# College Algebra

These curriculum maps are designed to address Common Core State Standards (CCSS) Mathematics and Literacy outcomes. The overarching focus for all curriculum maps is building students' content knowledge focusing on their math practice abilities and literacy skills. Each unit provides several weeks of instruction. Each unit also includes various assessments. Taken as a whole, this curriculum map is designed to give teachers recommendations and some concrete strategies to address the shifts required by CCSS.

## Instructional Shifts in Mathematics

| | |
|---|---|
| **Focus:**<br><br>Focus strongly where the Standards focus | **Focus requires that we significantly narrow and deepen the scope of content in each grade so that students experience concepts at a deeper level.**<br>• Instruction engages students through cross-curricular concepts and application. Each unit focuses on implementation of the Math Practices in conjunction with math content.<br>• Effective instruction is framed by performance tasks that engage students and promote inquiry. The tasks are sequenced around a topic leading to the big idea and essential questions in order to provide a clear and explicit purpose for instruction. |
| **Coherence:**<br><br>Think across grades, and link to major topics within grades | **Coherence in our instruction supports students to make connections within and across grade levels.**<br>• Problems and activities connect clusters and domains through the art of questioning.<br>• A purposeful sequence of lessons build meaning by moving from concrete to abstract, with new learning built upon prior knowledge and connections made to previous learning.<br>• Coherence promotes mathematical sense making. It is critical to think across grades and examine the progressions in the standards to ensure the development of major topics over time. The emphasis on problem solving, reasoning and proof, communication, representation, and connections require students to build comprehension of mathematical concepts, procedural fluency, and productive disposition. |
| **Rigor:**<br><br>In major topics, pursue conceptual understanding, procedural skills and fluency, and application | **Rigor helps students to read various depths of knowledge by balancing conceptual understanding, procedural skills and fluency, and real-world applications with equal intensity.**<br>• Conceptual understanding underpins fluency; fluency is practiced in contextual applications; and applications build conceptual understanding.<br>• These elements may be explicitly addressed separately or at other times combined. Students demonstrate deep conceptual understanding of core math concepts by applying them in new situations, as well as writing and speaking about their understanding. Students will make meaning of content outside of math by applying math concepts to real-world situations.<br>• Each unit contains a balance of challenging, multiple-step problems to teach new mathematics, and exercises to practice mathematical skills |

# 8 Standards for Mathematical Practice

**The Standards for Mathematical Practice** describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. They describe how students should learn the content standards, helping them to build agency in math and become college and career ready. **The Standards for Mathematical Practice are interwoven into every unit. Individual lessons may focus on one or more of the Math Practices, but every unit must include all eight.**

| | |
|---|---|
| **1. Make sense of problems and persevere in solving them** | Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. |
| **2. Reason Abstractly and quantitatively** | Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. |
| **3. Construct viable arguments and critique the reasoning of others** | Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students |

| | |
|---|---|
| | at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. |
| **4. Model with mathematics** | Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. |
| **5. Use appropriate tools strategically** | Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. |
| **6. Attend to precision** | Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. |
| **7. Look for and make use of structure** | Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see $7 \times 8$ equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as $2 \times 7$ and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a |

| | |
|---|---|
| | positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers $x$ and $y$. |
| **8. Look for and express regularity in repeated reasoning** | Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results. |

# SAUSD Curriculum Map 2015-2016: College Algebra

## English Language Development Standards

**The California English Language Development Standards** (CA ELD Standards) describe the key knowledge, skills, and abilities in core areas of English language development that students learning English as a new language need in order to access, engage with, and achieve in grade-level academic content, with particular alignment to the key knowledge, skills, and abilities for achieving college- and career-readiness. English Learners must have full access to high quality English language arts, mathematics, science, and social studies content, as well as other subjects, at the same time as they are progressing through the ELD level continuum. The CA ELD Standards are intended to support this dual endeavor by providing fewer, clearer, and higher standards. **The ELD Standards are interwoven into every unit.**

| **Interacting in Meaningful Ways** |
|---|
| **A. Collaborative** (engagement in dialogue with others) |
| 1. Exchanging information/ideas via oral communication and conversations |
| |
| **B. Interpretive** (comprehension and analysis of written and spoken texts) |
| 5. Listening actively and asking/answering questions about what was heard |
| 8. Analyzing how writers use vocabulary and other language resources |
| |
| **C. Productive** (creation of oral presentations and written texts) |
| 9. Expressing information and ideas in oral presentations |
| 11. Supporting opinions or justifying arguments and evaluating others' opinions or arguments |

# SAUSD Curriculum Map 2015-2016: College Algebra

## How to Read this Document

- The purpose of this document is to provide an overview of the progression of units of study within a particular grade level and subject describing what students will achieve by the end of the year. The work of **Big Ideas and Essential Questions** is to provide an overarching understanding of the mathematics structure that builds a foundation to support the rigor of subsequent grade levels. The **Performance Task** will assess student learning via complex mathematical situations. Each unit incorporates components of the **SAUSD Theoretical Framework** and the philosophy **of Quality Teaching for English Learners (QTEL).** Each of the math units of study highlights the Common Core instructional shifts for mathematics of focus, coherence, and rigor.

- The **8 Standards for Mathematical Practice** are the key shifts in the pedagogy of the classroom. These 8 practices are to be interwoven throughout every lesson and taken into consideration during planning. These, along with the **ELD Standards,** are to be foundational to daily practice.

- First, read the **Framework Description/Rationale** paragraph, as well as the **Common Core State Standards**. This describes the purpose for the unit and the connections with previous and subsequent units.

- The units show the progression of units drawn from various domains.

- The timeline tells the length of each unit and when each unit should begin and end.

# SAUSD Scope and Sequence for College Algebra

| Pre-Unit | Unit 1 | Unit 2 | Unit 3 |
|---|---|---|---|
| *9/2-9/18*<br>2.5 Weeks | *9/21-10/23*<br>5 Weeks | *10/26-12/4*<br>5 Weeks | *12/7-01/22*<br>5 Weeks |
| Preparing the Learner | Linear & Piecewise-Defined Functions | Polynomial Functions | Exponential and Logarithmic Functions |

******SEMESTER******

| Unit 4 | Unit 5 | Unit 6 | Unit 7 |
|---|---|---|---|
| *2/1-3/11*<br>6 Weeks | *3/14-4/15*<br>4 Weeks | *4/18-5/20*<br>5 Weeks | *5/23-6/16*<br>4 Weeks |
| Radical and Rational Functions | Operations on Matrices | Trigonometric Functions | Enrichment |

# SAUSD Curriculum Map 2015-2016: College Algebra

## College Algebra Overview:

College Algebra combines all of the standards from CCSS Algebra 2 and select standards from CCSS Precalculus (see below). It begins with a unit on Preparing the Learner, to provide students with necessary supports so they can be successful with the content of the year. Since many students taking this course will also be taking Placement Exams this school year, the units include links for the Practice Placement Exam implementation. Students are encouraged to take the online Practice Placement Exam prior to taking the actual test. During the course of this year when working through problems, students should be exposed to multiple strategies, and should be encouraged to become independent in correctly selecting those strategies.

### From the Algebra 2 Framework:

The purpose of this course is to extend students' understanding of functions and the real numbers, and to increase the tools students have for modeling the real world. They extend their notion of number to include complex numbers and see how the introduction of this set of numbers yields the solutions of polynomial equations and the Fundamental Theorem of Algebra. Students deepen their understanding of the concept of function, and apply equation-solving and function concepts to many different types of functions. The system of polynomial functions, analogous to the integers, is extended to the field of rational functions, which is analogous to the rational numbers. Students explore the relationship between exponential functions and their inverses, the logarithmic functions. Trigonometric functions are extended to all real numbers, and their graphs and properties are studied. Finally, students' statistics knowledge is extended to understanding the normal distribution, and they are challenged to make inferences based on sampling, experiments, and observational studies.

Building on their work with linear, quadratic, and exponential functions, in Algebra II students extend their repertoire of functions to include polynomial, rational, and radical functions. Students work closely with the expressions that define the functions and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. Based on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena. 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. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. Students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data— including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn.

(From the CA Mathematics Framework for Algebra 2)

### From the PreCalculus Framework

Precalculus combines the trigonometric, geometric, and algebraic concepts needed to prepare students for the study of Calculus, and strengthens students' conceptual understanding of problems and mathematical reasoning in solving problems. Facility with these topics is especially important for students intending to study calculus, physics, and other sciences, and/or engineering in college. The main topics in the course are complex numbers, rational functions, trigonometric functions and their inverses, inverse functions, and matrices. This course is highly suggested as preparation before taking a standard Calculus course that would lead to taking an Advanced Placement Calculus exam.

In Precalculus, students begin working with matrices and their operations, experiencing for the first time an algebraic system in which multiplication is not commutative. They also find inverse matrices and use matrices to represent and solve linear systems. Students extend their work with trigonometric functions, investigating the reciprocal functions secant, cosecant, and cotangent and their graphs and properties. They find inverse trigonometric functions by appropriately restricting the domains of the standard trigonometric functions and use them to solve problems that arise in modeling contexts. While students have worked previously with parabolas and circles, they now work with ellipses and hyperbolas. Finally, students work with more complicated rational functions, graphing them and determining zeros, y-intercepts, symmetry, asymptotes, intervals for which the function is increasing or decreasing, and maximum or minimum points.

(From the CA Mathematics Framework for Precalculus)

# Pre-Unit: **Preparing the Learner** *(2.5 weeks 9/2-9/18)*

| **Big Idea** | The set of real numbers is infinite and each real number can be associated with a unique point on the number system. |
|---|---|

| **Essential Questions** | **Performance Task (MARS Tasks)** | **Problem of the Month** |
|---|---|---|
| • How do you solve equations and inequalities with one variable?<br>• How do you model a mathematical situation using an equation?<br>• What features can help to identify where equations have one, none, or infinitely many solutions? | • Yogurt p.59-60<br>• Cat Food p.74<br>• The Number Cruncher p.2-3<br>• Rabbit Costumes p. 52-53<br>• How Much Money? p.16<br>• Smallest and Largest p.19-20<br>• Soup and Beans [Algebra 2009] p.81<br>• Multiples of Three [Algebra 2005] p.10-11 | Got Your Number POM and Teacher's Notes |

| **Unit Topics/Concepts** | **Content Standards** | **Resources** |
|---|---|---|
| **Introduction to Algebra**<br>• **Practice Placement Exam** *(this will serve as the unit pre-test-- see information on next page)*<br>• Apply knowledge of the structure of expressions with the properties (distributive, commutative, associative, etc.) to help solve equations<br>• Transform equations into simpler forms<br>• Expand expressions to help solve equations<br>• Apply expressions to represent contextual situations (i.e. changing words into symbols and expressions and making sense of them)<br>• Operations on the real number line<br>• Solve for a given variable in equations or inequalities<br>• Identify number of solutions: one, infinitely many, or no solution<br>• Perform operations with fractions and decimals in context | **8.EE.C.7.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).<br><br>**HSA.REI.B.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | **Essential Resource:**<br>Textbook: *Elementary and Intermediate Algebra*- Chapter 1-Sections 1.2, 1.3, 1.5, 1.6, 1.7, 1.8, 2.2, 2.5, 2.6<br><br>**Additional Resources:**<br>Web Resources for spiral review:<br>Khan Academy |

# Pre-Unit: **Preparing the Learner** *(Support & Strategies)*

## Framework Description/Rationale

The purpose of this unit is to refresh student knowledge of previously learned algebraic concepts that will be used heavily in College Algebra. These basic concepts include various properties and rules (commutative, associative, distributive, order of operations), fractions, integers, and solving basic equations and inequalities. It is also recommended that students take the practice Level 2 College Math Placement Exam (Released/Practice questions from Santa Ana College) in the first few days of class. The test serves as a pre-test to assess their college level math readiness at the beginning of the course (*see the Placement Exam Review box below for further details*).

| Academic Language Support | Instructional Tool/Strategy Examples | Pre-Unit: Preparing the Learner (number of days) |
|---|---|---|
| Vocabulary:<br>• Variable<br>• Constants<br>• Fraction/Ratio<br>• Integers<br>• Commutative Property<br>• Associative Property<br>• Distributive Property<br>• Like Terms<br>• Inverses (Opposite and Additive)<br>• Real Numbers<br>• Exponential Base<br>• Clearing Fractions/Decimals<br>• Equation<br>• Inequalities | • Use real life examples to illustrate various types of models using fractions, integers, equations, and inequalities.<br>• Use software or calculators to illustrate various types of models using fractions, integers, equations, and inequalities. | |

## Placement Exam Review

At the beginning of this unit, is recommended that students take the online practice exam provided by Santa Ana College (SAC).

Students should also re-take the practice exam at the end of Unit 2 (Level 2 exam) and at the end of Unit 3 (Level 3 Exam) to gage progress and identify areas for re-teaching to prepare students for the College Math Placement Exams for Community College [SAC and California State Universities]. The topics covered in this pre-unit also serve as a review for the exam.

**Links to Practice Exam Placement:**

Practice Placement Test Codes (SAC) -- WSSMMT-GIBLI-BRAYS-BURAN-PIZZA-WISES
Practice Test Testing Website (SAC) (Level 1 or 2)
Santa Ana College: General Testing Center Information

**Teacher Notes:**

# SAUSD Curriculum Map 2015-2016: College Algebra

## Unit 1: **Linear & Piecewise-Defined Functions** *(5 weeks 9/21-10/23)*

| **Big Idea** | Recalling and recognizing, using procedures, explaining and concluding and making connections, extensions and justifying. |
|---|---|

| **Essential Questions** | **Performance Task** | **Problem of the Month** |
|---|---|---|
| • How can functions be represented in multiple ways?<br>• How can they be useful in modeling given situations?<br>• How do various functions compare to each other?<br>• How can new functions be created from linear functions?<br>• How can linear functions be used in real-life situations?<br>• How do transformations affect the parent linear function?<br>• What does the number of solutions (none, one or, infinite) of a system of linear equations represent?<br>• What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically?<br>• How can a system of equations be used to represent situations and solve problems in real-life? | Patchwork Quilt C1 2006 p.30-31<br>Swimming Race C1 1999 p.1<br>Speed, Distance, Time C1 2000 p.1<br>Toothpick Square C1 2002 p.7-8<br>Number Machine C1 2002 p.9-10 | On Balance<br>Teacher's Notes |

| **Unit Topics/Concepts** | **Content Standards** | **Resources** |
|---|---|---|
| **Linear Functions**<br>• Determine the relationship between data and the corresponding function<br>• Recognize key features of graphs and tables including: intercepts; intervals where the function is increasing/decreasing, positive/negative; relative maximum/minimum, symmetries; end behavior<br>• Identify slope in terms of Rates of Change<br>• Graphing in terms of transformations; effect of *k* on transforming a function<br>• Solving equations, including rearranging formulas<br>• Creating equations<br>• Model a situation using systems of equations<br>• Identify domain<br>• Using technology to graph and find intercepts<br>• Represent constraints by equations or inequalities, and systems and interpret solutions<br>• Determine unknowns using multiple constraints<br><br>**Piecewise-Defined Functions**<br>• Graphing, including step and absolute value | **A-SSE.1a** Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.<br>**A-CED.1** Create equations and inequalities in one variable, including ones with absolute value, and use them to solve problems.<br>**A-CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.<br>**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.<br>**A-CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.<br>**A-REI.3.1** Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context.<br>**F-BF.1** Write a function that describes a relationship between two quantities.<br>**F-BF.3** Identify the effect on the graph by replacing f(x) by f(x)+k, kf(x), f(kx), and f(x+k) for specific values of *k*. Experiment with cases and illustrate an explanation of the effects on the graph using technology.<br>**F-IF.5** Relate the domain of a function to its graph, and where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble in engines in a factory, then the positive integers would be an appropriate domain for the function.<br>**F-IF.6** Calculate and interpret the average rate of change of a function over a specified interval. Estimate the rate of change from a graph.<br>**F-IF.7b** Graph piecewise-defined functions, including step functions and absolute value functions. | **Essential Resource:**<br>Textbook:<br>*Elementary and Intermediate Algebra*<br>Chapter 2- Sections 2.1, 2.2, 2.3, 2.6, 2.7<br>Chapter 3- Sections 3.2, 3.3, 3.4, 3.5, 3.6, 3.7<br>Chapter 7- Sections 7.1, 7.2<br>Chapter 8- Sections 8.1, 8.2, 8.3<br><br>**Additional Resources:**<br>Real World Application: Ch. 2<br>Project:http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=agd&wcsuffix=0261<br><br>EngageNY: Complete curriculum for all grades with performance test, common core, lessons, worksheet.<br>http://schools.nyc.gov<br>Geogebra algebra/geometry modeling software:<br>http://www.geogebra.org |

| | | |
|---|---|---|
| • Identify key features of graphs: intercepts, max and min, symmetry<br>• Identify domain<br><br>• **Practice Placement Exam**<br>*(See information on next page)* | | /cms/download<br><br>MARS – Building and Solving Equations:http://map.mathshell.org/materials/lessons.php?taskid=554&subpage=concept<br><br>MARS – Algebraic Expressions: http://map.mathshell.org/materials/lessons.php?taskid=221&subpage=concept<br><br>Dan Meyer 3-act videos (list and interactive link to Dan Meyer's videos by standard)<br><br>Web Resources for spiral review:<br>Khan Academy |

# Unit 1: **Linear & Piecewise-Defined Functions** *(Support & Strategies)*

## Framework Description/Rationale

The purpose of this unit is to extend students' understanding of functions and the real numbers, and to increase the tools students have for modeling the real world. Students deepen their understanding of the concept of function, and apply equation solving concepts to linear functions. They explore the effects of transformations on graphs of linear functions in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of underlying function

(See CCSS CA Algebra 2 Framework and Precalculus Framework for more details)

| Academic Language Support | Instructional Tool/Strategy Examples | Pre-Unit: Preparing the Learner (number of days) |
|---|---|---|
| Vocabulary:<br>• Table<br>• T-Chart<br>• Linear<br>• Domain<br>• Range<br>• Function<br>• Transformation<br>• Intercept<br>• Slope<br>• Rate of change<br>• Ordered pairs<br>• Input<br>• Output | • Work to develop ways of thinking that are general and allow students to approach the work with any function. Have students first create a T-chart that will lead to a graph, to build on their understanding of input and output.<br><br>Activity examples:<br>• Silent board game: Given x and y values in a T-chart, students must fill in remaining values and as a final result, students determine the resultant functions<br>• Matching equations to and expressions to a real-life context, and be able to connect the context to questions and answers | • Sets of numbers<br>• Properties of Real Numbers<br>• Simplify Algebraic Expressions<br>• Relations and Functions<br>• Function notation and evaluating functions |

**Placement Exam Review**

Upon completion of this unit, it is recommended that students take the Level 2 online practice placement exam provided by Santa Ana College (SAC) again. This should be done at the end of this unit to allow time for growth between this practice exam and the practice exam students took at the beginning of the school year.

In a later unit (Unit 3) students should take the practice exam again (Level 3 Exam) to gage progress and identify areas for re-teaching to prepare students for the College Math Placement Exams for Community College [SAC and California State Universities (CSU)].

The daily content of this course helps to prepare students for the placement exam. Based on the results of the practice placement exam, it may be necessary to review additional topics separate from the unit. As a suggestion, these additional topics may be addressed during warm-ups, 2-3 times per week.

**Links to Practice Exam Placement:**

Practice Placement Test Codes (SAC) --WSSMMT-GIBLI-BRAYS-BURAN-PIZZA-WISES
Practice Test Testing Website (SAC) (Level 1 or 2)
Santa Ana College: General Testing Center Information

## Teacher Notes:

# SAUSD Curriculum Map 2015-2016: College Algebra

## Unit 2: **Polynomial Functions** *(5 weeks 10/26-12/4)*

| **Big Idea** | Relationships can be defined how one member is relates to another member by the rules in which it functions in a given situation. |
|---|---|

| **Essential Questions** | **Performance Task** | **Problem of the Month** |
|---|---|---|
| • What key features of higher degree polynomial function distinguish it from those of linear functions?<br>• How transformations of polynomial functions are related their parent function?<br>• How can you find a solution to a polynomial equation algebraically and graphically?<br>• How can features of polynomial functions such as the equation, solutions, axis of symmetry, vertex, etc. be represented in tables, equations, and in "real world" contexts?<br>• How do zeros and imaginary numbers represent solutions to polynomial equations?<br>• How does symmetry change with even and odd functions?<br>• How are the domain and range of the original function related to the inverse function?<br>• How have I grown from my first practice placement exam? (See teacher notes) | Patchwork C2 2000 p.3-4<br>One less than a Square C2 2001 p.9-10<br>Painted Cubes C2 2002 p.8-10<br>Number Patterns C2 2003 p.5-6<br>Sum of Two Squares C2 2005 p.10-11<br>Functions C1 2008 p.77-78 | Miles of Tiles<br>Teacher's Notes |

| **Unit Topics/Concepts** | **Content Standards** | **Resources** |
|---|---|---|
| • Level 2 Placement Re-Take (ideally at the end of the unit)<br>• Connect key features of graphs and tables including: intercepts; intervals where the function is increasing/decreasing, positive/negative; relative maximum/minimum, symmetries; end behavior<br>• Identify domain in the appropriate context<br>• Identify arithmetic effects and transformations on graphs by specific values of k such as f(x)+k, etc.<br>• Identify rates of change<br>• Understand the relationships between zeros and factors in relation to graphs of polynomials<br>• Graph quadratic functions in standard/vertex forms<br>• Solve quadratics by completing the square, using the quadratic formula, and using the zero product property<br>• Introduction to inverse and find the inverses of quadratics<br>• Perform arithmetic operations on polynomials<br>• Find zeros, factors, and | **A-APR.1** Understand that polynomials form a closed system under addition, subtraction, and multiplication; add, subtract, and multiply polynomials.<br>**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 $p(x)$.<br>**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.<br>**A-APR.4** Use polynomial identities to solve problems. Prove and use polynomial identities to describe numerical relationships. *E.g,.* $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*<br>**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.<br>**N-CN.2** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.<br>**N-CN.7** Solve quadratic equations with real coefficients and complex solutions.<br>**A-SSE.1b** Interpret complicated expressions by viewing one or more of their parts as a single entity. E.g., *interpret* $P(1 + r)^n$ *as the product of P and a factor not depending on P.*<br>**A-SSE.2** Use the structure of an expression to identify ways to rewrite it. *E.g., 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* $(x^2 - y^2)(x^2 + y^2)$.<br>**F-IF.4** Interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features, such as *intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative* | **Essential Resource:**<br>Textbook: *Elementary and Intermediate Algebra: Concepts and Applications*<br>Chapter 4- Sections 4.2, 4.3, 4.4, 4.6<br>Chapter 5- Sections 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8<br>Chapter 10- Section 10.8<br>Chapter 11- Sections 11.1, 11.3, 11.4, 11.6, 11.7<br><br>**Additional Resources:**<br>Algebra II Mathematics Framework:http://www.cde.ca.gov/ci/ma/cf/documents/aug2013algebra2.pdf<br><br>Engage NY: Polynomial, Rational, and Radical Relationships: https://www.engageny.org/node/4641/file/5896<br><br>Real World Application: Ch. 5 & Ch. 6 Project: http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=agk&wcsuffix=0099<br><br>Geogebra algebra & geometry |

| | | |
|---|---|---|
| imaginary solutions to polynomial functions<br>• Understand Remainder Theorem<br>• Prove polynomial identities to describe numerical relationships<br>• Operations on complex in the form *a + bi*<br>• Interpret complicated expressions by it breaking down into smaller parts<br>• Using structure of known expressions<br>• Review use of graphing calculator<br>• Use graphing calculators to graph/solve more complicated functions<br>• Recognize even and odd functions from their graphs<br>• Determine if one function is an inverse of another, using composite functions, graphs, and tables.<br>• **Practice Placement Exam Review** *(See information on next page)* | *maximums and minimums; symmetries; and end behavior,* given a verbal description of the relationship.<br>**F-IF.5** Relate the domain of a function to its graph and to the quantitative relationship it describes. *E.g., if the function h(n) gives the number of hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*<br>**F-IF.6** Calculate, interpret, and/or estimate the average rate of change of a function (presented symbolically or as a table) over a specified interval or from a graph.<br>**F-IF.7c** Analyze functions using different representations. Graph functions by factoring, identifying zeros, and showing end behavior.<br>**F-IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.<br>**F-IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).<br>**F-BF.1b** Build a function that models a relationship between 2 quantities. Combine standard function types using arithmetic operations. *E.g., 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.*<br>**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.<br>**HSF.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br>**HSF.BF.B.3** Identify the effect on the graph of replacing f(x) by f(x)+k, k f(x), f(kx), and f(x+k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.<br>**HSF.BF.B.4.b** Verify by composition that one function is the inverse of another.<br>**HSF.BF.B.4c** Read values of an inverse function from a graph or a table, given that the function has an inverse. | modeling software:http://www.geogebra.org/cms/download<br>Khan Academy Complex Numbers:https://www.youtube.com/watch?v=kpywdu1afas<br><br>MARS - Solving Quadratic Equations: http://map.mathshell.org/materials/lessons.php?taskid=432&subpage=problem<br><br>MARS – Forming Quadratics:http://map.mathshell.org/materials/lessons.php?taskid=224&subpage=concept<br><br>MARS – Representing Polynomials: http://map.mathshell.org/materials/lessons.php?taskid=436&subpage=concept<br><br>Mars- Manipulating Polynomials: http://map.mathshell.org/materials/lessons.php?taskid=437&subpage=concept<br><br>Dan Meyer 3-act videos (list and interactive link to Dan Meyer's videos by standard) |

# Unit 2: **Polynomial Functions** *(Instructional Support & Strategies)*

## Framework Description/Rationale

The purpose of this unit is to extend students' understanding of functions and the real numbers, and to increase the tools students have for modeling the real world. This unit is lengthier in order to include key features of quadratic functions as well as other polynomial functions. Students should understand that quadratic functions are inclusive in the set of polynomial functions and should not be taught in isolation of other degree functions.

Students extend their notion of number to include complex numbers and see how the introduction of this set of numbers yields the solutions of polynomial equations and the Fundamental Theorem of Algebra. Students will explore solutions to polynomial functions, cases where there is no real solution, and how they relate to complex numbers.

Students deepen their understanding of the concept of function, and apply equation-solving and function concepts to many different types of functions. Graphs help us reason about rates of change of functions (F.IF.6). Students learned in Grade 8 that the rate of change of a linear function is equal to the slope of its graph. And because the slope of a line is constant, the phrase "rate of change" is clear for linear functions. For nonlinear functions, however, rates of change are not constant, and so we talk about average rates of change over an interval.

Students can make good use of graphing software to investigate the effects of replacing a function $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for different types of functions (MP.5). For example, starting with the simple quadratic function $(x) = x^2$, students see the relationship between these transformed functions and the vertex-form of a general quadratic, $(x) = (x-h)^2 + k$ . They understand the notion of a family of functions, and characterize such function families based on their properties. These ideas will be explored further with trigonometric functions (F-TF.5).

In F-BF.4a, students learn that some functions have the property that an input can be recovered from a given output, i.e., the equation $(x) = c$ can be solved for $x$, given that $c$ lies in the range of . They understand that this is an attempt to "undo" the function, or to "go backwards." Tables and graphs should be used to support student understanding here. This standard dovetails nicely with standard F-LE.4 described below and should be taught in progression with it. Students will work more formally with inverse functions in advanced mathematics courses, and so this standard should be treated carefully as preparation for a deeper understanding. They will later discover the inverse relationship with polynomial/radical and logarithmic/exponential functions.

Students use what they learned about polynomial functions to examine curves represented by the equation $ax^2 + by^2 + cx + dy + e = 0$. They use complete the square to determine whether the equation represents a circle or parabola. They graph the shapes and relate them to their equation. They will explore ellipses and hyperbolas in later units

(See CCSS CA Algebra 2 Framework and Precalculus Framework for more details)

| Academic Language Support | Instructional Tool/Strategy Examples | Pre-Unit: Preparing the Learner |
|---|---|---|
| Vocabulary:<br>• Quadratic<br>• Polynomial<br>• Parabola<br>• Maximum<br>• Minimum<br>• Vertex<br>• Axis/line of symmetry<br>• Root<br>• Zero<br>• Intercept<br>• Solution<br>• Imaginary number<br>• Complex number<br>• Factoring<br>• Inverse | Activity examples:<br>• Pattern growth activity<br>Showing the change resulting from a linear or quadratic equation. A group of images is presented that change slightly from one image to another (either increasing or decreasing in size). Students create T-chart to represent the change and start to recognize that this change can also determine different types of functions. They also represent them graphically and as a function, and they begin making connections between them.<br>• Collect class data, graph, and try to fit models or functions to the data.<br>• Use software or graphing calculators to model transformations with functions to help students make connections between the various representations.<br>• Use quadratics to help introduce polynomial identities. To help students perform arithmetic operations with complex numbers, make comparisons between a variable and *i* once students conceptually understand the meaning of *i*.<br>• Think-pair-share should be used to discuss similarities and | Use of tables to graph functions. A basic understanding of factoring.<br>Students should have already had experience with solving and graphing linear equations and quadratics. They can then learn to apply rules and functions to polynomials as a whole. Students should see that linear and quadratics belongs to the set of polynomials and are just special, more simplified cases of polynomials. |

| | | |
|---|---|---|
| | differences in polynomials by reviewing the various properties and the Euclidean Algorithm.<br>● Use a sequence of diagrams to create a pattern of terms, and then sum the areas to create a sequence. | |

**Placement Exam Review**

In this unit, students should not take the practice placement exam as they will be taking it in Unit 3. However, based on the results of the practice placement exam students took in Unit 1, it may be necessary to review additional topics separate from the unit. As a suggestion, these additional topics may be addressed during warm-ups, 2-3 times per week.

**Teacher Notes:**

# Unit 3: **Exponential Functions and Logarithms** *(5 weeks 12/7-01/22)*

| **Big Idea(s)** | Relationships can be defined how one member is related to another member by its function in a given situation.<br>Some instances have situations where certain relationships are always true. They can be represented both "real life" as well in (mathematically) logarithmically. |
|---|---|

| **Essential Questions** | **Performance Task** | **Problem of the Month** |
|---|---|---|
| • How do you evaluate exponential functions for given values?<br>• How do you use transformations to sketch graphs of exponential and logarithmic functions?<br>• How do you solve exponential and logarithmic equations?<br>• How do you use exponential models so solve real-world problems?<br>• How do you change bases in logarithmic expressions?<br>• How do you use properties of logarithms to evaluate or rewrite expressions? | Multiply Cells C2 2005 p.6-7<br>Growth Rates C3 2012 p.2-3<br>Shooting Rubberbands C3 2013 p.2-3<br>Height by Age C3 2014 p.4-5<br>Shrinking Shapes C3 2012 p.8-9 | Double Down<br>Teacher's Notes |

| **Unit Topics/Concepts** | **Content Standards** | **Resources** |
|---|---|---|
| • Key features of graphs and tables including: intercepts; intervals where the function is increasing/decreasing, positive/negative; relative maximum/minimum, symmetries; end behavior<br>• Graph exponential and logarithmic functions and identify the key features<br>• Identify the rate of change of exponential and logarithmic functions<br>• Perform transformations of exponential and logarithmic functions<br>• Utilize the laws of logarithms to rewrite and evaluate<br>• Continue with the conceptual understanding of inverses to understand logarithmic functions as being inverse functions of exponential functions<br><br>• **Practice Placement Exam** *(See information on next page)* | **F-IF.4** Interpret functions that arise in applications in terms of the context. 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 or minimums; symmetries; end behavior; and periodicity.*<br>**F-IF.7e** Analyze functions using different representations. Graph exponential and logarithmic functions, showing intercepts and end behavior.<br>**F-LE.4** Construct and compare linear, quadratic and exponential models and solve problems. 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.<br>**F-LE.4.1** Construct and compare linear, quadratic and exponential models and solve problems. Prove simple laws of logarithms.<br>**F-LE.4.2** Construct and compare linear, quadratic and exponential models and solve problems. Use the definition of logarithms to translate between logarithms of any base.<br>**F-LE.4.3** Construct and compare linear, quadratic and exponential models and solve problems. Understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. | **Essential Resource:**<br>Textbook: *Elementary and Intermediate Algebra: Concepts and Applications*<br>Chapter 12- Sections 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7<br><br>**Additional Resources:**<br>Algebra II Mathematics Framework:http://www.cde.ca.gov/ci/ma/cf/documents/aug2013algebra2.pdf<br><br>Project:http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=agd&wcsuffix=0861<br><br>EngageNY: Complete curriculum for all grades with performance test, common core, lessons, and worksheets. http://schools.nyc.gov<br><br>Geogebra algebra/geometry modeling software: http://www.geogebra.org/cms/download<br><br>Dan Meyer 3-act videos (list and interactive link to Dan Meyer's videos by standard) |

# Unit 3: **Exponential Functions and Logarithms** *(Support & Strategies)*

## Framework Description/Rationale

Students have worked with exponential models in Algebra I and further in Algebra II. Since the exponential function $f(x) = b^x$ is always increasing or always decreasing for $b \neq 0,1$, we can deduce that this function has an inverse, called the logarithm to the base $b$, denoted by $g(x) = \log_b x$. The logarithm has the property that $\log_b x = y$ if and only if $b^y = x$, and arises in contexts where one wishes to solve an exponential equation. Students find logarithms with base $b$ equal to 2, 10, or $e$, by hand and using technology (MP.5). In F.LE.4.1-4.3, students explore the properties of logarithms, such as that $\log_b xy = \log_b x + \log_b y$, and connect these properties to those of exponents (e.g., the previous property comes from the fact that the logarithm is representing an exponent, and that $b^{n+m} = b^n \cdot b^m$). Students solve problems involving exponential functions and logarithms and express their answers using logarithm notation (F-LE.4). In general, students understand logarithms as functions that undo their corresponding exponential functions; opportunities for instruction should emphasize this relationship.

(See CCSS CA Algebra 2 Framework for more details)

| Academic Language Support | Instructional Tool/Strategy Examples | Pre-Unit: Preparing the Learner (number of days) |
|---|---|---|
| Vocabulary:<br>• Exponential<br>• Logarithmic<br>• Base<br>• Exponent<br>• Asymptote<br>• Evaluate<br>• Product<br>• Quotient<br>• Power | • Use real life examples to illustrate various types of growth<br>• Use multiple representations (graphs, tables, equations) to help students make connections to other functions<br>• Use software or calculators to illustrate inverses and logarithms to help students make connections | Inverses<br>Laws of exponents |

**Placement Exam Review**

During this unit, it is recommended that students take the Santa Ana College (SAC) practice placement exam a final time. This time, students should take the Level 3 online practice exam, as this is the exam they will likely be taking during the actual exam placement exams. This exam should be used to gage progress and identify areas for re-teaching to prepare students for the College Math Placement Exams for Community College [SAC and California State Universities (CSU)].

The daily content of this course helps to prepare students for the placement exam. Based on the results of the practice placement exam, it may be necessary to review additional topics separate from the unit. As a suggestion, these additional topics may be addressed during warm-ups, 2-3 times per week.

**Links to Practice Exam Placement:**

Practice Placement Test Codes (SAC) --WSSMMT-GIBLI-BRAYS-BURAN-PIZZA-WISES
Practice Test Testing Website (SAC) (Level 2 or 3)
Santa Ana College: General Testing Center Information

**Teacher Notes:**

# SAUSD Curriculum Map 2015-2016: College Algebra

## Unit 4: **Radical and Rational Functions** *(6 weeks 2/1-3/11 )*

| **Big Idea** | Situations can be represented in many ways whether they it be mathematically or in "real life." |
|---|---|

| **Essential Questions** | **Performance Task** | **Problem of the Month** |
|---|---|---|
| • What are the key features of the graphs of radical and rational functions?<br>• How can functions be manipulated to make new functions? | Cubic Graph C2 2011 p.6-7<br>Shooting a Jump Shot C3 2014 p.10-11<br>Sorting Functions C1 2008 p.69-70<br>Circles and Spheres C1 2009 p.88-89 | Perfect Pair<br>Teacher's Notes |

| **Unit Topics/Concepts** | **Content Standards** | **Resources** |
|---|---|---|

Key Features of Graphs**:**
Intercepts

- Intervals (increasing, decreasing, positive, negative)
- Max and Min
- Symmetries
- End Behavior
- Domain and Range
- Discontinuities
- Calculate Average Rate of Change
- Solve Equations and identify extraneous solutions
- Rewrite Rational Expressions using Long Division
- Building New Functions from Old
- Graphing in terms of transformations; effect of *k* on transforming a parent function
- Representing a function in more than one way
- Graph square root and cube root functions
- Finding inverse functions
- Explore the inverse relationship between radicals and exponential functions

- **Practice Placement Exam Review**
  *(See information on next page)*

**A-SSE.1b** Interpret complicated expressions by viewing one or more of their parts as a single entity.
**A-SSE.2** Use structures of an expression to identify ways to rewrite it.
**A-CED.1** Create equations in one variable and use them to solve problems. Include simple rational functions.
**A-APR.6** Rewrite simple rational expressions in different forms: write $\frac{a(x)}{b(x)}$ in the form $q(x)+\frac{r(x)}{b(x)}$, using inspection or long division.
**A-REI.2** Solve simple rational and radical equations in one variable, and give examples of how extraneous solutions may arise.
**F-IF.4** Interpret key features of graphs and tables. Sketch graphs showing key features given a verbal description of the relationship between two quantities. Key features include: intercepts; intervals of increase; decrease, positive, or negative; max and min; symmetry; and end behavior.
**F-IF.5** Relate the domain of a function to its graph.
**F-IF.6** Calculate and interpret the average rate of change of a function over a specified interval.
**F-BF.1b** Combine standard function types using arithmetic operations.
**F-BF.3** Identify the effect on the graph by replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of *k*.
Experiment with cases and illustrate an explanation of the effects on the graph using technology.
**F-BF.4** Find inverse functions
**N-RN.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radical in terms of rational exponents.
**N-RN.2** Rewrite expressions involving radicals and rational exponents using properties of exponents.

**Essential Resource:**
Textbook: *Elementary and Intermediate Algebra: Concepts and Applications*
Chapter 6- Sections 6.1, 6.2, 6.3, 6.4,6.5, 6.6, 6.7
Chapter 10- Sections 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

**Additional Resources:**
Algebra II Mathematics Framework:http://www.cde.ca.gov/ci/ma/cf/documents/aug2013algebra2.pdf

Real World Application: Ch. 7 Project: http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=agd&wcsuffix=0761

Real World Application: Ch. 9 Project: http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=agd&wcsuffix=0961

EngageNY: Complete curriculum for all grades with performance test, common core, lessons, worksheet. http://schools.nyc.gov

Refer to Engage NY from Unit 2

Geogebra algebra/geometry modeling software: http://www.geogebra.org/cms/download

Dan Meyer 3-act videos (list and interactive link to Dan Meyer's videos by standard)

# Unit 4: **Radical and Rational Functions** *(Instructional Support & Strategies)*

**Framework Description/Rationale**

Building on previous units and prior courses that explored linear equations and expressions, students will begin to explore functions radicals and rationals. Student will learn the inverse relationship between radicals and exponential functions. This unit is a further exploration of polynomial functions with rational (fractional) as well as integer exponents. Students will be able to explore the features of radical and rational functions and compare their different functions by certain features such as end behavior, average rate of change, etc. Finally, students will be able to identify the appropriate function to model a situation as well as explore how transformations of functions relate to their parent function.

(See CCSS CA Algebra 2 Framework for more details).

| Academic Language Support | Instructional Tool/Strategy Examples | Pre-Unit: Preparing the Learner (number of days) |
|---|---|---|
| Vocabulary:<br>• Radical<br>• Ratio<br>• Rational<br>• Fractional<br>• Integer<br>• End behavior<br>• Rate of change | • Use real life examples to illustrate when to apply the various functions.<br>• Use multiple representations (graphs, tables, equations) to help students make connections to other functions.<br>• Use software or calculators to illustrate radical and rational functions to help students make connections between them as well as other functions. | |

**Placement Exam Review**

In this unit, students should not take the practice placement exam since they will be preparing for the actual exam. Based on the results of the practice placement exam students took in Unit 3, it may be necessary to review additional topics separate from the unit. Since students will be taking the actual placement exam over the next few months, so this is a good time to incorporate any final preparations. As a suggestion, these additional topics may be addressed during warm-ups, 2-3 times per week. Please note that the actual placement exam at SAC will contain radical simplification but not rational functions. It may be best for the student to begin the unit with topics relating to radicals first so that they are prepared for the placement exam.

**Teacher Notes:**

# Unit 5: **Operations on Matrices** *(4 Weeks 3/14-4/15)*

| **Big Idea** | Data can be represented visually using tables, charts, and graphs. The type of data determines the best choice of visual understanding. |
|---|---|

| **Essential Questions** | **Performance Task** | **Problem of the Month** |
|---|---|---|
| • How can matrices be useful in modeling real-life information?<br>• How can matrices be used to represent and solve linear systems? | She Loves Math real-world application<br>Cycle Shop<br>The Matrix | The Wheel Shop and Teacher's Notes |

| **Unit Topics/Concepts** | **Content Standards** | **Resources** |
|---|---|---|
| • Understanding matrix dimensions in relation to operations on matrices<br>• Perform operations on matrices such as addition, subtraction, and multiplication<br>• Scalar multiplication<br>• Using augmented matrices as another method to solve linear systems<br>• Connect the process of elimination to the use of augmented matrices<br>• Model and solve real-life scenarios using matrices | **VM.C.6** Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.<br><br>**VM.C.7** Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.<br><br>**VM.C.8** Add, subtract, and multiply matrices of appropriate dimensions.<br><br>**VM.C.9** Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.<br><br>**VM.C.10** Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers.<br><br>**VM.C.11** Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors. | **Essential Resource:**<br>Textbook:<br>*Elementary and Intermediate Algebra*<br>Chapter 8- Sections 8.4, 8.5, 8.6, 8.7, 8.8<br><br>**Additional Resources:**<br>EngageNY Precalculus Module 2 Topic A<br><br>Kahn Academy<br>https://www.khanacademy.org/math/precalculus/precalc-matrices |

# Unit 5: **Operations on Matrices** *(Instructional Support & Strategies)*

**Framework Description/Rationale**

The purpose of this unit is to introduce students to the use of matrices, performing basic operations on matrices, and using matrices to solve systems of equations. The augmented matrix/identity matrix should be shown as an alternative method to solve systems. They will explore various ways to apply the concept of matrices to real-life information.

(See CCSS CA Precalculus Framework for more details)

| Academic Language Support | Instructional Tool/Strategy Examples | Pre-Unit: Preparing the Learner (number of days) |
|---|---|---|
| • Matrix/Matrices<br>• Element<br>• Entry<br>• Vector<br>• Scalar<br>• Systems of equations<br>• Row<br>• Column<br>• Identity Matrix<br>• Augmented Matrix<br>• Dimensions | • Use software or graphing calculators to model and perform operations on matrices<br>• Have students work in groups to create their own matrices based on information of their own choosing (such as their own grades since freshman year, polling their friends' favorite movies/sports, or sales of their favorite companies over several different years) | Sets of numbers<br>Performing basic operations on numbers<br>Systems of equations |

**Teacher Notes:**

# SAUSD Curriculum Map 2015-2016: College Algebra

## Unit 6: **Trigonometric Functions** *(5 weeks 4/18 - 5/20)*

| **Big Idea** | Situations that repeat over a given period can be predicted and modeled. |
|---|---|

| **Essential Questions** | **Performance Task** | **Problem of the Month** |
|---|---|---|
| • How do you evaluate trigonometric functions for given values, periods, and intervals?<br>• How trigonometric functions relate to the unit circle?<br>• How do we model "real world" scenarios to trigonometric functions?<br>• How can inverse trigonometric functions be used to solve "real world" scenarios? | Ramps C2 2005 p.17<br>Remote Measures C3 2013 p.4-5 | Turn Up the Volume Level D Teacher's Notes |

| **Unit Topics/Concepts** | **Content Standards** | **Resources** |
|---|---|---|
| • Key features of graphs and tables including: intercepts; intervals where the function is increasing/decreasing, positive/negative; relative maximum/minimum, symmetries; end behavior; and periodicity<br>• Graph 6 basic trigonometric functions (sine, cosine, tangent, secant, cosecant, cotangent) and make connections with symmetry as it relates to even and odd trigonometric functions<br>• Understand, explore, and apply the Unit Circle<br>• Understand Radians<br>• Understand, prove, and apply trigonometric identities<br>• Interpret values based on trigonometric functions<br>• Model with trigonometric functions to show concepts involving waves, amplitude, frequency, and midline<br>• Introduce students to half/double angle identities and addition/subtraction formulas<br>• Understand and apply inverse trigonometric functions in solving equations and real-life situations | **F-TF.1** Extend the domain of trigonometric functions using the unit circle. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.<br>**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.<br>**F-TF.2.1** Graph all 6 basic trigonometric functions. (CA)<br>**F-TF.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.<br>**F-TF.8** Prove and apply trigonometric identities. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.<br>**FBF.1b** Combine standard functions types using arithmetic operations.<br>**F-IF.4** Interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features, such as *intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior,* given a verbal description of the relationship.<br>**F-IF.5** Relate the domain of a function to its graph and to the quantitative relationship it describes. *E.g., if the function h(n) gives the number of hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*<br>**F-IF.6** Calculate, interpret, and/or estimate the average rate of change of a function (presented symbolically or as a table) over a specified interval or from a graph.<br>**F-IF.7e** Graph trigonometric functions showing period, midline, an amplitude.<br>**F-IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.<br>**TF.C.9** Use the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.<br>**TF.A.4** Use unit circle to explain symmetry (odd/even) and periodicity of trigonometric functions.<br>**TF.B.6** Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.<br>**TF.B.7** Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.<br>**TF.C.9** Half angle and double angle identities for sine and cosine and use them to solve problems. | **Additional Resources:**<br><br>EngageNY Trigonometry Unit<br><br>Real World Application: Ch. 13 Project:http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=agd&wcsuffix=1361<br><br>Real World Application: Ch. 14 Project:http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=agd&wcsuffix=1461<br><br>Geogebra algebra/geometry modeling software: http://www.geogebra.org/cms/download<br><br>Dan Meyer 3-act videos (list and interactive link to Dan Meyer's videos by standard) |

# Unit 6: **Trigonometric Functions** *(Instructional Support & Strategies)*

**Framework Description/Rationale**

In this unit students will learn about the properties of trigonometric functions and how they relate to the unit circle. Students will also be able to interpret and identify various concepts such as period, amplitude and midline. In geometry, students began trigonometry through the study of right triangles. In this unit they will be able to extend the three basic functions to the unit circle. They will also be able to explore trigonometric identities and connect them to what they already learned about various geometric concepts such as the Pythagorean Theorem. Students will also model how trigonometric functions relate to the "real world" with various concepts involving waves, amplitude, trends, etc.

(See CCSS CA Algebra 2 Framework and Precalculus Framework for more details)

| Academic Language Support | Instructional Tool/Strategy Examples | Pre-Unit: Preparing the Learner (number of days) |
|---|---|---|
| Vocabulary:<br>• Trigonometric functions<br>• Period<br>• Amplitude<br>• Midline<br>• Radian<br>• π<br>• Angles<br>• Unit circle<br>• Clockwise<br>• Counter-clockwise<br>• Pythagorean Theorem | • Have students construct unit circles to discover their properties including radians.<br>• Use software that models tides and periodicity, real world examples such as Ferris Wheels videos showing motion with graphing simultaneously (several websites offer this visual).<br>• Connect the trig identities to the Pythagorean Theorem, cutting out right triangles and fitting them to the unit circle, working hands on with the triangles. | |

**Teacher Notes:**