Sacramento City Unified School District

Curriculum Map

Common Core Mathematics Grade 8

Draft

Sacramento City Unified School District

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Unit 1: Geometry and Transformations

(Approx. # Days)

Content Standards: 8.G.1 – 5

Math Common Core Content Standards:

Domain: Geometry 8.G

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

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

Standards for Mathematical Practice:

1. Make Sense of Problems and Persevere in Solving Them
3. Construct Viable Arguments and Critique the Reasoning of Others
5. Use Appropriate Tools Strategically
6. Attend to Precision
7. Look For and Make Use of Structure

ELD Standards to Support Unit:

[Add text]

SEL Competencies:

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
• What conclusions can you make about the properties of rotations, reflections, and translations of geometric figures? • What does it mean for figures to be congruent to each other? • How is a dilation of a figure different from a rotation, reflection, or translation of a figure? • What does it mean for figures to be similar to each other? • How is similarity different from congruence? (And how are they the same?) • How can you tell from a sequence of transformations if figures are similar or congruent (or both)? • Does order always matter in a sequence of transformations? Why or why not? • Why are corresponding angles congruent?	Assessments/Tasks aligned to learning experiences: Learning Experiences 1 – 5: http://map.mathshell.org/materials/lessons.php?taskid=490&subpage=concept http://map.mathshell.org/materials/tasks.php?taskid=361#task361 http://www.illustrativemathematics.org/illustrations/1231 7) http://www.illustrativemathematics.org/illustrations/1501 http://www.illustrativemathematics.org/illustrations/59 8) http://map.mathshell.org/materials/lessons.php?taskid=492#task492	Students will be able to… 1) Use physical models, transparencies, the coordinate plane, and geometry software to experiment with rotations, reflections, and translations of geometric figures, and make conjectures about their properties. (Framework p. 26-27) 2) Define congruence through rotations, reflections, and translations; 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. (Framework p. 28) 3) Describe a sequence of rotations, reflections, and/or translations that maps one figure on to another. 4) Use a coordinate plane to draw and describe dilations of two-dimensional figures, and make conjectures about the properties of dilations, including angle-angle criterion for similarity of triangles. 5) Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of dilations, translations, rotations, and reflections. 6) Describe the sequence of transformations that exhibits the similarity between two figures. 7) Use informal arguments to establish facts about the angle sum and exterior angle of triangles. 8) Use informal arguments to establish facts about the angles created when parallel lines are cut by a transversal, including corresponding angles and alternate interior angles.	Physical models: manipulate hands-on materials (manipulatives) through rotations, reflections, and translations (cc.betterlesson.com) Transparencies: Patty paper Geometry software: Geogebra Demonstrate congruence through a transformation sequence – rotations, translation, and reflection (LearnZillion) When describing dilations, draw attention to the relationships of side lengths and angle measures in similar figures. Example of an informal argument for angle sum and exterior angle of triangles: *Framework Gr. 8,* page 30 Example of an informal argument for angles created when parallel lines are cut by a transversal (youtube video):	Geogebra http://www.geogebra.org/cms/download	*CA Mathematics Framework Gr. 8* p. 25 – 30 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf North Carolina 8th Grade Math Unpacked Content: p. 26 – 32 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf *8th Grade Common Core State Standards Flip Book* http://katm.org/wp/wp-content/uploads/flipbooks/8thFlipFinaledited.pdf

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Unit 2: Solving One-Variable Equations

(Approx. # Days)

Content Standards: 8.EE.7

Math Common Core Content Standards:

Domain: Expressions and Equations 8.EE

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

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.

Standards for Mathematical Practice:

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
6. Attend to Precision

ELD Standards to Support Unit:

[Add text]

SEL Competencies:

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
• What is a solution? • How can you make assumptions or predictions about the number of solutions at multiple points throughout the process of solving linear equations? • What does it mean for a linear equation to have one solution, no solutions, or infinite solutions?	Assessments/Tasks aligned to learning experiences: http://www.illustrativemathematics.org/illustrations/550 http://www.illustrativemathematics.org/illustrations/392 http://www.illustrativemathematics.org/illustrations/999 http://map.mathshell.org/materials/download.php?fileid=1154 http://map.mathshell.org/materials/lessons.php?taskid=442#task442 http://map.mathshell.org/materials/lessons.php?taskid=487#task487	Students will be able to… 1. Use inverse operations to solve linear equations in one variable with rational coefficients, including equations that have variables and constants on both sides of the equal sign, arising in algebraic, geometric, and real-world situations. 2. Analyze a given equation to determine whether it has one solution (x = a), infinite solutions (a = a), or zero solutions (a = b); explain their reasoning using the definition of solution.* 3. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms, arising in algebraic, geometric, and real-world situations.	Inverse operations (creating zeroes with terms and ones with factors) Ex: 2x + 4 = 5x – 1 (adding one or subtracting 4 from each side creates a zero) 5 = 3x (Diving by 3 on each side creates a one) “Geometric situations”: For example, writing a linear equation to solve for the measure of a missing angle of a triangle. *Embed in Learning Experiences 1 & 3 (*See* Framework p. 18). Throughout the process of solving an equation, students should make assumptions or predictions about the number of solutions by comparing each side of the equation. *For example,* students should reason that the equation 5*x* + 2 = 5*x* + 2 must have infinite solutions without having to simplify further.		*CA Mathematics Framework Gr. 8* p. 17-18 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf *Progressions for the Common Core* – Expressions and Equations Gr. 6-8 http://commoncoretools.files.wordpress.com/2011/04/ccss_progression_ee_2011_04_25.pdf North Carolina 8th Grade Math Unpacked Content: p. 15 – 16 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf *8th Grade Common Core State Standards Flip Book* http://katm.org/wp/wp-content/uploads/f

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
					lipbooks/8thFlipFinaledited.pdf

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Unit 3: Linear Relationships

(Approx. # Days)

Content Standards: 8.EE.5,6 and 8.F.2

Math Common Core Content Standards:

Domain: Expressions and Equations 8.EE

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

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.*
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.

Domain: Functions 8.F

Define, evaluate, and compare functions.

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.*

Standards for Mathematical Practice:

1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
4. Model with Mathematics
5. Use Appropriate Tools Strategically
8. Look For and Express Regularity in Repeated Reasoning

ELD Standards to Support Unit

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SEL Competencies:

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
• What does the slope of a proportional relationship mean in the context of a problem? • Where do you see the slope in the problem? In the table? In the graph? In the equation? • What are some examples of linear relationships that are/are not proportional? How do you know? • What is similar/different about the equations y=mx and y=mx + b? • How can you use the slope of a line to find additional points on the line? • Given a context, which quadrants are reasonable for your graph? Why?	Assessments/Tasks aligned to learning experiences: For Learning Experiences 1 & 2: http://www.illustrativemathematics.org/illustrations/129 http://www.illustrativemathematics.org/illustrations/55 http://www.illustrativemathematics.org/illustrations/184 For Learning Experience 3: http://www.illustrativemathematics.org/illustrations/1537 For Learning Experiences 4 – 7: http://www.illustrativemathematics.org/illustrations/641 http://www.illustrativemathematics.org/illustrations/352 http://www.illustrativemathematics.org/illustrations/86 http://www.illustrativemathematics.org/illustrations/1552	Students will be able to… 1) Graph proportional relationships given a real-world context and interpret the unit rate as the slope of the graph. 2) Compare two different proportional relationships represented in different ways, for example, in a graph, a table, an equation, and a verbal description. 3) 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. (Framework p. 16) 4) Derive and understand slope/rate of change given a real-world context by using graphs, tables, equations (y=mx) and verbal descriptions in the first quadrant. 5) Derive and understand slope/rate of change with a y-intercept given a real-world context by using graphs, tables, equations (y=mx + b) and verbal descriptions in the first quadrant. 6) Derive and understand slope/rate of change and y-intercept in context in all quadrants. 7) Model real-world problems with the relationships y=mx and y=mx + b. Determine what parts of the graph make sense in context of the situation.	Using similar triangles to prove slope formula (videos and practice problem): http://www.youtube.com/watch?v=TqpT0xsiMGY https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-relationships-functions/cc-8th-similarity-slope/v/similar-triangles-to-prove-that-the-slope-is-constant-for-a-line http://www.illustrativemathematics.org/illustrations/1537 When given a context, pay attention to the units involved throughout problem solving process. Use side-by-side instruction with graphs, tables, equations, and verbal descriptions for a given real-world context (for example, use a graphic organizer for student work). Emphasize the similarities and differences between proportional and non-proportional		*CA Mathematics Framework Gr. 8* p. 11 – 17, 23 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf *Progressions for the Common Core* – Expressions and Equations Gr. 6-8 http://commoncoretools.files.wordpress.com/2011/04/ccss_progression_ee_2011_04_25.pdf North Carolina 8th Grade Math Unpacked Content: p. 13 – 14 and 20 – 21 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf *8th Grade Common Core State Standards Flip Book* http://katm.org/wp/wp-content/uploads/f

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
			relationships. Derivation (in experiences 4-6) should be studied in Framework, p. 17		lipbooks/8thFlipFinaledited.pdf

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Unit 4: Functions

(Approx. # Days)

Content Standards: 8.F.1, 3, 4, 5

Math Common Core Content Standards:

Domain: Functions 8.F

Define, evaluate, and compare functions.

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]
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.*

Use functions to model relationships between quantities.

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.
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.

Standards for Mathematical Practice:

2. Reason Abstractly and Quantitatively
6. Attend to Precision
7. Look For and Make Use of Structure

ELD Standards to Support Unit

[Add text]

SEL Competencies:

[Add text]

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
• How do you know whether a relationship between two quantities is a function or not? • What are examples of linear/non-linear functions? • Are all linear equations functions? Are all functions linear? How do you know? • What does the rate of change mean in terms of a given situation? • How do you know what the initial value is? • How is the initial value different from the y-intercept? • How do you read a graph to determine whether a function is increasing or decreasing? • What can you infer about a situation, given the descriptive qualities of its graph (e.g. where the graph is increasing/decreasing)?	Assessments/Tasks aligned to learning experiences: For Learning Experiences 1 & 2: http://www.illustrativemathematics.org/illustrations/715 http://www.illustrativemathematics.org/illustrations/1165 http://www.illustrativemathematics.org/illustrations/713 For Learning Experience 3: http://www.illustrativemathematics.org/illustrations/813 For Learning Experience 4: http://www.illustrativemathematics.org/illustrations/417 http://www.illustrativemathematics.org/illustrations/1365 http://www.illustrativemathematics.org/illustrations/383 http://www.illustrativemathematics.org/illustrations/552 For Learning Experiences 5 & 6: http://www.illustrativemathematics.org/illustrations/633 http://www.illustrativemathematics.org/illustrations/632 http://www.illustrativemathematics.org/illustrations/674	Students will be able to… 1) Discover and understand the meaning of a function through examples and non-examples in real-life contexts 2) Given real-life relationships in the form of tables, graphs, or verbal descriptions, determine if that relationship is a function and explain why. 3) Compare and contrast linear and non-linear functions and give examples of each, with the purpose of understanding that not all functions are linear. (Framework p. 22) 4) Construct a function (i.e. write an equation) to model a situation, given at least two data points in the form of a description, table, or graph. Identify the rate of change and the initial value of the function, and interpret their meaning in terms of the situation. (Framework p. 24 – 25) 5) Given the graph of a functional relationship (linear and non-linear), describe its qualities (for example, where the graph is increasing/decreasing). 6) Sketch a graph from a verbal description of its specific qualities (for example, where the graph is increasing/decreasing).	Example of a functional relationship: Time of day and temperature; i.e. there can only be one temperature (output) for any given time of the day (input). Example of a non-functional relationship: Age and height; i.e. a person's age (input) does not necessarily yield a distinct height (output), and in fact, there will be various height measurements for a given age. Possible opportunity to informally introduce function concepts and vocabulary (e.g. domain, range, "function of"). Use sentence starters to help students talk about functions. For example, ____ is a function of ____ because…		*CA Mathematics Framework Gr. 8* p. 21 – 25 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf *Progressions for the Common Core* – Functions Gr. 8 - HS http://commoncoretools.me/wp-content/uploads/2013/07/ccss_progression_functions_2013_07_02.pdf North Carolina 8th Grade Math Unpacked Content: p. 19 – 25 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf

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Unit 5: Systems of Equations

(Approx. # Days)

Content Standards: 8.EE.8

Math Common Core Content Standards:

Domain: Expressions and Equations 8.EE

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

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.*

Standards for Mathematical Practice:

1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
4. Model with Mathematics
5. Use Appropriate Tools Strategically

ELD Standards to Support Unit

[Add text]

SEL Competencies:

[Add text]

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
• What does the point of intersection mean of a graph of a system of two linear equations? • Why does it make sense that two equations that form parallel lines have no solution? • Why does it make sense that two equations that form the same line have infinite solutions? • How can you use a table to represent a system of linear equations and to find/estimate its solution? • Without graphing or solving algebraically, how can you determine the number of solutions to a system of linear equations? • How do you determine the most efficient method for graphing a linear equation? • How do you determine the most efficient method for solving (algebraically) a system of two linear equations? • When graphing equations to represent a real-world context, how do you label your axes with the appropriate variables? • When modeling a real-world situation, when might you write an equation in slope-intercept	Assessments/Tasks aligned to learning experiences: http://map.mathshell.org/materials/lessons.php?taskid=411#task411 http://map.mathshell.org/materials/lessons.php?taskid=433#task433 http://www.illustrativemathematics.org/illustrations/553 http://www.illustrativemathematics.org/illustrations/554 http://www.illustrativemathematics.org/illustrations/73 http://www.illustrativemathematics.org/illustrations/1362	Students will be able to… 1) Write a system of two linear equations in slope-intercept form given a real-world context, and graph the system. Understand that the point of intersection is the solution to the system, and analyze what that solution means in the context of the problem. (Students may need to estimate the point of intersection from their graph). 2) Analyze a graph of a system of two linear equations by determining what different parts and specific points of the graph represent. For example, analyze what the parts of the graph represent *before, after,* and *at* the point of intersection, and make comparisons between the two output values (from each line) at a given input value. 3) Graph a system of two linear equations in slope-intercept form given a real-world context where there is either no solution or infinite solutions. Analyze what "no solution" and "infinite solutions" mean both in terms of the graph, the equations, and the situations they model. 4) Algebraically solve systems of two linear equations in slope-intercept form in mathematical and real-world contexts (for example, using methods for substitution and elimination.) Connect algebraic solutions to graphical representations. 5) Graph linear equations in standard form, Ax + By = C, in mathematical and real-world contexts. Identify x- and y-intercepts and slope, and make sense of each of them in terms of the graph and the context. 6) Write a system of two linear equations in standard form given a real-world context, and graph the system. Understand that the point of intersection is the solution	In addition to graphing, students may use a table to represent relationships between two linear equations in order to analyze a system. For example, students can analyze the table below to estimate where the solution (i.e. point of intersection) will be for lines y_1 and y_2: x | y_1 | y_2 0 | 1.5 | 3.5 1 | 2.5 | 3 2 | 3.5 | 2.5 3 | 4.5 | 2 4 | 5.5 | 1.4 Use the concept of "no solution" to explore the concept of "infinite solutions." For example, start with a system that has no solutions: y = 4x + 5 and y = 4x + 3 and ask students what they can change about one of the equations to make the system have infinite solutions. http://learnzillion.com/lesson	Graphing calculators	*CA Mathematics Framework Gr. 8* p. 19 – 20 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf *Progressions for the Common Core* – Expressions and Equations Gr. 6-8 http://commoncoretools.files.wordpress.com/2011/04/ccss_progression_ee_2011_04_25.pdf North Carolina 8th Grade Math Unpacked Content: p. 16 – 18 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf *8th Grade Common Core State Standards Flip Book* http://katm.org/wp/wp-content/uploads/f

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
form and when might you write an equation in standard form?		to the system, and analyze what that solution means in the context of the problem. (Students may need to estimate the point of intersection). 7) Graph a system of two linear equations in standard form given a real-world context where there is either no solution or infinite solutions. Analyze what "no solution" and "infinite solutions" mean both in terms of the graph, the equations, and the situations they model. 8) Algebraically solve systems of two linear equations in standard form in mathematical and real-world contexts (for example, using methods for substitution and elimination.) Connect algebraic solutions to graphical representations. 9) Given a real-world or mathematical context, write and solve a system of two linear equations in two variables (using slope-intercept form and/or in standard form). 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.	s/1020-predict-the-number-of-solutions-a-system-of-two-linear-equations-in-two-variables-has-by-inspection Analyze a system of equations to determine the number of solutions, for example 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6. Make connections to these equations forming parallel lines. http://www.illustrativemathematics.org/illustrations/554 http://cc.betterlesson.com/lesson/441482/baseball-helmets-day-1-of-2 In Experience 9, provide word problems for students that require them to determine which form to write their equation in. Students strategically choose how to solve their system algebraically.		lipbooks/8thFlipFinaledited.pdf

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Unit 6: Irrational Numbers and the Pythagorean Theorem

(Approx. # Days)

Content Standards:

8.NS.1,2

8.EE.2

8.G.6 – 9

Math Common Core Content Standards:

Domain: The Number System 8.NS

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

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.
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., π2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

Domain: Expressions and Equations 8.EE

Work with radicals and integer exponents.

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 √2 is irrational.

Domain: Geometry 8.G

Understand and apply the Pythagorean Theorem.

6. Explain a proof of the Pythagorean Theorem and its converse.
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. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

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

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

Standards for Mathematical Practice:

1. Make Sense of Problems and Persevere in Solving Them

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3. Construct Viable Arguments and Critique the Reasoning of Others
4. Model with Mathematics
8. Look For and Express Regularity in Repeated Reasoning

ELD Standards to Support Unit
[Add text]

SEL Competencies:
[Add text]

Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
1) How do you know if a number is rational? 2) How do you determine what to multiply the equation by when converting non-terminating repeating decimals into fractions? 3) Are all square roots irrational? Why or why not? 4) What is the appropriate level of precision in estimating an irrational number in a given real-world context? 5) In the Pythagorean Theorem, does it matter which side is labeled a? Which two lengths are able to be interchanged within the Pythagorean Theorem? 6) What do square root and cube root actually mean? 7) What conditions need to be	Assessments/Tasks aligned to learning experiences: Learning Experiences 1 – 3: http://map.mathshell.org/materials/lessons.php?taskid=421#task421 http://www.illustrativemathematics.org/illustrations/334 http://www.illustrativemathematics.org/illustrations/1538 Learning Experiences 4 – 6: http://www.illustrativemathematics.org/illustrations/336 http://www.illustrativemathematics.org/illustrations/337 http://www.illustrativemathematics.org/illustrations/1221 http://illuminations.nctm.org/Lesson.aspx?id=4082	Students will be able to… 1) Investigate how to prove that terminating decimals are rational because they can be written in the form $\frac{p}{q}$ using place value. 2) Investigate non-terminating, repeating decimals are rational because they can be written in the form $\frac{p}{q}$ using the conversion method (Framework p. 7). 3) Use a calculator to explore the expanded decimal values of π and non-perfect squares to notice that they are non-terminating and non-repeating. Students will use this understanding to conclude why they cannot be written as fractions using the conversion method. 4) Estimate the values of irrational numbers using a method of squaring rational numbers (For example estimate the decimal expansion of $\sqrt{2}$ by showing 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 - Framework p. 8). Represent this number on the number line. 5) Evaluate expressions for square roots of small	For experiences 1-2, all values should be explored, not only numbers between 0 and 1 (e.g., 2.8, -3.6, and $\sqrt{9}$). Students should use a calculator to verify their decimal-to-fraction conversion. For experiences 1-3, it may be valuable for students to place the numbers on a number line. Distingush between rational and irrational numbers Converting repeating decimals into fractions. Find where a square root fits between whole numbers		*CA Mathematics Framework Gr. 8* p. 6 – 11, 30 – 32 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf *Progressions for the Common Core* – The Number System Gr. 6-8 http://commoncoretools.me/wp-content/uploads/2013/07/ccssm_progression_NS+Number_2013-07-09.pdf North Carolina 8th Grade Math Unpacked Content:

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
met in order to prove a triangle is a right triangle? 8) What strategies do you have to turn a decimal into a fraction and vice-versa? 9) Why are squares and square roots and cubes and cube roots inverse operations?	Learning Experiences 7 – 9: http://map.mathshell.org/materials/download.php?fileid=804 http://map.mathshell.org/materials/lessons.php?taskid=408#task408 http://map.mathshell.org/materials/tasks.php?taskid=280#task280 http://map.mathshell.org/materials/tasks.php?taskid=276#task276 http://map.mathshell.org/materials/download.php?fileid=1098 Learning Experience 10: http://www.illustrativemathematics.org/illustrations/520 http://www.illustrativemathematics.org/illustrations/521 http://www.illustrativemathematics.org/illustrations/112 http://www.illustrativemathematics.org/illustrations/517 http://map.mathshell.org/materials/lessons.php?taskid=410#task410	perfect squares and cube roots of small perfect cubes, using the concept of repeated multiplication. 6) Solve equations in the form of $x^2 = p$ and $x^3 = p$ using inverse operations (where p is a positive rational number). 7) Understand the Pythagorean Theory using a proof and explore the proof with multiple right triangles. Using the same proof, students will explore whether or not the Pythagorean Theorem applies to non-right triangles. 8) Use the Pythagorean Theorem to solve for unknown side lengths (rational and irrational) in right triangles in real-world and mathematical problems in two and three dimensions. 9) Given two coordinates, students will draw a right triangle and use the Pythagorean Theorem to find the distance between the two coordinates (i.e. the length of the hypotenuse of the right triangle). 10) Solve real-life and mathematical problems using the formulas for volume of cylinders, cones, and spheres.	Find the square root of a perfect square Pythagorean Theorem construction Pythagorean Theorem discovery and real-world problem to solve Review of right triangles and the relationships of their sides. Find distance between two points on the coordinate plane using Pythagorean Use Experience #4 to approximate irrational answers appropriately for real-world Pythagorean Theorem problems		p. 6 – 7, 9 – 10, 33 – 38 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf *8th Grade Common Core State Standards Flip Book* http://katm.org/wp/wp-content/uploads/flipbooks/8thFlipFinaledited.pdf

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Unit 7: Exponents

(Approx. # Days)

Content Standards: 8.EE.1,3,4

Math Common Core Content Standards:

Domain: Expressions and Equations 8.EE

Work with radicals and integer exponents.

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

Standards for Mathematical Practice:

1. Make Sense of Problems and Persevere in Solving Them
3. Construct Viable Arguments and Critique the Reasoning of Others
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

ELD Standards to Support Unit

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SEL Competencies:

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
• Where do the rules for exponents come from? • How can you prove that $a^0 = 1$? • Why isn't $a^{-n} = -a^n$? • Why do we use scientific notation? • Why do we use 10 as a base for numbers expressed in scientific notation? • How can you use estimation to compare two numbers expressed in scientific notation? • How do the rules of exponents apply to performing operations with numbers expressed in scientific notation?	Assessments/Tasks aligned to learning experiences: Learning Experiences 1 – 5: http://www.illustrativemathematics.org/illustrations/395 Learning Experiences 6 – 9: http://www.illustrativemathematics.org/illustrations/823 http://www.illustrativemathematics.org/illustrations/476 http://www.illustrativemathematics.org/illustrations/1291 http://www.illustrativemathematics.org/illustrations/1593 http://www.illustrativemathematics.org/illustrations/113	Students will be able to… 1) Use the definition of an exponent to expand and simplify expressions (with positive integer exponents only) in order to generate the rule for multiplying powers with the same base: $a^m \cdot a^n = a^{m+n}$ 2) Expand and simplify expressions (with positive integer exponents only) in order to generate the rule for raising a power to a power: $(a^m)^n = a^{mn}$ 3) Expand and simplify expressions by "finding ones" (with positive integer exponents only) in order to generate the rule dividing powers with the same base: $\frac{a^m}{a^n} = a^{m-n}$ 4) Make predictions about powers raised to zero exponents. Generate and prove the rule for zero exponents: $a^0 = 1$ 5) Make predictions about powers raised to negative exponents. Generate and prove the rule for negative exponents: $a^{-n} = \frac{1}{a^n}$ 6) Given large or small numbers in standard form, express them in scientific notation; Given large or small numbers in scientific notation, express them in standard form. 7) Use numbers expressed in scientific notation (in the form of a single digit times an integer power of 10) to determine which one has a greater value (for example, determine which value is greater and explain how you know: 8×10^5 and 9×10^4). 8) Using numbers expressed in scientific notation (in the form of a single digit times an integer power of 10),	Use the definition of an exponent to expand and simplify expressions in order to general rules, for example: $2^3 \cdot 2^4 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^7$ Use vocabulary like "How many factors of 2 do you see?" For example, $(2^3)^2 = (2^3)(2^3) = (2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2) = 2^6$ Why is $a^0 = 1$? (See proofs…) http://www.homeschoolmath.net/teaching/zero-exponent-proof.php https://www.khanacademy.org/math/arithmetic/exponents-radicals/world-of-exponents/v/raising-a-number-to-the-0th-and-1st-power Why is $a^{-n} = \frac{1}{a^n}$? (See proofs…) http://www.homeschoolmath.net/teaching/negative_zero_exponents.php https://www.khanacademy.org/math/arithmetic/exponents-radicals/negative-exponents-tutorial/v/negative-exponent-intuition	Scientific or graphing calculators (for reading numbers expressed in scientific notation on technology)	*CA Mathematics Framework Gr. 8* p. 8 – 11 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf *Progressions for the Common Core* – Expressions and Equations Gr. 6-8 http://commoncoretools.files.wordpress.com/2011/04/ccss_progression_ee_2011_04_25.pdf North Carolina 8th Grade Math Unpacked Content: p. 8 – 12 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf *8th Grade Common Core State Standards Flip Book* http://katm.org/wp/

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
		estimate how many times greater one number is than the other number (for example, the population of the U.S. is 3 x 10^8 and the population of the world is 7 x 10^9, so the population of the world is more than 20 times larger). 9) Given a mathematical or real-world problem, perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.	For Learning Experiences 8 & 9, students will choose units of appropriate size for a given situation. Students should be able to interpret and understand scientific notation as it has been generated by a calculator. About how much greater is the world population than the U.S. population? $\frac{7\times10^9}{3\times10^8} = \frac{7\times10\times10^8}{3\times10^8} = \frac{70}{3} \approx 23$ The world population is about 23 times greater. How much greater is 6 x 10^{-8} than 9 x 10^{-9}? $\frac{6\times10^{-8}}{9\times10^{-9}} = \frac{6\times10\times10^{-9}}{9\times10^{-9}} = \frac{60}{9} \approx 6.7$ Use the rules for integer exponents (*see Learning Experiences 1 – 5)* to perform operations with numbers expressed in scientific notation.		wp-content/uploads/flipbooks/8thFlipFinaledited.pdf

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Unit 8: Bivariate Data

(Approx. # Days)

Content Standards: 8.SP.1 – 4

Math Common Core Content Standards:

Domain: Statistics and Probability 8.SP

Investigate patterns of association in bivariate data.

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.
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.
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.*
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?*

Standards for Mathematical Practice:

1. Make Sense of Problems and Persevere in Solving Them
2. Reason Abstractly and Quantitatively
4. Model with Mathematics
5. Use Appropriate Tools Strategically
6. Attend to Precision

ELD Standards to Support Unit

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SEL Competencies:

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources
• Why is a scatter plot a good representation of bivariate data? • What kind of patterns and associations can you see from looking at a scatter plot? • When is it appropriate to use a straight line to model data from a scatter plot? • How can you use a linear equation to make predictions about bivariate data? • How can you use a two-way table to describe possible associations between variables?	Assessments/Tasks aligned to learning experiences: http://www.illustrativemathematics.org/8 (There are multiple assessments and tasks at the bottom of this page under 8.SP. 1-4) http://dese.mo.gov/divimprove/assess/documents/asmt-sbac-math-gr8-sample-items.pdf (Pg. 28, Pg. 66, Pg. 86) This website has a lot of lessons and tasks related to statistics. http://illuminations.nctm.org/Search.aspx?view=search&st=d&gr=9-12	Students will be able to… 1) Use a set of bivariate data (i.e. data that represents two variables) to construct a scatter plot. 2) Analyze a scatter plot of bivariate data, paying close attention to patterns such as clustering, outliers, positive or negative association, linear associate, and nonlinear association. 3) Informally construct a line that best fits data on a scatter plot (for scatter plots that suggest a linear association), and assess how well the line models the data. 4) Write an equation in slope-intercept form for a line of best fit and use the equation to solve mathematical and real-world problems. 5) Construct a two-way table that summarizes data on two categorical variables collected from the same subjects (for example, students collect data from their classmates about whether or not they have a curfew and whether or not they do chores at home.) 6) Calculate frequencies (the number of times an event occurs) and relative frequencies (the ratio of the number of times an event occurs to the total number of events) from a two-way table to describe a possible association between two variables (for example, students may see a positive correlation between having a curfew and having chores).	**Online Tools for creating scatter plots and lines of best fit:** http://www.mathcracker.com/linear_regression.php http://www.alcula.com/calculators/statistics/linear-regression/ **Videos on constructing and using lines of best fit:** http://learnzillion.com/search?query=scatter_plot&page=1&filters[grade_levels][]=8th&filters[common_core_codes][]=8.SP.2&filters[common_core_codes][]=8.SP.3 Learning Experiences 5 and 6 may be taught concurrently. **Two way frequency tables:** http://learnzillion.com/search?query=frequency&page=1&filters[grade_levels][]=8th		*CA Mathematics Framework Gr. 8* p. 32 – 36 http://www.cde.ca.gov/ci/ma/cf/documents/aug2013gradeeight.pdf *Progressions for the Common Core* – Statistics and Probability Gr. 6-8 http://commoncoretools.files.wordpress.com/2011/12/ccss_progression_sp_68_2011_12_26_bis.pdf North Carolina 8th Grade Math Unpacked Content: p. 39 – 42 http://www.ncpublicschools.org/docs/acre/standards/common-core-tools/unpacking/math/8th.pdf

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Essential Questions	Suggested Assessments for Learning	Sequence of Learning Experiences	Strategies for Teaching and Learning	Differentiation (EL/SpEd/GATE)	Resources

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