Agile Mind Intensified Algebra I Scope and Sequence, 2016-2017
Common Core State Standards for Mathematics

These course materials are designed to support 164-169 lessons (1 lesson equals 80 minutes).

Agile Mind Topics	Time allotment	Topic Descriptions	Common Core State Standards for Mathematics • Standards in black are the primary instructional focus of the topic. • Standards in grey support topic content or indicate foundations for future work.
Opportunities for students to apply the practices of making sense of problems and persevere in solving them, reasoning abstractly and quantitatively, constructing viable arguments, modeling with mathematics, using appropriate tools strategically, attending to precision, looking for and making use of structure, and looking for and expressing regularity in repeated reasoning are evident throughout this course. (Standards for Mathematical Practice) **Because Intensified Algebra I incorporates review and repair strategies for pre-algebra concepts and skills, standards prior to Algebra I have been included.**			
Unit 1: Getting started with Algebra			
1: Exploring problem-solving strategies	5-6 lessons This topic contains an optional reinforce lesson on addition and subtraction of signed numbers.	Students experience collaboration as a strategy to solve problems. They share problem-solving strategies as they explore problems that have one or more solutions. They also begin an exploration of arithmetic and geometric sequences. **Shaping attitudes toward learning:** • Students learn about their teacher, their classmates, and this course; • Students learn strategies for being effective communicators; • Students learn and practice norms and routines to aid collaboration and overall learning. **Focus Skill work:** • Operations with signed numbers • Addition • Subtraction	**6-NS.6a:** Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself. **6-NS.7c:** Understand the absolute value of a rational number as its distance from 0 on the number line; ~~interpret absolute value as magnitude for a positive or negative quantity in a real-world situation~~. **7-NS.1a:** Describe situations in which opposite quantities combine to make 0. **7-NS.1b:** ~~Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative.~~ Show that a number and its opposite have a sum of 0 (are additive inverses). ~~Interpret sums of rational numbers by describing real-world contexts.~~ **7-NS.1c:** Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference~~, and apply this principle in real-world contexts~~. **7-NS.1d:** Apply properties of operations as strategies to add and subtract rational numbers. **7-NS.3:** Solve real-world and mathematical problems involving the four operations with rational numbers.[1] **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~~. **F-LE.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).
2: Getting smarter through algebraic reasoning	5 lessons	This topic introduces students to the ideas of malleable intelligence and brain growth through learning. Students continue to develop problem-solving strategies as they extend their understanding of patterns. **Shaping attitudes toward learning:**	**7-NS.2a:** Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. **7-NS.2b:** Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then –(p/q) = (–p)/q = p/(–q). Interpret quotients of rational numbers by describing real- world contexts. **7-NS.2c:** Apply properties of operations as strategies to multiply and divide rational numbers.

		• Students examine and reflect on the perceptions of their math ability; • Students learn how intelligence is malleable, not fixed; • Students understand how working on challenging problems affects the brain. **Focus Skill work:** • Operations with signed numbers • Multiplication • Division	**N-Q.2:** Define appropriate quantities for the purpose of descriptive modeling.
3: Foundations of algebra	10 lessons	Students investigate the use of variables to represent unknowns and to generalize relationships. They also review important graphing skills.	**6-EE.2a:** Write expressions that record operations with numbers and with letters standing for numbers. **6-EE.2c:** Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole- number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). **6-EE.3:** Apply the properties of operations to generate equivalent expressions. **6-EE.4:** Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). **6-EE.6:** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. **7-EE.1:** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. **7-EE.4a:** Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* . **A-SSE.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 $(x^2 – y^2)(x^2 + y^2)$. **F-BF.1a**: Determine an explicit expression, a recursive process, or steps for calculation from a context. **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).~~ **A-CED.2:** Create equations in two or more variables to represent relationships between quantities~~; graph equations on coordinate axes with labels and scales~~.

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Unit 2: Introduction to functions and equations			
4: Representing mathematical relationships in multiple ways	6-7 lessons This topic includes an optional extension lesson that builds upon students' work with the Banquet Table Problem in Lesson 2, extending the problem to tables of other shapes.	This topic begins a key theme of the course: Relationships between variables can be represented using words, tables, graphs, or symbols. Students are formally introduced to different ways to represent patterns and relationships and begin to connect various representations of proportional and non-proportional situations to one another (verbal, numeric, graphical, algebraic). They also extend their understanding of multiple representations in a way that will pay big dividends in Algebra I: They begin to learn to generate other, related representations when given a single representation of a pattern or relationship.	**6-EE.6:** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. **6-EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, though of as the dependent variable, in terms of the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at a constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.* **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 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.* **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-SSE.1a**: Interpret parts of an expression, such as terms, factors, and coefficients. **A-SSE.1b:** 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.*
5: Problem solving and metacognition	5 lessons	Students further develop their problem-solving capabilities and their algebraic thinking by working on a non-routine problem. Students also explicitly explore the use of metacognitive strategies to improve their problem solving and learning. **Shaping attitude toward learning:** • Students understand the roles of confusion and metacognition in the learning process. **Focus Skill work:** Scaling graph axes.	**6-EE.6:** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. **6-EE.9:** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, though of as the dependent variable, in terms of the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at a constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.* **6-NS.06c:** Find and position integers and other rational numbers on a horizontal or vertical numberline diagram; find and position pairs of integers and other rational numbers on a coordinate plane. **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.
6: Working with functions and equations	7-8 lessons This topic includes an optional reinforce lesson that provides students with additional practice around the concepts	Students are informally introduced to the concept of function as a dependency relationship between two variables, in which one depends on the other in a systematic way. Students extend their growing understanding of multiple representations and use them to	**6-EE.9:** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, though of as the dependent variable, in terms of the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at a constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.* **7-RP.2a**: Decide whether two quantities are in a proportional relationship, e.g., by testing for

	covered in this topic.	represent functions involving proportional and non-proportional linear relationships algebraically, numerically, graphically and verbally. Students also extend their understanding of functions to include representing sequences as functions.	equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. **8-F.1:** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. **N-Q.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **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. **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. **A-REI.10:** Understand that the graph of an equation in two variables is the set of all its solution plotted in the coordinate plane, often forming a curve (which could be a line). **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. **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. **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 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.** **F-BF.1a:** Determine an explicit expression, a recursive process, or steps for calculation from a context. **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. **F-LE.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).

Unit 3: Rate of change			
7: Exploring rate of change in motion problems	8 lessons	Understanding the rate at which one quantity changes with respect to another is key to understanding how the two quantities are related. In this topic, students explore the concept of rate by analyzing motion over time. Students investigate the rate at which distance changes numerically and graphically.	**8-F.5:** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. **N-Q.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **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 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.** **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.* **F-LE.1b:** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
8: Mindset, motivation, and algebraic thinking	5 lessons	Students further develop their problem-solving capabilities and algebraic thinking by working on a non-routine problem. Students reflect on their mindset as they work on the problem, and learn that mindset can affect success. **Shaping attitudes toward learning:** • Students learn what is meant by the term mindset and how mindsets can affect success; • Students develop strategies to maintain a positive mindset; • Students understand that maintaining motivation while engaged in learning tasks can result in more effective effort; • Students recognize that setting goals can help maintain motivation; • Students set useful goals. **Focus Skill work:** Working with unit rates.	**6-RP.1:** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. **6-RP.2:** Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. **7-RP.1:** Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

9: Exploring rate of change in other situations	7 lessons	This topic deepens student understanding of the central ideas of rate of change. Students discover that they can model data sets that have a constant rate of change with a linear function. Students also learn that not all data are linear, and thus require other models.	**8-EE.5:** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. **8-F.4:** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. **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. **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.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-LE.1b:** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
Unit 4: Linear functions			
10: Understanding slope and intercepts	6 lessons	This topic relates the constant rate of change of a linear function, the slope of the line that is the linear function's graph, and the value of m in the linear function rule y = mx + b. Students explore this connection using tables, graphs, and function rules. It also develops students' understanding of the x- and y-intercepts of the graph of a linear model and the relationship between the intercepts and the situation being modeled. Students learn to find the values of the intercepts directly from linear function rules expressed in slope intercept form (y = mx + b) or standard form (Ax + By = C).	**A-CED.2:** Create equations in two or more variables to represent relationships between quantities~~; graph equations on coordinate axes with labels and scales~~. **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.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.7a**: Graph linear ~~and quadratic~~ functions and show intercepts, maxima, and minima. **F-IF.7b:** Graph ~~square root, cube root, and piecewise defined functions, including~~ absolute value functions. **F-IF.9:** Compare properties of two functions each represented in a different way. **F-BF.1a:** Determine an explicit expression, a recursive process, or steps for calculation from a context. **F-LE.1a:** Prove that linear functions grow by equal differences over equal intervals~~, and that exponential functions grow by equal factors over equal intervals~~. **F-LE.1b**: Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **F-LE.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).

			F-LE.5: Interpret the parameters in a linear ~~or exponential~~ function in terms of a context. **S-ID.7:** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
11: Parallel and perpendicular lines	3 lessons	Students explore the value of m in the linear function rule y = mx + b and the relationships between slopes of parallel and perpendicular lines and connect the equations of lines to their graphs and descriptions. **Focus Skill work:** Writing and analyzing various forms of equations of lines including standard form, slope-intercept form, and point-slope form while practicing the distributive property and collecting like terms.	**A-CED.2:** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **F-IF.7a:** Graph linear ~~and quadratic~~ functions and show intercepts~~, maxima, and minima~~. **F-LE.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). **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.~~
12: Creating linear models for data	7 lessons	This topic revisits analyzing rate of change to determine whether using a linear model to represent data is appropriate. It also develops the point-slope form for the equation of a line, explicitly connects the point-slope and slope intercept forms, and introduces students to the idea of transformations of functions by transforming the basic function y=x to create linear models for data. Linear regression and correlation is explored when finding the line of best fit for a data set.	**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. **A-CED.2:** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **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 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.* **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-LE.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). **S-ID.6a:** Fit a function to 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.* **S-ID.6c**: Fit a linear function for a scatter plot that suggests a linear association. **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. **S-ID.9:** Distinguish between correlation and causation.

Unit 5: Statistical modeling			
13: Analyzing univariate data	4 lessons	In this topic, students explore and analyze univariate numerical data. They will construct different graphical displays to represent data and use these displays to investigate properties of data distributions such as measures of center and spread. Students will also summarize data using different measures of center and spread, including mean, median, IQR, and standard deviation.	**6.SP.2:** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. **6.SP.4:** Display numerical data in plots on a number line, including dot plots, histograms, and box plots. **6.SP.5c:** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. **6.SP.5d:** Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. **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).
14: Comparing distributions	3 lessons	In this topic, students will continue to explore and analyze univariate numerical data focusing on comparing two data sets. They will use different graphical displays to represent data to compare data sets and also also compute measures of central tendency and variability and use these measures to compare the data sets.	**6.SP.2:** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. **6.SP.4:** Display numerical data in plots on a number line, including dot plots, histograms, and box plots. **6.SP.5c:** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. **6.SP.5d:** Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. **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.
15: Analyzing bivariate data	5 lessons	Students will explore methods for analyzing bivariate categorical data. Students create two-way frequency tables and compute marginal, joint, and conditional relative frequencies and interpret these proportions within the context of the data. They will also continue to investigate bivariate numerical data as they learn about ways to assess the suitability of a linear model.	**8.SP.4:** Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?* **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. **S-ID.6b:** Informally assess the fit of a function by plotting and analyzing residuals.

Unit 6: Linear equations and inequalities			
16: Solving linear equations	8-9 lessons *Lesson 7 addresses analytic solution techniques for absolute value equations, which may go beyond your district's expectations for Algebra I students.*	In this topic, students learn how equations are related to functions. The topic explores how different representations of a function lead to techniques to solve linear equations, including tables, graphs, concrete models, algebraic operations, and "undoing" (reasoning backwards).	**6-EE.5:** Understand solving an equation ~~or inequality~~ as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? **Use substitution to determine whether a given number in a specified set makes an equation**~~ or inequality true.~~ **6-EE.7:** Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which, p, q, and x are all non-negative rational numbers. **7-EE.4a:** Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. **8-EE.7a:** Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). **8-EE.7b**: Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. **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.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. **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. **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. **A-REI.3:** Solve linear equations ~~and inequalities~~ in one variable, including equations with coefficients represented by letters. **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.
17: Problem solving with slope triangles	3 lessons	Students apply what they know about linear functions and equations in order to solve a challenging problem, while continuing to reinforce effective communication skills **Focus Skill work:** Working with slope, with an emphasis on slope triangles and the geometric connection to slope.	**A.CED.2:** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **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~~.*

18: Solving linear inequalities	6-7 lessons *Lesson 4 addresses analytic solution techniques for absolute value inequalities, which may go beyond your district's expectations for Algebra I students.*	This topic introduces students to solution techniques for linear inequalities. Students learn to solve with graphs, tables, and algebraic operations.	**6-EE.5:** Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the ~~equation or~~ inequality true? Use substitution to determine whether a given number in a specified set makes an ~~equation or~~ inequality true. **6-EE.8:** Write an inequality of the form x > c or x < c to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams. **7-EE.4b**: Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. **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.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. **A-REI.3:** Solve linear ~~equations and~~ inequalities in one variable~~, including equations with coefficients represented by letters~~. **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~~.
Unit 7: Systems of linear equations and inequalities			
19: Formulating and solving systems	9 lessons	This topic builds on students' understanding of solving linear equations and inequalities while introducing the concept of a system of equations and inequalities as connected to finding the values of two different variables in a situation. Students further develop their skill at representing situations, now using two variables and systems of equations and inequalities, engage in activities that help them understand the meaning of a solution to a system across multiple representations, and learn to solve systems using logical thinking, tables, and graphs. These activities help surface underlying mathematical ideas, introduce vocabulary, and develop a conceptual foundation to prepare students for success with the more general symbolic methods introduced in Topic 18.	**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. **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.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.
20: Building fluency with equation solving	3 lessons	Students continue to develop their problem solving and algebraic thinking capabilities by working on a non-routine problem, The Speeding Car Problem. **Focus Skill Work:** Solving multi-step equations.	**A-REI.3:** Solve linear equations ~~and inequalities~~ in one variable, including equations with coefficients represented by letters.

21: Other methods for solving systems	8 lessons	Continuing with the exploration of systems of two linear equations, this topic introduces two additional algebraic methods for solving systems: the substitution method and the linear combination method. Students begin to see when to use each method, and how to interpret the results each method yields.	**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. **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.
Unit 8: Quadratic functions and equations			
22: Quadratic models and equations	10 lessons	This topic introduces students to quadratic equations that arise from quadratic functions. Students learn how to use functions of the form $y = ax^2 + c$ to model quadratic relationships. They also explore the effects of parameter changes, including vertical and horizontal shifts and dilations. Students make connections among the x-intercepts of a graph, the zeros of a function, and the solutions of an equation as they learn to solve quadratic equations by graphing. Students are also introduced to the quadratic formula as a second method for solving quadratic equations. Since using this formula sometimes requires students to simplify expressions containing square roots, the connection between the algebra and the geometry of square roots is explored. Students also learn how the value of the discriminant indicates the nature of the solutions.	**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. **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-REI.4b:** 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 ± bi for real numbers a and b. **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. **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 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.* **F-IF.7a:** Graph ~~linear and~~ quadratic functions and show intercepts, maxima, and minima. **F-BF.1a:** Determine an explicit expression, ~~a recursive process, or steps for calculation~~ from a context. **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.~~ **S-ID.6a:** Fit a function to 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.*
23: Operations on polynomials	6 lessons	In this topic students explore polynomial operations in a situation involving the floor plan of a house. They learn how to multiply, add, and subtract polynomials using concrete models and analytic techniques.	**A-SSE.1a**: Interpret parts of an expression, such as terms, factors, and coefficients. **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.

24: Factoring and quadratic equations	9 lessons	This topic builds on the work of the previous topic by introducing students to the concept of factoring a polynomial expression. Students develop an understanding of the factoring process by making connections between concrete models and analytic techniques. Students also use concrete models to solve an equation by completing the square and connect the concrete model to the algebraic technique. Students then apply the methods of factoring and completing the square to solve quadratic equations and further solidify their understanding of the connections among the solutions of an equation, the x-intercepts of a graph, and the zeros of a function. Completing the square is also used to reveal certain characteristics about quadratic functions.	**A-SSE.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.3a:** Factor a quadratic expression to reveal the zeros of the function it defines. **A-SSE.3b:** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. **A-APR.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-REI.4a:** 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. **A-REI.4b** 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 ± bi for real numbers a and b.~~ **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.7a:** Graph ~~linear and~~ quadratic functions and show intercepts, maxima, and minima. **F-IF.8a:** 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 the context.
Unit 9: Other nonlinear relationships			
25: Exponents and exponential models	6 lessons	Students review the meaning of exponents and use patterns to build their understanding of zero, negative, and rational exponents with a numerator of 1. They use their prior understanding of multiplication to work from examples to develop the laws of exponents, then apply these laws to solve problems and to simplify numerical and variable expressions. Students also apply their understanding of functions and exponents to understand the connection with repeated multiplication and growth and decay.	**6-EE.1:** Write and evaluate numerical expressions involving whole-number exponents. **8-EE.1:** Know and apply the properties of integer exponents to generate equivalent numerical expressions. **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. **F-LE.1a:** Prove that ~~linear functions grow by equal differences over equal intervals, and that~~ exponential functions grow by equal factors over equal intervals. **F-LE.1c:** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **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.~~
26: Problem solving with exponential functions	4 lessons	Students continue investigating exponential functions by writing rules for exponential functions and examining their behavior. Students also explore the effects of changing the a and b parameters in a function of the form $y = ab^x$.	**A-SSE.3c:** Use the properties of exponents to transform expressions for exponential functions. For example, the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} = 1.01212^t$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%. **A-CED.2:** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **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.05: 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.* **F-IF.7e:** Graph exponential ~~and logarithmic~~ functions, showing intercepts and end behavior~~, and trigonometric functions, showing period, midline, and amplitude~~. **F-IF.8b:** 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. **F-BF.1a:** Determine an explicit expression, a recursive process, or steps for calculation from a context. **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-LE.1a:** Prove that ~~linear functions grow by equal differences over equal intervals, and that~~ exponential functions grow by equal factors over equal intervals. **F-LE.1c:** 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 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. **F-LE.5:** Interpret the parameters in a ~~linear or~~ exponential function in terms of a context. **S-ID.6a:** Fit a function to 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.*
27: Cubic, square root, and cube root functions	6 lessons	Students explore square root, cube root, and piecewise functions. Students graph these functions and explore their characteristics including the effects of the parameters on the graphs of square root and cube root 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. **A-APR.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. **F-IF.7b:** Graph square root, cube root, and piecewise-defined functions, including step functions ~~and absolute value 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.~~