-60-90 triangles. (I, D, E, A)**
 - h. Use a compass, straightedge, and technology to perform basic constructions and measurements. (I, D, E,)**
- 6. Analyze characteristics and properties of 2- and 3-dimensional geometric shapes and develop.**
- a. Reason about 3-D geometric figures and the relationships among them based on their definitions and properties, with emphasis on spheres, prisms, pyramids, cylinders and cones. (I, D, E, A)**
 - b. Reason about 2-D geometric figures and the relationships among them based on their definitions and properties with emphasis on special triangles, special quadrilaterals, regular polygons, and circles. (I, D, E, A)**
 - c. Justify similarity of 2-D and 3-D geometric figures based on theorems, postulates and properties. (I, D, E, A)**
 - d. Determine and justify congruence of geometric figures using deductive reasoning. (I, D, E, A)**
 - e. Use the sine, cosine, and tangent functions to find lengths and angle measures. (I, D, E, A)**
 - f. Find counterexamples to disprove false geometric statements. (E, A)**
 - g. Solve problems involving similarity and congruence in 2-D and 3-D figures using theorems, postulates and properties. (I, D, E, A)**
 - h. Solve triangles using Laws of Cosine and Law of Sine. (I, D)**
- 7. Use visualization, spatial reasoning and geometric modeling to solve problems.**
- a. Determine relationship of points, lines, parts of lines and planes in space. (I, D, E, A)**
 - b. Visualize and draw 3-D objects from different perspectives and analyze their cross-sections. (I, D, E, A)**
 - c. Explore Non-Euclidean Geometry. (I)**
- 8. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.**
- a. Determine lengths of segments using the distance formula, finding midpoints, and determining whether lines are parallel or perpendicular using slopes. (A)**
 - b. Use coordinate geometry to classify geometric figures by finding slope and length of side. (I, D, E, A)**

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9. Apply transformations and use symmetry to analyze mathematical situations.
- a. Determine and identify the image of a figure using transformations (rotation, reflection, translation and dilation).** (I, D, E, A)
 - b. Use multiple representations including sketches, vectors, matrices, and coordinates to describe transformations.** (I, D, E, A)
 - c. Apply the properties of transformations with regard to similarity, congruence and determining lines and points of symmetry. (A)

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

10. Understand patterns, relations and functions.

- a. Draw conclusions and make predictions based on mathematical patterns and relationships. (A)
- b. Determine solutions to quadratic functions through factoring, square roots, and graphs. (D)

11. Understanding reasoning and logic statements.

- a. **Identify the hypothesis and conclusion of conditional statements.** (I, D, E, A)
- b. **Identify and determine the converse, inverse and contrapositive of a conditional statement.** (I, D, E, A)
- c. **Determine the validity of conditional statements.** (I, D, E, A)
- d. **Apply various proof techniques including algebraic, two-column, paragraph, flow and coordinate proofs.** (I, D, E, A)

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

12. The learner will understand and apply basic concepts of probability.

- a. **Apply a geometric model to determine experimental and theoretical probability.** (I, D, E, A)
- b. Model with linear functions (i.e. $C=2\pi r$). (A)

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

13. The learner will understand and apply basic concepts of technological tools.

- a. **Use appropriate technology to explore and discover geometric relationships and gain insights into real-world applications and career opportunities.** (I, D, E, A)
- b. Compute using matrices. (I, D)
- c. Evaluate trigonometric values. (I, D)