OFFICE OF CURRICULUM, INSTRUCTION & PROFESSIONAL DEVELOPMENT

ACADEMIC COURSE OUTLINE

Department	Mathematics	**Course Title**	Math 8	**Course Code**	2981
Grade Level	8	**Short Title**	MATH 8	**Course Length**	1 year
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) • Multiple Subject Credential or Single Subject Credential in content other than math, with a Single Subject Authorization in Introductory Mathematics (SMA)			**Required**	yes
				Elective	no

COURSE OVERVIEW:

According to the Common Core State Standards for Mathematics, eighth grade mathematics is about (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

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 Math 8. 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)

The Number System **8.NS**

8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers.

8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

Expressions and Equations 8.EE

8.EEA Work with radicals and integer exponents.

8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.*

8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

8.EE.B Understand the connections between proportional relationships, lines, and linear equations.

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

8.EE.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

8.EE.C Analyze and solve linear equations and pairs of simultaneous linear equations.

8.EE.7 Solve linear equations in one variable.

a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8.EE.8 Analyze and solve pairs of simultaneous linear equations.

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.*

c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

Functions 8.F

8.F.A Define, evaluate, and compare functions.

8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[1]

8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*

8.F.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*

[1] Function notation is not required in the Grade 8 standards.

8.F.B Use functions to model relationships between quantities.

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Geometry 8.G

8.G.A Understand congruence and similarity using physical models, transparencies, or geometry software.

8.G.1 Verify experimentally the properties of rotations, reflections, and translations:

a. Lines are taken to lines, and line segments to line segments of the same length.
b. Angles are taken to angles of the same measure.
c. Parallel lines are taken to parallel lines.

8.G.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

8.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*

8.G.B Understand and apply the Pythagorean Theorem.

8.G.6 Explain a proof of the Pythagorean Theorem and its converse.

8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Statistics and Probability 8.SP

8.SP.A Investigate patterns of association in bivariate data.

8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a*

curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

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.

Unit 1: Equations

Duration: 29 days

Description:
The course begins in **Unit 1** with students extending their understanding of solving linear equations in one variable to solving equations with variables on both sides of the equal sign. Students analyze and solve linear equations in one variable with one solution, infinitely many solutions, or no solutions.

Required Assignment:
Solving Linear Equations in One Variable
http://map.mathshell.org/lessons.php?unit=8240&collection=8
This lesson assesses how well students are able to solve linear equations in one variable with rational number

coefficients, collect like terms, expand expressions using the distributive property, and categorize linear equations in one variable as having one, none, or infinitely many solutions. Before the lesson, students work individually on an assessment task that is designed to reveal their current understanding and difficulties. The teacher then reviews their responses and creates questions for students to consider when improving their work. After a whole-class introduction, students work in small groups on a collaborative discussion task, categorizing equations based on the number of solutions. Throughout their work, students justify and explain their thinking and reasoning. In the same small groups, students critique the work of others and then discuss as a whole-class what they have learned. In a follow-up lesson, students return to their original task and try to improve their own, individual responses.

Suggested Activities: See the Unit 1 Guide for Math 8.

Materials: Big Ideas MATH Course 3 text: Chapter 1

Standards Addressed: CCSS-M Cluster 8.EE.C

Unit 2: Transformational Geometry

Duration: 24 days

Description:
In **Unit 2**, students study congruency and similarity by experimenting with dilations, rotations, reflections, and translations of geometrical figures. During this unit, students are introduced to similar figures. Students will explore the relationships between interior and exterior angles of triangles and angles formed by parallel lines that are cut by a transversal.

Required Assignment:
Representing and Combining Transformations
http://map.mathshell.org/lessons.php?unit=8310&collection=8
This lesson assesses how well students are able to recognize and visualize transformations of 2D shapes, and translate, reflect and rotate shapes, and combine these transformations. 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 consider in order to improve their solutions. After a whole-class introduction, students work in small groups on a collaborative task. In a whole-class discussion, students review the main mathematical concepts of the lesson. Students return to their original task, and try to improve their own responses.

Suggested Activities: See the Unit 2 Guide for Math 8.

Materials: Big Ideas MATH Course 3 text: Chapters 2 and 3

Standards Addressed: CCSS-M Cluster 8.G.A

Unit 3: Linear Equations

Duration: 20 days

Description:
In **Unit 3**, students learn about linear equations in two variables. Students explore concepts of slope and intercepts as they write and graph linear equations in two variables. A study of linear equations will provide students with opportunities to model relationships between two quantities.

Required Assignment:
Defining Lines by Points, Slopes and Equations
http://map.mathshell.org/lessons.php?unit=8215&collection=8
This lesson assesses how well students are able to find the slopes and equations of linear graphs defined by pairs of coordinates, calculate the slope and *y*-intercept of a straight line, and use the slope and *y*-intercept of a straight line to derive its equation. Before the lesson, students work individually on an assessment task designed to reveal their current understanding. The teacher then reviews their responses and creates questions for students to consider when improving their work. After a whole-class introduction, students work in small groups on a collaborative discussion task, matching cards that describe the same line. Throughout their work, students justify and explain their thinking and reasoning. Students review their work by comparing their matches with those of their peers. In a whole-class discussion, students discuss what they have learned. In a follow-up lesson, students revisit their initial work on the assessment task and work alone on a similar task to the introductory task.

Suggested Activities: See the Unit 3 Guide for Math 8.

Materials: Big Ideas MATH Course 3 text: Chapter 4

Standards Addressed: CCSS-M Clusters 8.EE.B, 8.F.B

Unit 4: Systems of Linear Equations and Functions

Duration: 42 days

Description:
Students extend their knowledge of linear equations to solve systems of linear equations in **Unit 4**. Students also solve systems of linear equations graphically and algebraically through methods of substitution and elimination. Students are then introduced to functions. Students will use equations, tables, and/or graphs to compare properties of functions and distinguish between linear and nonlinear functions.

Required Assignment:
Classifying Solutions to Systems of Equations
http://map.mathshell.org/lessons.php?unit=8220&collection=8
This lesson assesses how well students are able to classify solutions to a pair of linear equations by considering their graphical representations, use substitution to complete a table of values for a linear equation, identify a linear equation from a given table of values, and graph and solve linear equations. Before the lesson, students attempt the assessment task individually. The teacher then reviews students' solutions and formulates questions that will help them improve their work. During the lesson, students work collaboratively in pairs or threes, plotting graphs, completing tables of values and deducing equations. Then, based on the number of common solutions, students link these representations. In a follow-up lesson, students receive your comments on the assessment task and use these to attempt the similar task, approaching it with insights gained from the lesson.

Suggested Activities: See the Unit 4 Guide for Math 8.

Materials: Big Ideas MATH Course 3 text: Chapters 5 and 6

Standards Addressed: CCSS-M Clusters 8.EE.C, 8.F.A, 8.F.B

Unit 5: Exponents and Roots

Duration: 34 days

Description:
Students will use properties of exponents to generate equivalent expressions in **Unit 5**. Students will express very large quantities and very small quantities using scientific notation. Their study of exponents and scientific notation will culminate with students performing operations with numbers written in scientific notation. Students will begin working with square roots and cube roots and will understand how to solve an equation containing a root. Students will apply their knowledge of exponents and roots by using, proving, and applying the Pythagorean Theorem. Students will also apply their knowledge of exponents by finding the volume of cylinders, cones, and spheres.

Required Assignment:
Applying Properties of Exponents
http://map.mathshell.org/lessons.php?unit=8110&collection=8
This lesson assesses how well students are able to recall and use the properties of exponents to generate equivalent numeric expressions, identify the appropriate property to use and apply it correctly, and check the numerical value of an expression involving exponents without using a calculator. Before the lesson, students work individually on an assessment task designed to reveal their current understanding. The teacher then reviews their responses and creates questions for students to consider when improving their work. After a whole-class introduction, students work in small groups on a collaborative discussion task, grouping cards based on numerical equivalence. Throughout their work, students justify and explain their thinking and reasoning. Students review their work by comparing their card groupings with their peers'. In a whole-class discussion, students discuss what they have learned. In a follow-up lesson, students revisit their initial work on the assessment task and work alone on a similar task to the introductory task.

Suggested Activities: See the Unit 5 Guide for Math 8.

Materials: Big Ideas MATH Course 3 text: Chapters 7, 8 and 10

Standards Addressed: CCSS-M Clusters 8.NS.A, 8.EE.A, 8.G.B, 8.G.C

Unit 6: Statistics

Duration: 19 days

Description:
Students will investigate patterns of association in bivariate quantitative data by constructing and interpreting scatterplots in **Unit 6**. Students will extend their understanding of linear functions by representing quantitative bivariate data with a linear equation and interpret the slope and *y*-intercept in the context of the situation. They will also create and analyze two-way frequency tables for bivariate categorical data.

Required Assignment:
Interpreting and Using Data: Setting Taxi Fares
http://map.mathshell.org/lessons.php?unit=8410&collection=8
This lesson assesses how well students are able to select and use mathematical ideas to solve a problem and then compare and critique alternative approaches. The lesson presents students with a distance-time scatter plot representing journeys made by a taxi cab. They use this to decide upon a suitable rate at which the driver should charge passengers. Before the lesson, students attempt the *Taxi Fares* task individually. The teacher then assesses their responses and formulates questions that will prompt students to review their work. At the start of the lesson, students think individually about their responses to the questions set. Next, students work in small groups to combine their thinking and work together to produce a collaborative solution to the *Taxi Fares*

task, in the form of a poster. Working in the same small groups, students evaluate, comment on and complete sample responses. In a whole-class discussion students compare and evaluate the methods they have seen and used. In a follow-up lesson, students reflect on their work and what they have learned.

Suggested Activities: See the Unit 6 Guide for Math 8.

Materials: Big Ideas MATH Course 3 text: Chapter 9

Standards Addressed: CCSS-M Cluster 8.SP.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: Big Ideas MATH Course 3, 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
- CTE Standards ..... http://www.cde.ca.gov/ci/ct/sf/ctemcstandards.asp
- 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.

	F	D	C	B	A
Assessments Unit Tests Chapter Tests Quizzes	0 – 59%	60 – 69%	70 – 79%	80 – 89%	90 – 100%
Classwork	0 – 59%	60 – 69%	70 – 79%	80 – 89%	90 – 100%
Homework	0 – 59%	60 – 69%	70 – 79%	80 – 89%	90 – 100%

Standard Grading Scale:

A	90 – 100%
B	80 – 89%
C	70 – 79%
D	60 – 69%
F	0 – 59%

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: