

# Algebra I

## Mathematics

### Curriculum Framework

Revised 2004  
Amended 2006

Course Title: Algebra I  
 Course/Unit Credit: 1  
 Course Number:  
 Teacher Licensure: Secondary Mathematics  
 Grades: 9-12

## Algebra I

These are the SLEs that must be mastered in Algebra I. Other algebraic properties should be taught to adequately prepare students for Geometry and Algebra II. Students should be able to describe and translate among graphic, algebraic, numeric, tabular, and verbal representations of relations and use those representations to solve problems. The process of collecting and analyzing data should be embedded throughout this course. Appropriate technology and manipulatives should be used regularly for instruction and assessment. Students should be able to judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.

Strand	Standards
Language of Algebra	
	1. Students will develop the language of algebra including specialized vocabulary, symbols, and operations.
Solving Equations and Inequalities	
	2. Students will write, with and without appropriate technology, equivalent forms of equations, inequalities and systems of equations and solve with fluency.
Linear Functions	
	3. Students will analyze functions by investigating rates of change, intercepts, and zeros.
Non-linear Functions	
	4. Students will compare the properties in the family of functions.
Data Interpretation and Probability	
	5. Students will compare various methods of reporting data to make inferences or predictions.

\* denotes amended changes to the framework

## Language of Algebra

Content Standard 1. Students will develop the language of algebra including specialized vocabulary, symbols, and operations.

LA.1.A1.1	Evaluate <i>algebraic expressions</i> , including radicals, by applying the order of operations
LA.1.A1.2	Translate word phrases and sentences into <i>expressions, equations, and inequalities</i> , and vice versa
LA.1.A1.3	Apply the laws of (integral) <i>exponents and roots</i> .
LA.1.A1.4	*Solve problems involving <i>scientific notation, including multiplication and division</i> .
LA.1.A1.5	Perform <i>polynomial</i> operations (addition, subtraction, multiplication) with and without manipulatives
LA.1.A1.6	Simplify <i>algebraic fractions</i> by <i>factoring</i>
LA.1.A1.7	Recognize when an expression is undefined
LA.1.A1.8	Simplify <i>radical expressions</i> such as $\frac{3}{\sqrt{7}}$
LA.1.A1.9	Add, subtract, and multiply simple radical expressions like $3\sqrt{20} + 7\sqrt{5}$ and $4\sqrt{5} * 2\sqrt{3}$

## Solving Equation and Inequalities

Content Standard 2. Students will write, with and without appropriate technology equivalent forms of equations, inequalities, and systems of equations and solve with fluency.

SEI.2.AI.1	Solve multi-step equations and inequalities with rational <i>coefficients</i> <ul style="list-style-type: none"> <li>• numerically (from a table or guess and check)</li> <li>• algebraically (including the use of manipulatives)</li> <li>• graphically</li> <li>• technologically</li> </ul>
SEI.2.AI.2	Solve systems of two linear equations <ul style="list-style-type: none"> <li>• numerically (from a table or guess and check)</li> <li>• algebraically (including the use of manipulatives)</li> <li>• graphically</li> <li>• technologically</li> </ul>
SEI.2.AI.3	Solve linear <i>formulas</i> and <i>literal equations</i> for a specified <i>variable</i> (Ex. Solve for p in $I = prt.$ )
SEI.2.AI.4	Solve and graph simple <i>absolute value equations</i> and <i>inequalities</i> (Ex. $ x  = 5$ , $ x  \leq 5$ , $ x  > 5$ )
SEI.2.AI.5	Solve real world problems that involve a combination of rates, <i>proportions</i> and percents
SEI.2.AI.6	Solve problems involving <i>direct variation</i> and indirect ( <i>inverse</i> ) <i>variation</i> to model rates of change
SEI.2.AI.7	Use coordinate geometry to represent and/or solve problems (midpoint, length of a line segment, and <i>Pythagorean Theorem</i> )
SEI.2.AI.8	Communicate real world problems graphically, algebraically, numerically and verbally

Linear Functions

Content Standard 3. Students will analyze functions by investigating rates of change, intercepts, and zeros.

LF.3.A1.1	Distinguish between <i>functions</i> and non-functions/ <i>relations</i> by inspecting graphs, ordered pairs, <i>mapping diagrams</i> and/or <i>tables</i> of data
LF.3.A1.2	Determine <i>domain</i> and <i>range</i> of a relation from an algebraic expression, graphs, set of ordered pairs, or table of data
LF.3.A1.3	Know and/or use <i>function notation</i> , including evaluating functions for given values in their domain
LF.3.A1.4	Identify <i>independent variables</i> and <i>dependent variables</i> in various representational modes: words, symbols, and/or graphs
LF.3.A1.5	Interpret the rate of change/ <i>slope</i> and intercepts within the context of everyday life (Ex. telephone charges based on base rate ( <i>y-intercept</i> ) plus rate per minute ( <i>slope</i> ))
LF.3.A1.6	Calculate the slope given <ul style="list-style-type: none"> <li>• two points</li> <li>• the graph of a line</li> <li>• the equation of a line</li> </ul>
LF.3.A1.7	Determine by using slope whether a pair of lines are parallel, perpendicular, or neither
LF.3.A1.8	*Write an equation in <i>slope-intercept</i> , <i>point-slope</i> , and <i>standard</i> forms given <ul style="list-style-type: none"> <li>• two points</li> <li>• a point and y-intercept</li> <li>• <i>x-intercept</i> and y-intercept</li> <li>• a point and slope</li> <li>• a table of data</li> <li>• the graph of a line</li> </ul>
LF.3.A1.9	Describe the effects of parameter changes, slope and/or y-intercept, on graphs of linear functions and vice versa

## Non-linear Functions

Content Standard 4. Students will compare the properties in the family of functions.

NLF.4.AI.1	Factoring polynomials <ul style="list-style-type: none"><li>• greatest common factor</li><li>• <i>binomials</i> (difference of squares)</li><li>• <i>trinomials</i></li></ul>
NLF.4.AI.2	Determine <i>minimum</i> , <i>maximum</i> , <i>vertex</i> , and <i>zeros</i> , given the graph
NLF.4.AI.3	Solve <i>quadratic equations</i> using the appropriate methods with and without technology <ul style="list-style-type: none"><li>• <i>factoring</i></li><li>• <i>quadratic formula</i> with real number solutions</li></ul>
NLF.4.AI.4	Recognize function families and their connections including <i>vertical shift</i> and <i>reflection over the x-axis</i> <ul style="list-style-type: none"><li>• quadratics (with rational coefficients)</li><li>• <i>absolute value</i></li><li>• <i>exponential functions</i></li></ul>
NLF.4.AI.5	Communicate real world problems graphically, algebraically, numerically and verbally

## Data Interpretation and Probability

Content Standard 5 Students will compare various methods of reporting data to make inferences or predictions.

DIP.5.AI.1	Construct and use <i>scatter plots</i> and <i>line of best fit</i> to make <i>inferences</i> in real life situations
DIP.5.AI.2	Use simple matrices in addition, subtraction, and scalar multiplication
DIP.5.AI.3	Construct simple matrices for real life situations
DIP.5.AI.4	Determine the effects of changes in the data set on the measures of <i>central tendency</i>
DIP.5.AI.5	Use two or more graphs (i.e., <i>box-and-whisker</i> , <i>histograms</i> , <i>scatter plots</i> ) to compare <i>data sets</i>
DIP.5.AI.6	Construct and interpret a cumulative frequency <i>histogram</i> in real life situations
DIP.5.AI.7	Recognize <i>linear functions</i> and non-linear functions by using a table or a graph
DIP.5.AI.8	Compute simple <i>probability</i> with and without replacement
DIP.5.AI.9	Recognize patterns using <i>explicitly</i> defined and <i>recursively</i> defined linear functions
DIP.5.AI.10	Communicate real world problems graphically, algebraically, numerically and verbally
DIP.5.AI.11	*Explain how sampling methods, bias, and phrasing of questions in data collection impact the conclusions
DIP.5.AI.12	*Recognize when arguments based on data confuse correlation with causation

ALGEBRA I Glossary

<i>Absolute value</i>	A number's distance from zero on a number line (The absolute value of $-4$ is 4; the absolute value of 4 is 4.)
<i>Absolute value equation</i>	Equation whose graph forms a V that opens up or down.
<i>Absolute value inequality</i>	Inequalities involving absolute value
<i>Additive inverse</i>	The opposite of a number (The additive inverse of 3 is $-3$ . The sum of a number and its additive inverse is zero.)
<i>Algebra</i>	A generalization of arithmetic in which symbols represent members of a specified set of numbers and are related by operations that hold for all numbers in the set
<i>Algebraic expression</i>	An expression that contains a variable Ex. $X - 2$
<i>Algebraic fraction</i>	A fraction that contains a variable
<i>Algorithms</i>	A mechanical procedure for performing a given calculation or solving a problem through step-by-step procedures such as those used in long division
<i>Array</i>	A rectangular arrangement of objects in rows and columns
<i>Associative Property</i>	If three or more numbers are added or multiplied, the numbers can be regrouped without changing the results. Ex. $4 + (6 + 5) = (4 + 6) + 5$
<i>Axis</i>	Either of two number lines used to form a coordinate grid
<i>Bar graph</i>	A graph in which horizontal or vertical bars represent data
<i>Binomial</i>	An expression consisting of two terms connected by a plus or minus sign, such as $4a + 6$
<i>Box-and-whisker plot</i>	A graphic method for showing a summary of data using median, quartiles, and extremes of data (A box-and-whisker plot makes it easy to see where the data are spread out and where they are concentrated. The longer the box, the more the data are spread out.)
<i>Central tendencies</i>	A single number that is used to describe a set of numbers (Ex. mean, median, mode, etc.)
<i>Chance</i>	The probability of an outcome in an uncertain event (Ex. In tossing a coin, there is an equal chance of getting heads or tails.)
<i>Coefficient</i>	The numerical factor when a term has a variable (Ex. In the expression $3x + 2y = 16$ , 2 and 3 are coefficients.)
<i>Commutative Property</i>	If two numbers are added or multiplied, the operations can be done in any order. Ex. $4 \times 5 = 5 \times 4$
<i>Composite number</i>	Any integer that is not a prime number (evenly divisible by numbers other than one and itself)
<i>Consecutive</i>	Following one another in an uninterrupted order (Ex. 6, 7, 8, and 9 are consecutive numbers.)
<i>Constant</i>	In an algebraic expression, the number without the variable (Ex. In the expression $2x + 5$ , 5 is the constant.)
<i>Coordinate</i>	A set of numbers that locates the position of a point usually represented by $(x, y)$ values
<i>Coordinate system/Cartesian Plane</i>	A method of locating points in the plane or in space by means of numbers (A point in a plane can be located by its distances from both a horizontal and a vertical line called the axes. The horizontal line is called the x-axis. The vertical line is called the y-axis. The pairs of numbers are called ordered pairs. The first number, called the x-coordinate, designates the distance along the horizontal axis. The second number, called the y-coordinate, designates the distance along the vertical axis. The point at which the two axes intersect has the coordinates $(0,0)$ and is called the origin.)
<i>Data</i>	Information gathered by observation, questioning, or measurement
<i>Dependent variable</i>	A variable that provides the output values of a function
<i>Difference</i>	The result of subtraction

<i>Direct variation</i>	A linear function of the form $y = kx$ , where $k$ is the constant of variation and $k$ is not equal to zero
<i>Distributive Property</i>	A property that relates two operations on numbers, usually multiplication and addition, or multiplication and subtraction Ex. $a(x + y) = ax + ay$
<i>Domain</i>	The set of all first coordinates from the ordered pairs of a relation
<i>Equation</i>	A mathematical sentence containing an equal sign
<i>Explicit equation</i>	An equation that relates the inputs to the outputs
<i>Exponent</i>	A number showing how many times the base is used as a factor (Ex. $3^2 = 3 \times 3$ or 9)
<i>Exponential Function</i>	A function in the form of $f(x) = a^x$ , where $x$ is a real number, and $a$ is positive and not 1
<i>Expression</i>	A mathematical statement that does not contain an equal sign
<i>Extrapolate</i>	To extend and estimate data based on given information
<i>Factor</i>	Any numbers multiplied by another number to produce a product
<i>Factoring</i>	A method used to solve a quadratic equation that requires using the zero product property (Factoring is a process of rewriting a number or expression as product of two or more numbers or expressions.)
<i>Formulas</i>	Specific equations giving rules for relationships between quantities
<i>Function</i>	A relation in which each member of the domain is paired with one, and only one, member of the range
<i>Function Notation</i>	To write a rule in function notation, you use the symbol $f(x)$ in place of $y$ . (Ex. $f(x) = 3x - 8$ is in functional notation.)
<i>Graph of a function</i>	A pictorial way to display a function
<i>Histogram</i>	A graphic representation of the frequency distribution of a continuous variable (Rectangles are drawn in such a way that their bars lie on a linear scale representing different intervals (bin width), and their heights are proportional to the frequencies of the values within each of the intervals.)
<i>Independent variable</i>	A variable that provides the input values of a function
<i>Inequality</i>	A mathematical statement that one quantity is less than ( $<$ ) or greater than ( $>$ ) another
<i>Inference</i>	Reasoning from data, premises, graphs, and incomplete and inconsistent sources to from sensible conclusions
<i>Integers</i>	The set of whole numbers and their opposites
<i>Interest</i>	Amount paid for the use of money
<i>Interpolate</i>	To interpret and estimate data between given values
<i>Irrational numbers</i>	Real numbers that cannot be expressed in the form $a/b$ ( $a$ fraction) where $a$ and $b$ are integers
<i>Inverse variation</i>	A function that can be written in the form $xy = k$ or $y = k/x$ (The product of the quantities remains constant, so as one quantity increases, the other decreases.)
<i>Linear function</i>	A function that has a constant rate of change and can be modeled by a straight line
<i>Line graph</i>	A means of displaying statistical information by connecting graphs of ordered pairs to show changes in quantities
<i>Line of best fit</i>	The most accurate trend line on a scatter plot showing the relationship between two sets of data
<i>Lines</i>	A set of points $(x, y)$ that satisfy the equation $ax + by + c = 0$ where $a$ and $b$ are not both zero
<i>Literal equation</i>	An equation involving two or more variables
<i>Mapping diagram</i>	A diagram that maps an input value to an output value to determine whether a relation is a function (See diagram)
<i>Matrices</i>	Ordered tables or listings of numerical data
<i>Maximum</i>	The greatest value of the function if it has such an extreme value

<i>Mean</i>	The sum of a set of numbers divided by the number of numbers in that set
<i>Median</i>	In a list of data ordered from least to greatest or greatest to least, the middle number or the average of the middle two numbers
<i>Minimum</i>	The least value of the function if it has such an extreme value
<i>Mode</i>	In a list of data, the number or item occurring most frequently
<i>Monomial</i>	An expression that is a number, a variable, or a product of a number and variable (Ex. 7, x and 8xy are all monomials.)
<i>Natural Numbers</i>	One of the numbers 1, 2, 3, 4... also called counting numbers
<i>Number sense</i>	The ability of the learner to make logical connections between new information and previously acquired knowledge to understand the meanings, relationships, and magnitudes of numbers and common measurements
<i>Number Theory</i>	Concepts of numbers such as prime, composite, squares, factors and multiples
<i>Parabola</i>	The graph of a quadratic function
<i>Patterns</i>	Repeated sequences
<i>Perfect Square Trinomial</i>	Any trinomial in the form $a^2 + 2ab + b^2$
<i>Point slope form</i>	A linear equation of a non-vertical line written as $y - y_1 = m(x - x_1)$
<i>Polynomial</i>	In algebra, an expression consisting of two or more terms (Ex. $x^2 - 2xy + y^2$ )
<i>Powers</i>	Numbers that can be expressed using exponents
<i>Prime Numbers</i>	A whole number greater than one having exactly two distinct factors, one and itself
<i>Probability</i>	How likely it is that an event will occur (Written formally as P(event))
<i>Proportion</i>	An equation that states that two ratios are equal
<i>Pythagorean Theorem</i>	In a right triangle, the sum of the squares of the length of the legs is equal to the square of the length of the hypotenuse. Ex. $a^2 + b^2 = c^2$
<i>Quadratic formula</i>	The solutions of a quadratic equation of the form $ax^2 + bx + c = 0$ where $a \neq 0$ are given by the quadratic formula which is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
<i>Quadratic function</i>	A function that has an equation of the form $y = Ax^2 + Bx + C$ where 'A' does not equal 0
<i>Radicals</i>	A radical symbol ( $\sqrt{\quad}$ ) and its radicand
<i>Radical Equation</i>	An equation that has a variable in a radicand
<i>Radical expression</i>	An expression with a radical in it
<i>Radicand</i>	An expression under the radical sign
<i>Range</i>	The set of all the second coordinates from the set of ordered pairs of a relation
<i>Range (statistics)</i>	The difference between the greatest and least numbers in a set of numerical data
<i>Ratio</i>	A comparison of two numbers, represented in one of the following ways: 2 to 5, 2 out of 5, 2:5, or $\frac{2}{5}$
<i>Rational Numbers</i>	A number in the form of an $\frac{a}{b}$ , where a and b are integers and b is not equal to zero
<i>Real Roots</i>	The zeros of an equation that occur at x-intercepts of the graph of the related function
<i>Recursive function</i>	A recursive formula has two parts: the value(s) of the first term(s), and a recursion equation that shows how to find each term from the term(s) before it
<i>Reflection</i>	Mirror image of a figure (Objects remain the same shape, but their positions change through a flip.)

<i>Regression</i>	Statistical technique that predicts the equation that best fits the data
<i>Relation</i>	A set of ordered pairs of data
<i>Scale</i>	The numeric ratio used to produce an enlarged or reduced drawing of a picture or an object
<i>Scalar multiplication</i>	Multiplication of a matrix by a constant (scalar)
<i>Scatter plot</i>	A graph of the points representing a collection of data
<i>Scientific Notation</i>	A means of expressing a number as a product of a number between one and ten and a power of ten Ex. $1100 = 1.1 \times 10^3$
<i>Simultaneous (Systems) Equations</i>	Pair of equations of the first degree upon which two different conditions are put on the same variables at the same time (Ex. Find two numbers whose sum is 7 and whose difference is 1. $x + y = 7$ and $x - y = 1$ .)
<i>Slope</i>	The ratio of the vertical change to the horizontal change
<i>Slope-intercept form</i>	A linear equation in the form $y = mx + b$ , where $m$ is the slope of the graph of the equation and $b$ is the $y$ -intercept
<i>Square root</i>	That number which, when multiplied by itself, produces the given number (Ex. 5 is the square root of 25, because $5 \times 5 = 25$ .)
<i>Standard form of a linear equation</i>	The form of a linear equation $Ax + By = C$ where $A$ , $B$ , and $C$ are real numbers and $A$ and $C$ are not both zero (Ex. $6x - y = 12$ )
<i>Standard form of a polynomial</i>	The form of a polynomial in which the degree of the terms decreases from left to right (descending order)
<i>Stem-and-leaf display</i>	A means of organizing data in which certain digits are uses as stems, and the remaining digits are leaves
<i>Table</i>	A display of data, usually arranged in rows and columns
<i>Term</i>	A number, variable, or the product or quotient of a number and one or more variables
<i>Theoretical probabilities</i>	Probabilities determined without performing an experiment
<i>Unit rates</i>	Any fixed amount, quantity, etc., used as a standard
<i>Trinomial</i>	An expression containing three terms connected by a plus or minus sign (Ex. $5x^2 + 3x - 6$ )
<i>Units of measure</i>	Inches, meters, pounds, grams, etc.
<i>Variable</i>	A letter that can assume different values
<i>Vertex</i>	The maximum or minimum value of a parabola
<i>Vertical Line Test</i>	A method used to determine if a relation is a function or not (If a vertical line passes through a graph more than once, the graph is not the graph of a function.)
<i>Vertical Shift</i>	Movement of a graph up or down the $y$ -axis
<i>Whole numbers</i>	The set of natural numbers and zero
<i>X-axis</i>	The horizontal axis of a coordinate plane
<i>X-coordinate</i>	The location on the $x$ -axis of a point on the coordinate plane
<i>X-intercept</i>	The $x$ -coordinate of the point where a line crosses the $x$ -axis
<i>Y-axis</i>	The vertical axis of a coordinate plane
<i>Y-coordinate</i>	The location on the $y$ -axis of a point on the coordinate plane
<i>Y-intercept</i>	The $y$ -coordinate of the point where the line crosses the $y$ -axis
<i>Zeros</i>	The $x$ -intercepts of a quadratic equation that crosses the $x$ -axis