OFFICE OF CURRICULUM, INSTRUCTION & PROFESSIONAL DEVELOPMENT

ACADEMIC COURSE OUTLINE

<table>
<thead>
<tr>
<th>Department</th>
<th>Mathematics</th>
<th>Course Title</th>
<th>Algebra 2</th>
<th>Course Code</th>
<th>2963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level</td>
<td>9 – 12</td>
<td>Short Title</td>
<td>ALG 2</td>
<td>Grad Requirement</td>
<td>N/A</td>
</tr>
<tr>
<td>Course Length</td>
<td>2 semesters</td>
<td>Credits per Semester</td>
<td>5</td>
<td>Approved for Honors</td>
<td>No</td>
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<td></td>
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<td>Required</td>
<td>No</td>
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<tr>
<td>Prerequisites</td>
<td>C or better in Geometry</td>
<td></td>
<td></td>
<td>Elective</td>
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<tr>
<td>Co-requisites</td>
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</table>

Articulated with LBCC: No
Articulated with CSULB: No

Meets UC “a-g” Requirement: Yes (c)
Meets NCAA Requirement: Yes

Teaching Credential(s): Teachers with any of these credentials are authorized to teach this course:
- Single Subject Credential in Mathematics (SS)
- Single Subject Credential in Foundational Mathematics (SSFM)

COURSE OVERVIEW:
Building on their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include logarithmic, polynomial, rational, and radical functions in the Algebra 2 course. This course includes standards from the conceptual categories of Number and Quantity, Algebra, Functions, Geometry, and Statistics and Probability. Some standards are repeated in multiple higher mathematics courses; therefore instructional notes, which appear in brackets, indicate what is appropriate for study in this particular course. Standards that were limited in Algebra 1 no longer have those restrictions in Algebra 2. Students work closely with the expressions that define the functions, competently manipulate algebraic expressions, 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.

For the Algebra 2 course, instructional time should focus on four critical areas: (1) relate arithmetic of rational expressions to arithmetic of rational numbers; (2) expand understandings of functions and graphing to include trigonometric functions; (3) synthesize and generalize functions and extend understanding of exponential functions to logarithmic functions; and (4) relate data display and summary statistics to probability and explore a variety of data collection methods.

EXPECTED OUTCOMES
Students are expected to perform at a proficient level on a variety of tasks and assessments addressing the Common Core Standards for Mathematical Practice and the Common Core State Standards addressed in Algebra 2. Levels of proficiency are defined near the end of this course outline under Performance Criteria.

Common Core State Standards for Mathematical Practice (SMP)
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.
Common Core State Standards for Mathematical Content (CCSS-M)

Number and Quantity

The Complex Number System N-CN

N-CN.A 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.

N-CN.C Use complex numbers in polynomial identities and equations. [Polynomials with real coefficients]
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.

Algebra

Seeing Structure in Expressions A-SSE

A-SSE.A Interpret the structure of expressions. [Polynomial and rational]
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
   \( (x^2 - y^2)(x^2 + y^2) \).
A-SSE.B 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. For example, calculate mortgage payments.*

Arithmetic with Polynomials and Rational Expressions A-APR

A-APR.A Perform arithmetic operations on polynomials. [Beyond quadratic]
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.
A-APR.B 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.
A-APR.C Use polynomial identities to solve problems.
A-APR.4 Prove polynomial identities and use them to describe numerical relationships. For example, the
   polynomial identity \( (x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2 \) can be used to generate Pythagorean triples.
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.¹
A-APR.D Rewrite rational expressions. [Linear and quadratic denominators]
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.

¹ The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.
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.

Creating Equations*

A-CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*

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.*

Reasoning with Equations and Inequalities

A-REI.1 Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context. CA

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.*

Functions

Interpreting Functions

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **Key features include:** intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

F-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.

- Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

**Building Functions**

**F-BF**

**F-BF.A** Build a function that models a relationship between two quantities. [Include all types of functions studied]

- Write a function that describes a relationship between two quantities. *

**F-BF.1** 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-BF-B** Build new functions from existing functions. [Include simple radical, rational, and exponential functions; emphasize common effect of each transformation across function types]

- 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.

- Find inverse functions.

  - 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 $x \neq 1$.

**Linear, Quadratic, and Exponential Models**

**F-LE**

**F-LE.A** Construct and compare linear, quadratic, and exponential models and solve problems. [Logarithms as solutions for exponentials]

- 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. *

**F-LE.4.1** Prove simple laws of logarithms. CA

**F-LE.4.2** Use the definition of logarithms to translate between logarithms in any base. CA

**F-LE.4.3** Understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. CA

**Trigonometric Functions**

**F-TF**

**F-TF.A** 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.

- 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.

- Graph all 6 basic trigonometric functions. CA

**F-TF.B** Model periodic phenomena with trigonometric functions.

- Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*
F-TF.C 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 of the angle.

Geometry

Expressing Geometric Properties with Equations

G-GPE.A Translate between the geometric description and the 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 2, this standard addresses only circles and parabolas.] CA

Statistics and Probability*

Interpreting Categorical and Quantitative Data

S-ID.A 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, and tables to estimate areas under the normal curve.

Making Inferences and Justifying Conclusions

S-IC.A Understand and evaluate random processes underlying statistical experiments.
S-IC.1 Understand statistics as a process for making inferences 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?
S-IC.B 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.

Using Probability to Make Decisions

S-MD.B Use probability to evaluate outcomes of decisions. [Include more complex situations]
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).

EXPECTED INTEGRATED OUTCOMES

(From the California Career Technical Education Model Curriculum Standards, adopted by the California State Board of Education in January, 2013)

Students are also expected to proficiently apply common skills that are relevant across curriculum areas and career pathways.
Standards for Career Ready Practice (CR)

1. **Apply appropriate technical skills and academic knowledge.**
   Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and performing other work-related practices.

2. **Communicate clearly, effectively, and with reason.**
   Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others: they are active listeners who speak clearly and with purpose, and they are comfortable with terminology that is common to workplace environments. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome.

3. **Develop an education and career plan aligned with personal goals.**
   Career-ready individuals take personal ownership of their educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process, and they understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans.

4. **Apply technology to enhance productivity.**
   Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks - personal and organizational - of technology applications, and they take actions to prevent or mitigate these risks.

5. **Utilize critical thinking to make sense of problems and persevere in solving them.**
   Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior to introducing solutions. They carefully consider options to solve a problem and, once agreed upon, follow through to ensure the problem is resolved.

6. **Practice personal health and understand financial literacy.**
   Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success.

7. **Act as a responsible citizen in the workplace and the community.**
   Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them, and they think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good.

8. **Model integrity, ethical leadership, and effective management.**
   Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.
9. Work productively in teams while integrating cultural and global competence.
Career-ready individuals contribute positively to every team, as both team leaders and team members. To avoid barriers to productive and positive interaction, they apply an awareness of cultural differences. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members.

10. Demonstrate creativity and innovation.
Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices.

11. Employ valid and reliable research strategies.
Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices.

12. Understand the environmental, social, and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization.

COURSE CONTENT AND SUGGESTED TIME ALLOTMENT:
Content sequencing, activities, and time allocations are only suggestions and may be adjusted to suit school site curriculum plans, available materials, and student needs.

<table>
<thead>
<tr>
<th>Unit 1: Linear and Quadratic Functions</th>
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<tbody>
<tr>
<td>Duration: 24 days</td>
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<tr>
<td>Description: In Unit 1, students explore and transform linear, absolute value and quadratic parent functions. Characteristics of the functions are given both abstract and contextual meaning. Applying their knowledge of these functions in a real world situations, including writing equations based on given data, using lines of best fit to approximate data and solving 3-by-3 systems of equations, will give significance and relevance to these functions, their graphs, and their equations.</td>
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<tr>
<td>Required Assignment: Representing Quadratic Functions Graphically</td>
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<tr>
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<td><a href="http://map.mathshell.org/lessons.php?unit=9245&amp;collection=8">http://map.mathshell.org/lessons.php?unit=9245&amp;collection=8</a></td>
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This lesson assesses how well students are able to understand what the different algebraic forms of a quadratic function reveal about the properties of its graphical representation. In particular, the lesson will help you identify and help students who have the following difficulties: 1) Understanding how the factored form of the function can identify a graph’s roots, 2) Understanding how the completed square form of the function can identify a graph’s maximum or minimum point, and 3) Understanding how the standard form of the function can identify a graph’s intercept. Before the lesson, students work individually on an assessment task that is designed to reveal their current understandings and difficulties. The teacher then reviews their work and creates questions for students to answer in order to improve their solutions. After a whole-class interactive introduction, students work in pairs on a collaborative discussion task in which they match quadratic graphs to their algebraic representation. As they do this, they begin to link different algebraic forms of a quadratic...
function to particular properties of its graph. At the end of the lesson there is a whole-class discussion. In a follow-up lesson students attempt to improve their original response to the assessment task.

**Suggested Activities:** See the Unit 1 Guide for Algebra 2.

**Materials:** Big Ideas Algebra 2 text: Chapters 1 and 2


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**Unit 2:** Quadratic Equations and Polynomial Functions

**Duration:** 32 days

**Description:** Students will build on their prior knowledge of how to solve quadratic equations. In Unit 2, solutions are no longer limited to real numbers, but now include the set of complex numbers. Students will now have five strategies to use to solve quadratic equations: graphing, factoring, square rooting, completing the square and the Quadratic Formula. Solving nonlinear systems and quadratic inequalities broaden the students’ knowledge of linear functions and quadratic equations. Viewing polynomials through the lens of quadratics, students already have a familiarity with factoring, graph behavior and transformations. Extending from second degree functions to those of third and fourth degree, students work with the end behaviors of graphs, the number of zeros of an \( n \)th-degree polynomial and the Fundamental Theorem of Algebra. Important for student understanding of polynomials is that polynomials form a system analogous to integers, namely, they are closed under the operations of addition, subtraction and multiplication.

**Required Assignment:** Representing Polynomials Graphically


This lesson assesses how well students are able to translate between graphs and algebraic representations of polynomials. In particular, this unit aims to help you identify and assist students who have difficulties: 1) Recognizing the connection between the zeros of polynomials when suitable factorizations are available and graphs of the functions are defined by polynomials, and 2) Recognizing the connection between transformations of the graphs and transformations of the functions obtained by replacing \( f(x) \) by \( f(x + k) \), \( f(x) + k \), \(-f(x)\), \( f(-x) \). Before the lesson, students attempt the assessment task individually. The teacher then reviews their work and formulates questions that will help them improve their solutions. During the lesson, students work collaboratively in pairs or threes, matching functions to their graphs and creating new examples. Throughout their work students justify and explain their decisions to peers. During a whole-class discussion, students explain their reasoning. Finally, students improve their solutions to the initial task and complete a second, similar task.

**Suggested Activities:** See the Unit 2 Guide for Algebra 2.

**Materials:** Big Ideas Algebra 2 text: Chapters 3 and 4


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**Unit 3:** Radical and Rational Functions

**Duration:** 29 days

**Description:** A theme of Unit 3 is that the arithmetic of rational expressions is governed by the same rules of the arithmetic
of rational numbers. Connecting to the properties of exponents learned in Algebra 1, students now see that exponents can be rational numbers and are no longer restricted to being nonzero integers. Graphs help to illustrate the solutions to radical equations and inequalities. Even and odd functions and domains are investigated and defined. Function operations lead to solving for the inverses of functions where possible. The graphs of functions compared to the graphs of their inverses add a visual component to understanding inverse relationships. From direct variation in middle school, the students in Algebra 2 move on to rational functions, the simplest of which is inverse variation. Graphs play an important role in understanding rational functions as students are introduced to asymptotes and note the effect of simple transformations. Operations with rational expressions are primarily symbolic manipulation, but graphs can be used to confirm results.

**Required Assignment:**

**Evaluating Statements about Radicals**


This lesson assesses how well students are able to use the properties of exponents, including rational exponents and manipulate algebraic statements involving radicals, and discriminate between equations and identities. Before the lesson, students work alone on an assessment task designed to reveal their current understanding. The teacher reviews their work, creating questions to help students improve their solutions. During the lesson, students first work in small groups on a collaborative discussion task. After sharing their solutions with another group, students extend and generalize the math. An optional collaborative task focuses on imaginary numbers. During a whole-class discussion, students review the main mathematical concepts of the lesson. In a follow-up lesson, students review their initial solutions and then use what they have learned to revise the same introductory assessment task and complete a second, similar task.

**Suggested Activities:** See the Unit 3 Guide for Algebra 2.

**Materials:** Big Ideas Algebra 2 text: Chapters 5 and 7


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**Unit 4: Exponential and Logarithmic Functions**

**Duration:** 37 days

**Description:**

In Unit 4, students add to their list of function families with exponential and logarithmic functions. Drawing on their experience with exponential growth and decay functions in Algebra 1, students will be working with the natural base, \(e\), along with other bases, and applying them to compound interest, continuous compounding, and other applications. Logarithmic functions follow naturally from an exploration of the properties of exponents. Graphs confirm the inverse relationship between exponential and logarithmic functions. Transformations of the graphs of these functions reinforce that transformations on a graph always have the same effect regardless of the type of underlying function. Exponential functions lead naturally to geometric sequences. New this year is the skill of adding the terms of a sequence. Along with arithmetic and geometric sequences and series, partial sums and sums of infinite geometric series will be explored numerically and graphically.

**Required Assignment:**

**Representing Linear and Exponential Growth**


This lesson assesses how well students are able to interpret exponential and linear functions and in particular, to identify and help students who have the difficulty translating between descriptive, algebraic, tabular, and graphical representation of the functions, and recognizing how and why a quantity changes per unit interval. Before the lesson, students work individually on an assessment task designed to reveal their current understanding and difficulties working with linear and exponential functions. The teacher reviews their responses and creates questions for students to consider, to help them improve their work. After a whole-class
interactive introduction, students work in small groups on a series of collaborative card matching tasks involving simple and compound interest. In a whole-class discussion, students review the main mathematical concepts of the lesson and the strategies used. Students then return to the original task, consider their own responses and the questions posed and use what they have learned to complete a similar task.

**Suggested Activities:** See the Unit 4 Guide for Algebra 2.

**Materials:** Big Ideas Algebra 1 text: Chapters 7, 8 and 9


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**Unit 5:** Trigonometry

**Duration:** 20 days

**Description:**
This year's last addition to the function families are the trigonometric functions. Students worked with trigonometric ratios and circles in Geometry and were introduced briefly to radian measure. Developing their understanding of trigonometric functions, students will define radian measure and the six trigonometric functions in terms of the unit circle. The concept of a periodic function is developed as students graph sine and cosine by plotting functional values for benchmark angles. The graphs of the remaining four trigonometric functions are deduced from the students' knowledge of sine and cosine. Graphs are again transformed beyond the parent functions. Students will complete Unit 5 with an introduction to the trigonometric identities and the sum and difference formulas.

**Required Assignment:**
**Representing Trigonometric Functions**
http://map.mathshell.org/lessons.php?unit=9255&collection=8

This lesson assesses how well students are able to model a periodic situation, the height of a person on a Ferris wheel, using trigonometric functions, and interpret the constants $a$, $b$, $c$ in the formula $h = a + b \cos ct$ in terms of the physical situation, where $h$ is the height of the person above the ground and $t$ is the elapsed time.

Before the lesson, students attempt the assessment task individually. The teacher then reviews their solutions and formulates questions for students to answer in order for them to improve their work. In the lesson, students engage in pairs or threes on a related card-matching task involving graphs, functions and verbal descriptions of Ferris Wheels. Throughout their work they justify and explain their decisions to peers. In a whole-class discussion, students explain and extend their solutions and methods. Finally, students work alone on a task similar to the assessment task.

**Suggested Activities:** See the Unit 5 Guide for Algebra 2.

**Materials:** Big Ideas Algebra 2 text: Chapter 9

**Standards Addressed:** CCSS-M Clusters F-IF.C, F-BF.A, F-BF.B, F-TF.A, F-TF.B, F-TF.C

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**Unit 6:** Probability and Data

**Duration:** 27 days

**Description:**
Drawing on their knowledge of probability from Algebra 1, students construct sample spaces from a given data set and calculate the probability of an independent, dependent or compound event. Two-way frequency tables are used to compute joint and marginal relative frequencies. Permutations and combinations are used to solve...
for probabilities of compound events and real-world applications. Binomial and Normal probability distributions are introduced, defined, described, and used to solve for probabilities. In a broad overview, students look at sampling populations and collecting data without introducing bias. Experiments and observational studies are discussed in the context of design, correlation and causation. Unit 6 finishes with the students drawing inferences from experiments and sample surveys where possible.

**Required Assignment:**
*Representing Data with Frequency Graphs*


This lesson assesses how well students are able to use frequency graphs to identify a range of measures and make sense of this data in a real-world context, and understand that a large number of data points allow a frequency graph to be approximated by a continuous distribution. Before the lesson, students work alone to complete an assessment task designed to reveal their current understanding. After a whole-class introduction, students work in pairs or threes on a collaborative discussion task, matching written interpretations and graphs as they begin to link these two representations. There is a whole-class discussion to end the lesson. In a follow-up lesson, students work alone on a similar task to the assessment task.

**Suggested Activities:** See the Unit 6 Guide for Algebra 2.

**Materials:** Big Ideas Algebra 2 text: Chapters 10 and 11

**Standards Addressed:** CCSS-M Clusters A-APR.C, S-ID.A, S-IC.A, S-IC.B, S-MD.A

**INSTRUCTIONAL METHOD AND/OR STRATEGIES:**
A variety of instructional strategies will be utilized to accommodate all learning styles. See the “Using Formative Assessment to Address the Specific Learning Needs of Low Achieving Students, High Achieving Students, Students with Disabilities and English Language Learners in K-12 MATHEMATICS” document.

**COURSE MATERIALS:**

Core Text: Algebra 2, Larson & Boswell, Big Ideas Learning, © 2015

Supplemental Materials: In addition to the basic text, a variety of instructional tools will be used to meet the needs of all students.

**RESOURCES:**

**Documents**
- LBUSD Scope and Sequence.................................................................LBUSD Mathematics Webpage
- LBUSD Unit Guides .................................................................LBUSD Mathematics Webpage
- LBUSD Instructional Tools ..................................................LBUSD Mathematics Curriculum Intranet
- Using Formative Assessment for Differentiation..............LBUSD Math/ELA Curriculum Documents
- Work-Based Learning Continuum........................................LBUSD Work-Based Learning Webpage
- ELD Standards ...............................................................http://www.cde.ca.gov/sp/el/er/eldstandards.asp

**District Offices**
- Math Curriculum Office ..........................................................(562) 997-8000, ext. 2962
- Research Office .................................................................(562) 997-8143
PERFORMANCE CRITERIA:
Defines how good is good enough on which measures to demonstrate achievement of content standards.

Classroom Performance Standards
The objective of instruction is to help all students achieve at or above the Proficient Level and receive a C or better in the course.

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Standard Grading Scale:

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Suggested Grade Weighting:

1. Assessment 60 – 80%
   - Graded work assessing a student's mastery of mathematics such as any of the following:
     - Tests (district exams and classroom tests)
     - Quizzes
     - Project work that assesses a student's understanding

2. Classwork/Activities 10 – 25%
   - Graded work completed in class such as any of the following:
     - In class assignments
     - Project work completed in class
     - Notes
     - Warm-ups
     - Graded participation

3. Homework 5 – 15%
   - Graded work completed outside of class such as any of the following:
     - Assignments
     - Project work completed outside of class

Submitted by: Becky Afghani
Submission Date: August 24, 2015
School/Office: Math Curriculum Office

Original Board Approval Date: November 3, 2015
Revised Board Approval Date: