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

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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

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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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★ F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ★ 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. *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.* ★ **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.* 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 $x \neq 1$*

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2	*Functions – Linear, Quadratics, and Exponential Models*	**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	*Number & Quantity-Complex Number System*	**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. *For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.* N-CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials
4	*Geometry and Trigonometry*	**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,

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. *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?* **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.7chttp://www.illustrativemathematics.org/illustrations/627
- Exponentials and Logarithms I: F-BF.4http://www.illustrativemathematics.org/illustrations/600
- Exponentials and Logarithms II: F-BF.5, F-LE.4http://www.illustrativemathematics.org/illustrations/615
- Complex number patterns: N-CN.1http://www.illustrativemathematics.org/illustrations/722
- Powers of a complex number: N-CN.2http://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.7chttp://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

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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.7chttp://www.illustrativemathematics.org/illustrations/1539
- Graphs of Power Functions: F-IF.7chttp://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.4http://www.illustrativemathematics.org/illustrations/615
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Inside Mathematics

- 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 7http://www.illustrativemathematics.org/illustrations/1197

Miscellaneous Sources

- **The Normal Distribution: S.ID.4** http://www.wmich.edu/cpmp/1st/unitsamples/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

- 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