About the CPS Middle Grades Algebra Blueprint
Updated July 2023

The CPS Middle Grades Algebra Initiative (both the coursework and the Algebra Exit Exam) were revised for the 2014-2015 school year to align materials to the Common Core State Standards for Mathematics (CCSSM). This Blueprint is a well researched outline of the scope for the middle grades algebra course and end-of-year assessment, which prepares students for success in high school mathematics.

For the Algebra Exit Exam, some Algebra I standards will be assessed in their entirety, while others will be only assessed partially as they overlap with other courses – such as Algebra II. In the blueprint we indicate those standards that are partially assessed and provide further clarification in the third column of the table on the following pages.

Please consider the following when reviewing the blueprint:

1. The Exit Exam will consist of 40 questions, including both multiple choice type questions and numeric response (NR) items.

2. The standards in this blueprint are coded using the following color scheme:
   - **Green**: Major Content
   - **Blue**: Supporting Content
   - **Yellow**: Additional Content

   Note that standards are listed in the order of the CCSS Mathematics Framework, which does not reflect the order in which they may appear in the assessment.

3. Any Algebra I standards that are partially assessed are indicated in the bluprint are listed in (*italics and parentheses)*. Clarification of the portion of the standard that is relevant to Algebra I coursework is provided in the third column.

4. Items indicated as not assessed are still a valuable part of the Algebra learning experience. They either lay a foundational framework or connections to other concepts that are crucial to the comprehension of Algebra as a topic of study. Although they are not assessed directly on this limited exam, they are woven into the understandings of other items that are assessed.

CPS Middle Grades Algebra Blueprint

Domain	CCSSM Algebra I Standards	Algebra Exit Exam Assessment Limits & Notes
The Real Number System (N-RN)	**Additional Content** ▾ **B. Use properties of rational and irrational numbers** 3. 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.	***CPS Limit***: *Will not be assessed*
Quantities (N-Q)	**Supporting Content** ▾ **A. Reason quantitatively and use units to solve problems** 1. 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. 2. *(Define appropriate quantities for the purpose of descriptive modeling.)* 3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	***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.* ***CPS Limit***: *Standards N-Q.1, 2 and 3 will not be assessed individually but will be applied as they relate to major content (ex. defining variables when writing a system of equations).*
Seeing Structure in Expressions (A-SSE)	**Major Content** ▾ **A. Interpret the structure of expressions** 1. Interpret expressions that represent a quantity in terms of its context 2. *(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 $(x^2 - y^2)(x^2 + y^2)$.)*	***A-SSE.2***: i.) *Items 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).*

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Seeing Structure in Expressions (A-SSE)	**Supporting Content** ▾ **B. Write expressions in equivalent forms to solve problems** 3. *(Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.)*	*A-SSE.3c:* iii.) *Items 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.* iv.) *Items are limited to exponential expressions with integer exponents.*
Arithmetic with Polynomials and Rational Expressions (A-APR)	**Major Content** ▾ **A. Perform arithmetic operations on polynomials** 1. 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.	
	Supporting Content ▾ **B. Understand the relationship between zeros and factors of polynomials** 3. *(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.)*	*A-APR.3:* *Standard A-APR.3 will not be assessed individually but will be applied as it relates to major content.*

Domain	CCSSM Algebra I Standards	Algebra Exit Exam Assessment Limits & Notes
Creating Equations (A-CED)	**Major Content** ⌄ **A. Create equations that describe numbers or relationships** 1. *(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.)* 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. 3. 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. 4. 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.	*A-CED.1:* *Items are limited to linear, quadratic, or exponential equations with integer exponents.*
Reasoning with Equations and Inequalities (A-REI)	**Major Content** ⌄ **A. Understand solving equations as a process of reasoning and explain the reasoning** 1. *(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.)*	*A-REI.1:* *Tasks are limited to quadratic equations.* *Tasks will not require students to write explanations.*

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Reasoning with Equations and Inequalities (A-REI)	**Major Content** ▾ **B. Solve equations and inequalities in one variable** 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. 4. *(Solve quadratic equations in one variable.)*	***A-REI.4b:*** *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 A2.
	Additional Content ▾ **C. Solve systems of equations** 5. 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.	***CPS Limit***: *Standard A-REI.5 will not be assessed individually but will be applied as it relates to major content. Tasks will require students to apply their understanding rather than prove.*
	Major Content ▾ **C. Solve systems of equations** 6. *(Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.)*	

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Reasoning with Equations and Inequalities (A-REI)	**Major Content** ▾ **D. Represent and solve equations and inequalities graphically** 10. 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). 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.*)* 12. 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.	***A-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.*
Interpreting Functions (F-IF)	**Major Content** ▾ **A. Understand the concept of a function and use function notation** 1. 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 $y = f(x)$. 2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	

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Interpreting Functions (F-IF)	**Additional Content** ⌄ **A. Understand the concept of a function and use function notation** 3. *(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 $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ <u>for</u> $n \geq 1$.)*	*CPS Limit*: *Will not be assessed*
Interpreting Functions (F-IF)	**Major Content** ⌄ **B. Interpret functions that arise in applications in terms of the context** 4. *(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.)* 5. 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. 6. *(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.*)*	*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.* *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.*

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Interpreting Functions (F-IF)	**Supporting Content** ⌄ **C. Analyze functions using different representations** 7. *(Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*)* 8. *(Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.)* 9. *(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.)*	*CPS Limit*: *Standards F-IF.7 and 8 will not be assessed individually but will be applied as they relate to major content (e.g., graphing functions and writing equivalent functions in different forms)* *F-IF.9:* *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.*
Building Functions (F-BF)	**Supporting Content** ⌄ **A. Build a function that models a relationship between two quantities** 1. *(Write a function that describes a relationship between two quantities.)*	*CPS Limit*: *Will not be assessed*
	Additional Content ⌄ **B. Build new functions from existing functions** 3. *(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.)*	*F-BF.3:* i.) *Identifying 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) 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.*

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Linear, Quadratic, and Exponential Models (F-LE)	**Supporting Content** ⌄ **A. Construct and compare linear, quadratic, and exponential models and solve problems** 1. Distinguish between situations that can be modeled with linear functions and with exponential functions. 2. *(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).* 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	**F-LE.2:** *Tasks are limited to constructing linear and exponential functions in simple context (not multi-step).*
	Supporting Content ⌄ **B. Interpret expressions for functions in terms of the situation they model** 5. *(Interpret the parameters in a linear or exponential function in terms of a context.)*	**F-LE.5:** i.) *Tasks have a real-world context.* ii.) *Exponential functions are limited to those with domains in the integers.*
Interpreting Categorical and Quantitative Data (S-ID)	**Additional Content** ⌄ **A. Summarize, represent, and interpret data on a single count or measurement variable** 1. Represent data with plots on the real number line (dot plots, histograms, and box plots). 2. 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. **3.** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	

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Interpreting Categorical and Quantitative Data (S-ID)	**Supporting Content** ▾ **B. Summarize, represent, and interpret data on two categorical and quantitative variables** 5. 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. 6. *(Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.)*	**S-ID.6a:** i) *Tasks have a real-world context.* ii) *Exponential functions are limited to those with domains in the integers.*
	Major Content ▾ **C. Interpret linear models** 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. 8. Compute (using technology) and interpret the correlation coefficient of a linear fit. 9. Distinguish between correlation and causation.	