Algebra I

Curriculum Framework

2013

Compiled using the Common Core State Standards for Mathematics and the PARCC Model Content Frameworks for Mathematics Version 3.0 (November 2012 revision)

Course Title:	Algebra I
Course/Unit Credit:	1
Course Number:	430000
Teacher Licensure:	Secondary Mathematics
Grades:	9-12

Course Description: "The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. Because it is built on the middle grades standards, this is a more ambitious version of Algebra I than has generally been offered. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations." - http://www.corestandards.org/

This document was created to delineate the standards for this course in a format familiar to the educators of Arkansas. For the state-provided Algebra A/B, Algebra I, Geometry A/B, Geometry, and Algebra II documents, the language and structure of the Common Core State Standards for Mathematics (CCSS-M) have been maintained. The following information is helpful to correctly read and understand this document.

> "**Standards** define what students should understand and be able to do.
> **Clusters** are groups of related standards. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.
> **Domains** are larger groups of related standards. Standards from different domains may sometimes be closely related." - http://www.corestandards.org/

"Standards do not dictate curriculum or teaching methods. For example, just because topic A appears before topic B in the standards for a given grade, it does not necessarily mean that topic A must be taught before topic B. A teacher might prefer to teach topic B before topic A, or might choose to highlight connections by teaching topic A and topic B at the same time. Or, a teacher might prefer to teach a topic of his or her own choosing that leads, as a byproduct, to students reaching the standards for topics A and B. . . . These Standards are not intended to be new names for old ways of doing business. They are a call to take the next step. It is time for states to work together to build on lessons learned from two decades of standards based reforms. It is time to recognize that standards are not just promises to our children, but promises we intend to keep." - http://www.corestandards.org/

This document includes only the standards designated as assessable by the PARCC Model Content Frameworks. The standards in this document appear exactly as written in the CCSS-M. Italicized portions of the standards offer clarification. The Plus Standards (+) from the Common Core State Standards for Mathematics may be incorporated into the curriculum to adequately prepare students for more rigorous courses (e.g., Advanced Placement, International Baccalaureate, or concurrent credit courses).

If a standard is assessed on more than one end-of-course test, the assessment limitations and clarifications (ALC) for that standard are included below the standard.

Algebra I

Domain	Cluster	Course Emphases
The Real Number System		
	1. Use properties of rational and irrational numbers	Additional
Quantities*		
	2. Reason quantitatively and use units to solve problems	Supporting
Seeing Structure in Expressions		
	3. Interpret the structure of expressions	Major
	4. Write expressions in equivalent forms to solve problems	Supporting
Arithmetic with Polynomials and Rational Expressions		
	5. Perform arithmetic operations on polynomials	Major
	6. Understand the relationship between zeros and factors of polynomials	Supporting
Creating Equations*		
	7. Create equations that describe numbers or relationships	Major
Reasoning with Equations and Inequalities		
	8. Understand solving equations as a process of reasoning and explain the reasoning	Major
	9. Solve equations and inequalities in one variable	Major
	10. Solve systems of equations	Additional
	11. Represent and solve equations and inequalities graphically	Major
Interpreting Functions		
	12. Understand the concept of a function and use function notation	Major
	13. Interpret functions that arise in applications in terms of the context	Major
	14. Analyze functions using different representations	Supporting
Building Functions		
	15. Build a function that models a relationship between two quantities	Supporting
	16. Build new functions from existing functions	Additional
Linear, Quadratic, and Exponential Models*		
	17. Construct and compare linear, quadratic, and exponential models and solve problems	Supporting
	18. Interpret expressions for functions in terms of the situation they model	Supporting
Interpreting categorical and quantitative data		
	19. Summarize, represent, and interpret data on a single count or measurement variable	Additional
	20. Summarize, represent, and interpret data on two categorical and quantitative variables	Supporting
	21. Interpret linear models	Major

* *Asterisks identify potential opportunities to integrate content with the modeling practice*

Domain: The Real Number System
Cluster(s): 1. Use properties of rational and irrational numbers

N.RN.3	1	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	Additional (NS)

Domain: Quantities*
Cluster(s): 2. Reason quantitatively and use units to solve problems

N.Q.1	2	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	Supporting (NS)
N.Q.2	2	Define appropriate quantities for the purpose of descriptive modeling. ALC for N.Q.2: This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean.	Supporting (DS)
N.Q.3	2	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	Supporting (NS)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Domain: Seeing Structure in Expressions
Cluster(s): 3. Interpret the structure of expressions
4. Write expressions in equivalent forms to solve problems

A.SSE.1	3	Interpret expressions that represent a quantity in terms of its context.* a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of* P *and a factor not depending on* P.	Major (LCA)
A.SSE.2	3	Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$. ALC for A.SSE.2: i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize $53^2 - 47^2$ as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form $(53+47)(53-47)$. See an opportunity to rewrite $a^2 + 9a + 14$ as $(a+7)(a+2)$.	Major (NCA)
A.SSE.3	4	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%* ALC for A.SSE.3c: i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents.	Supporting (NCS)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Domain: Arithmetic with Polynomials and Rational Expressions

Cluster(s): 5. Perform arithmetic operations on polynomials

6. Understand the relationship between zeros and factors of polynomials

A.APR.1	5	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	Major (NCS)
A.APR.3	6	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. ALC for A.APR.3 i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x-2)(x^2-9)$.	Supporting (NCA)

Domain: Creating Equations*

Cluster(s): 7. Create equations that describe numbers or relationships

A.CED.1	7	Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* ALC for A.CED.1: i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents.	Major (LCM, NCM)
A.CED.2	7	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	Major (FLCM, FNCM)
A.CED.3	7	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	Major (LCS)
A.CED.4	7	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R.*	Major (LCS)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Domain: Reasoning with Equations and Inequalities

Cluster(s): 8. Understand solving equations as a process of reasoning and explain the reasoning
9. Solve equations and inequalities in one variable
10. Solve systems of equations
11. Represent and solve equations and inequalities graphically

A.REI.1	8	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. ALC for A.REI.1: i) Tasks are limited to quadratic equations.	Major (LCS, NCS)
A.REI.3	9	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	Major (LCS)
A.REI.4	9	Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. ALC for A.REI.4b: i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in Algebra II.	Major (NCS)
A.REI.5	10	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.	Additional (LCA)
A.REI.6	10	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. ALC for A.REI.6: i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).	Additional (LCS)
A.REI.10	11	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	Major (FLCA)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

A.REI.11	11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* ALC for REI.11: i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions.	Major (LCA, NCA)
A.REI.12	11	Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	Major (LCS)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Domain: Interpreting Functions
Cluster(s): 12. Understand the concept of a function and use function notation
13. Interpret functions that arise in applications in terms of the context
14. Analyze functions using different representations

F.IF.1	12	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.	Major (FLCS, FNCS)
F.IF.2	12	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	Major (FLCS, FNCS)
F.IF.3	12	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by* $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$. ALC for F.IF.3: i) This standard is part of the Major work in Algebra I and will be assessed accordingly.	Major (FLCA, FNCA)
F.IF.4	13	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.** ALC for F.IF.4: i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.	Major (FLCA, FNCA)
F.IF.5	13	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function* $h(n)$ *gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**	Major (FLCA, FNCA)
F.IF.6	13	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.* ALC for F.IF.6: i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9.	Major (FLCA, FNCA)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

F.IF.7	14	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	Supporting (FLCM, FNCM, NCM)
F.IF.8	14	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	Supporting (NCA)
F.IF.9	14	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* ALC for F.IF.9: i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6.	Supporting (FLCA, FNCA)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Domain: Building Functions

Cluster(s): 15. Build a function that models a relationship between two quantities

16. Build new functions from existing functions

F.BF.1	15	Write a function that describes a relationship between two quantities.* a. Determine an explicit expression, a recursive process, or steps for calculation from a context. ALC for F.BF.1a: i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers.	Supporting (FLCA, FNCM)
F.BF.3	16	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* ALC F.BF.3: i) Identifying the effect on the graph of replacing $\mathrm{f(x)}$ by $\mathrm{f(x) + k}$, $\mathrm{k\,f(x)}$, $\mathrm{f(kx)}$, and $\mathrm{f(x + k)}$ for specific values of k (both positive and negative) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9.	Additional (FLCA, FNCA)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Domain: Linear, Quadratic, and Exponential Models*

Cluster(s): 17. Construct and compare linear, quadratic, and exponential models and solve problems

18. Interpret expressions for functions in terms of the situation they model

F.LE.1	17	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	Supporting (FLCA, FNCA)
F.LE.2	17	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ALC for F.LE.2: i) Tasks are limited to constructing linear and exponential functions in simple context (not multi-step).	Supporting (LCM, NCM)
F.LE.3	17	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	Supporting (NCA)
F.LE.5	18	Interpret the parameters in a linear or exponential function in terms of a context. ALC for F.LE.5: i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers.	Supporting (LCA, NCA)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Domain: Interpreting categorical and quantitative data

Cluster(s): 19. Summarize, represent, and interpret data on a single count or measurement variable
20. Summarize, represent, and interpret data on two categorical and quantitative variables
21. Interpret linear models

S.ID.1	19	Represent data with plots on the real number line (dot plots, histograms, and box plots).	Additional (DS)
S.ID.2	19	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	Additional (DS)
S.ID.3	19	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	Additional (DS)
S.ID.5	20	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	Supporting (DS)
S.ID.6	20	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. ALC for S.ID.6a: i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers.	Supporting (LCA, FNCM)
S.ID.7	21	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	Major (LCA)
S.ID.8	21	Compute (using technology) and interpret the correlation coefficient of a linear fit.	Major (LCA)
S.ID.9	21	Distinguish between correlation and causation.	Major (LCA)

Key:

CCSS-M Domain and Standard #	CCSS-M Cluster	CCSS-M Standard	PARCC Course Emphases (Category)

Make sense of problems and persevere in solving them Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
Reason abstractly and quantitatively Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
Construct viable arguments and critique the reasoning of others Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
Model with mathematics Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Use appropriate tools strategically Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.
Attend to precision Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
Look for and make use of structure Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(x – y) 2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
Look for and express regularity in repeated reasoning Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through $(1, 2)$ with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

The information contained in this document provides one way to frame discussions about scope and sequence of the standards leading to the development of local curriculum maps. This document incorporates the priorities assigned to each standard in the PARCC Model Content Frameworks (Major, Supporting, and Additional), which will help guide discussions related to priority, focus, and time allocated for each topic. In the spring of 2013, a committee composed of Arkansas educators categorized each standard based on its cognitive demand or complexity. These categories are defined below. Districts are encouraged to approach the development of a curriculum in a manner that best serves the needs of their students.

Frameworks Committee Categorization of Algebra I Standards (indicated in the column to the far right of each standard):

- Descriptive Statistics (DS)
- Number Sense (NS)
- Linear Compare and Analyze (LCA)
- Linear Create and Model (LCM)
- Linear Compute and Solve (LCS)
- Nonlinear Compare and Analyze (NCA)
- Nonlinear Create and Model (NCM)
- Nonlinear Compute and Solve (NCS)
- Functions Linear Compare and Analyze (FLCA)
- Functions Linear Create and Model (FLCM)
- Functions Linear Compute and Solve (FLCS)
- Functions Nonlinear Compare and Analyze (FNCA)
- Functions Nonlinear Create and Model (FNCM)
- Functions Nonlinear Compute and Solve (FNCS)