

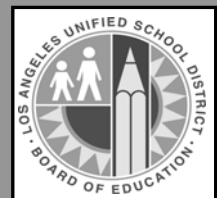
**LOS ANGELES UNIFIED
SCHOOL DISTRICT**

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**Guidelines for
Standards-Based Instruction
(Summer School)**

Secondary
Mathematics
Grades 8 - 12

Secondary Instructional Support Services
Secondary Mathematics Branch



Summer School **Mathematics Bridge** Curricular Map

Week	Conceptual Cat	CCSS Standards	Domains and Clusters	Resources (Concept Tasks)
1	Expressions and Equations	8.EE.5, 8.EE.6, 8.EE.7, 8.EE.8 MP 1, 3, 4	- Understand the connection between proportional relationships, lines, and linear equations. - Integer exponents	Stack of Cups  Two Storage Tanks 
2	Statistics and Probability	8.SP.1, 8.SP.2, 8.SP.3, 8.SP.4 MP 1, 3, 4	- Analyze and solve linear equations and pairs of simultaneous linear equations. - Investigate patterns of association in bivariate data.	Tying the knot 
3	Functions	8.F.1, 8.F.2, 8.F.3, 8.F.4, 8.F.5 MP 1, 3, 4, 5	Define, evaluate, and compare functions.	Illustrative Mathematics http://www.illustrativemathematics.org Mathematics Assessment Project – MARS Task http://map.mathshell.org/
4	Functions	8.F.1, 8.F.2, 8.F.3, 8.F.4, 8.F.5 MP 1, 3, 4, 5	Use functions to model relationships between quantities.	Illustrative Mathematics http://www.illustrativemathematics.org Mathematics Assessment Project – MARS Task http://map.mathshell.org/

Summer School Mathematics Bridge Curricular Map

5	Geometry	8.G.1, 8.G.2, 8.G.3, 8.G.4, 8.G.5 MP 1, 2,3, 4, 6, 7, 8	Understand congruence and similarity using physical models, transparencies, or geometry software.	Illustrative Mathematics http://www.illustrativemathematics.org Mathematics Assessment Project – MARS Task http://map.mathshell.org/
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*Emphasize the Mathematical Practices (MP) in **Bold** type*

Week	Domains	Standards
1	Understand the connections between proportional relationships, lines, and linear equations.	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. <i>For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</i> 8.EE.6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b. 8.EE.7. Solve linear equations in one variable. a. 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). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
	Analyze and solve linear equations and pairs of simultaneous linear equations.	8.EE.8. Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6. c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Summer School **Mathematics Bridge** Curricular Map

2	Investigate patterns of association in bivariate data.	8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. 8.SP.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. 8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. <i>For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.</i> 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. <i>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?</i>
3	Define, evaluate, and compare functions.	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.1 8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change. 8.F.3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.
4	Use functions to model relationships between quantities.	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. 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.
5	Understand congruence and similarity using physical models, transparencies, or geometry software.	8.G.1 Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines. 8.G.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. 8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. 8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. 8.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

Summer School **Mathematics Bridge** Curricular Map

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Resources

LAUSD Mathematics Website

<http://math.lausd.net/middle-school/grade-8-ccss-curriculum-map-2013-2014>

Illustrative Mathematics

<http://www.illustrativemathematics.org>

Mathematics Assessment Project – MARS Task

<http://map.mathshell.org/>

Noyce Foundation – Inside Mathematics

<http://insidemathematics.org/common-core-math-tasks/>

Common Core ALGEBRA 1 AB
(Annual Course – Grade 8 or 9)
Prerequisite: CC Mathematics 8AB

310341 CC Algebra 1A

310342 CC Algebra 1B

COURSE DESCRIPTION (Summer School)

The purpose of CC Algebra I is for students to use reasoning about structure to define and make sense of rational exponents and explore the algebraic structure of the rational and real number systems. They understand that numbers in real world applications often have units attached to them, that is, they are considered quantities. Students explore the structure of algebraic expressions and polynomials. They see that certain properties must persist when working with expressions that are meant to represent numbers, now written in an abstract form involving variables. When two expressions with overlapping domains are set equal to each other, resulting in an equation, there is an implied solution set (be it empty or non-empty), and students not only refine their techniques for solving equations and finding the solution set, but they can clearly explain the algebraic steps they used to do so.

In CC Algebra I, students extend this knowledge to working with absolute value equations, linear inequalities, and systems of linear equations. After learning a more precise definition of function in this course, students examine this new idea in the familiar context of linear equations (for example, by seeing the solution of a linear equation as solving $f(x)=g(x)$ for two linear functions f and g). Students continue building their understanding of functions beyond linear ones by investigating tables, graphs, and equations that build on previous understandings of numbers and expressions. They make connections between different representations of the same function. They learn to build functions in a modeling context, and solve problems related to the resulting functions. Note that the focus in Algebra I is on linear, simple exponential, and quadratic equations.

The intent of the course is to develop skill and understanding of the language of algebra, functions, number operations, solving and graphing equations and inequalities involving real-world concepts, ratios, quadratic functions, factoring terms, completing the square, using the quadratic formula, monomial and polynomial expressions, exponents and rational expressions, and problem solving. Through the study and use of Algebra, the learner develops an understanding of the symbolic language of mathematics and the sciences. CC Algebra 1 develops the skills and concepts to help solve a wide variety of problems.

Finally, students extend their prior experiences with data, using 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.

The following Mathematical Practices are recurring throughout the course:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

COURSE SYLLABUS (Summer School)

Unit 1: Relationships between Quantities and Reasoning with Equations

- **Interpret the structure of expressions.**
Limit to linear expressions and to exponential expressions with integer exponents.
- **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.
- **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 for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5x = 125$ or $2x = \frac{1}{16}$

Unit 2: Linear and Exponential Relationships

- 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.
- 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.
- Construct and compare linear, quadratic, and exponential models and solve problems.
For F.LE.3, limit to comparisons between linear and exponential models. In constructing linear functions in F.LE.2, draw on and consolidate previous work in Grade 8 on finding equations for lines and linear functions (8.EE.6, 8.F.4).
- Interpret expressions for functions in terms of the situation they model.
Limit exponential functions to those of the form $f(x) = bx + k$.

Unit 3: Descriptive Statistics

- 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.
- 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 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.

- 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.

Unit 4: Expressions and Equations

- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.
- Perform arithmetic operations on polynomials.
- Create equations that describe numbers or relationships.
- Solve equations and inequalities in one variable.
- Solve systems of equations.

Unit 5: Quadratic Functions and Modeling

- **Use properties of rational and irrational numbers.**
- **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.
- **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.
- **Build a function that models a relationship between two quantities.**
Focus on situations that exhibit a quadratic relationship.
- **Build new functions from existing 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 $f(x) = x^2$, $x > 0$.
- **Construct and compare linear, quadratic, and exponential models and solve problems.**
Compare linear and exponential growth to quadratic growth.

Summer School **CC Algebra 1** Curricular Map

Week	Conceptual Cat	CCSS Standards	Domains and Clusters	Resources (Concept Tasks)
1	Functions <i>Interpreting Functions</i> <i>Building Functions</i>	A.CED.1-3 F-IF.1-3 F-IF.4-6 F-IF.7-9 MP 1, 3, 4	Creating Equations Create equations that describe numbers or relationships Interpreting Functions - Understand the concept of a function and use function notation. - Interpret functions that arise in applications in terms of the context. - Analyze functions using different representations.	Tying the knot  Surround the Pool  MARS Task: Function and Everyday Situations
2	Functions <i>Building Functions</i> <i>Linear, Quadratic, and Exponential Models</i>	F-BF.1-2 F-BF.3-5 F-LE.1-4 F-LE.5 MP 1, 3, 4, 5	Building Functions - Build a function that models a relationship between two quantities. - Build new functions from existing functions. Linear, Quadratic, and Exponential Models - Construct and compare linear, quadratic, and exponential models and solve problems.	Bend it like Beckham  S-Pattern  Quadratic quandary  Illustrative Math Skeleton Tower Engage New York
3	Functions <i>Linear, Quadratic, and Exponential Models</i>	F-LE.1-4 F-LE.5 MP 1, 3, 4, 5	Linear, Quadratic, and Exponential Models - Construct and compare linear, quadratic, and exponential models and solve problems. - Interpret expressions for functions in terms of the situation they model.	Bend it like Beckham  S-Pattern  MARS: Comparing Investment
4	Statistics and Probability	S.ID.1-4 S.ID.5-6 S.ID.7-9 MP 1, 3, 4	Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable. - Summarize, represent, and interpret data on two categorical and quantitative variables. - Interpret linear models	Stack of Cups  NCTM Illuminations: Line of Best Fit Illustrative Math: Haircut Costs
5	Algebra <i>Reasoning with Equations and Inequalities</i>	A.SSE.1, 2, 4 A-REI.5-9 A-REI.10-12 MP 1, 2, 3, 4, 6, 7, 8	Seeing Structure in Expressions Interpret the structure of expressions Reasoning with Equations and Inequalities - Solve systems of equations. - Represent and solve equations and inequalities graphically. Mathematics Modeling	Two Storage Tanks  MARS Task: Interpreting Algebraic Expressions

*Emphasize the Mathematical Practices (MP) in **Bold** type*

Summer School **CC Algebra 1** Curricular Map

Week	Domains	Standards
1	Creating Equations Interpreting Functions	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. 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. Understand the concept of a function and use function notation. 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. <i>For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n + 1) = f(n) + f(n - 1)$ for $n \geq 1$.</i> 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. ★ Interpret functions that arise in applications in terms of the context. 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 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. Analyze functions using different representations. 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. ★ e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, and $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.

Summer School **CC Algebra 1** Curricular Map

		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.
2	Building Functions Construct and compare linear, quadratic, and exponential models and solve problems.	Build a function that models a relationship between two quantities. 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. F-BT.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Build new functions from existing functions. F-BF.3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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. [In Algebra I this standard addresses linear, exponential, quadratic, and absolute value functions.] 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, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$. Construct and compare linear, quadratic, and exponential models and solve problems. 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.
3	Linear, Quadratic and Exponential Functions	Construct and compare linear, quadratic, and exponential models and solve problems. 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 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. Interpret expressions for functions in terms of the situation they model. F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.
4	Interpreting Categorical and	Summarize, represent, and interpret data on a single count or measurement variable. 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

Summer School CC Algebra 1 Curricular Map

	Quantitative Data	(outliers). Summarize, represent, and interpret data on two categorical and quantitative variables. 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.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. <i>Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.</i> 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. Interpret linear models. 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.
5	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 $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
	Reasoning with Equations and Inequalities	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. 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%. Solve systems of equations. 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 equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.</i>

Summer School **CC Algebra 1** Curricular Map

		Represent and solve equations and inequalities graphically. 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.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.
Mathematical Practices		
		1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Resources		
Illustrative Mathematics Logistic Growth Model, Explicit Version: F-IF.4 http://www.illustrativemathematics.org/illustrations/804 Influenza epidemic : F-IF.4 http://www.illustrativemathematics.org/illustrations/637 Average Cost – F-IF.B.4-5 http://www.illustrativemathematics.org/illustrations/387 Haircut Costs:S.ID.1-3 http://www.illustrativemathematics.org/illustrations/942 Speed Trap – S.ID.1, 2, 3 http://www.illustrativemathematics.org/illustrations/1027 Coffee and Crime – S.ID.6-9 http://www.illustrativemathematics.org/illustrations/1307 Warming and Cooling – F-IF.4: http://www.illustrativemathematics.org/illustrations/639 How is the weather – F-IF.4: http://www.illustrativemathematics.org/illustrations/649 The Canoe Trip, Variation 1 – F-IF.4-5 http://www.illustrativemathematics.org/illustrations/386 The High School Gym – F-IF.6b http://www.illustrativemathematics.org/illustrations/577 Temperature Change –F-IF.6 http://www.illustrativemathematics.org/illustrations/1500 Which Function? - F-IF.8a http://www.illustrativemathematics.org/illustrations/640 Throwing Baseballs – F-IF.9 and F-IF.4 http://www.illustrativemathematics.org/illustrations/1279 Mathematics Assessment Project – MARS Task Function and Everyday Situations - F-IF.7-8 http://map.mathshell.org/materials/download.php?fileid=1259		

Summer School **CC Algebra 1** Curricular Map

Comparing Investment – F.LE 1-5. <http://map.mathshell.org/materials/download.php?fileid=1250>

Devising a Measure for Correlation – S.ID : <http://map.mathshell.org/materials/download.php?fileid=1234>

Interpreting Statistics: A Case of Muddying the Waters – S.ID 7-9 <http://map.mathshell.org/materials/download.php?fileid=686>

Solving Linear Equations in Two Variables – A.REI.5-7: <http://map.mathshell.org/materials/download.php?fileid=669>

Noyce Foundation – Inside Mathematics

Sorting Functions – F.IF.4, 7a, 7c, 8a, F.LE.2 <http://insidemathematics.org/common-core-math-tasks/high-school/HS-F-2008%20Sorting%20Functions.pdf>

Mathematics Assessment Project – MARS Task

Function and Everyday Situations - F.IF.7-8 <http://map.mathshell.org/materials/download.php?fileid=1259>

COMMON CORE GEOMETRY AB

(Grade 8, 9 or 10)

Prerequisite: CC Algebra 1AB

310423 CC Geometry A

310424 CC Geometry B

COURSE DESCRIPTION (Summer School)

The essential purpose of this Geometry course is to introduce students to formal geometric proofs and the study of plane figures, with an emphasis on plane Euclidean geometry—both synthetically and analytically. Furthermore, transformations of rigid motion are the foundations of proof for congruency and similarity. Concepts included in this course are geometric transformations, proving geometric theorems, congruence and similarity, analytic geometry, right triangle trigonometry, and probability and statistics. Students are expected to model real world situations and make decisions using these ideas.

Course Purpose:

The purpose of this course is to formalize and deepen a students' understanding of how transformational geometry, trigonometry, probability and statistics can be used to model and interpret the real world. Students will be able to grasp abstract Euclidean proofs, transformational proofs, and apply them to understand real world, geometric relationships—including relationships between two and three dimensional objects. Students will continue to develop mathematical ways of thinking through the Mathematical Practice Standards and content standards. Students will be expected to make sense of real world situations and apply mathematics to develop solutions.

Mathematical Practices

- 1. Make sense of problems and persevere in solving them.**
- 2. Reason abstractly and quantitatively.**
- 3. Construct viable arguments and critique the reasoning of others.**
- 4. Model with mathematics.**
- 5. Use appropriate tools strategically.**
- 6. Attend to precision.**
- 7. Look for and make use of structure.**
- 8. Look for and express regularity in repeated reasoning.**

Use of technology. The availability of good computer software makes the accurate drawing of geometric figures far easier. Such software can enhance the experience of creating the constructions described previously. In addition, the ease of making accurate drawings encourages the formulation and exploration of geometric conjectures. If students do have access to such software, the potential for a more intense mathematical encounter is certainly there.

COURSE SYLLABUS (Summer School)

Geometry A

Unit 1: Congruence

In this unit, students will make geometric constructions; experiment with transformations in the plane; understand congruence in terms of rigid motion; and, prove geometric theorems using rigid motion. Students understand that a geometric construction is a visual representation of geometric principles that allows them to develop a deeper understanding of the spatial relationship between pairs of figures. Conceptually, students will understand that the properties of transformations are rigid motions that can be used to identify and prove congruence of figures in a plane.

Unit 2: Similarity

In this unit, students will understand similarity in terms of dilations in transformations; and, prove theorems involving similarity. Students will define two objects as similar if there is a sequence of transformations that maps one figure exactly onto another. Students prove similarity of two objects using their given ratio by a scale factor; prove similar triangles have corresponding pairs of angles and proportional pairs of sides; prove theorems about triangles (e.g. the line parallel to one side of a triangle divides the other two proportionately and conversely; using triangle similarity to prove the Pythagorean Theorem).

Geometry B

Unit 3: Expressing Geometric Properties with Equations; Circles

In this unit, students will use coordinates to prove simple geometric theorems algebraically; understand and prove theorems about circles; find arc lengths and areas of sectors of circles; and, translate between the geometric description and the equation for a conic section. Students derive the equation of a circle using the distance formula; derive the equation of a parabola in terms of the focus and directrix. Students prove and justify algebraically the relationships between slopes of parallel and perpendicular lines; use the algebraic representation of a geometric problem to prove theorems in the coordinate plane; extend the concept of similarity to circles with proofs; investigate relationships between angles, radii and chords; and, apply similarity to derive arc length and sector area.

Unit 4: Similarity, Right Triangles, and Trigonometry; Geometric Measurement and Dimensions; Conditional Probability and the Rules of Probability

In this unit, students will define trigonometric ratios and solve problems involving right triangles; explain volume formulas and use them to solve problems; visualize relationships between 2-D and 3-D objects; understand independence and conditional probability and use them to interpret data; use rules of probability to compute probabilities of compound events in a uniform probability model; and, use probability to evaluate outcomes of decisions. Based on similarity, students will connect the concept of side ratios as angle properties to define the three trigonometric ratios. Students will define trigonometric ratios; understand that trigonometric ratios are relationships between sides and angles in right triangles; derive the three trigonometric ratios for special right triangles (30° , 60° , 90° and 45° , 45° , 90°). Students will solve real world problems using right triangles, trigonometric ratios and the Pythagorean Theorem. Students develop formulas for circumference of a circle, area of a circle, volume of a cylinder, pyramid, and a cone, using informal reasoning. Students recognize and explain the concepts of conditional probability and independence in everyday language and situations. Students will also use probabilities to make fair decisions and analyze decisions and strategies using probability concepts.

Summer School **CC Geometry A** Curricular Map

Congruence through Constructions and Transformations

Week	Conceptual Category	CCSS-M Standards/Practices	Domains and Clusters	Resources
1	Geometry - Congruence <i>Make a variety of formal geometric constructions using a variety of tools.</i>	G.CO. 12-13 MP 1, 2, 3, 4, 7	G-CO-D -Make geometric constructions	Math Open Reference Math is Fun
2	Geometry - Congruence <i>Develop precise definitions of geometric figures based on the undefined notions of point, line, distance along a line and distance around a circular arc.</i> <i>Experiment with transformations in the plane.</i>	G.CO. 1 -5 MP 1, 2, 3, 4, 7	G-CO-A -Experiment with transformations in the plane	Illustrative Math Building a tile pattern by reflecting hexagons Engage New York Floor Pattern
3	Geometry - Congruence <i>Use rigid motion to map corresponding parts of congruent triangle onto each other.</i> <i>Explain triangle congruence in terms of rigid motions.</i> <i>Prove theorems about lines and angles, triangles; and parallelograms</i>	G.CO. 6-8 G.CO. 9-11 MP 1, 2, 3, 4, 7	G-CO-B - Understand congruence in terms of rigid motion G-CO-C -Prove geometric theorems	Illustrative Math Analyzing Congruence Proofs – G-CO.6-8 LAUSD Concept Task: Squaring Triangles
4	Geometry - Similarity, Right Triangles and Trigonometry	G-SRT. 1-3 MP 1, 2, 3, 4, 7	G-SRT-A -Understand similarity in terms of similarity transformations	Illustrative Mathematics Similar Triangles : G-SRT.3 LAUSD Concept Task: Bermuda Triangle
5	Geometry - Similarity, Right Triangles and Trigonometry <i>Apply geometric concepts in modeling situations</i>	G-SRT. 4-5 G-MG 1-3 MP 1, 2, 3, 4, 7	G-SRT-B -Prove theorems involving similarity G-MG 1-3 -Modeling with Geometry: Applying geometric concepts in modeling situations	Mathematics Assessment Project (MARS Tasks): Solving Geometry Problems : Floodlights G-SRT.5, G.MG.1-3 LAUSD Concept Task: Amazing Amanda

Summer School **CC Geometry A** Curricular Map

Congruence through Constructions and Transformations

Week	Domains	Clusters and Standards
1	Make geometric constructions	Make geometric constructions G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software etc. Copying a segment, copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines including the perpendicular bisector of a line segment; and constructing a line parallel to a give line through a point not on the line. G.CO.13 Construct an equilateral triangle, a square, a regular hexagon inscribed in a circle. Make geometric constructions
2	Experiment with transformations in the plane	Experiment with transformations in the plane G.CO.1 Know precise definitions of angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G.CO.2 Represent transformations in the plane using e.g. transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g. translation versus horizontal stretch.) G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles perpendicular lines, parallel lines, and line segments. G.CO.5 Given a geometric figure and a rotation, reflection or translation, draw the transformed figure using e.g. graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
3	Understand congruence in terms of rigid motion	Understand congruence in terms of rigid motion G.CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. G.CO.7 Use definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow the definition of congruence in terms of rigid motions.

Summer School **CC Geometry A** Curricular Map Congruence through Constructions and Transformations

	Prove geometric theorems	Prove geometric theorems G.CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. G.CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. G.CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent; the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.
4	Understand similarity in terms of similarity transformations	Understand similarity in terms of similarity transformations G-SRT.1. Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. G-SRT.2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. G-SRT.3. Use the properties of similarity transformations to establish the Angle-Angle (AA) criterion for two triangles to be similar.
5	Prove theorems involving similarity	Prove theorems involving similarity G-SRT.4. Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. G-SRT.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures Supporting clusters: G-MG 1-3: Modeling with Geometry: Apply geometric concepts in modeling situations

★ Indicates a modeling standard linking mathematics to everyday life, work, and decision-making.

(+) Indicates additional mathematics to prepare students for advanced courses.

Summer School **CC Geometry A** Curricular Map

Congruence through Constructions and Transformations

Mathematical Practices

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Resources

Math Open Reference

- <http://mathopenref.com/tocs/constructionstoc.html>

(online resource that illustrates how to generate constructions)

Math is Fun

- <http://www.mathsisfun.com/geometry/constructions.html> H-G.CO.12, 13

Manga High

- http://www.mangahigh.com/en_us/games/transtar

Engage New York

- <http://www.engageny.org/sites/default/files/resource/attachments/geometry-m1-teacher-materials.pdf>
Circles in Triangles <http://map.mathshell.org/materials/tasks.php?taskid=256#task256>
- <http://map.mathshell.org/materials/tasks.php?taskid=258#task258>

Mathematics Assessment Project (MARS Tasks)

- Hopwell Geometry – G.SRT.5 <http://map.mathshell.org/materials/download.php?fileid=499>

Summer School **CC Geometry A** Curricular Map Congruence through Constructions and Transformations

- Inscribing and Circumscribing Right Triangles – G.SRT: <http://map.mathshell.org/materials/lessons.php?taskid=403&subpage=problem>

Illustrative Mathematics

- Similar Triangles : G-SRT.3 <http://www.illustrativemathematics.org/illustrations/1422>
- Pythagorean Theorem : G-SRT.4 <http://www.illustrativemathematics.org/illustrations/1568>
- Joining two midpoints of sides of a triangle : G-SRT.4 <http://www.illustrativemathematics.org/illustrations/1095>

Illustrative Mathematics

- Dilating a Line : G-SRT.1 <http://www.illustrativemathematics.org/illustrations/602>
- Are they Similar? G-SRT.2 <http://www.illustrativemathematics.org/illustrations/603>
- Folding a Square into Thirds : G-SRT.5 <http://www.illustrativemathematics.org/illustrations/1572>

LAUSD Concept Lessons – <http://math.lausd.net>

- [Squaring Triangles](#)

Mathematics Assessment Project (MARS Tasks):

- Geometry Problems: Circles and Triangles – G-SRT <http://map.mathshell.org/materials/lessons.php?taskid=222#task222>
- Inscribing and Circumscribing Right Triangles - <http://map.mathshell.org/materials/lessons.php?taskid=403&subpage=problem>
- Modeling: Rolling Cups- <http://map.mathshell.org/materials/lessons.php?taskid=428&subpage=problem>
- Solving Geometry Problems: Floodlights – G-SRT.5, G-MG.1-3 <http://map.mathshell.org/materials/lessons.php?taskid=429&subpage=problem>
- Analyzing Congruence Proofs – G-CO.6-8 <http://map.mathshell.org/materials/lessons.php?taskid=452&subpage=concept>
- Calculating Volumes of Compound Objects – G-MD <http://map.mathshell.org/materials/lessons.php?taskid=216&subpage=concept>
- Proofs of the Pythagorean Theorem <http://map.mathshell.org/materials/lessons.php?taskid=419&subpage=concept>

Summer School CC Geometry B Curricular Map
Similarity Right Triangles, and Trigonometry

Week	Conceptual Category	CCSS-M Standards/Practices	Domains and Clusters	Resources
1	Geometry - <i>Expressing Geometric Properties with Equations; Circles</i>	G.GPE. 4 - 7 MP 1, 2, 3, 4, 7	Expressing Geometric Properties with Equations; Circles G-PE-B-Use coordinates to prove simple geometric theorem algebraically	Mathematics Assessment Project (MARS Tasks): Slopes and Circles : G.GPE.1 Illustrative Mathematics A Midpoint Miracle: G.GPE.4b, 5b
2	Geometry - <i>Expressing Geometric Properties with Equations; Circles</i>	G.C. 1 -5 GPE.1 -2 MP 1, 2, 3, 4, 7	Expressing Geometric Properties with Equations; Circles G-C-A- Understand and apply theorems about circles G-C-B- Find arc lengths and areas of sectors of circles G-PE-A- Translate between the geometric description and the equation for a conic section	Illustrative Mathematics Locating Warehouse : G.C.3a, G.CO.13 LAUSD Concept Task: • Awesome Amanda
3	Geometry - <i>Similarity, Right Triangles and Trigonometry; Geometric Measurement and Dimension</i>	G-SRT. 6 - 8.1 G-GMD. 1-6 MP 1, 2, 3, 4, 7	Similarity, Right Triangles and Trigonometry G-SRT-C - Define trigonometric ratios and solve problems involving right triangles. Geometric Measurement and Dimension G-GMD-A-Explain volume formulas and use them to solve problems G-GMD-B-Visualize relationships between two-dimensional and three- dimensional objects	Illustrative Mathematics Defining Trigonometric Ratios: G.SRT.6 LAUSD Concept Task: Chocolate Factory
4	Statistic and Probability- <i>Conditional Probability and the Rules of Probability</i>	S.CP.1-5 MP 1, 2, 3, 4, 7	Conditional Probability and the Rules of Probability S-CP-A-Understand independence and conditional probability and use them to interpret data	Illustrative Mathematics • The Titanic 1: S.CP.1,4, and 6 • The Titanic II: S.CP.2-6
5	Statistic and Probability- <i>Conditional Probability and the Rules of Probability</i> <i>Use Probability to Make Decisions</i>	S.CP.6-9 S-MD.6-7 MP 1, 2, 3, 4, 7	Conditional Probability and the Rules of Probability S-CP-B-Use the rules of probability to compute probabilities of compound events in a uniform probability model Use Probability to Make Decisions S-MD-B-Use probability to evaluate outcomes of decisions	Illustrative Mathematics Fred's Factory But Mango is My Favorite...

Summer School **CC Geometry B** Curricular Map

Similarity Right Triangles, and Trigonometry

Week	Domains	Clusters and Standards
1	Expressing Geometric Properties with Equations; Circles	Use coordinates to prove simple geometric theorem algebraically G.GPE.4. Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.</i> G.GPE.5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). G.GPE.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. G.GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★
2	Expressing Geometric Properties with Equations; Circles	Understand and apply theorems about circles G.C.1. Prove that all circles are similar. G.C.2. Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i> G.C.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. Find arc lengths and areas of sectors of circles G.C.5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. Convert between degrees and radians. CA Translate between the geometric description and the equation for a conic section G.GPE.1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. G.GPE.2. Derive the equation of a parabola given a focus and directrix.
3	Similarity, Right Triangles and Trigonometry;	Define trigonometric ratios and solve problems involving right triangles. G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles. G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. G.SRT.8.1 Derive and use the trigonometric ratios for special right triangles ($30^\circ, 60^\circ, 90^\circ$ and $45^\circ, 45^\circ, 90^\circ$). CA Explain volume formulas and use them to solve problems G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i>

Summer School **CC Geometry B** Curricular Map

Similarity Right Triangles, and Trigonometry

	<i>Geometric Measurement and Dimension</i>	G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. Visualize relationships between two-dimensional and three- dimensional objects G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. G.GMD.5 Know that the effect of a scale factor k greater than zero on length, area, and volume is to multiply each by k, k^2, and k^3, respectively; determine length, area and volume measures using scale factors. CA G.GMD.6 Verify experimentally that in a triangle, angles opposite longer sides are larger, sides opposite larger angles are longer, and the sum of any two side lengths is greater than the remaining side length; apply these relationships to solve real-world and mathematical problems. CA
4	<i>Conditional Probability and the Rules of Probability</i>	Understand independence and conditional probability and use them to interpret data S.CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). S.CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. S.CP.3 Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. □ □ S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i> □ ★ S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
5	<i>Conditional Probability and the Rules of Probability</i> <i>Use Probability to Make Decisions</i>	Use the rules of probability to compute probabilities of compound events in a uniform probability model S.CP.6 Find the conditional probability of A given B as the fraction of B’s outcomes that also belong to A, and interpret the answer in terms of the model. S.CP.7 Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. S.CP.8 (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$, and interpret the answer in terms of the model. S.CP.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems. Use probability to evaluate outcomes of decisions S.MD.6 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). S.MD.7 (+) Analyze decisions and strategies using probability concepts (e.g. product testing, medical testing, pulling a hockey goalie at the end of a game).

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Summer School **CC Geometry B** Curricular Map

Similarity Right Triangles, and Trigonometry

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Resources

Illustrative Mathematics

- Right triangles inscribed in circles II: G.C.2a <http://www.illustrativemathematics.org/illustrations/1093>
- Inscribing a triangle in a circle : G.C.3a <http://www.illustrativemathematics.org/illustrations/1013>
- Two Wheels and a Belt : G.C. B <http://www.illustrativemathematics.org/illustrations/621>
- Equal Area Triangles on the Same Base II : G.GPE.5b <http://www.illustrativemathematics.org/illustrations/1348>
- Geometry Problems: Circles and Triangles – G-SRT <http://map.mathshell.org/materials/lessons.php?taskid=222#task222>
- Inscribing and Circumscribing Right Triangles - <http://map.mathshell.org/materials/lessons.php?taskid=403&subpage=problem>
- Modeling: Rolling Cups- <http://map.mathshell.org/materials/lessons.php?taskid=428&subpage=problem>
- Solving Geometry Problems: Floodlights – G-SRT.5, G-MG.1-3 <http://map.mathshell.org/materials/lessons.php?taskid=429&subpage=problem>
- Analyzing Congruence Proofs – G-CO.6-8 <http://map.mathshell.org/materials/lessons.php?taskid=452&subpage=concept>
- Calculating Volumes of Compound Objects – G-MD <http://map.mathshell.org/materials/lessons.php?taskid=216&subpage=concept>
- Proofs of the Pythagorean Theorem <http://map.mathshell.org/materials/lessons.php?taskid=419&subpage=concept>

Illustrative Mathematics

- Right triangles inscribed in circles I: G.C.2 <http://www.illustrativemathematics.org/illustrations/1091>
- Tangent Lines and the Radius of a Circle : G.C.2a, 9 <http://www.illustrativemathematics.org/illustrations/963>
- Locating Warehouse : G.C.3a, G.CO.13 <http://www.illustrativemathematics.org/illustrations/507>
- Tangent to a circle from a point : G.C.4a <http://www.illustrativemathematics.org/illustrations/1096>
- A Midpoint Miracle : G.GPE.4b, 5b <http://www.illustrativemathematics.org/illustrations/605>
- Slopes and Circles : G.GPE.1 <http://www.illustrativemathematics.org/illustrations/479>
- Explaining the equation for a circle : G.GPE.1 <http://www.illustrativemathematics.org/illustrations/1425>
- Finding triangle coordinates : G.GPE.6, G.SRT.5 <http://www.illustrativemathematics.org/illustrations/1685>
- The Bermuda Triangle; <http://math.lausd.net>

Summer School **CC Geometry B** Curricular Map

Similarity Right Triangles, and Trigonometry

- **Awesome Amanda:** <http://math.lausd.net>

Mathematics Assessment Project (MARS Tasks):

- Inscribing and Circumscribing Right Triangles - G.C.3 <http://map.mathshell.org/materials/lessons.php?taskid=403&subpage=problem>
- Geometry Problems: Circles and Triangles-<http://map.mathshell.org/materials/lessons.php?taskid=222&subpage=problem>
- Finding Equations of Parallel and Perpendicular Lines –G.GPE.5 <http://map.mathshell.org/materials/lessons.php?taskid=226&subpage=concept>
- Sectors of Circles-G.C.5 <http://map.mathshell.org/materials/lessons.php?taskid=441&subpage=concept>
- Equations of Circles 1-G.GPE.1 <http://map.mathshell.org/materials/lessons.php?taskid=406&subpage=concept>
- Equations of Circles 2: G.GPE.3.1; MP 1,7: <http://map.mathshell.org/materials/lessons.php?taskid=425#task425>

Illustrative Mathematics

- Defining Trigonometric Ratios: G.SRT.6 <http://www.illustrativemathematics.org/illustrations/1635>
- Sine and Cosine of Complementary Angles: G.SRT.7 <http://www.illustrativemathematics.org/illustrations/1443>
- Shortest line segment from a point P to a line L : G.SRT.8 <http://www.illustrativemathematics.org/illustrations/962>
- Doctor's Appointment: G.GMD.3 <http://www.illustrativemathematics.org/illustrations/527>
- Centerpiece: G.GMD.3 <http://www.illustrativemathematics.org/illustrations/514>
- Area of a circle: G.GMD.1 <http://www.illustrativemathematics.org/illustrations/1567>
- Global Positioning System: G.GMD.4, A.CED.2 I <http://www.illustrativemathematics.org/illustrations/1215>
- Rain and Lightning: S.CP.2,3,5, and 7 <http://www.illustrativemathematics.org/illustrations/1112>
- Lucky Envelopes: S.CP.3 <http://www.illustrativemathematics.org/illustrations/944>
- Random Walk: S.CP.9 <http://www.illustrativemathematics.org/illustrations/689>

Illuminations

- Trigonometry for Solving Problems; <http://illuminations.nctm.org/LessonDetail.aspx?id=L383>

Mathematics Assessment Project

- Funsized cans: G-GMD.3 <http://map.mathshell.org/materials/download.php?fileid=756>
- Glasses: G-GMD.3 <http://map.mathshell.org/materials/tasks.php?taskid=259#task259>
- Bestsized Cans: G-GMD.3 <http://map.mathshell.org/materials/tasks.php?taskid=284#task284>
- Propane Tanks: G-GMD.3 <http://map.mathshell.org/materials/tasks.php?taskid=288#task288>
- Hopewell Geometry: G-SRT.5, 6, and 8 <http://map.mathshell.org/materials/tasks.php?taskid=127#task127>

Illustrative Mathematics

- Coins in a circular pattern: G.SRT.8, G.MG <http://www.illustrativemathematics.org/illustrations/720>
- Seven Circles III: G.SRT.8, G.SRT.D, G.MG.1 <http://www.illustrativemathematics.org/illustrations/710>
- Ask a pilot: G.SRT.8 <http://www.illustrativemathematics.org/illustrations/1638>

Summer School **CC Geometry B** Curricular Map

Similarity Right Triangles, and Trigonometry

- Use Cavalieri's Principle to Compare Aquarium: G.GMD.2, G.MG.1. <http://www.illustrativemathematics.org/illustrations/530>
- Tennis Balls in a Can: G.GMD.4, G.MG.1 <http://www.illustrativemathematics.org/illustrations/512>
- Global Positioning System II: G.GMD.4, G.MG.1 <http://www.illustrativemathematics.org/illustrations/1202>
- The Titanic 1: S.CP.1,4, and 6 <http://www.illustrativemathematics.org/illustrations/949>
- The Titanic II: S.CP.2-6 <http://www.illustrativemathematics.org/illustrations/950>
- Return to Fred's Fun Factory (with 50 cents): S.CP.1,2, and 9 <http://www.illustrativemathematics.org/illustrations/1198>
- Law of Sines and Law of Cosines: <http://illuminations.nctm.org/LessonDetail.aspx?ID=L703>

COMMON CORE ALGEBRA 2AB

(Grade 9, 10 or 11)

Prerequisite: CC Algebra 1AB or CC Geometry AB

310343 CC Algebra 2A

310344 CC Algebra 2B

COURSE DESCRIPTION (Summer School)

In this course, students expand understanding of expressions including rewriting, interpreting and examining rational, radical, polynomial expressions and deriving the formula of the sums of finite geometric series. Students continue expanding their knowledge of rational, polynomial, radical, exponential and logarithmic functions; they learn to represent functions algebraically, graphically, in numerical tables and by verbal descriptions. Students expand their knowledge of the real numbers to model/ solve a variety of equations/ inequalities and the systems of equations with two or more variables. Students practice creating equations for the real world situations, learn how to solve them, interpret the solutions and explain the reasoning. Students learn about complex numbers and explore real /complex roots of polynomial functions using the Fundamental Theorem of Algebra. Students explore/ apply the Remainder Theorem and the Binomial Theorem with the polynomial expressions and equations. Students explore the relationship between the exponential functions and their inverses, the logarithmic functions.

Students explore all conic sections and learn how to express geometric properties with equations. Students extend their trigonometry knowledge: they learn how to interpret the radian measure of angles in the unit circle, graph all six trigonometric functions, model the periodic phenomena of the graphs, and prove/apply trigonometric identities. Finally, students continue expanding their knowledge of statistics by summarizing, representing, and interpreting data using the normal distribution. Moreover, students make inferences and justify conclusions based on sampling, experiments and observational studies.

The standards in this Algebra II course cover the following conceptual categories: Modeling, Functions, Number and Quantity, Algebra, and Statistics and Probability. The standards are developed to help educators implement mathematical practices of reasoning abstractly/ quantitatively, constructing viable arguments, modeling with mathematics, analyzing the structure of algebraic problems and persevering in solving them. This course content provides the rich instructional experiences for students and helps them to succeed beyond the high school and compete in the 21st century job market.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

COURSE SYLLABUS (Summer School)

Unit 1: Model and Reason with Equations and Inequalities

Students use reasoning to analyze equations/ inequalities and develop strategies for solving them. Through reasoning students develop fluency writing, interpreting, analyzing and translating between various forms of linear equations and inequalities. By exploring a question about the world around them (mathematical modeling) and attempting to answer the question students expand the scope of algebraic operations to solve a wide variety of linear and quadratic real world problems. Students explain why the x-coordinates of the points where the graphs $y = f(x)$ and $y = g(x)$ intersects and explore cases involving polynomial, rational, absolute value, exponential, and logarithmic functions.

Unit 2: Structure in Expressions and Arithmetic with Polynomials.

Students connect the polynomial operations with the background knowledge of the algorithms found in multi-digit integer operations. Students realize that the operations on rational expressions (the arithmetic of rational expressions) are governed by the same rules as the arithmetic of rational numbers. Students analyze the structure in expressions and write them in equivalent forms. By modeling students expand the scope of algebraic operations to solve a wide variety of polynomial equations and real world problems. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The role of factoring, as both an aid to the algebra and to the graphing of polynomials, is explored.

Unit 3: Functions

Instructional time should focus on relating arithmetic of rational expressions to arithmetic of rational numbers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. Students will expand understandings of functions and graphing to include trigonometric functions. Building on their previous work with functions and on their work with trigonometric ratios and circles in the Geometry course, students now use the coordinate plane to extend trigonometry to model periodic phenomena. Students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function.

Unit 4: Geometry and Trigonometry

Students use algebraic manipulation, including completing the square, as a tool for geometric understanding to determine if the equation represents a circle or a parabola. They graph shapes and relate the graphs to the behavior of the functions with the transformation on the variable (e.g. the graph of $y=f(x+2)$). Students expand on their understanding of the trigonometric functions first developed in Geometry to explore the graphs of trigonometric functions with attention to the connection between the unit circle representation of the trigonometric functions and their properties, use trigonometric functions to model periodic phenomena. Students use Pythagorean identity to find the trig function outputs given the angle and understand that interpretation of sine and cosine yield the Pythagorean Identity. Finally, students model and apply Trigonometric Functions.

Unit 5: Statistics and Probability

Students analyze data to make sound statistical decisions based on probability models. By investigating examples of simulations of experiments and observing outcomes of the data, students gain an understanding of what it means for a model to fit a particular data set. Students develop a statistical question in the form of a hypothesis (supposition) about a population parameter, choose a probability model for collecting data relevant to that parameter, collect data, and compare the results seen in the data with what is expected under the hypothesis. Students build on their understanding of data distributions to help see how the normal distribution uses area to make estimates of frequencies (which can be expressed as probabilities). In addition, they can learn through examples the empirical rule, that for a normally distributed data set, 68% of the data lies within one standard deviation of the mean, and that 95% are within two standard deviations of the mean.

Summer School **CC Algebra 2A** Curricular Map

Model and Reason with Equations/Inequalities and Expressions Structure

Week	Conceptual Category	CCSS-M Standards/Practices	Domains and Clusters	Resources
1	Algebra <i>Creating Equations</i>	A-CED.1-2 A-CED.3-4 MP 1, 2, 3, 4, 7	Creating Equations A-CED -Create equations that describe numbers or relationships	Illustrative Mathematics • Buying a Car: A-CED.1 • Dimes and Quarters: A-CED.2 & A-CED.3 • Equations and Formulas: A-CED.4
2	Algebra <i>Reasoning with Equations and Inequalities</i>	A-REI.2 A-REI.3.1 A-REI.11 MP 1, 2, 3, 4, 7	Reasoning with Equations and Inequalities A-REI -A-Understand solving equations as a process of reasoning and explain the reasoning; A-REI -B-Solve equations and inequalities in one variable (absolute value); A-REI -D-Represent and solve equations and inequalities graphically	Illustrative Mathematics • Radical Equations: A-REI.2 • Introduction to Polynomials - College Fund: A-REI.11 • Population and Food Supply: A-REI.2, 3, 11
3	Algebra <i>Seeing Structure in Expressions</i>	A-SSE.1-2 A-SSE.4 MP 1, 2, 3, 4, 7	Seeing Structure in Expressions A-SSE-A -Interpret the structure of expressions A-SSE-B- Write expressions in equivalent forms to solve problems	Illustrative Mathematics • Animal Populations: A-SSE.1, 2 • Sum of Even and Odd: A-SSE.2 • A Lifetime of Savings: A-SSE.4
4	Algebra <i>Arithmetic with Polynomials and Rational Expressions</i>	A-APR.1 A-APR.2-3 A-APR.4-5 A-APR.6-7 MP 1, 2, 3, 4, 7	Arithmetic with Polynomials and Rational Expressions A-APR-A -Perform arithmetic operations on polynomials; A-APR-B -Understand the relationship between zeros and factors of polynomials ; A-APR-C -Use polynomial identities to solve problems A-APR-D- Rewrite Rational Expressions	Mathematics Assessment Project • Representing Polynomials: A-APR • Zeroes and factorization of a quadratic polynomial I: A-APR.2
5	Algebra <i>Arithmetic with Polynomials and Rational Expressions</i>	A-APR.4-5 A-APR.6-7 MP 1, 2, 3, 4, 7	Arithmetic with Polynomials and Rational Expressions A-APR-C -Use polynomial identities to solve problems A-APR-D- Rewrite Rational Expressions	Mathematics Assessment Project Representing Polynomials: A-APR • Interpreting Algebraic Expressions: A-APR LAUSD Mathematics website – http://achieve.lausd.net/math • Parabola Activity

Summer School **CC Algebra 2A** Curricular Map

Model and Reason with Equations/Inequalities and Expressions Structure

Week	Domains	Clusters and Standards
1	Creating Equations	Create equations that describe numbers or relationships A-CED.1. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. CA ★ 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-CED.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. ★
2	Reasoning with Equations and Inequalities	Understand solving equations as a process of reasoning and explain the reasoning; A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. Solve equations and inequalities in one variable (absolute value); A-REI.3.1. Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context. CA Represent and solve equations and inequalities graphically 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. ★
3	Seeing Structure in Equations	Interpret the structure of 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. <i>For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.</i> ★ A-SSE.2. Use the structure of an expression to identify ways to rewrite it. Write expressions in equivalent forms to solve problems A-SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i> ★ <i>Seeing Structure in Equations</i>

★ Indicates a modeling standard linking mathematics to everyday life, work, and decision-making.

(+) Indicates additional mathematics to prepare students for advanced courses.

Summer School CC Algebra 2A Curricular Map
Model and Reason with Equations/Inequalities and Expressions Structure

Week	Domains	Clusters and Standards
4	Arithmetic with Polynomials and Rational Expressions	Perform arithmetic operations on polynomials; 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. Understand the relationship between zeros and factors of polynomials A-APR.2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$. 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 Use polynomial identities to solve problems A-APR.4. Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples</i> A-APR.5. Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.(+) Rewrite Rational Expressions A-APR.6. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. (+)A-APR.7. Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Summer School CC Algebra 2A Curricular Map
Model and Reason with Equations/Inequalities and Expressions Structure

Week	Domains	Clusters and Standards
5	Arithmetic with Polynomials and Rational Expressions	Use polynomial identities to solve problems A-APR.4. Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples</i> A-APR.5. Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle. (+) Rewrite Rational Expressions A-APR.6. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. (+)A-APR.7. Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

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Mathematical Practices	
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Summer School **CC Algebra 2A** Curricular Map

Model and Reason with Equations/Inequalities and Expressions Structure

Resources

Illustrative Mathematics

- Buying a Car: A-CED.1
<http://www.illustrativemathematics.org/illustrations/582>
- Basketball: A-CED.1 & A-REI.2 <http://www.illustrativemathematics.org/illustrations/702>
- How Much Folate: A-CED.2 <http://www.illustrativemathematics.org/illustrations/1351>
- Dimes and Quarters: A-CED.2 & A-CED.3 <http://www.illustrativemathematics.org/illustrations/220>
- Growing Coffee: A-CED.3 <http://www.illustrativemathematics.org/illustrations/611>
- Bernado and Sylvia Play a Game: A-CED.3 <http://www.illustrativemathematics.org/illustrations/1010>
- Clea on an Escalator: A-CED.2 <http://www.illustrativemathematics.org/illustrations/1003>
- Equations and Formulas: A-CED.4 <http://www.illustrativemathematics.org/illustrations/393>
- Radical Equations: A-REI.2 <http://www.illustrativemathematics.org/illustrations/391>
- Introduction to Polynomials - College Fund: A-REI.11 <http://www.illustrativemathematics.org/illustrations/1551>

Illustrative Mathematics

Growth Rate: Given growth charts for the heights of girls and boys, students will use slope to approximate rates of change in the height of boys and girls at different ages. Students will use these approximations to plot graphs of the rate of change of height vs. age for boys and girls.

<http://illuminations.nctm.org/LessonDetail.aspx?id=L668>

Mathematics Assessment Project

- Solving Linear Equations in two Variables: A-CED.2, 3; MP 2,3
<http://map.mathshell.org/materials/lessons.php?taskid=209#task209>
- Optimization Problems: Boomerangs: A-CED.2; MP 1,2,3,4
<http://map.mathshell.org/materials/download.php?fileid=1241>

Illustrative Mathematics

- Population and Food Supply : A-REI.2, 3, 11 <http://www.illustrativemathematics.org/illustrations/645>

NCTM Illuminations

- Trout Pond Population: A-CED.2. This investigation illustrates the use of iteration, recursion and algebra to model and analyze a changing fish population. Graphs, equations, tables, and technological tools are used to investigate the effect of varying parameters on the long-term population.

Summer School **CC Algebra 2A** Curricular Map

Model and Reason with Equations/Inequalities and Expressions Structure

<http://illuminations.nctm.org/LessonDetail.aspx?ID=L476>

- Exploring Linear Data: A-CED.2. Students model linear data in a variety of settings that range from car repair costs to sports to medicine. Students work to construct scatterplots, interpret data points and trends, and investigate the notion of line of best fit.

<http://illuminations.nctm.org/LessonDetail.aspx?id=L298>

Illustrative Mathematics

- Animal Populations: A-SSE.1, 2 <http://www.illustrativemathematics.org/illustrations/436>
- Sum of Even and Odd: A-SSE.2
<http://www.illustrativemathematics.org/illustrations/198>
- Seeing Dots: A-SSE.1, 2 <http://www.illustrativemathematics.org/illustrations/21>
- Zeroes and factorization of a quadratic polynomial I: A-APR.2
<http://www.illustrativemathematics.org/illustrations/787>
- Zeroes and factorization of a quadratic polynomial II: A-APR.2
<http://www.illustrativemathematics.org/illustrations/789>
- Zeroes and factorization of a non-polynomial function: A-SSE.2 <http://www.illustrativemathematics.org/illustrations/796>
- Trina's Triangles: A-SSE.4 <http://www.illustrativemathematics.org/illustrations/594>

Egyptian Fraction II: A-SSE.6 <http://www.illustrativemathematics.org/illustrations/1346>

Illustrative Mathematics

- Course of Antibiotics: A-SSE.4 <http://www.illustrativemathematics.org/illustrations/805>
- Cantor Set: A-SSE.4 <http://www.illustrativemathematics.org/illustrations/929>
- A Lifetime of Savings: A-SSE.4 <http://www.illustrativemathematics.org/illustrations/1283>
- Combined Fuel Efficiency: A-SSE.6 <http://www.illustrativemathematics.org/illustrations/825>

Mathematics Assessment Project

Representing Polynomials: A-APR <http://map.mathshell.org/materials/download.php?fileid=1271>

Interpreting Algebraic Expressions: A-APR <http://map.mathshell.org/materials/download.php?fileid=694>

LAUSD Mathematics website – <http://math.lausd.net>

Parabola Activity

Summer School **CC Algebra 2B** Curricular Map Arithmetic with Polynomials and Functions

Week	Conceptual Category	CCSS-M Standards /Practices	Domains and Clusters	Resources
1	Functions – Interpreting & Building Functions,	F-IF.4-6 F-IF.7-9 F-BF.1 F-BF.3-4 MP 1, 2, 3, 4, 7	Interpreting Functions F-IF-A-Understand the concept of function and use function notation F-IF-B-Interpret functions that arise in applications in terms of a context Building Functions F-BF-A-Build a function that models a relationship between two quantities F-BF-B-Build new functions from existing functions	Illustrative Mathematics Running Time: F-IF.7c Exponentials and Logarithms I: FBF.4 Mathematics Assessment Project Formative Assessments/Tasks Sidewalk Patterns –F-BF.1
2	Functions – Linear, Quadratics, and Exponential Models	F-LE.4 F-LE.4.1-4.3 MP 1, 2, 3, 4, 7	Linear, Quadratic, and Exponential Models F-LE-A-Construct and compare linear, quadratic, and exponential models and solve problems	Illustrative Mathematics Exponentials and Logarithms II: F-BF.5, FLE.4
3	Number & Quantity- Complex Number System	N-CN.1-3 N-CN.7-9 MP 1, 2, 3, 4, 7	Complex Number System N-CN-A-Perform arithmetic operations with complex numbers N-CN-C-Use complex numbers and their operations on the complex plane	Illustrative Mathematics Powers of a complex number: N-CN.2 Completing the square: N-CN.7; A-REI.4 Complex number patterns: N-CN.1
4	Geometry and Trigonometry	G-GPE.3.1 F-TF.1,2 & 2.1 F-TF.5 F-TF.8 MP 1, 2, 3, 4, 7	Expressing Geometric Properties with Equations G-PE-A-Translate between the geometric description and equation for a conic section Trigonometric Functions F-TF-A-Extend the domain of trigonometric functions using the unit circle F-TF-B-Model periodic phenomena with trigonometric functions F-TF-C-Prove and apply trigonometric identities	Illustrative Mathematics Explaining the equation for a circle:G-GPE.3 Foxes and Rabbits 3: F-TF.5 Trig Functions and the Unit Circle : F-TF.2 NCTM Illuminations Graphs from the Unit Circle: F-TF.1, 2

Summer School **CC Algebra 2B** Curricular Map

Arithmetic with Polynomials and Functions

Week	Conceptual Category	CCSS-M Standards /Practices	Domains and Clusters	Resources
5	Statistics & Probability	S.ID.4 S.IC.1-2 S.IC.3-4 S.MD.6. (+) S.MD.7. (+) MP 1, 2, 3, 4, 7	Statistics and Probability – Interpreting Categorical and Quantitative Data SID-A -Summarize, represent, and interpret data on a single count or measurement variable Making Inferences and Justify Conclusions SIC-A -Understand and evaluate random processes underlying statistical experiments SIC-B -Make inferences and justify conclusions from sample surveys, experiments, and observational studies Statistics and Probability – Using Probability to Make Decisions S-MD-Use probability to evaluate outcomes of decisions	Mathematics Assessment Projects (MARS Tasks) - Modeling Conditional Probabilities 1: Lucky Dip: S.MD.6 http://map.mathshell.org/materials/lessons.php?taskid=409&subpage=problem Illustrative Mathematics - SAT Score: S.ID.4 http://www.illustrativemathematics.org/illustrations/216 - Strict Parents: S-IC.1, 3 http://www.illustrativemathematics.org/illustrations/122

★ Indicates a modeling standard linking mathematics to everyday life, work, and decision-making.

(+) Indicates additional mathematics to prepare students for advanced courses

Summer School **CC Algebra 2B** Curricular Map

Arithmetic with Polynomials and Functions

Week	Domains	Clusters and Standards
1	Functions – Interpreting & Building Functions,	Understand the concept of function and use function notation 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. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i> ★ F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ★ 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. ★ Interpret functions that arise in applications in terms of a context 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. ★ b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. ★ c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. ★ e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ★ F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Build a function that models a relationship between two quantities F-BF.1 Write a function that describes a relationship between two quantities. ★ b. Combine standard function types using arithmetic operations. <i>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.</i> ★ Build new functions from existing functions F-BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i> 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. <i>For example, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$</i>

Summer School **CC Algebra 2B** Curricular Map Arithmetic with Polynomials and Functions

2	<i>Functions – Linear, Quadratics, and Exponential Models</i>	Construct and compare linear, quadratic, and exponential models and solve problems F-LE.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. ★ [Logarithms as solutions for exponentials.] 4.1 Prove simple laws of logarithms. CA ★ 4.2 Use the definition of logarithms to translate between logarithms in any base. CA ★
3	<i>Number & Quantity- Complex Number System</i>	Perform arithmetic operations with complex numbers N-CN.1. Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real. N-CN.2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. Use complex numbers and their operations on the complex plane N-CN.7 Solve quadratic equations with real coefficients that have complex solutions. N-CN.8 (+) Extend polynomial identities to the complex numbers. <i>For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$.</i> N-CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials
4	<i>Geometry and Trigonometry</i>	Translate between the geometric description and equation for a conic section G-GPE.3.1. Given a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, use the method for completing the square to put the equation into standard form; identify whether the graph of the equation is a circle, ellipse, parabola, or hyperbola, and graph the equation. [In Algebra II, this standard addresses circles and parabolas only.] CA Extend the domain of trigonometric functions using the unit circle F-TF.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. F-TF.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. F-TF.2.1. Graph all 6 basic trigonometric functions. Model periodic phenomena with trigonometric functions F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★ Prove and apply trigonometric identities F-TF.8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant.
		Summarize, represent, and interpret data on a single count or measurement variable S.ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets,

Summer School **CC Algebra 2B** Curricular Map

Arithmetic with Polynomials and Functions

5	Statistics & Probability	and tables to estimate areas under the normal curve. Understand and evaluate random processes underlying statistical experiments S.IC.1. Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population. S.IC.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i> Make inferences and justify conclusions from sample surveys, experiments, and observational studies S.IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. S.IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. S.IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. S.IC.6. Evaluate reports based on data. Use probability to evaluate outcomes of decisions S.MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). S.MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
Mathematical Practices		
1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.		

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Resources

Illustrative Mathematics

- Bacteria Populations: F-LE.4 <http://www.illustrativemathematics.org/illustrations/370>
- Running Time: F-IF.7c <http://www.illustrativemathematics.org/illustrations/1539>
- Graphs of Power Functions: F-IF.7c <http://www.illustrativemathematics.org/illustrations/627>
- Exponentials and Logarithms I: F-BF.4 <http://www.illustrativemathematics.org/illustrations/600>
- Exponentials and Logarithms II: F-BF.5, F-LE.4 <http://www.illustrativemathematics.org/illustrations/615>
- Complex number patterns: N-CN.1 <http://www.illustrativemathematics.org/illustrations/722>
- Powers of a complex number: N-CN.2 <http://www.illustrativemathematics.org/illustrations/1689>
- Completing the square: N-CN.7; A-REI.4 <http://www.illustrativemathematics.org/illustrations/1690>

Inside Mathematics

- Measuring Mammals- F-BF.4 <http://www.insidemathematics.org/problems-of-the-month/pom-measuringmammals.pdf>

Mathematics Assessment Project Formative Assessments/Tasks

- Patchwork – F-BF.1 <http://map.mathshell.org/materials/download.php?fileid=754>
- Sidewalk Patterns – F-BF.1 <http://map.mathshell.org/materials/download.php?fileid=760>
- Printing Tickets – F-IF.4 <http://map.mathshell.org/materials/download.php?fileid=772>

Illustrative Mathematics

- Identifying graph of functions – F-IF.7c <http://www.illustrativemathematics.org/illustrations/803>

Inside Mathematics

- Digging Dinosaurs- F-IF.8, F-LE.1 <http://www.insidemathematics.org/problems-of-the-month/pom-diggingdinosaurs.pdf>

California Revised Mathematics Framework:

- <http://www.cde.ca.gov/be/cc/cd/draftmathfwchapters.asp>.

Illustrative Mathematics Resources:

- Explaining the equation for a circle: G-GPE.3 <http://www.illustrativemathematics.org/illustrations/1425>
- Foxes and Rabbits 3: F-TF.5 <http://www.illustrativemathematics.org/illustrations/817>

Summer School **CC Algebra 2B** Curricular Map

Arithmetic with Polynomials and Functions

NCTM Illuminations

- Graphs from the Unit Circle: F-TF.1, 2 <http://illuminations.nctm.org/LessonDetail.aspx?id=L785>

Miscellaneous Sources

- Gravel Roads and Sinusoidal Patterns: http://www.nsa.gov/academia/files/collected_learning/high_school/trigonometry/gravel_roads.pdf

Illustrative Mathematics

- Bacteria Populations: F-LE.4 <http://www.illustrativemathematics.org/illustrations/370>
- Running Time: F-IF.7c <http://www.illustrativemathematics.org/illustrations/1539>
- Graphs of Power Functions: F-IF.7c <http://www.illustrativemathematics.org/illustrations/627>
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- Measuring Mammals- F-BF.4 <http://www.insidemathematics.org/problems-of-the-month/pom-measuringmammals.pdf>

Mathematics Assessment Projects (MARS Tasks)

- Modeling Conditional Probabilities 1: Lucky Dip: S-MD.6 <http://map.mathshell.org/materials/lessons.php?taskid=409&subpage=problem>

NCTM Illuminations Lessons

- **Should We Send a Certificate?:** S.ID.4 <http://www.illustrativemathematics.org/illustrations/1218>
- **Exploration with Chance:** S.ID.6 <http://illuminations.nctm.org/LessonDetail.aspx?id=L290>

- **Illuminations**

Fred's Fun Factory: S-MD.2, 5 and 7 <http://www.illustrativemathematics.org/illustrations/1197>

Miscellaneous Sources

- **The Normal Distribution:** S.ID.4 http://www.wmich.edu/cpmp/1st/unit/samples/pdfs/C3U5_362-375.pdf

Illustrative Mathematics:

- School Advisory Panel: S-IC.1 <http://www.illustrativemathematics.org/illustrations/186>
- Strict Parents: S-IC.1, 3 <http://www.illustrativemathematics.org/illustrations/122>

Summer School CC Algebra 2B Curricular Map
Arithmetic with Polynomials and Functions

- Musical Preferences: S-IC.1, S-ID.5 <http://www.illustrativemathematics.org/illustrations/123>
- SAT Score: S.ID.4 <http://www.illustrativemathematics.org/illustrations/216>
- Do You Fit In This Car?: S.ID.4 <http://www.illustrativemathematics.org/illustrations/1020>

- Should We Send Out a Certificate?: S.ID.4 <http://www.illustrativemathematics.org/illustrations/1218>