

# ALGEBRA I

## PURPOSE:

Students will demonstrate number sense by performing computational procedures on algebraic expressions. They will solve and generate equations and inequalities of the following types: systems, quadratic, radical, and absolute value. Students will be able to recognize and identify characteristics of functions. Students will apply properties of geometric shapes and measurement formulas to solve real world problems, manipulate and analyze all aspects of linear equations, and predict outcomes of transformations on 2-d and 3-d objects.

## BENCHMARKS AND INDICATORS:

### Number Sense

#### 1.1 Demonstrates number sense for real numbers and algebraic expressions

- AI11K1 produces equivalent representations for real numbers and algebraic expressions including integers, fractions, decimals, percents, ratios, rational number bases with integer exponents, scientific notation, and absolute value

#### 1.2 Demonstrates an understanding of the real number system; recognizes, applies, and explains their properties, and extends these properties to algebraic expressions

- **\*AI12K3a-e names, uses, and describes these properties with the real number system and demonstrates their meaning including the use of concrete objects**
  - a. commutative ( $a + b = b + a$  and  $ab = ba$ ), associative [ $a + (b + c) = (a + b) + c$  and  $a(bc) = (ab)c$ ], distributive [ $a(b + c) = ab + ac$ ], and substitution properties (if  $a = 2$ , then  $3a = 3 \times 2 = 6$ );
  - b. identity properties for addition and multiplication and inverse properties of addition and multiplication (additive identity:  $a + 0 = a$ , multiplicative identity:  $a \cdot 1 = a$ , additive inverse:  $+5 + -5 = 0$ , multiplicative inverse:  $8 \times 1/8 = 1$ );
  - c. symmetric property of equality (if  $a = b$ , then  $b = a$ );
  - d. addition and multiplication properties of equality (if  $a = b$ , then  $a + c = b + c$  and if  $a = b$ , then  $ac = bc$ ) and inequalities (if  $a > b$ , then  $a + c > b + c$  and if  $a > b$ , and  $c > 0$  then  $ac > bc$ );
  - e. zero product property (if  $ab = 0$ , then  $a = 0$  and/or  $b = 0$ )

#### 1.3 Uses computational estimation with real numbers

- **\*AI13A1 adjusts original rational number estimate of a real-world problem based on additional information (a frame of reference) e.g., estimate how long it takes to walk from here to there; time how long it takes to take five steps and adjust your estimate (must be able to set up a proportion to do these problems)**

#### 1.4 Models, performs, and explains computation with real numbers and polynomials

- **AI14A1a,b,d generates and/or solves multi-step real-world problems with real number and algebraic expressions using computational procedures (addition, subtraction, multiplication, division, roots, and powers excluding logarithms), and mathematical concepts with**

- a. applications from business, chemistry, and physics that involve addition, subtraction, multiplication, division, squares, and square roots when the formulae are given as part of the problem and variables are defined
- b. volume and surface area given the measurement formulas of rectangular solids and cylinders
- d. application of percents including compound interest given the formula
- AI14K1 Multiply radicals
- NAI14K2a Simplifies numeric and algebraic expressions using order of operations
- AI14K2b Solves various types of percent problems including basic percent equations and percent of increase and decrease problems
- NAI14K2d Simplify radicals to an exact answer including rationalize the denominator
- NAI14K2e Multiply polynomials
- AI14K2f Simplify algebraic monomial expressions using the properties of exponents
- NAI14K2g Factor binomials and trinomials with a degree of no more than 2

## Algebra

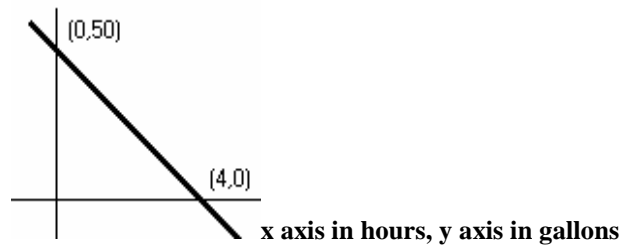
2.2 Uses variables, symbols, real numbers, and algebraic expressions to solve equations and inequalities

- **N\*AI22K3 Solves equations in the following formats**
  - a. linear equations and inequalities, must be able to give answer analytically and graphically
  - a. Quadratic equations using factoring (using the box) and by taking the square root of both sides
  - b. **\*Systems of linear equations and inequalities with two unknowns using integer coefficients and constants and how the solution relates to the graph**
  - c. Radical equations (and inequalities)
  - d. Rational equations with binomials within the fraction
  - e. absolute value equations and inequalities
- **N\*AI22A2a generates linear equations and inequalities both analytically and graphically, e.g., tickets for a school play are \$5 for adults and \$3 for students. You need to sell at least \$65 in tickets. Give an inequality and a graph that represents this situation and three possible solutions**

2.3 Analyzes functions

- AI23K2 Matches equations, graphs, and names of the linear, quadratic, absolute value and square root functions
- AI23K3 Determine if a relation (given in a variety of formats) is a function
- AI23K5 Identify the domain and range for a relation (given in a variety of formats)
- AI23K7 Uses function notation
- **AI 23K6 recognizes how changes in the constant and/or slope within a linear function changes the appearance of a graph**
- **AI23A2 interprets the meaning of the x- and y- intercepts, slope, and/or points on and off the line on a graph in the context of a real-world situation, e.g., the graph below represents a tank full of water being emptied. What does the y-intercept represent? What does the x-intercept represent? What is the rate at which it is emptying? What does the point (2, 25) represent in this situation? What does the point (2,30) represent in this situation?**

## The Water Tank



## Geometry

3.1 Recognizes geometric figures and compares and justifies their properties of geometric figures

- **\*AI31A1a applying the Pythagorean Theorem, e.g., when checking for square corners on concrete forms for a foundation, determine if a right angle is formed by using the Pythagorean Theorem;**

3.2 Estimates, measures and uses geometric formulas

- AI32K3 Approximates conversions between customary and metric systems given the conversion unit or formula using unit multipliers

3.3 Recognizes and applies transformations on two- and three-dimensional figures

- **AI33A1 analyzes the impact of transformations on the perimeter and area of circles, rectangles, and triangles and volume of rectangular prisms and cylinders (2.4.A1f), e.g., reducing by a factor of  $\frac{1}{2}$  multiplies an area by a factor of  $\frac{1}{4}$  and multiplies the volume by a factor of  $\frac{1}{8}$ , whereas, rotating a geometric figure does not change perimeter or area**
- 33K1 Describes and draw multiple transformation on a function

3.4 Uses an algebraic perspective to analyze the geometry of two- and three-dimensional figures

- **AI34K4 finds and explains the relationship between the slopes of parallel and perpendicular lines (2.4.K1f), e.g., the equation of a line  $2x + 3y = 12$ . The slope of this line is  $-\frac{2}{3}$ . What is the slope of a line perpendicular to this line?**
- **\*34K6 recognizes the equation of a line and transforms the equation from standard or point slope form into slope-intercept form in order to identify the slope and y-intercept and uses this information to graph the line**
- AI34K3 Calculates the slope of a line from a list of ordered pairs or from the graph of a line and explain how the graph of the line relates to the slope
- AI34K5 Uses Pythagorean theorem to find the distance between two points
- AI34K7 Identifies characteristics of various functions such open up or down, vertex, axis of symmetry, compression or stretch, sketch the graph, etc.

## Data

4.1 Applies probability theory to draw conclusions, generate convincing arguments, make predictions and decisions, and analyze decisions including the use of concrete objects

- **AI41K3 explains the relationship between probability and odds and computes one given the other**

4.2 Collects, organizes, displays, explains, and interprets numerical (rational) and non-numerical data sets

- **AI42K4 explains the effects of outliers on the measures of central tendency (mean, median, mode) and range and interquartile range of a real number data set**
- **AI42K5 approximates a line of best fit given a scatter plot and makes predictions using the graph or the equation of that line**
- **AI42A1a-h uses data analysis (mean, median, mode, range, quartile, interquartile range) in real-world problems with rational number data sets to compare and contrast two sets of data, to make accurate inferences and predictions, to analyze decisions, and to develop convincing arguments from these data displays**
  - a. **frequency tables and line plots;**
  - b. **bar, line, and circle graphs;**
  - c. **Venn diagrams or other pictorial displays;**
  - d. **charts and tables;**
  - e. **stem-and-leaf plots (single and double);**
  - f. **scatter plots**
  - g. **box-and-whiskers plots;**
  - h. **histograms**