

**BILLINGS PUBLIC SCHOOLS
MATHEMATICS
MIDDLE SCHOOL ALGEBRA
Learning Objectives**

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 students 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 OBJECTIVES

- 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 understand meaning of operations and how they relate to one another.**
- 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 number sense and mathematical properties (I, D, E, A)**

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I. The learner will develop an understanding of number sense and mathematical properties.

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

- 1. Apply proportions and percents to real-world problems and develop an understanding of percent change (*E, A*)**
- 2. Interpret integral exponents and square roots (*E, A*)**
- 3. Translating between standard and scientific notation with positive and negative exponents and utilize to simplify calculations (*D, E, A*)**
- 4. Order and compare real numbers (*I, D, E, A*)**
- 5. Determining numbers belonging to various subsets of the real number system and recognizing the relationships among the subsets, e.g., whole numbers, rational numbers, real numbers (*I, D, E, A*)**

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.

- 6. Approximate square roots and memorize the perfect squares up to and including 625 (*I, D, E*)**
- 7. Recognize and generate forms of real numbers (*D, E, A*)**
- 8. Apply order of operations and laws of exponents (*I, D, E, A*)**
- 9. Apply appropriate estimation strategies and recognize when estimation, approximation, or exact answers are appropriate and recognize errors (*D, E, A*)**
- 10. Use mental math and numbers sense to compute with real numbers (*D, E, A*)**
- 11. Add, subtract, multiply and divide with real numbers, and demonstrate an understanding of how mathematical operations effect real numbers including operations involving exponents and roots (*D, E, A*)**

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

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

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.

- 13. Convert among derived units in the customary and metric systems, eg. Converting feet per minute to miles per hour (*D, E, A*)**

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Object 3.2: Apply appropriate techniques, tools and formulas to determine measurements.

- 14. Apply and manipulate formulas to determine the perimeters and areas of triangles, parallelograms, circles, regular polygons, trapezoids, and irregular shapes** (emphasize when this arises in lessons) (*E, A*)
- 15. Estimating perimeter, area, and volume of irregular regions** (emphasize when this arises in lessons) (*E, A*)
- 16. Calculate and analyze changes in volume in relation to changes in linear measures of figures** (emphasize when this arises in lessons) (*E, A*)
- 17. Develop and use formulas to find the volumes and surface area of prisms, cylinders, cones, and pyramids** (emphasize when this arises in lessons) (*E, A*)
- 18. Solve problems involving the Pythagorean theorem** (*E, A*)
- 19. Solve problems involving rates and derived measurements** (*I, D, E, A*)

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

- 20. Solve problems involving geometric similarity** (*E, A*)

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

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

- 21. Determine lengths of segments using the distance formula, find midpoints, and determine whether lines are parallel or perpendicular using slopes** (*I, D, E, A*)

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

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.

- 22. Recognize functions represented by verbal descriptions, equations, tables, or graphs as linear or non-linear** (*I, D, E, A*)
- 23. Draw conclusions and make predictions based on mathematical patterns and relationships** (*I, D, E, A*)

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

- 24. Represent real life situations with algebraic expressions, equations, and inequalities** (*D, E, A*)

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- 25. Determine solutions to linear equations and systems of linear equations in two variables algebraically and graphically (I, D, E, A)**
- 26. Determine solutions to linear in two variables graphically (I, D, E)**
- 27. Determine the slope and intercepts of a linear equation represented by a graph or an equation and interpret the meaning of those values relative to the context of the problem (I, D, E, A)**
- 28. Graph linear equations and linear inequalities (I, D, E, A)**
- 29. Write equations to represent a given linear graph in slope-intercept form and standard form using two points and using a point and slope (I, D, E, A)**
- 30. Recognize, write, and evaluate, for given values, equivalent expressions (D, E, A)**
- 31. Represent, analyze and generalize patterns relating to linear functions through multiple representations (e.g. words, charts, algebraic expressions or equations and graphical representations) (I, D, E, A)**
- 32. Determine in a relationship (function) how a change in one variable affects the other variable (D, E, A)**
- 33. Add, subtract, multiply and factor polynomials (I, D, E, A)**
- 34. Determine solutions to quadratic functions through factoring, quadratic formula, square roots and graphically (I, D)**
- 35. Determine the domain and range of a function (D, A)**

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.

- 36. Find the experimental (empirical) and theoretical probability of an event, given a set of data (E, A)**
- 37. Determine all possible outcomes for an event (sample space) using a tree diagram, an organized list, or when appropriate, the fundamental counting principle (E, A)**
- 38. Make predictions based on probability (E, A)**
- 39. Apply theoretical probability that involves independent events, dependent events, and events with equally likely outcomes (E, A)**

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

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

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

- 42. Select appropriate graphic representations for data sets (E, A)**

43. Recognize how different representations for the same data sets can affect interpretations (D, *E*, A)

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

44. Analyze, construct, and make predictions from a circle graph, histograms, box-and-whisker plot, and scatterplots (*E*, A)
45. Analyze, construct and make predictions based on data given in charts and graphs (*E*, A)
46. Determine 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 tool (I, D, *E*, A)

47. Use technology to graph linear and quadratic functions with an appropriate window (I, D)