USD 203 Piper Curriculum
Mathematics

Algebra 1 and Algebra 1 Plus
Grade(s): 8-9
Credit(s): 1
Prerequisite(s): See PHS Course Overview

Standard	Benchmark	KSMS Knowledge Base	KSMS Application
1--NUMBER & COMPUTATION			
	1--Number Sense		
▲ Recommended High School Assessed Indicator		1.1.1K. Knows, explains, and uses equivalent representations for real numbers and algebraic expressions including integers, fractions, decimals, percents, ratios; rational number bases with integer exponents; rational numbers written in scientific notation; absolute value; time; and money. (2.4.K1a) ($)	1.1.1A. Generates and/or solves real-world problems using equivalent representations of real numbers and algebraic expressions (2.4A1a) ($)
		1.1.2K. Compares and orders real numbers and/or algebraic expressions and explains the relative magnitude between them (2.4.K1a) ($).	1.1.2A. Determines whether or not solutions to real-world problems using real numbers and algebraic expressions are reasonable (2.4.A1a) ($)
		1.1.3K Knows and explains what happens to the product or quotient when a real number is multiplied or divided by (2.4.K1a) :	
		a. a rational number greater than zero and less than one,	
		b. a rational number greater than one,	
		c. a rational number less than zero.	
	2--Number Systems and their Properties		
		1.2.1K. Explains and illustrates the relationship between the subsets of the real number system [natural (counting) numbers, whole numbers, integers, rational numbers, irrational numbers] using mathematical models (2.4.K1a)	1. 2.1A. Generates and/or solves real-world problems with real numbers using the concepts of these properties to explain reasoning (2.4.A1a) ($):
		1.2.2K. Identifies all the subsets of the real number system [natural (counting) numbers, whole numbers, integers, rational numbers, irrational numbers] to which a given number belongs (2.4.K1m).	a. commutative, associative, distributive, and substitution properties,
		1.2.3K. ▲ Names, uses, and describes these properties with the real number system and demonstrates their meaning including the use of concrete objects (2.4.K1a) ($):	b. identity and inverse properties of addition and multiplication,
		a. commutative, associative, distributive, and substitution properties;	c. symmetric property of equality,
		b. identity properties for addition and multiplication and inverse properties of addition and multiplication;	d. addition and multiplication properties of equality,
		c. symmetric property of equality;	e. zero product property.

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		d. addition and multiplication properties of equality and inequalities;	1.2.2A Analyzes and evaluates the advantages and disadvantages of using integers, whole numbers, fractions (including mixed numbers), decimals or irrational numbers and their rational approximations in solving a given real-world problem (2.4.A1a) ($).
		e. zero product property.	
		1.2.4K. Uses and describes these properties with the real number system (2.4.K1a) ($):	
		a. transitive property,	
		b. reflexive property.	
	3--Estimation		
		1.3.1K. Estimates real number quantities using various computational methods including mental math, paper and pencil, concrete objects, and/or appropriate technology (2.4.K1a) ($).	**1.3.1A. ▲ Adjusts original rational number estimate of a real-world problem based on additional information (a frame of reference) (2.4.A1a) ($).**
		1.3.2K. Uses various estimation strategies and explains how they were used to estimate real number quantities and algebraic expressions (2.4.K1a) ($).	1.3.2A. Estimates to check whether or not the result of a real-world problem using real numbers and/or algebraic expressions is reasonable and makes predictions based on the information (2.4.A1a) ($).
		1.3.3K. Knows and explains why a decimal representation of an irrational number is an approximate value (2.4.K1a).	1.3.3A. Determines if a real-world problem calls for an exact or approximate answer and performs the appropriate computation using various computational strategies including mental math, paper and pencil, concrete objects, and/or appropriate technology (2.4.A1a) ($).
		1.3.4K. Knows and explains between which two consecutive integers an irrational number lies (2.4.K1a).	1.3.4A. Explains the impact of estimation on the result of a real-world problem (underestimate, overestimate, range of estimates) (2.4.A1a) ($).
	4--Computation		
		1.4.1K. Computes with efficiency and accuracy using various computational methods including mental math, paper and pencil, concrete objects and appropriate technology (2.4.K1a) ($).	1.4.1A. Generates and/or solves multi-step real-world problems with real numbers and algebraic expressions using computational procedures (addition, subtraction, multiplication, division, roots, and powers excluding logarithms), and mathematical concepts with ($):
		1.4.2K. Performs and explains these computational procedures (2.4.K1a):	**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 (2.4.A1a) ($).**

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		a. **N** addition , subtraction, multiplication, and division using the order of operations;	**b. ▲volume and surface area given the measurement formulas of rectangular solids and cylinders (2.4.A1f)**
		b. multiplication or division to find ($):	c. probabilities (2.4.A1h)
		i. A percent of a number,	**d. ▲■ application of percents (2.4.A1a)**
		ii. Percent of increase and decrease ,	e. simple exponential growth and decay (excluding logarithms) and economics (2.4.A1a) ($)
		iii. Percent one number is of another number,	
		iv. A number when a percent of the number is given,	
		c. manipulation of variable quantities within an equation or inequality (2.4.K1d),	
		d. simplification of radical expressions (without rationalizing denominators) including square roots of perfect square monomials and cube roots of perfect cubic monomials;.	
		e. simplification or evaluation of real number and algebraic monomial expressions raised to a whole number power and algebraic binomial expressions squared or cubed;	
		f. simplification of products and quotients of real number and algebraic monomial expressions using the properties of exponents;	
		1.4.3K. Finds prime factors, greatest common factor, multiples, and the least common multiple of algebraic expressions (2.4.K1b).	
2--ALGEBRA			
	1--Patterns		
		2.1.1K. Identifies, states, and continues the following patterns using various formats including numeric (list or table), algebraic (symbolic notation), visual (picture, table, or graph), verbal (oral description), kinesthetic (action), and written:	2.1.1A. Recognizes the same general pattern presented in different representations [numeric (list or table), visual (picture, table, or graph), and written (2.4.A1i) ($).
		a. arithmetic and geometric sequences using real numbers and/or exponents (2.4.K1a);	2.1.2A. Solves real-world problems with arithmetic or geometric sequences by using the explicit equation of the sequence (2.4.K1c) ($).
		c. algebraic patterns including consecutive number patterns or equations of functions (2.4.K1c,e);	
		d. special patterns (2.4.K1a).	
		2.1.2K. Generates and explains a pattern (2.4K1f).	

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		2.1.3K. Classify sequences as arithmetic, geometric, or neither.	
		2.1.4K. Defines (2.4.K1a):	
		a. a recursive or explicit formula for arithmetic sequences and finds any particular term.	
	2--Variables, Equations, and Inequalities		
		2.2.1K. Knows and explains the use of variables as parameters for a specific variable situation (2.4.K1f)	2.2.1A. Represents real-world problems using variables, symbols, expressions, equations, inequalitites, and simple systems of linear equations (2.4.Ac-e) ($)
		2.2.2K. Manipulates variable quantities within an equation or inequality (2.4.K1e)	2.2.2A. Represents and/or solves real-world problems with (2.4.A1c) ($) :
		2.2.3K. Solves (2.4.K1d)	**a. ▲N linear equations and inequalities both analytically and graphically,**
		a. **N** linear equations and inequalities both analytically and graphically;	b. quadratic equations with integer solutions (may be solved by trial and error, graphing, quadratic formula, or factoring),
		b . quadratic equations with integer solutions (may be solved by trial and error, graphing, quadratic formula, or factoring);	c. systems of linear equations with two unknowns,
		c. ▲N systems of linear equations with two unknowns using integer coefficients and constants;	d. radical equations with no more than one inverse operation around the radical expression
		d. radical equations with no more than one inverse operation around the radical expression;	e. a rational equation where the solution can be simplified as a linear equation with a nonzero denominator.
		e. equations where the solution to a rational equation can be simplified as a linear equation with a nonzero denominator;	2.2.3A. Explains the mathematical reasoning that was used to solve a real-world problem using equations and inequalities and analyzes the advantages and disadvantages of various strategies that may have been used to solve the problem (2.4.A1c).
		f. equations and inequalities with absolute value quantities containing one variable with a special emphasis on using a number line and the concept of absolute value.	
		g. exponential equations with the same base without the aid of a calculator or computer	
	3--Functions		

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		2.3.1K. Evaluates and analyzes functions using various methods including mental math, paper and pencil, concrete objects, and graphing utilities or other appropriate technology (2.4.K1a,d-f).	2.3.1A. Translates between the numerical, graphical, and symbolic representations of functions (2.4.A1c-e) ($).
		2.3.2K. Matches equations and graphs of constant and linear functions and quadratic functions limited to y = ax2 + c (2.4.K1d,f).	**2.3.2A. ▲■ Interprets the meaning of the x- and y-intercepts, slope, and/or points on and off the line on a graph in the context of a real-world situation (2.4.A1e).**
		2.3.3K. Determines whether a graph, list of ordered pairs, table of values, or rule represents a function (2.4K1e-f). .	2.3.3A. Analyzes (2.4.A1c-e).
		2.3.4K. Determines x- and y-intercepts and maximum and minimum values of the portion of the graph that is shown on a coordinate plane (2.4.K1f).	a. the effects of parameter changes (scale changes or restricted domains) on the appearance of a function's graph,
		2.3.5K. Identifies domain and range of :	b. how changes in the constants and/or slope within a linear function affects the appearance of a graph.
		a. relationships given the graph or table (2.4.K1e-f).	c. how changes in the constants and/or coefficients within a quadratic function in the form of y = ax2 + c affects the appearance of a graph.
		b. linear, constant and quadratic functions given the equation(s) (2.4.K1d).	
		2.3.6K. ▲ Recognizes how changes in the constant and/or slope within a linear function changes the appearance of a graph (2. 4.K1f) ($).	
		2.3.7K. Uses function notation.	
		2.3.8K. Evaluates function(s) given a specific domain ($).	
		2.3.9K. Describes the difference between independent and dependent variables and identifies independent and dependent variables ($).	
	4--Models		
		2.4.1K. Knows, explains, and uses mathematical models to represent and explain mathematical concepts, procedures, and relationships. Mathematical models include:	2.4.1A. Recognizes that various mathematical models can be used to represent the same problem situation. Mathematical models include:
		a. process models (concrete objects, pictures, diagrams, number lines, hundred charts, measurement tools, multiplication arrays, division sets, or coordinate grids) to model computational procedures, algebraic relationships, and mathematical relationships and to solve equations (1.1K1-3, 1.2.K1, 1.2.K3-4, 1.3.K1-4, 1.4K1, 1.4.K2a-b, 2.1K1a, 2.1.K1d, 2.1.K2, 2.2K4, 2.3K1, 3.2.K1-3, 3.2.K6, 3.3.K1-4, 4.2.K3-4) ($).	a. process models (concrete objects, pictures, diagrams, flowcharts, number lines, hundred charts, measurement tools, multiplication arrays, division sets, or coordinate grids) to model computational procedures, algebraic relationships, mathematical relationships, and problem situations and to solve equations (1.1.K1, 1.2.A1-2, 1.3.A1-4, 1.4.A1a, 1.4.A1d-e, 3.1.A1-3, 3.2.A1-3, 3.3.A2, 3.3.A4, 3.4.A2, 4.2.A1a-b) ($);

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		b. factor trees to model least common multiple, greatest common factor, and prime factorization (1.4.K3);	b. algebraic expressions to model relationships between two successive numbers in a sequence or other numerical patterns;
		c. algebraic expressions to model relationships between two successive numbers in a sequence or other numerical patterns (2.1.K1c);	c. equations and inequalities to model numerical and geometric relationships (2.1.A2, 2.2.A1-3, 2.3.A1) ($);
		d. equations and inequalities to model numerical and geometric relationships (1.4.K2c, 2.2.K3, 2.3.K1-2, 3.2.K7) ($);	d. function tables to model numerical and algebraic relationships (2.3.A1, 2.3.A3, 3.4.A2) ($);
		e. function tables to model numerical and algebraic relationships (1.4.K2c, 2.2.K3, 2.3.K1-2, 3.2.K7) ($);	e. coordinate planes to model relationships between ordered pairs and equations and inequalities, and linear and quadratic functions (2.2.A1, 2.3.A1-3, 3.4.A1-2, 3.4.A4) ($):
		f. coordinate planes to model relationships between ordered pairs and equations and inequalities, and linear and quadratic functions (2.2.K1, 2.3.K1-6, 3.4.K1-8) ($);	f. two- and three-dimensional geometric models (geoboards, dot paper, coordinate plane, nets, or solids) and real-world objects to model perimete, area, volume, and surface area, properties of two- and three-dimensional figures (3.3.A1, 4.2.A1c);
		h. two- and three-dimensional geometric models (geoboards, dot paper, coordinate plane, nets, or solids) and real-world objects to model perimete, area, volume, and surface area, properties of two- and three- dimensional figures, and isometric views of three-dimensional figures. (2.1.K1b, 3.1.K1-8, 3.2.K1, 3.2.K4-5, 3.3.K1-4);	g. scale drawings to model large and small real-world objects (3.3.A3, 3.4.A3);
		i. scale drawings to model large and small real-world objects;	h. geometric models (spinners, targets, or number cubes), process models (coins, pictures or diagrams), and tree diagrams to model probability (1.4.A1c, 4.2.A1, 4.2.A3);
		k. geometric models (spinners, targets, or number cubes), process models (concrete objects, pictures, diagrams, or coins), and tree diagrams to model probability (4.1.K1-3);	i. frequency tables, bar graphs, line graphs, circle graphs, Venn diagrams, charts, tables, single and double stem-and-leaf plots, scatter plots, box-and-whisker plots, histograms, and matrices to describe, interpret, and analyze data (2.1.A1, 4.1.A1, 4.1.A3-4,4.1.A62 4.2.A1) ($);
		l. frequency tables, bar graphs, line graphs, circle graphs, Venn diagrams, charts, tables, single and double stem-and-leaf plots, scatter plots, box-and-whisker plots, histograms, and matrices to organize and display data (4.2.K1, 4.2.K5-6) ($);	2.4.2A Uses the mathematical modeling process to analyze and make inferences about real-world situations ($).
		m. Venn diagrams to sort data and to show relationships (1.2.K2).	

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3--GEOMETRY			
	1--Geometric Figures and their Properties		
	2--Measurement and Estimation		
		3.2.4K. States, recognizes, and applies formulas for (2.4.K1h) ($):	3.2.1A. solves real-world problems (2.4.A1a) ($)
		a. perimeter and area of squares, rectangle, and triangles;	b. finding the perimeter and the area of circles, squares, rectangles, triangles, parallelograms, and trapezoids;
		b. circumference and area of circles; volume of rectangular solids.	c. finding the volume and the surface area of rectangular solids and cylinders;
		3.2.5K uses given measurement formulas to find perimeter, area, volume, and surface area of two- and three-dimensional figures (regular and irregular) (2.4.K1h)	3.2.2A. Estimates to check whether or not measurements or calculations for length, weight, volume, temperature, time, distance, perimeter, area, surface area, and angle measurement in real-world problems are reasonable and adjusts original measurement or estimation based on additional information (a frame of reference) (2.4.A1a) ($).
	4--Geometry from an Algebraic Perspective		
		3.4.1K. Recognizes and examines two- and three-dimensional figures and their attributes including the graphs of functions on a coordinate plane using various methods including mental math, paper and pencil, concrete objects, and graphing utilities or other appropriate technology (2.4.K1f)	3.4.3A. Recognizes and explains the effects of scale changes on the appearance of the graph of an equation involving a line or parabola (2.4.A1g)
		3.4.2K. Determines if a given point lies on the graph of a given line or parabola without graphing, and justifies the answer (2.4.K1f).	3.4.4A. Analyzes how changes in the constants and/or leading coefficients within the equation of a line or parabola affects the appearance of the graph of the equation (2.4.A1e).
		3.4.3K. Calculates the slope of a line from a list of ordered pairs on the line and explains how the graph of the line is related to its slope (2.4.K1f).	
		3.4.4K. ▲ Finds and explains the relationship between the slopes of parallel and perpendicular lines (2.4.K1f).	
		3.4.6K. ▲ Recognizes the equation of a line and transforms the equation into slope-intercept form in order to identify the slope and y-intercept and uses this information to graph the line (2.4.K1f).	

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		3.4.7K. Recognizes the equation y =ax2 + c as a parabola; represents and identifies characteristics of the parabola including opens upward or opens downward, steepness (wide/narrow), the vertex, maximum and minimum values, and line of symmetry; and sketches the graph of the parabola (2.2.K1f).	
4--DATA			
	1--Probability		
		4.1.1K. Finds the probability of two independent events in an experiment, simulation, or situation (2.4.K1k) ($).	4.1.1A. Conducts an experiment or simulation with two dependent events; records the results in charts, tables, or graphs; and uses the results to generate convincing arguments, draw conclusions and make predictions (2.4.A1h-i).
		4.1.2K. Finds the conditional probability of two dependent events in an experiment, simulation, or situation (2.4.K1k).	4.1.2A Uses theoretical or empirical probability of a simple or compound event composed of two or more simple, independent events to make predictions and analyze decisions about real-world situations including:
		4.1.3K. ▲ Explains the relationship between probability and odds and computes one given the other (2.4.K1a,k).	a. work in economics, quality control, genetics, meteorology, and other areas of science (2.4.A1a);
			b. games (2.4.A1a);
			4. 1.3A Compares theoretical probability (expected results) with empirical probability (experimental results) of two independent and/or dependent events and understands that the larger the sample size, the greater the likelihood that experimental results will match theoretical probability (2.4.A1h).
			4.1.4A Uses conditional probabilities of two dependent events in an experiment, simulation, or situation to make predictions and analyze decisions.
	2--Statistics		
		4.2.1K. Organizes, displays and reads quantitative (numerical) and qualitative (non-numerical) data in a clear, organized and accurate manner including a title, labels, categories, and rational number intervals using these **data displays** (2.4.K1l).	**4.2.1A. ▲ Uses data analysis (mean, median, mode, range, quartile, interquartile range) in real-world problems with rational number data sets to compare and contrast two sets of data, to make accurate inferences and predictions, to analyze decisions, and to develop convincing arguments from these data displays (2.4.A1i) ($):**
		a. frequency tables and line plots;	a. ■ frequency tables and line plots;

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		b. bar, line, and circle graphs;	b. bar, line, and circle graphs;
		c. Venn Diagrams or other pictorial displays;	c. Venn diagrams or other pictorial displays;
		d. charts and tables;	d. charts and tables;
		e. stem-and-leaf plots (single and double);	e. stem-and-leaf plots (single and double);
		f. scatter plots;	f. scatter plots;
		g. box-and-whiskers plots;	g. box-and-whiskers plots;
		h. histograms.	h. histograms.
		4.2.2K. Explains how the reader's bias, measurement errors, and display distortions can affect the interpretation of data.	4.2.2A. Determines and describes appropriate data collection techniques (observations, surveys, or interviews) and sampling techniques (random sampling, samples of convenience, biased sampling, census of total population, or purposeful sampling) in a given situation.
		4.2.3K. Calculates and explains the meaning of range, quartiles and interquartile range for a real number data set (2.4.K1a).	4.2.3A. Uses changes in scales, intervals, and categories to help support a particular interpretation of the data (2.4.A1i).
		4.2.4K. ▲ 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 (2.4.K1a).	4.2.4A. Determines and explains the advantages and disadvantages of using each measure of central tendency and the range to describe a data set (2.4.K1i).
		4.2.5K. ▲ Approximates a line of best fit given a scatter plot and makes predictions using the equation of that line (2.4.K1k).	4.2.5A. Analyzes the effects of:
		4.2.6K. Compares and contrasts the dispersion of two given sets of data in terms of range and the shape of the distribution including (2.4.K1k):	a. outliers on the mean, median, and range of a real number data set;
		a. symmetrical (including normal),	b. changes within a real number data set on mean, median, mode, range, quartiles, and interquartile range.
		b. skew (left or right),	4.2.6A. Approximates a line of best fit given a scatter plot, makes predictions, and analyzes decisions using the equation of that line (2.4.A1i).
		c. bimodal,	
		d. uniform (rectangular)	