

Math

ALGEBRA I

STANDARD 1

The student understands and applies the concepts and procedures of number sense and numeration.

To meet this standard, the student will:

Benchmark A1.1.1: Solve multi-step problems requiring numerical answers, using a variety of strategies and tools

Indicators:

- A1.1.1.1 Demonstrate facility with critical numerical skills, including mental mathematics, estimation, proper order of operations with integers (as necessary for working with equations and analytic geometry)
- A1.1.1.2 Demonstrate facility with critical numerical skills, including mental mathematics, estimation, proper order of operations with rational numbers (as necessary in analytic geometry, measurement, and equation solving)
- A1.1.1.3 Solve multi-step problems involving applications of percent, ratio, and rate as they arise throughout the course
- A1.1.1.4 Use a scientific calculator effectively for applications that arise throughout the course
- A1.1.1.5 Judge the reasonableness of answers to problems by considering likely results within the situation described in the problem
- A1.1.1.6 Judge the reasonableness of answers produced by a calculator, a computer, or pencil and paper, using mental mathematics and estimation

Benchmark A1.1.2: Demonstrate understanding of the three basic exponent rules and apply them to simplify expressions

Indicators:

- A1.1.2.1 Evaluate numerical expressions involving natural-number exponents with rational-number bases
- A1.1.2.2 Substitute into and evaluate algebraic expressions involving exponents, to support other topics of the course (e.g., measurement, analytic geometry)
- A1.1.2.3 Determine the meaning of negative exponents and of zero as an exponent from activities involving graphing, using technology, and from activities involving patterning
- A1.1.2.4 Represent and calculate with very large and very small numbers, using scientific notation
- A1.1.2.5 Enter and interpret exponential notation on a scientific calculator, as necessary in calculations involving very large and very small numbers
- A1.1.2.6 Determine, from the examination of patterns, the exponent rules for multiplying and dividing monomials and the exponent rule for the power of a power, and apply these rules in expressions involving one and two variables and both integers and fractions
- A1.1.2.7 Apply exponent rules to growth and decay problems

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STANDARD 2

The student understands and applies the concepts and procedures of algebra and patterns.

To meet this standard, the student will:

Benchmark A1.2.1: Translate verbal to mathematical expressions (and visa versa) and apply to real world problems

Indicators:

- A1.2.1.1 Interpret verbal cues into mathematical expressions in order to solve algebraic equations, especially first-degree polynomial equations
- A1.2.1.2 Solve word problems using systems of equations
- A1.2.1.3 Identify and make predictions with patterns in number sequences and translate them into algebraic expressions
- A1.2.1.4 Identify and use the properties of algebra
- A1.2.1.5 Understand basic transformations of absolute value

Benchmark A1.2.2: Operate with polynomials and manipulate first-degree polynomial expressions to solve first-degree equations

Indicators:

- A1.2.2.1 Add and subtract polynomials
- A1.2.2.2 Classify polynomials by degree and number of terms
- A1.2.2.3 Multiply a polynomial by a monomial, and factor a polynomial by removing a common factor
- A1.2.2.4 Expand and simplify polynomial expressions involving one variable or several variables, like binomials and trinomials

Benchmark A1.2.3: Solve problems, using the strategy of algebraic modeling

Indicators:

- A1.2.3.1 Solve first-degree equations and inequalities, including equations with fractional coefficients, using an algebraic method
- A1.2.3.2 Solve absolute value equations and inequalities
- A1.2.3.3 Rearrange formulas involving variables in the first degree, with and without substitution, as they arise in topics throughout the course (e.g., analytic geometry, measurement)
- A1.2.3.4 Solve proportions in a variety of situations
- A1.2.3.5 Solve problems involving percents
- A1.2.3.6 Solve direct variation problems
- A1.2.3.7 Solve systems of equations and inequalities using a variety of techniques (e.g., graphing, substitution, elimination)

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- A1.2.3.8 Solve 2nd degree equations by factoring and the quadratic formula
- A1.2.3.9 Evaluate the discriminant for the number of solutions to a function
- A1.2.3.10 Use algebraic modeling as one of several problem-solving strategies in various topics of the course (e.g., relations, measurement, direct and partial variation, the Pythagorean theorem, percent)
- A1.2.3.11 Compare algebraic modeling with other strategies used for solving the same problem
- A1.2.3.12 Solve multi-step problems involving applications of percent, ratio, and rate as they arise throughout the course

Benchmark A1.2.4: Determine, through investigation, the relationships between the form of an equation and the shape of its graph with respect to linearity and non-linearity

Indicators:

- A1.2.4.1 Demonstrate an understanding that straight lines represent linear relations and curves represent non-linear relation
- A1.2.4.2 Identify properties and relationships of data in tables, graphs, and equations (distinguish between relations and functions, dependent and independent variables, domain and range)
- A1.2.4.3 Identify, by calculating finite differences in its table of values, whether a relation is linear or non-linear
- A1.2.4.4 Compare the graphs and formulas of linear and non-linear relations
- A1.2.4.5 Compare the graphs and forms of inequalities
- A1.2.4.6 Determine values of a linear relation by using the formula of the relation
- A1.2.4.7 Find the equation of a line based on 2 points
- A1.2.4.8 Identify the equation of a line in any of the forms $y=mx + b$, $Ax + By + C=0$, $y - y_1 = m(x - x_1)$, $x=a$, $y=b$, $y-y_1=m(x-x_1)$
- A1.2.4.9 Rearrange the equation of a line from the form $y=mx + b$ to the form $Ax + By + C=0$, and vice versa
- A1.2.4.10 Understand and demonstrate the changes in the graph of a parent function based on changes in its equation

Benchmark A1.2.5: Determine, through investigation, the properties of the slope and y-intercept of a linear relation

Indicators:

- A1.2.5.1 Determine the slope of a line ($m = \text{slope}$) segment, using various formulas:

$$(m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-A}{B})$$
- A1.2.5.2 Identify the slope of a linear relation as representing a constant rate of change
- A1.2.5.3 Calculate the finite differences in the table of values of a linear relation and relate the result to the slope of the relation
- A1.2.5.4 Identify the geometric significance of m and b in the equation $y=mx + b$ through investigation
- A1.2.5.5 Identify the properties of the slopes of line segments (e.g., direction, positive or negative rate of change, steepness, parallelism, perpendicularity) through investigations facilitated by graphing technology, where appropriate

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Benchmark A1.2.6: Solve problems, using the properties of linear relations

Indicators:

- A1.2.6.1 Plot points on the xy -plane and use the terminology and notation of the xy -plane correctly
- A1.2.6.2 Graph lines by hand, using a variety of techniques (e.g., making a table of values, using intercepts, using the slope and y -intercept)
- A1.2.6.3 Graph lines, using graphing calculators or graphing software
- A1.2.6.4 Determine the equation of a line, given information about the line (e.g., the slope and y -intercept, the slope and a point, two points, a line parallel to a given line and having the same x -intercept as another given line)
- A1.2.6.5 Calculate the midpoint of a line using the coordinates of the endpoints
- A1.2.6.6 Communicate solutions to multi-step problems in established mathematical form, with clear reasons given for the steps taken
- A1.2.6.7 Describe the meaning of the slope and y -intercept for a linear relation arising from a realistic situation, interpolate and extrapolate from the graph and the equation of the relation, and identify and explain any restrictions on the variables in the relation
- A1.2.6.8 Describe a situation that would be modeled by a given linear equation
- A1.2.6.9 Determine the point of intersection of two linear relations, by hand for simple examples, and using graphing calculators or graphing software for more complex examples; interpret the intersection point in the context of an application

Benchmark A1.2.7: Evaluate rational and radical functions

Indicators:

- A1.2.7.1 Add, subtract, multiply, divide and simplify rational expressions
- A1.2.7.2 Add, subtract, multiply, divide and simplify radical expressions
- A1.2.7.3 Evaluate radical expressions to roots other than two

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ALGEBRA I

STANDARD 3

The student *understands and applies the concepts and procedures of geometry.*

To meet this standard, the student will:

Benchmark A1.3.1: Formulate conjectures and generalizations about geometric relationships involving two-dimensional figures, through investigations facilitated by dynamic geometry software, where appropriate

Indicators:

- A1.3.1.1 Pose questions about geometric relationships, test them, and communicate the findings, using appropriate language and mathematical forms (e.g., written explanations, diagrams, formulas, tables)
- A1.3.1.2 Describe, extend, and express algebraically a wide variety of geometric patterns

Benchmark A1.3.2: Specify locations and describe spatial relationships using coordinate geometry

Indicator:

- A1.3.2.1 Use coordinate geometry to determine if a figure is a rectangle

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STANDARD 4

The student *understands and applies the concepts and procedures of measurement.*

To meet this standard, the student will

Benchmark A1.4.1: Determine the optimal values of various measurements through investigations facilitated, where appropriate, by the use of concrete materials, diagrams, and calculators or computer software

Indicator:

A1.4.1.1 Judge the reasonableness of answers to measurement problems by considering likely results within the situation described in the problem

Benchmark A1.4.2: Solve problems involving formulas from geometry

Indicator:

A1.4.2.1 Use formulas to solve simple problems, using the formulas from geometry, science, statistics, etc. (e.g., area and perimeter of figures, sides of a right triangle using the Pythagorean Theorem)

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STANDARD 5

The student understands and applies the concepts and procedures of data analysis and probability.

To meet this standard, the student will:

Benchmark A1.5.1: Determine relationships between two variables by collecting and analyzing data

Indicators:

- A1.5.1.1 Demonstrate an understanding of some principles of sampling and surveying and apply the principles in designing and carrying out experiments to investigate the relationships between variables
- A1.5.1.2 Interpret data from a variety of types of displays (e.g., histogram, stem-and-leaf, circle graph, line graph, frequency table, box-and-whisker plots)
- A1.5.1.3 Organize and analyze data, using appropriate techniques (e.g., making tables and graphs: line or curve of best fit)
- A1.5.1.4 Describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain the differences between the inferences and the hypotheses (like measures of center, variability, and range)
- A1.5.1.5 Communicate the findings of an experiment clearly and concisely, using appropriate mathematical forms (e.g., written explanations, formulas, charts, tables, graphs), and justify the conclusions reached
- A1.5.1.6 Solve and/or pose problems related to an experiment, using the findings of the experiment

Benchmark A1.5.2: Describe the connections between various representations of relations

Indicators:

- A1.5.2.1 Construct tables of values, graphs, and formulas to represent linear relations derived from descriptions of realistic situations (e.g., the cost of holding a banquet in a rented hall is \$25 per person plus \$975 for the hall)
- A1.5.2.2 Construct tables of values and scatter plots for linearly related data collected from experiments (e.g., the rebound height of a ball versus the height from which it was dropped) or from secondary sources (e.g., the number of calories in fast food versus the number of grams of fat)
- A1.5.2.3 Communicate solutions to problems in appropriate mathematical forms (e.g., written explanations, formulas, charts, tables, graphs) and justify the reasoning used in solving the problems

Benchmark A1.5.3: Apply the concepts and procedures from probability

Indicators:

- A1.5.3.1 Apply experimental and theoretical probability methods to simple events
- A1.5.3.2 Explain the properties of dependent and independent events

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