Elementary Algebra Overview

The academic standards for the elementary algebra core area establish the process skills and core content for Algebra 1, Mathematics for the Technologies 1, and Mathematics for the Technologies 2, which should provide students with the mathematics skills and conceptual understanding necessary for them to further their mathematical education or to pursue mathematics-related technical careers. These standards will be the basis for the development of the items on the state-required end-of-course examination for Algebra 1 and Mathematics for the Technologies 2.

The content of the elementary algebra standards encompasses the real number system; operations involving exponents, matrices, and algebraic expressions; relations and functions; writing and solving linear equations; graphs and characteristics of linear equations; and quadratic relationships and functions. Teachers, schools, and districts should use the elementary algebra standards to make decisions concerning the structure and content of Algebra 1, Mathematics for the Technologies 1, and Mathematics for the Technologies 2. Content in these three courses may go beyond the elementary algebra standards.

All courses based on the academic standards for elementary algebra must include instruction using the mathematics process standards, allowing students to engage in problem solving, decision making, critical thinking, and applied learning. Educators must determine the extent to which such courses or individual classes may go beyond these standards. Such decisions will involve choices regarding additional content, activities, and learning strategies and will depend on the objectives of the particular courses or individual classes.

In all courses based on the elementary algebra standards, hand-held graphing calculators are required for instruction and assessment. Students should learn to use a variety of ways to represent data, to use a variety of mathematical tools such as graph paper, and to use technologies such as graphing calculators to solve problems.

Note: The term *including* appears in parenthetical statements in the high school mathematics indicators to introduce a list of specifics that are intended to clarify and focus the teaching and learning of the particular concept. That is, within these parenthetical including statements are specified the components of the indicator that are critical for the particular core area with regard both to the state assessments and to the management of time in the classroom. While instruction must focus on the entire indicator, educators must be certain to cover the components specified in the parenthetical *including* statements.

Elementary Algebra

> The mathematical processes provide the framework for teaching, learning, and assessing in all high school mathematics core courses. Instructional programs should be built around these processes.

Standard EA-1: The student will understand and utilize the mathematical processes of problem solving, reasoning and proof, communication, connections, and representation.

Indicators

EA-1.1   Communicate a knowledge of algebraic relationships by using mathematical terminology appropriately.

EA-1.2   Connect algebra with other branches of mathematics.

EA-1.3   Apply algebraic methods to solve problems in real-world contexts.

EA-1.4   Judge the reasonableness of mathematical solutions.

EA-1.5   Demonstrate an understanding of algebraic relationships by using a variety of representations (including verbal, graphic, numerical, and symbolic).

EA-1.6   Understand how algebraic relationships can be represented in concrete models, pictorial models, and diagrams.

EA-1.7   Understand how to represent algebraic relationships by using tools such as handheld computing devices, spreadsheets, and computer algebra systems (CASs).

Elementary Algebra

Standard EA-2: The student will demonstrate through the mathematical processes an understanding of the real number system and operations involving exponents, matrices, and algebraic expressions.

Indicators

EA-2.1   Exemplify elements of the real number system (including integers, rational numbers, and irrational numbers).

EA-2.2   Apply the laws of exponents and roots to solve problems.

EA-2.3   Carry out a procedure to perform operations (including multiplication and division) with numbers written in scientific notation.

EA-2.4   Use dimensional analysis to convert units of measure within a system.

EA-2.5   Carry out a procedure using the properties of real numbers (including commutative, associative, and distributive) to simplify expressions.

EA-2.6   Carry out a procedure to evaluate an expression by substituting a value for the variable.

EA-2.7   Carry out a procedure (including addition, subtraction, multiplication, and division by a monomial) to simplify polynomial expressions.

EA-2.8   Carry out a procedure to factor binomials, trinomials, and polynomials by using various techniques (including the greatest common factor, the difference between two squares, and quadratic trinomials).

EA-2.9   Carry out a procedure to perform operations with matrices (including addition, subtraction, and scalar multiplication).

EA-2.10   Represent applied problems by using matrices.

Elementary Algebra

Standard EA-3: The student will demonstrate through the mathematical processes an understanding of relationships and functions.

Indicators

EA-3.1   Classify a relationship as being either a function or not a function when given data as a table, set of ordered pairs, or graph.

EA-3.2   Use function notation to represent functional relationships.

EA-3.3   Carry out a procedure to evaluate a function for a given element in the domain.

EA-3.4   Analyze the graph of a continuous function to determine the domain and range of the function.

EA-3.5   Carry out a procedure to graph parent functions
(including $y = x$, $y = x^2$, $y = \sqrt{x}$, $y = |x|$, and $y = \dfrac{1}{x}$).

EA-3.6   Classify a variation as either direct or inverse.

EA-3.7   Carry out a procedure to solve literal equations for a specified variable.

EA-3.8   Apply proportional reasoning to solve problems.

Elementary Algebra

Standard EA-4: The student will demonstrate through the mathematical processes an understanding of the procedures for writing and solving linear equations and inequalities.

Indicators

EA-4.1   Carry out a procedure to write an equation of a line with a given slope and a *y*-intercept.

EA-4.2   Carry out a procedure to write an equation of a line with a given slope passing through a given point.

EA-4.3   Carry out a procedure to write an equation of a line passing through two given points.

EA-4.4   Use a procedure to write an equation of a trend line from a given scatterplot.

EA-4.5   Analyze a scatterplot to make predictions.

EA-4.6   Represent linear equations in multiple forms (including point-slope, slope-intercept, and standard).

EA-4.7   Carry out procedures to solve linear equations for one variable algebraically.

EA-4.8   Carry out procedures to solve linear inequalities for one variable algebraically and then to graph the solution.

EA-4.9   Carry out a procedure to solve systems of two linear equations graphically.

EA-4.10 Carry out a procedure to solve systems of two linear equations algebraically.

Elementary Algebra

Standard EA-5:   The student will demonstrate through the mathematical processes an understanding of the graphs and characteristics of linear equations and inequalities.

Indicators

EA-5.1   Carry out a procedure to graph a line when given the equation of the line.

EA-5.2   Analyze the effects of changes in the slope, *m,* and the *y*-intercept, *b,* on the graph of $y = mx + b$.

EA-5.3   Carry out a procedure to graph the line with a given slope and a *y*-intercept.

EA-5.4   Carry out a procedure to graph the line with a given slope passing through a given point.

EA-5.5   Carry out a procedure to determine the *x*-intercept and *y*-intercept of lines from data given tabularly, graphically, symbolically, and verbally.

EA-5.6   Carry out a procedure to determine the slope of a line from data given tabularly, graphically, symbolically, and verbally.

EA-5.7   Apply the concept of slope as a rate of change to solve problems.

EA-5.8   Analyze the equations of two lines to determine whether the lines are perpendicular or parallel.

EA-5.9   Analyze given information to write a linear function that models a given problem situation.

EA-5.10   Analyze given information to determine the domain and range of a linear function in a problem situation.

EA-5.11   Analyze given information to write a system of linear equations that models a given problem situation.

EA-5.12   Analyze given information to write a linear inequality in one variable that models a given problem situation.

Elementary Algebra

Standard EA-6: The student will demonstrate through the mathematical processes an understanding of quadratic relationships and functions.

Indicators

EA-6.1 Analyze the effects of changing the leading coefficient a on the graph of $y = ax^2$.

EA-6.2 Analyze the effects of changing the constant c on the graph of $y = x^2 + c$.

EA-6.3 Analyze the graph of a quadratic function to determine its equation.

EA-6.4 Carry out a procedure to solve quadratic equations by factoring.

EA-6.5 Carry out a graphic procedure to approximate the solutions of quadratic equations.

EA-6.6 Analyze given information to determine the domain of a quadratic function in a problem situation.