

Algebra I

Symbolic reasoning and calculations with symbols are central in algebra. Through the study of algebra, a student develops an understanding of the symbolic language of mathematics and the sciences. In addition, algebraic skills and concepts are developed and used in a wide variety of problem-solving situations.

- 1.0 Students identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers, including closure properties for the four basic arithmetic operations where applicable:
 - 1.1 Students use properties of numbers to demonstrate whether assertions are true or false.

- 2.0 Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.

- 3.0 Students solve equations and inequalities involving absolute values.

- 4.0 Students simplify expressions before solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$.

- 5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.

- 6.0 Students graph a linear equation and compute the x - and y -intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y < 4$).

- 7.0 Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations by using the point-slope formula.

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- 8.0** Students understand the concepts of parallel lines and perpendicular lines and how those slopes are related. Students are able to find the equation of a line perpendicular to a given line that passes through a given point.
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- 9.0** Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets.
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- 10.0** Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.
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- 11.0** Students apply basic factoring techniques to second- and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials.
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- 12.0** Students simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms.
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- 13.0** Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.
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- 14.0** Students solve a quadratic equation by factoring or completing the square.
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- 15.0** Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.
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- 16.0** Students understand the concepts of a relation and a function, determine whether a given relation defines a function, and give pertinent information about given relations and functions.

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- 17.0** Students determine the domain of independent variables and the range of dependent variables defined by a graph, a set of ordered pairs, or a symbolic expression.
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- 18.0** Students determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion.
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- 19.0** Students know the quadratic formula and are familiar with its proof by completing the square.
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- 20.0** Students use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations.
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- 21.0** Students graph quadratic functions and know that their roots are the x -intercepts.
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- 22.0** Students use the quadratic formula or factoring techniques or both to determine whether the graph of a quadratic function will intersect the x -axis in zero, one, or two points.
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- 23.0** Students apply quadratic equations to physical problems, such as the motion of an object under the force of gravity.
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- 24.0** Students use and know simple aspects of a logical argument:
- 24.1 Students explain the difference between inductive and deductive reasoning and identify and provide examples of each.
 - 24.2 Students identify the hypothesis and conclusion in logical deduction.
 - 24.3 Students use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion.

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- 25.0** Students use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove or disprove statements:
- 25.1 Students use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions.
 - 25.2 Students judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step.
 - 25.3 Given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities, students determine whether the statement is true sometimes, always, or never.