

BILLINGS PUBLIC SCHOOLS
MATHEMATICS
9TH GRADE PRE-ALGEBRA
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

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

Objective 1.1: The learner will develop an understanding of number system by relating, counting, grouping and place value concepts.

- 1. Apply proportions and percents to real-world problems and develop an understanding of percent change. (D, *E*, A)**
- 2. Solve problems involving multiples, factors, primes, and divisibility. (*E*, A)**
- 3. Interpret integral exponents and square roots. (D, *E*, A)**
- 4. Express numbers in scientific notation with positive and negative exponents. (I, D, *E*, A)**
- 5. Order and compare rational numbers and square roots. (I, D, *E*, A)**
- 6. Demonstrate the meaning of absolute value. (D, A)**
- 7. Introduce the concept of irrational numbers. (I)**

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

Objective 2.1: The learner will compute fluently and make reasonable estimates.

- 8. Approximate square roots and memorize the perfect squares up to and including 400. (I, D, *E*)**
- 9. Generate equivalent fractions, decimals, and percents. (D, *E*, A)**
- 10. Apply order of operations and laws of exponents. (I, D, *E*, A)**
- 11. Apply appropriate estimation strategies and recognize when estimation, approximation, or exact answers are appropriate and recognize errors. (D, A)**
- 12. Use mental math and number sense to compute with rational numbers. (D, *E*, A)**
- 13. Add, subtract, multiply and divide with rational numbers, including negative rational numbers, and demonstrate an understanding of how mathematical operations effect rational numbers and square roots. (D, *E*, A)**
- 14. Utilize scientific notation to simplify calculations. (I, D)**

Objective 2.2: The learner will understand meanings of operations and how they relate to one another.

- 15. Identify and apply the associative, commutative, distributive, identity and inverse Properties. (*E*, A)**

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

Objective 3.1: Understand measurable attributes of objects and the units, systems and processes of measurement.

- 16. Convert within the conventional and metric systems, this should also include conversions among measurements of the area and volume.** (I, *E*, A)
- 17. Select the best measurement strategy and measure the dimensions and calculate the volume and surface area of a prism in metric and conventional units.** (D, *E*)
- 18. Estimate equivalent capacity measures between the customary and the metric Systems.** (*E*, A)

Objective 3.2: Apply appropriate techniques, tools and formulas to determine measurement.

- 19. Apply and manipulate formulas to determine the perimeters and areas of triangles, parallelograms, circles, regular polygons, trapezoids, and irregular shapes** (I, D, *E*)
- 20. Estimating perimeter, area, and volume of irregular regions.** (D, *E*)
- 21. Calculate and analyze changes in volume in relation to changes in linear measures of figures.** (I, D, *E*)
- 22. Develop and use formulas to find the volumes and surface area of prisms, cylinders, cones, and pyramids.** (D, *E*, A)
- 23. Solve problems involving the Pythagorean theorem.** (I, D, *E*, A)

Objective 3.3: Analyze characteristics and properties 2- and 3-dimensional geometric shapes and develop mathematical arguments about them.

- 24. Reason about geometric figures and the relationships among them based on their definitions and properties.** (D, *E*)
- 25. Determine similarity of geometric figures based on congruence of angles and proportionality of sides and solve problems involving geometric similarity.** (A)
- 26. Provide justification or counterexample that a geometric property is true or false.** (I, D, *E*)

Objective 3.4: Use visualization, spatial reasoning and geometric modeling to solve problems.

- 27. Draw a net (pattern) for 3-dimensional figures such as a prism, pyramid, cones, & Cylinders.** (I, D, *E*)
- 28. Identify views (e.g. Front, top, side) of a 3-dimensional structure.** (D, *E*)
- 29. Solve problems using simple networks (e.g. Konigsberg Bridge Problem).** (I, D, *E*)

Objective 3.5: Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

- 30. Connect properties of geometric figures and coordinate geometry (e.g. finding lengths of sides of polygons or coordinates of the midpoints of the sides).** (I, D, *E*)

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

Objective 3.6: Apply transformations and use symmetry to analyze mathematical situations.

- 31. Use and describe transformations(s) required to transform a figure into its image.**
(I, D, *E*)
- 32. Recognize the connections between transformation and congruence, line symmetry, and rotational symmetry.** (I, D, *E*)

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

Objective 4.1: Understand patterns, relations and functions.

- 33. Define a function as a relation in which for each input there is exactly one output.**
(I, D, *E*)
- 34. Classify graphs and equations as linear or nonlinear.** (I, D, *E*)

Objective 4.2: Represent and analyze mathematical situations and structures using algebraic symbols.

- 35. Represent linear real-life situations with algebraic expressions, equations, or simple quadratics.** (I, D, *E*)
- 36. Simplify and solve equations using mathematical properties.** (D, *E*)
- 37. Determine solutions to linear equations and systems of linear equations using graphing.** (D, *E*, A)
- 38. Identify slope and y-intercepts in a linear equation and graph.** (I, D, *E*)
- 39. Write equations to represent a given linear graph in slope-intercept form.**
(I, D, *E*)
- 40. Recognize, write, and evaluate, for given values, equivalent expressions.** (D, *E*)
- 41. Represent, analyze, and generalize patterns relating to linear functions with tables, graphs, and symbolic rules.** (I, D, *E*)
- 42. Determine in a relationship (function) how a change in one variable affects the other variable.** (I, D, *E*)
- 43. Draw conclusions and make predictions based on patterns and relationships, both mathematical and from real life.** (I, D, *E*)
- 44. Solve applied problems involving simple interest and percent change** (I, D)
- 45. Graph solutions to inequalities on a number line.** (D)
- 46. Match a situation involving a variable rate of change to a graphic representation that best represents that situation.** (I, D, *E*)

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Objective 4.3 Understand reasoning and logic statements.

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

Objective 5.1: The learner will understand and apply basic concepts of probability.

- 47. Find the experimental (empirical) and theoretical probability of an event, given a set of data.** (D, *E*, A)
- 48. Determine all possible outcomes for an event (sample space) using the fundamental counting principle when appropriate.** (D, *E*, A)
- 49. Make predictions based on probability.** (A)
- 50. Apply theoretical probability that involves independent events, dependent events, and events with equally likely outcomes.** (D, *E*, A)

Objective 5.2: Select and use appropriate statistical methods to analyze data.

- 51. Compute, interpret, and make judgments based on mean, median, mode, range, quartiles, and outliers regarding the shape and spread of the data** (*E*, A)
- 52. Determine how a change in one or more data points affects the mean and median of a data set** (I, D, *E*, A)

Objective 5.3: Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them.

- 53. Collect, compare, and determine appropriate display for data.** (*E*, A)
- 54. Recognize how different representations of the same data sets can affect interpretations.** (I, D, *E*, A)

Objective 5.4: Develop and evaluate inferences and predictions based on data.

- 55. Analyze, construct, and make predictions from a circle graph, histograms, box-and-whisker plot, and scatterplots.** (*E*, A)
- 56. Draw a line of best fit on a scatterplot and use it to make predictions.** (I, D, *E*, A)

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

Objective 6.1: The learner will understand and apply basic concepts of technological tools.

- 57. Use graphing technology to analyze functions and statistics.** (I, D)
- 58. Use a spreadsheet to organize numeric and algebraic data.** (I, D, A)
- 59. Use appropriate technology to explore and discover geometric relationships (e.g. a geometry drawing utility and/or web-based math applets).** (D)