CPM Algebra 1 Textbook to Curriculum Map Alignment for CC Algebra 1

Algebra 1 – UNIT 1
Relationships between Quantities and Reasoning with Equations

Critical Area: By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. This unit builds on these earlier experiences by asking students to analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations. All of this work is grounded on understanding quantities and on relationships between them.

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTION	OTHER RESOURCES
(m) Interpret the structure of expressions. *Limit to linear expressions and to exponential expressions with integer exponents.*	**Algebra - Seeing Structure in Expressions** A.SSE.1 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 single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P.*	2.1.4, 3.3.2, and throughout text MN: 3.2.3, 7.2.3, 8.1.1, 8.2.4 2-44, 6-35(a), 9-126, 10-145, 11-52, 11-92, 11-130 2.1.4, 4.1.1, 7.1.3, 8.2.5, 10.2.3, 10.2.6 MN: 10.2.3, 10.2.6 7-75, 10-53, 10-67, 10-92, 11-49, 11-92	**MARS Tasks:** Solving Equation in One Variable Sorting Equations and Identities Manipulating Polynomials Defining Regions of Inequalities Comparing Investments **Teaching Channel:** Using Stations to Explore Algebra Expressions
(m) Understand solving equations as a process of reasoning and explain the reasoning. *Students should focus on and master A.REI.1 for linear equations and be able to extend and apply their reasoning to other types of equations in future courses.*	**Algebra - Reasoning with Equations and Inequalities** A.REI.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.	3.2.1, 3.3.1, 10.2.2, 10.2.3, 10.2.6 MN: 3.2.1, 3.2.4, 10.2.1, 10.2.3 3-99, 3-102, 3-104, 4-16, 4-92, 4-102, 10-67	**Illustrative Mathematics:** Exploring Equations Algebra Tiles **Mathematics Vision Project:** Module 1: Getting Ready Module
(m) Solve equations and inequalities in one variable. *Extend earlier work with solving linear equations to solving linear inequalities in one variable and to solving literal equations that are linear in the variable being solved*	A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	3.2.1, 3.3.1–3.3.3, 9.2.1, 9.2.2, 10.2.1, 10.2.2, 10.2.6, 10.3.3 MN: 10.2.1, 10.2.2, 10.2.3 Checkpoints 1 and 4 3-21, 3-94, 4-54, 8-22, 9-95, 9-116, 11-31, 11-3	

for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5x = 125$ or $2x = \frac{1}{16}$.	A.REI.3.1 Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context. **CA addition**	3.3.1, 9-82, 9-101, 10-65, 10.2.6, 10-106, 10.3.3 MN: 10.2.6 9-100, 9-108, 10-45, 10-92, 10-129	**Illustrative Mathematics:** Integer Solutions to Inequality **Teaching Channel:** Collaborate to Solve Compound Inequalities
(s/a) Reason quantitatively and use units to solve problems. *Working with quantities and the relationships between them provides grounding for work with expressions, equations, and functions.*	**Numbers - Quantities** N.Q.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. N.Q.2 Define appropriate quantities for the purpose of descriptive modeling. N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	2.2.2, 2.3.1, 4.3.1, 6.1.1–6.2.5, 7.1.6, 8.2.1 MN: 2.1.4, 6.1.2, 7.1.3 2-61, 2-90, 2-94, 6-24, 6-35, 7-17, 7-35, 7-39, 8-34, 8-114, 9-60, 9-109(b), 11-85. 2.2.2, 2.2.3, 2.3.1, 4.1.1, 4.1.2, 4.2.2, 5.1.1, 7.1.6, 7.2.3, 9.2.2, 9.3.2, 9.4.2, .4.3, 11.3.4, 11.3.5 MN: 4.1.1, 6.2.1, 6.2.5 Checkpoints 7A, 8, and 9 4-62, 5-70, 7-11, 7-38, 7-78, 7-117, 9-87, 9-115, 10-150 6.1.3, 11.3.4, 11.3.5 6-55, 6-73, 7-17, 7-78, 7-122, 7-123, 8-54, 8-111, 9-60	**MARS TASK:** Leaky Faucet Dan Meyer **Achieve the Core:** Yogurt Packing **Illustrative Mathematics:** How Much is a penny worth Traffic Jam **Georgia Standards:** Unit 1: Relationships Between Quantities
(m) Create equations that describe numbers or relationships. *Limit A.CED.1 and A.CED.2 to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs. Limit A.CED.3 to linear equations and inequalities. Limit A.CED.4 to formulas*	**Algebra - Creating Equations** A.CED.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.	4.1.1, 4.1.2, 7.1.2–7.1.6, 9.1.3, 9.1.4, 9.2.1, 9.2.2, 11.3.4, 11.3.5 MN: 9.2.1, 9.3.2 Checkpoint 7A 3-23, 5-70, 5-80, 5-121, 7-63, 9-50, 9-71, 10-116, [11-15, 11-24, 11-93]	**MARS Tasks:** Building and Solving Equations Optimization Problems: Boomerangs Intervention Task Lines and Linear Equations

which are linear in the variable of interest.	A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. A.CED.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.	2.2.1–2.2.3, 4.1.2, 4.3.1, 7.1.2–7.1.6, 8.2.1–8.2.4, 9.1.3, 9.1.4 Checkpoints 5B and 9 2-61, 2-93, 3-36, 4-51, 7-38, 7-48, 7-117, 9-87, 10-86 4.1.1–4.2.5, 9.3.1–9.4.3, 11.3.4, 11.3.5 MN: 9.3.2, 9.4.1 4-23, 5-132, 9-110, 9-115, 10-85, 10-150, 11-6 3.3.2, 3.3.3 Checkpoint 6A 3-94, 4-76, 4-121, 5-23, 6-8, 6-29, 6-126	**Illuminations:** Bathtub Water Levels **Inside Mathematics:** On a Balance **Illustrative Mathematics:** Dimes and Quarters Equations and Formulas Rewriting Equations **Teaching Channel** Reviewing Linear Equations in Two Variables

Algebra 1 – UNIT 2
Linear and Exponential Relationships

Critical Area: Students will learn function notation and develop the concepts of domain and range. They move beyond viewing functions as processes that take inputs and yield outputs and start viewing functions as objects in their own right. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. They work with functions given by graphs and tables, keeping in mind that, depending upon the context, these representations are likely to be approximate and incomplete. Their work includes functions that can be described or approximated by formulas as well as those that cannot. When functions describe relationships between quantities arising from a context, students reason with the units in which those quantities are measured. Students explore systems of equations and inequalities, and they find and interpret their solutions. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
Extend the properties of exponents to rational exponents.	**Number and Quantity - The Real Number System** **N.RN.1**. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5. **N.RN.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.	7.2.1 7.2.1 MN: 3.1.2, 7.2.2, 9.1.4 7-90, 7-100, 8-32, 8-50, 8-75, 9-9, 11-76	**Mars Tasks:** Applying Properties of Exponents Giantburgers Multiplying Cells The Real Number System Manipulating Radicals
Build a function that models a relationship between two quantities. *Limit to F.BF.1a, 1b, and 2 to linear and exponential functions. In F.BF.2, connect arithmetic sequences to linear functions and geometric sequences to exponential functions.*	**Functions - Building Functions** **F.BF.1.** 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. b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a*		**MARS Tasks:** A Golden Crown **Illuminations:** Graphing Real-Life Data **Illustrative Mathematics:** Skeleton Tower A Sum of Functions Lake Algae

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
	decaying exponential, and relate these functions to the model. **F.BF.2.** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★		Kim and Jordan Intervention **MARS Task:** Modeling Situations with Linear Equations
Build new functions from existing functions. *Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept. While applying other transformations to a linear graph is appropriate at this level, it may be difficult for students to identify or distinguish between the effects of the other transformations included in this standard.*	**Functions - Building Functions** **F.BF.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.*		**Illustrative Mathematics:** Campus Flu **Teaching Channel:** **Intervention** Conjecturing About Functions **YouCubed.org** **Intervention** Patterns and Functions Unit
Understand the concept of a function notation.	**Functions - Interpreting Functions** **F.IF.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 $y = f(x)$. **F.IF.2.** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	1.1.1, 1.2.3–1.2.5, 11.1.1 MN: 1.2.5 1-69, 1-70, 1-78, 2-52, 4-28, 11-131 1.1.1, 1.2.3–1.2.5 MN: 1.2.5 1-80, 3-10, 4-30, 7-99, 11-4, 11-12, 11-78	**Illustrative Mathematics** Foxes and Rabbits **Mathematics Vision Project:** Module 5 Features of Functions Domain and Range

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
	F.IF.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) for n ≥ 1.*	5.2.2, 5.2.3, 5.3.3 5-123, 6-128, 7-18, 7-51, 7-76, 7-108	
Interpret functions that arise in applications in terms of a context. *Focus linear and exponential functions*	**Functions - Interpreting Functions** **F.IF.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.*★	1.1.3, 1.2.1, 2.1.3–2.2.3, 7.1.1, 7.1.5, 7.1.6, 8.2.1, 8.2.3, 8.2.4, 11.3.4, 11.3.5 MN: 1.1.2, 7.1.1, 2.2.3, 8.2.4 1-25, 1-47, 1-59, 6-114, 9-126, 11-130	
Analyze functions using different representations. *Linear, exponential, quadratic, absolute value, step, piecewise-defined.*	**Functions - Interpreting Functions** **F.IF.7.** 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. ★ **F.IF.9**. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal	a. 1.1.2, 1.1.3, 2.1.1–2.3.2, 8.2.1, 8.2.3–8.2.5, 11.1.1 MN: 2.2.3 2-33, 3-8, 3-41, 9-76, 8-11, 8-58, 10-41, 10-86, 11-110 b. 1.2.1, 1.2.2, 2.2.2, 7.1.3 MN:7.1.3, 7.1.5 1-86, 6-28, 6-109, 6-114, 7-61, 11-35, 11-73, 11-84, 11-90, 11-131 F.IF.9: 2.2.2, 7.1.6, 8.2.1, 8.2.4 1-79, 3-71, 4-49, 4-39, 9-42, 9-88, 9-94, 11-90	**Illustrative Mathematics** Foxes and Rabbits Interpreting the Graph

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
	descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.		
Solve systems of equations. *Linear-linear and linear-quadratic.*	**Algebra - Reasoning with Equations and Inequalities** **A.REI.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 **A.REI.6**. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	4.2.2–4.2.5 MN: 5.1.1 4-40, 4-83 4.1.1–4.2.5 MN: 4.1.2, 4.2.2 Checkpoint 7B 3-73, 4-62, 4-116, 4-122, 7-7, 7-40, 8-21, 8-62, 10-11	
Represent and solve equations and inequalities **Graphically.** *Linear and exponential; learn as general principle.*	**Algebra - Reasoning with Equations and Inequalities** **A.REI.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). **A.REI.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. ★	1.1.3–1.2.2, 2.1.4, 2.3.2, 4.2.2, 7.2.2, 9.3.1 MN: 4.2.3, 4.2.5 1-59, 1-86, 2-84, 4-49, 4-99, 6-114, 8-119 10.3.1, 10.3.2 10-114, 10-130, 10-140, 10-14	**Mars Tasks:** Defining Regions Using Inequalities

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
	A.REI.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.	9.3.1, 9.3.2, 9.4.1–9.4.3 9-127, 10-13, 10-18, 11-32, 11-58	

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Algebra 1 – UNIT 3
Descriptive Statistics

Critical Area: Experience with descriptive statistics began as early as Grade 6. Students were expected to display numerical data and summarize it using measures of center and variability. By the end of middle school they were creating scatterplots and recognizing linear trends in data. This unit builds upon that prior experience, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

CLUSTERS	COMMON CORE STATE STANDARDS	Textbook: CPM	OTHER RESOURCES
(*s*) Summarize, represent, and interpret data on a single count or measurement variable. ★ *In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.*	**Statistics and Probability - Interpreting Categorical and Quantitative Data** S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). S.ID.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. S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	11.2.1–11.2.3 MN: 11.2.1 11-34, 11-46, 11-53, 11-68, 11-72, 11-103, 11-115 11.2.2-11.2.3 MN: 11.2.2, 11.2.3 11-53, 11-67, 11-68, 11-85, 11-103, 11-141 11.2.1-11.2.3 MN: 11.2.2, 11.2.3 11-25, 11-46, 11-53, 11-68, 11-85, 11-103, 11-141	**MARS Tasks:** Using Frequency Graphs Using Box Plots **Illustrative Mathematics:** Haircut Costs Speed Trap Understanding the Standard Deviation Measuring Variability in a Data Set **Mathematics Vision Project:** Module 8-Modeling Data
(*s*) Summarize, represent, and interpret data on two categorical and quantitative variables. ★ *Students take a more sophisticated look at using a linear function to model the relationship between two*	**Statistics and Probability - Interpreting Categorical and Quantitative Data** S.ID.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.	10.1.1 10-16, 10-59, 10-113, 10-144, 11-144	**MARS Tasks:** A Case of Muddying the Waters Interpreting and Using a Graph: Taxi Fares Devising a Measure for Correlation

numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals. *S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.*	S.ID.6 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 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.	6.1.1–6.2.5, 11.3.1 MN: 4.1.1, 6.2.1, 6.2.5 Checkpoint 8 7-11, 7-17, 7-57, 7-78, 7-110, 7-121, 7-123, 8-34, 8-61, 8-111, 9-60, 9-109, 11-102 6.2.1, 11.3.1 MN: 6.1.4, 6.2.3 7-11, 7-39, 7-57, 7-110, 7-122, 7-123, 8-34, 8-54, 9-60 6.1.1–6.1.4, 11.3.1 MN: 4.1.1, 4.2.1, 6.2.1 Checkpoint 8 7-11, 7-110, 7-122, 8-54, 8-61, 8-111, 11-102	**Illustrative Mathematics:** Musical Preference Support for a Longer School Day Coffee and Crime Laptop Battery Charge Restaurant Bill and Party Size **Illuminations:** Automobile Mileage: Year vs. Mileage Barbie Bungee Impact of a Superstar
(*s*) Interpret linear models. ★ *Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical relationship and a cause-and-effect relationship arises in S.ID.9.*	**Statistics and Probability - Interpreting Categorical and Quantitative Data** S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S.ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.	6.1.1, 11.3.1 MN: 6.1.2 Checkpoint 8 7-11, 7-110, 7-122, 8-34, 8-54, 8-111, 8-122, 9-60, 9-109, 11-88 6.2.2, 6.2.4, 11.3.1 MN: 6.2.4 Checkpoint 8 7-11, 7-29, 7-110, 7-122, 8-34,	**MARS Tasks:** A Case of Muddying the Waters **Illustrative Mathematics:** Texting and Grades II Olympic Men's 100-meter Dash Coffee and Crime Golf and Divorce

		8-54, 8-111, 8-122, 9-60, 9-109, 11-88	High Blood Pressure Math Test Grades
	S.ID.9 Distinguish between correlation and causation.	6.2.3 6-100, 6-111, 6-127, 8-61	

Algebra 1 - Unit 4
Expressions and Equations

Description of the critical area: In this unit, students build on their knowledge from Unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of numbers and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions and determine the values of the function it defines. Students understand that polynomials form a system analogous to the integers, they choose and produce equivalent forms of an expression.

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
(m)Interpret the structure of expressions.	**Algebra - Seeing Structure in Expressions** A-SSE.1 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.* A-SSE.2 Use the structure of an expression to identify ways to rewrite it. *For example, see x4 – y4 as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.	2.1.4, 3.3.2, and throughout text MN: 3.2.3, 7.2.3, 8.1.1, 8.2.4 2-44, 6-35(a), 9-126, 10-145, 11-52, 11-92, 11-130 2.1.4, 4.1.1, 7.1.3, 8.2.5, 10.2.3, 10.2.6 MN: 10.2.3, 10.2.6 7-75, 10-53, 10-67, 10-92, 11-49, 11-92 8.1.4, 8.1.5 MN: 8.1.2 8-74, 9-33, 10-21, 10-28	**Mathematics Vision Project:** **Mathematics Vision Project:** Module 2- Structures of Expressions Module 1 – Quadratic Functions
(m)Write expressions in equivalent forms to solve problems.	**Algebra - Seeing Structure in Expressions** A-SSE.3 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.	3.2.2, 8.1.1–8.2.4, 11.3.4 MN: 8.1.2, 8.1.4, 9.1.1 Checkpoint 10B 8-83, 8-109, 8-112, 9-122, 10-72 8.2.5, 9.1.1 8-106, 9-21, 9-76, 9-117,	**Mars Tasks:** Interpreting Algebraic Expressions Forming Quadratics

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
	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 1.15t can be rewritten as* $(1.15^{1/2})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	10-125, 11-56 3.1.1, 3.1.2, 7.1.4, 10.2.1 MN: 3.1.2, 7.2.2 7-97, 10-53, 8-75, 10-83, 10-88	
(m)Perform arithmetic operations on polynomials.	**Algebra – Arithmetic with Polynomial and Rational Expressions** A-APR.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.		**Mathematics Vision Project:** Module 3: Polynomial Connections Lesson 3.4
(m)Create equations that describe numbers or relationships.	**Algebra - Creating Equations** A-CED.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.* A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	4.1.1, 4.1.2, 7.1.2–7.1.6, 9.1.3, 9.1.4, 9.2.1, 9.2.2, 11.3.4, 11.3.5 MN: 9.2.1, 9.3.2 Checkpoint 7A 3-23, 5-70, 5-80, 5-121, 7-63, 9-50, 9-71, 10-116, [11-15, 11-24, 11-93] 2.2.1–2.2.3, 4.1.2, 4.3.1, 7.1.2–7.1.6, 8.2.1–8.2.4, 9.1.3, 9.1.4 Checkpoints 5B and 9 2-61, 2-93, 3-36, 4-51, 7-38,	**Mars Tasks:** Printing Tickets **Inside Mathematics:** Miles of Tiles

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
	A-CED.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.*	7-48, 7-117, 9-87, 10-86 3.3.2, 3.3.3 Checkpoint 6A 3-94, 4-76, 4-121, 5-23, 6-8, 6-29, 6-126	
(m)Solve equations and inequalities in one variable.	**Algebra - Reasoning with Equations and Inequalities** A-REI.4 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 *x2* = 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* ± *bi* for real numbers *a* and *b*.	8.2.5, 9.1.1–9.1.4, 10.2.5, 10.2.6 MN: 9.1.2 9-52, 9-99, 9-117, 10-151, 11-56, 11-33, 11-137 8.2.2, .2.3, 9.1.1–9.1.4, 10.2.4, 10.2.5 MN: 8.1.3, 8.1.4, 8.2.2, 8.2.4, 9.1.2, 9.1.3, 10.2.4, 11.1.2 8-85, 9-52, 9-55, 9-63, 9-125, 10-91, 10-151, 11-33	**Mars Task:** Multiple Solutions **Illustrative Mathematics:** Completing the Square
(*s*)Solve systems of equations.	**Algebra - Reasoning with Equations and Inequalities** A-REI.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. A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables A-REI.7 Solve a simple system consisting of a linear	4.2.2–4.2.5 MN: 5.1.1 4-40, 4-83 4.1.1–4.2.5 MN: 4.1.2, 4.2.2 Checkpoint 7B 3-73, 4-62, 4-116, 4-122, 7-7, 7-40, 8-21, 8-62, 10-11 10.3.1, 10.3.2	**Illustrative Mathematics:** A Linear and Quadratic System

CPM Algebra 1 Textbook to Curriculum Map Alignment for CC Algebra 1

CLUSTERS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
	equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line* $y = -3x$ *and the circle* $x^2 + y^2 = 3$.	10-127, 11-70, 11-92, 11-116, 11-142	

CPM Algebra 1 Textbook to Curriculum Map Alignment for CC Algebra 1

Algebra 1– UNIT 5
Quadratic Functions and Modeling

Critical Area: In preparation for work with quadratic relationships students explore distinctions between rational and irrational numbers. They consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students learn that when quadratic equations do not have real solutions the number system must be extended so that solutions exist, analogous to the way in which extending the whole numbers to the negative numbers allows x+1 = 0 to have a solution. Formal work with complex numbers comes in Algebra II. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.

CLUSTER HEADINGS	COMMON CORE STATE STANDARDS	CPM CONNECTIONS	OTHER RESOURCES
(s)Use properties of rational and irrational numbers. *Connect N.RN.3 to physical situations, e.g., finding the perimeter of a square of area 2.*	**Number and Quantity - The Real Number System** N.RN.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.	10.2.5 MN 10.2.5 10-82, 10-96, 10-115	
(m)Interpret functions that arise in applications in terms of a context. *Focus on quadratic functions; compare with linear and exponential functions studied in Unit 2.*	**Functions - Interpreting Functions** F.IF.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.★* F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the*	1.1.3, 1.2.1, 2.1.3–2.2.3, 7.1.1, 7.1.5, 7.1.6, 8.2.1, 8.2.3, 8.2.4, 11.3.4, 11.3.5 MN: 1.1.2, 7.1.1, 2.2.3, 8.2.4 1-25, 1-47, 1-59, 6-114, 9-126, 11-130 1.2.4, 1.2.5, 7.1.5–7.2.1, 8.2.1, 11.3.2, 11.3.3 6-109(h), 7-43(f), 7-98, 10-87, 11-113, 11-131	**Illustrative Mathematics:** Influenza Epidemic Warming and Cooling How is the Weather? Logistic Growth Model, Explicit Version The Canoe Trip, Variation 1 The High School Gym Temperature Change Average Cost

	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 he function.★ F.IF.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.★	2.1.2–2.1.4, 2.2.2, 2.2.3, 5.3.1, 5.3.2, 7.1.2, 7.1.3 MN: 6.1.2 2-67, 4-122, 5-85, 6-86(a), 7-37, 9-42, 11-102	
(m)Analyze functions using different representations. *For F.IF.7b, compare and contrast absolute value, step and piecewise defined functions with linear, quadratic, and exponential functions. Highlight issues of domain, range, and usefulness when examining piecewise defined functions. Note that this unit, and in particular in F.IF.8b, extends the work begun in Unit 2 on exponential functions with integer exponents. For F.IF.9, focus on expanding the types of functions considered to include, linear, exponential, and quadratic. Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored.*	**Functions - Interpreting Functions** F.IF.7 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. F.IF.8 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	1.1.2, 1.1.3, 2.1.1–2.3.2, 8.2.1, 8.2.3–8.2.5, 11.1.1 MN: 2.2.3 2-33, 3-8, 3-41, 9-76, 8-11, 8-58, 10-41, 10-86, 11-110 1.2.1, 1.2.2, 2.2.2, 7.1.3 MN:7.1.3, 7.1.5 1-86, 6-28, 6-109, 6-114, 7-61, 11-35, 11-73, 11-84, 11-90, 11-131 8.2.1–8.2.5, 9.1.3, 9.1.4 Checkpoint 11 8-83, 8-92, 8-109, 9-21, 10-41, 10-86, 11-56	**MARS Tasks:** Functions and Everyday Situations **Illustrative Mathematics:** Identifying Graphs of Functions Which Function? Throwing Baseballs

	these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$ *and classify them as representing exponential growth or decay.* F.IF.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.*	 7.1.2–7.1.6, 11.3.5 MN: 7.1.3 Checkpoints 9 and 10A 7-54, 7-120, 10-58, 10-119c, 10-145, 11-52 2.2.2, 7.1.6, 8.2.1, 8.2.4 1-79, 3-71, 4-49, 4-39, 9-42, 9-88, 9-94, 11-90	
(m)Build a function that models a relationship between two quantities. *Focus on situations that exhibit a quadratic relationship.*	**Functions - Building Functions** F.BF.1 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. b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*		Graphing Stories (1-3 stories) **Mars Task:** Patchwork Sidewalk Patterns
(*s*)Build new functions from existing	**Functions - Building Functions**		

functions. *For F.BF.3, focus on quadratic functions, and consider including absolute value functions. For F.BF.4a, focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as f(x) = x2, x>0.*	F.BF.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.4 Find inverse functions. a. Solve an equation of the form *f(x) = c* for a simple function *f* that has an inverse and write an expression for the inverse. *For example, f(x) = 2 x3 or f(x) = (x+1)/(x-1) for x ≠ 1.*		
(*s*)Construct and compare linear, quadratic, and exponential models and solve problems. *Compare linear and exponential growth to quadratic growth.*	**Functions – Linear, Quadratic, and Exponential Model** F.LE.1 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. F.LE.2 Construct linear and exponential	2.1.1–2.1.4, 5.3.1, 7.1.2, 7.1.3 MN: 2.1.4 2-94, 7-28, 7-35, 7-36, 7-51 2.2.1–2.2.3, 4.1.1 3-23, 5-80, 6-115, 8-41, 10-57 5.1.1–5.1.3, 5.3.2, 7.1.2–7.1.6, 7.2.3, 11.3.5 MN: 7.1.3 Checkpoints 9 and 10A 5-121, 7-63, 8-20, 9-43, 10-19 2.1.1–2.3.2, 5.2.1–5.2.3, 5.3.2, 7.1.2, 7.2.2, 11.3.5 MN: 2.2.2, 3.3.2, 9.3.1 Checkpoints 5B, 7A, 9, and 10A 3-22, 3-38, 7-36, 7-73, 7-91, 7-96, 9-71, 9-78	**MARS Task:** Modeling: Having Kittens Sorting Functions Linear and Exponential Models **Mathematics Vision Project:** Arithmetic and Geometric Sequence Linear and Exponential Functions **NCTM Illuminations** Egg Launch

	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). F.LE.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.	5.3.1	
(*s*)Interpret expressions for functions in terms of the situation they model.	**Functions – Linear, Quadratic, and Exponential Model** F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.★ [Linear and exponential of form $f(x)=b^x+k$.] F.LE.6. Apply quadratic functions to physical problems, such as the motion of an object under the force of gravity. ★ CA	2.1.1–2.2.3, 7.1.2–7.1.6, 11.3.5 MN: 4.2.4 Checkpoints 7A and 10A 6-116, 7-54, 7-107, 10-145, 11-52 8.2.1, 9.1.3, 9.1.4, 10.2.6 Checkpoint 11 9-54, 10-41, 10-86, 11-121, 11-130	**Illustrative Mathematics:** Throwing Baseballs – F.IF.9 and F.IF.4