Common Core Math Units
Grade 8

Sequenced Units for the Common Core State Standards in Mathematics Grade 8

Prior to Grade 8, students have written and interpreted expressions, solved equations and inequalities, explored quantitative relationships between dependent and independent variables, and solved problems involving area, surface area, and volume. Students have also begun to develop an understanding of statistical thinking. The Grade 8 course outlined in this document begins with congruence transformations of the coordinate plane, followed by exploration of similarity transformations, which contribute to students' conceptual understanding of slope. Students apply their previous understandings of ratio and proportional reasoning to the study of linear functions, equations, and systems, including a deep understanding of slope. They explore negative integer exponents and irrational numbers, and they deepen their understanding of geometric concepts by investigating and applying the Pythagorean Theorem.

This document reflects our current thinking related to the intent of the Common Core State Standards for Mathematics (CCSSM) and assumes 160 days for instruction, divided among 14 units. The number of days suggested for each unit assumes 45-minute class periods and is included to convey how instructional time should be balanced across the year. The units are sequenced in a way that we believe best develops and connects the mathematical content described in the CCSSM; however, the order of the standards included in any unit does not imply a sequence of content within that unit. Some standards may be revisited several times during the course; others may be only partially addressed in different units, depending on the focus of the unit. Strikethroughs in the text of the standards are used in some cases in an attempt to convey that focus, and comments are included throughout the document to clarify and provide additional background for each unit.

Throughout Grade 8, students should continue to develop proficiency with the Common Core's eight 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.**
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.**

These practices should become the natural way in which students come to understand and do mathematics. While, depending on the content to be understood or on the problem to be solved, any practice might be brought to bear, some practices may prove more useful than others. Opportunities for highlighting certain practices are indicated in different units in this document, but this highlighting should not be interpreted to mean that other practices should be neglected in those units.

When using this document to help in planning your district's instructional program, you will also need to refer to the CCSSM document, relevant progressions documents for the CCSSM, and the appropriate assessment consortium framework.

The Charles A. Dana Center at The University of Texas at Austin January 13, 2013

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Unit 1: Introducing transformations. Suggested number of days: 10	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit provides an introduction to transformations as students explore the three congruence transformations: rotations, reflections, and translations. This unit builds on students' work in prior grades with parallel lines, angles, and symmetry in geometric figures (**4.G.A.1, 4.G.A.3**), and the coordinate plane (**G.NS.C.G**). In units 2 and 3, students build upon these foundations as they investigate combinations of translations that result in congruence or similarity transformations. This work with congruence and similarity provides support for development of the formal definition of slope in unit 7.			
Common Core State Standards for Mathematical Content **Geometry — 8.G** A. 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.	8.G.1.a.1 Construct an image from pre-image, using geometric tools. 8.G.1.a.2 Construct a rotation 8.G.1.a.3 Construction a reflection 8.G.1.a.4 Construction a translation 8.G.1.a.5 Understand image and pre-image are congruent in translations 8.G.1.a.6 Understand image and pre-image are congruent in reflections 8.G.1.a.7 Understand image and pre-image are congruent in rotations 8.G.1.a.8 Explore and justify figures created from transformations using compasses, protractors, and rulers or technology 8.G.1.b.1 Defend whether or not two figures are congruent given the graph of a figure and its transformation using translation 8.G.1.b.2 Defend whether or not two figures are congruent given the graph of a figure and its transformation using reflection 8.G.1.b.3 Defend whether or not two figures are congruent given the graph of a figure and its transformation using rotation	**Comments** As students investigate transformations, they attend to precision (**MP.6**) as they use appropriate terminology to describe and verify the properties of the various transformations. They also select and use tools such as geometry software, coordinate planes, and tracing paper strategically (**MP.5**).	

c. Parallel lines are taken to parallel lines. **Common Core State Standards for Mathematical Practice** 5. Use appropriate tools strategically. 6. Attend to precision.	8.G.1.c.1 8.G.1.c.2 8.G.1.c.3 8.G.1.c.4 8.G.1.c.5 8.G.1.c.6 8.G.1.c.7 8.G.1.c.8	Recognize the angles formed by two parallel lines and a transversal Justify why angles(formed by parallel lines and a transversal) are congruent using angle relationships Determine if two figures are congruent by identifying the transformation used to produce the figures Write congruent statements. Recognize the congruent symbol Define congruent Write statements that justify the process of transformation as well as the conclusion Describe the sequence of transformations from one figure to another		

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Unit 2: Understanding congruence through transformations Suggested number of days: 11	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit builds on the foundations of the previous unit as students deepen their understanding of congruence transformations to include sequences of rotations, reflections, and translations. They will expand on this idea in unit 3 as they explore similarity transformations.			
Common Core State Standards for Mathematical Content **Geometry — 8.G** A. Understand congruence and similarity using physical models, transparencies, or geometry software. 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.	8.G.2.1 Define congruent 8.G.2.2 Recognize the congruent symbol 8.G.2.3 Write congruent statements. 8.G.2.4 Determine if two figures are congruent by identifying the transformation used to produce the figures 8.G.2.5 Write statements that justify the process of transformation as well as the conclusion 8.G.2.6 Describe the sequence of transformations from one figure to another 8.G.3.1 Identify the new coordinates of a translation 8.G.3.2 Identify the new coordinates of a reflection 8.G.3.3 Identify the new coordinates of a rotation 8.G.3.4 Identify the new coordinates of a dilation 8.G.3.5 Understand image and pre-image are similar in dilations 8.G.3.6 Given two similar figures describe the sequence of rotations, reflections, translations, and dilations	**Comments** **8.G.A.2** Student will investigate and describe the effect of dilations on two-dimensional figures in unit 3. Students construct viable arguments and critique the reasoning of others (**MP.3**) as they describe the effect of transformations. As students investigate those effects, they attend to structure (**MP.7**) by recognizing the common attributes and properties generated by the transformations.	

Common Core State Standards for Mathematical Practice 3. Construct viable arguments and critique the reasoning of others. 7. Look for and make use of structure.	8.G.3.7 Create a figure congruent to a given figure by applying knowledge of translation 8.G.3.8 Create a figure congruent to a given figure by applying knowledge of reflection 8.G.3.9 Create a figure congruent to a given figure by applying my knowledge of rotation(90, 180, 270 degrees) both clockwise and counterclockwise		

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Unit 3: Understanding similarity. Suggested number of days: 13	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit builds on the previous two units as students expand their understanding of transformations to include similarity transformations. This unit also connects with students' prior work with scale drawings and proportional reasoning (**7.G.A.1**, **7.RP.A.2**). These understandings are applied in unit 7 as students 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 (**B.EE.B.6**).			
Common Core State Standards for Mathematical Content **Geometry — 8.G** A. Understand congruence and similarity using physical models, transparencies, or geometry software. 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-	8.G.3.1 Identify the new coordinates of a translation 8.G.3.2 Identify the new coordinates of a reflection 8.G.3.3 Identify the new coordinates of a rotation 8.G.3.4 Identify the new coordinates of a dilation 8.G.3.5 Understand image and pre-image are similar in dilations 8.G.3.6 Given two similar figures describe the sequence of rotations, reflections, translations, and dilations 8.G.3.7 Create a figure congruent to a given figure by applying knowledge of translation 8.G.3.8 Create a figure congruent to a given figure by applying knowledge of reflection 8.G.3.9 Create a figure congruent to a given figure by applying my knowledge of rotation(90, 180, 270 degrees) both clockwise and counterclockwise 8.G.4.1 Create similar figures using dilations and transform them	**Comments** In unit 13, students investigate the remaining geometric relationships described in **8.G.A.5**. As with unit 2, students attend to precision (**MP.6**) as they construct viable arguments and critique the reasoning of others (**MP.3**) while describing the effects of similarity transformations and the angle-angle criterion for similarity of triangles.	

dimensional figures, describe a sequence that exhibits the similarity between them.	8.G.4.2	Comprehend that the angles of similar figures are congruent and the sides of similar figures are proportional		
	8.G.4.3	Produce similar figures from dilations using scale factors		
	8.G.4.4	Describe that transformed images have congruent angles and proportionate sides		
	8.G.4.5	Interpret the meaning of similar figures and describe their similarities		
	8.G.4.6	Describe the list of steps that would produce similar figures when given the scale factors (dilation)		
	8.G.4.7	Differentiate between scale factor that would enlarge a figure's size and one that would reduce it		
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.5.1	Find the measures of missing angles		
	8.G.5.2	Make conjectures about relationships between angles		
	8.G.5.3	Determine the relationship between two angles when given parallel lines and a transversal.		
	8.G.5.4	Construct parallel lines and transversal to examine the relationships between created angles		
	8.G.5.5	Explore and justify relationships that exist between angles created when parallel lines are cut by a transversal		
	8.G.5.6	Apply my knowledge of vertical, adjacent, and supplementary angles to identify other pairs of congruent angles		

Common Core State Standards for Mathematical Practice 3. Construct viable arguments and critique the reasoning of others. 6. Attend to precision.	8.G.5.7	Find the missing angle of a triangle.		
	8.G.5.8	Find the exterior angle of a triangle		
	8.G.5.9	Find the missing angle measure when given two similar triangles.		
	8.G.5.10	Construct various triangles and find the measures of interior and exterior angles		
	8.G.5.11	Explore and justify relationships that exist between angle sums and exterior angle sums of triangles		
	8.G.5.12	Explore and justify relationships that exist between the angle – angle criterion for similarity of triangles		
	8.G.5.13	Construct various triangles and find measures of the interior and exterior angles		
	8.G.5.14	Form a hypothesis about the relationship between the measure of an exterior angle and the other two angles of a triangle		
	8.G.5.15	Construct triangles having line segments of different lengths but with two corresponding congruent angles		
	8.G.5.16	Compare ratios of sides to find a constant scale factor of similar triangles		

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Unit 4: Rational and irrational numbers Suggested number of days: 7	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit introduces the real number system and how real numbers are used in a variety of contexts. Students become familiar with irrational numbers (especially square and cube roots), but also learn how to solve equations of the form $x^2 = p$ and $x^3 = p$. Incorporating the Equations and Expression standards with the Number System standards provides context and motivation for learning about irrational numbers: for instance, to find the side length of a square of a certain area.			
Common Core State Standards for Mathematical Content **The Number System — 8.NS** A. 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., π^2). *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*.	8.NS.1.1 Distinguish between rational and irrational numbers 8.NS.1.2 Recognize that a repeating/terminating decimal is a rational number 8.NS.1.3 Recognize that all real numbers can be written in a decimal form 8.NS.1.4 Write a fraction a/b as a repeating decimal by filling in the missing numbers. 8.NS.1.5 Write a fraction using long division, a÷b. 8.NS.1.6 Write a repeating decimal as a fraction. 8.NS.1.7 Analyze and generate patterns and structure of repeating decimals. 8.NS.2.1 Estimate the value of irrational numbers 8.NS.2.2 Locate rational numbers on a number line 8.NS.2.3 Locate irrational numbers on a number line 8.NS.2.4 Compare irrational numbers based upon rational approximations. 8.NS.2.5 Understand that non-perfect square roots are irrational numbers.	**Comments** Understanding irrational numbers and their decimal approximations and evaluating square and cube roots requires persistence (**MP.1**) with precision and estimation (**MP.6**). Students look to express regularity in repeated reasoning as they convert fractions to decimals and notice that when they repeat the same calculations, the decimal also repeats (**MP.8**).	

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Expressions and Equations — 8.EE

A. 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.

Common Core State Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.

6. Attend to precision.

8.EE.2.1	Recognize and evaluate perfect square roots in the form of 1, 4, 9, …, 100
8.EE.2.2	Recognize and evaluate perfect cube roots of 1, 8, 27, 64, and 125.
8.EE.2.3	Recognize that non-perfect cubes are irrational numbers.
8.EE.2.4	Recognize the inverse operation of squared is square rooting and solve mathematical problems
8.EE.2.5	Solve equations of the form $x^2 = p$ where p is a perfect square (ex.,$x^2 = 4$ » $\sqrt{x^2}$=$\sqrt{4}$ » x=±2)
8.EE.2.6	Recognize the inverse operation of cubed is cube rooting.
8.EE.2.7	Solve equations of the form $x^3 = p$ where p is a perfect cube (x^3= 27 » $\sqrt[3]{x^3} = \sqrt[3]{27}$ » x=3).
8.EE.2.8	Solve equations of the form $x^2 = p$ and $x^3 = p$, representing solutions using √ symbols (ex. $x^2 = 5$ $where$ $x = \pm\sqrt{5}$).
8.EE.2.9	Solve word problems and geometric problems such as finding the edge length of a cubical object with a given volume.

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Unit 5: Pythagorean theorem Suggested number of days: 13	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit provides further motivation and context for using square roots. In future math courses, the Pythagorean theorem will continue to play an important role.			
Common Core State Standards for Mathematical Content **Geometry — 8.G** B. 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.G.6.1 Understand the Pythagorean Theorem 8.G.6.2 Use the Pythagorean Theorem to find the missing side of a right triangle. 8.G.6.3 Identify the parts of a right triangle (legs and hypotenuse) 8.G.6.4 Use the Pythagorean Theorem to determine if three length measurements form a right triangle 8.G.6.5 Recognize the diagonal of a parallelogram with right angles as the hypotenuse of the right triangles formed 8.G.6.6 Determine if a triangle is a right triangle by using the Pythagorean Theorem 8.G.6.7 Verify the Pythagorean Theorem by examining the area of squares coming off of each side of the right triangle 8.G.6.8 Identify Pythagorean triples 8.G.6.9 Explain a proof of the Pythagorean Theorem 8.G.7.1 Solve word problems using the Pythagorean Theorem 8.G.7.2 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world problems in 2 dimension	**Comments** Understanding, modeling, and applying (**MP.4**) the Pythagorean theorem and its converse require that students look for and make use of structure (**MP.7**) and express repeated reasoning (**MP.8**). Students also construct and critique arguments as they explain a proof of the Pythagorean Theorem and its converse (**MP.3**).	

8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. **Common Core State Standards for Mathematical Practice** 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	8.G.7.3	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in mathematical problems in 2 dimension		
	8.G.7.4	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world problems in 3 dimensions		
	8.G.7.5	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in mathematical problems in3 dimensions		
	8.G.8.1	Use the Pythagorean Theorem (instead of the distance formula) to find the distance between two points in a coordinate plane		
	8.G.8.2	Construct a right triangle on a coordinate plane to determine the distance between two points		
	8.G.8.3	Determine the length of the diagonal or hypotenuse of a right triangle on a coordinate plane		
	8.G.8.4	Use the coordinate plane to create a right triangle relationship whereby the distance between two points can be determined by solving for the hypotenuse of the Pythagorean Theorem.		

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Unit 6: Functions Suggested number of days: 5	I Can Statements	Notes/Comments	Unit Materials and Resources
In this unit, the term function is formally introduced for both linear and non-linear functions. Students model functions in different ways (algebraically, graphically, numerically in tables, or by verbal descriptions) and interpret those representations qualitatively and quantitatively.			
Common Core State Standards for Mathematical Content **Functions — 8.F** A. 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] *NOTE: [1]Function notation is not required in Grade 8.* 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.1.1 Identify the domain and range of a relation 8.F.1.2 Determine if a graph represents a function 8.F.1.3 Determine if a set of points represents a function 8.F.1.4 Calculate the y-value for an equation when given the x-value 8.F.1.5 Create a table for an equation 8.F.1.6 Determine if a table represents a function 8.F.1.7 Represent a function in the form of ordered pairs, mapping, graph, or listing 8.F.1.8 Graph functions in a coordinate plane 8.F.1.9 Read inputs and outputs from a graph of a function on a coordinate plane 8.F.2.1 Find the rate of change (slope) of a graph 8.F.2.2 Find the rate of change (slope) of a table 8.F.2.3 Find the slope of an equation 8.F.2.4 Compare two functions represented in the same way. (algebraically, graphically, numerically in tables, or by verbal description). 8.F.2.5 Compare two functions represented	**Comments** **8.F.A.3** Students will more fully investigate non- linear functions in unit 9. For this unit, students will be introduced to non-linear functions so that they are able to identify whether or not a function is linear, but they will not be required to generate their own examples until unit 9. **8.F.B.5** will also be addressed in unit as students investigate non-linear functions more explicitly. Understanding how functions model (**MP.4**) relationships requires that students reason abstractly and quantitatively (**MP.2**) while looking for and making use of structure (**MP.7**).	

	differently (algebraically, graphically, numerically in tables, or by verbal description).		
	8.F.2.6 Compare functions represented in different forms to determine which has the greater rate of change (slope)		
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*.	8.F.3.1 Explain that y=mx+b is a linear function. 8.F.3.2 Recognize that non-linear is not straight 8.F.3.3 Use graphs to categorize functions as linear or non-linear 8.F.3.4 Use equations to categorize functions as linear or non-linear 8.F.3.5 Identify and prove functions that are non-linear. 8.F.3.6 Give examples of functions that are non-linear.		
B. Use functions to model relationships between quantities. 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.	8.F.5.1 Identify equations as linear or nonlinear. 8.F.5.2 Explain how slope changes when given a graph. 8.F.5.3 Sketch a graph when given the description of the slope 8.F.5.4 Evaluate and describe properties based on a given graph 8.F.5.5 Analyze the graph for a functional relationships 8.F.5.6 Create a graph for a functional relationships 8.F.5.7 Sketch a graph by analyzing a situation that has been described verbally		
Common Core State Standards for Mathematical Practice 2. Reason abstractly and quantitatively. 4. Model with mathematics 7. Look for and make use of structure.			

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Unit 7: Introduction to linearity Suggested number of days: 11	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit builds on students' understanding of function and their work in earlier grades on constant of proportionality **(7.RP.A.2)** as they formally investigate linear relationships and slope. Students construct functions to model linear relationships.			
Common Core State Standards for Mathematical Content **Expressions and Equations — 8.EE** B. 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.	8.EE.5.1 Determine the slope of an equation 8.EE.5.2 Determine the slope of a graph 8.EE.5.3 Compare the slopes of 2 graphs 8.EE.5.4 Compare the slopes of 2 equations 8.EE.5.5 Compare the slope of an equation to the slope of a graph 8.EE.5.6 Identify slope is unit rate 8.EE.5.7 Interpret the unit rate of a graph as the slope of a line. 8.EE.5.8 Interpret the unit rate of a graph as the slope of a line in real-world problems. 8.EE.5.9 Graph data illustrating slope as the unit rate with and without technology. 8.EE.6.1 Explain why triangles are similar 8.EE.6.2 Determine the slope between two points 8.EE.6.3 Determine the slope between two points on a coordinate plane 8.EE.6.4 Determine the slope, looking at a graph 8.EE.6.5 Determine the y-intercept, looking at a graph	**Comments** Constructing functions to model linear relationships (**MP.4**) requires that students look for and express regularity in repeated reasoning (**MP.5**).	

	8.EE.6.6	Write the slope-intercept form of an equation of a line, looking at a graph		
	8.EE.6.7	Construct a right triangle using two points on a non-vertical line to compare slopes		
	8.EE.6.8	Identify m as the slope of a line and b as the point where the line intercepts the vertical axis (y-intercept)		
	8.EE.6.9	Derive an equation y=mx for a line through the origin.		
	8.EE.6.10	Derive an equation using the slope m and the y-intercept b in the form of y=mx + b		
	8.EE.6.11	Identify that the slope is the same between any two points on a line based on the proportional relationship of m = $\frac{\Delta y}{\Delta x}$ *or* $\frac{rise}{run}$		
Functions —— 8.F B. 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	8.F.4.1	Construct a linear function to determine the slope and y-intercept from a graph		
	8.F.4.2	Construct a linear function to determine the slope and y-intercept from a table		
	8.F.4.3	Construct a linear function given the slope and y intercept (initial point).		
	8.F.4.4	Construct a linear function given the slope and a point.		
	8.F.4.5	Construct a linear function given two points.		

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. **Common Core State Standards for Mathematical Practice** 4. Model with mathematics. 8. Look for and express regularity in repeated reasoning.	8.F.4.6	Construct a linear function based on a real-world problem.		
	8.F.4.7	Interpret the rate of change (slope) and the initial value(y-intercept) given real-world situations		
	8.F.5.1	Identify equations as linear or nonlinear.		
	8.F.5.2	Explain how slope changes when given a graph.		
	8.F.5.3	Sketch a graph when given the description of the slope		
	8.F.5.4	Evaluate and describe properties based on a given graph		
	8.F.5.5	Analyze the graph for a functional relationships		
	8.F.5.6	Create a graph for a functional relationships		
	8.F.5.7	Sketch a graph by analyzing a situation that has been described verbally		

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Unit 8: Patterns of association in bivariate data Suggested number of days: 15	I Can Statements	Notes/Comments	Unit Materials and Resources
In this unit, students will investigate bivariate categorical and numerical data. The work with categorical data connects with students' prior work with proportional relationships and rational numbers; the work with numerical data builds on students' learning from earlier units around linear functions and modeling.			
Common Core State Standards for Mathematical Content **Statistics and Probability — 8.SP** A. 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.	8.SP.1.1 Graph a set of points 8.SP.1.2 Interpret scatter plot as linear or nonlinear 8.SP.1.3 Interpret the graph as strong correlation (clustering) or weak (outliers) 8.SP.1.4 Construct a scatter plot on a plane using two variables 8.SP.1.5 Investigate the relationship between two quantities on a scatter plot 8.SP.1.6 Analyze the trend of a scatter plot and determine whether there is a positive, negative(linear), or no relationship(non-linear) 8.SP.1.7 Predict future outcomes using a scatter plot 8.SP.2.1 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.	**Comments** Representing and analyzing data requires that students use appropriate tools strategically (**MP.5**) and construct and critique arguments (**MP.3**) about the data.	

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.3.1	Graph the equation to demonstrate how the data is related		
	8.SP.3.2	Use the line of best fit to determine an equation in two variables for the data (y=mx + b)		
	8.SP.3.3	Use slope intercept form (y= mx + b) to determine the slope and y-intercept of the line of best fit		
	8.SP.3.4	Interpret the meaning of the slope and y-intercept in the context of the data given		
	8.SP.3.5	Determine relevant information from graph		
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?*	8.SP.4.1	Create a frequency table with collected data		
	8.SP.4.2	Interpret a frequency table		
	8.SP.4.3	Determine if there is a correlation between the information		
	8.SP.4.4	Read a graph to determine a correlation		
	8.SP.4.5	Construct a graph based on information given		
	8.SP.4.6	Make predictions and analyze the data between the variables in the frequency table		
	8.SP.4.7	Justify and defend the accuracy of my predictions		
Common Core State Standards for Mathematical Practice 3. Construct viable arguments and critique the reasoning of others. 5. Use appropriate tools strategically.				

Common Core Math Units
Grade 8

Unit 9: Nonlinear functions Suggested number of days: 10	I Can Statements	Notes/Comments	Unit Materials and Resources
In this unit, students investigate and interpret the representations of non-linear function and compare them to linear functions.			
Common Core State Standards for Mathematical Content **Functions — 8.F** A. Define, evaluate, and compare functions. 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*. **Functions — 8.F** B. Use functions to model relationships between quantities. 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. **Common Core State Standards for Mathematical Practice** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	8.F.3.1 Explain that y=mx+b is a linear function. 8.F.3.2 Recognize that non-linear is not straight 8.F.3.3 Use graphs to categorize functions as linear or non-linear 8.F.3.4 Use equations to categorize functions as linear or non-linear 8.F.3.5 Identify and prove functions that are non-linear. 8.F.3.6 Give examples of functions that are non-linear. 8.F.5.1 Identify equations as linear or nonlinear. 8.F.5.2 Explain how slope changes when given a graph. 8.F.5.3 Sketch a graph when given the description of the slope 8.F.5.4 Evaluate and describe properties based on a given graph 8.F.5.5 Analyze the graph for a functional relationships 8.F.5.6 Create a graph for a functional relationships 8.F.5.7 Sketch a graph by analyzing a situation that has been described verbally	**Comments** **8.F.A.3** was addressed in unit 6 in a general way as students learned to distinguish linear and non-linear functions by the graphs, tables, and equations. In this unit, students take that idea further by generating their own examples of functions that are not linear. This unit builds on the foundations of unit 6 as students investigate non-linear functions more explicitly (**8.F.B.5**). As students sketch graphs that exhibit the qualitative features of functions, they make sense of the situations (**MP.1**) while reasoning abstractly and quantitatively (**MP.2**).	

Common Core Math Units
Grade 8

Unit 10: Solving linear equations Suggested number of days: 11	I Can Statements	Notes/Comments	Unit Materials and Resources
With this unit, students build on their prior work in writing and solving equations **(6.EE.B.7, 7.EE.B.4a)** and their understanding of algebraic representations of linear functions.			
Common Core State Standards for Mathematical Content **Expressions and Equations — 8.EE** C. 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.	8.EE.7.a.1 Recognize one-variable linear equations with one solution (2x+3=7 or 5x + 3 = 3x + 7). 8.EE.7.a.2 Recognize one-variable linear equations with no solution (5x + 3 = 5x + 7). 8.EE.7.a.3 Recognize one-variable linear equations with infinite solutions (2x + 5 = 2x +5). 8.EE.7.a.4 Give examples of one-variable linear equations with one solution. 8.EE.7.a.5 Give examples of one-variable linear equations with no solution. 8.EE.7.a.6 Give examples of one-variable linear equations with infinite solutions. 8.EE.7.b.1 Solve multi-step one-variable linear equations, by combining like terms (w/rational coefficeints) . 8.EE.7.b.2 Solve multi-step one-variable linear equations, involving distributive property (w/rational coefficients). 8.EE.7.b.3 Solve real-world multi-step one-variable linear equations, involving distributive property (w/rational coefficients).	**Comments** Writing and solving equations require that students make use of structure (**MP.7**) and attend to precision (**MP.6**) as students apply properties of operations to transform equations into simpler forms.	

Common Core State Standards for Mathematical Practice 6. Attend to precision. 7. Look for and make use of structure.	8.EE.7.b.4	Solve real world one-variable equations, with variables on both sides of the equation (w/rational coefficients).		
	8.EE.7.b.5	Solve multi-step one-variable linear equations, with variables on both sides of the equation (w/rational coefficient).		

Common Core Math Units
Grade 8

Unit 11: Systems of linear equations Suggested number of days: 17	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit extends students' facility with solving problems by writing and solving equations.			
Common Core State Standards for Mathematical Content **Expressions and Equations — 8.EE** C. 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.*	8.EE.8.a.1 Recognize the solution of a system of equations by reading a graph of two linear equations and locating the point of intersection 8.EE.8.a.2 Recognize if there is no point of intersection, then the lines are parallel. 8.EE.8.a.3 Recognize if the graph is the same for the 2 equations, then the solution is infinitely many solutions. 8.EE.8.b.1 Solve systems of equations graphically or by inspection. 8.EE.8.b.2 Solve a system of equations algebraically (substitution or elimination), involving one solution. 8.EE.8.b.3 Solve a system of equations algebraically (substitution or elimination), involving no solution [parallel lines] 8.EE.8.b.4 Solve a system of equations algebraically (substitution or elimination), involving infinitely many solutions [same line] 8.EE.8.b.5 Convert linear equations from standard form to slope-intercept form	**Comments** Students' perseverance in solving real-world problems with systems of equations requires that they work with various solution methods and learn to discern when each method is most appropriate (**MP.1**). As with the previous unit, writing and solving systems require that students make use of structure (**MP.7**) and attend to precision (**MP.6**) as students apply properties of operations to transform equations into simpler forms.	

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*.		and vice-versa. Explain how the point of intersection represents the solution for two linear equations Examine real-world problems and create linear systems of equations Solve real-world problems algebraically or by inspection.		
Common Core State Standards for Mathematical Practice 1. Make sense of problems and persevere in solving them. 6. Attend to precision. 7. Look for and make use of structure.				

Common Core Math Units
Grade 8

Unit 12: Exponents and scientific notation Suggested number of days: 11	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit builds on the work of unit 4 as students extend their understanding of radicals and integer exponents to develop rules for working with exponents and scientific notation. Although the standards in this unit are in a major content cluster for Grade 8[1], this unit is sequenced near the end of the year since the content of this unit is not explicitly connected with other major content at this grade; however, this unit could be placed earlier in the year if desired.			
Common Core State Standards for Mathematical Content **Expressions and Equations — 8.EE** A. Work with radicals and integer exponents. 1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.*	8.EE.1.1 Identify the properties of integer exponents (laws of exponents). 8.EE.1.2 Apply properties of integer exponents when when multiplying and dividing with like bases. 8.EE.1.3 Simplify numerical expressions, by applying the one rule of exponents ($a^1 = a$) 8.EE.1.4 Simplify numerical expressions, by applying the zero rule of exponents ($a^0 = 1$ 8.EE.1.5 Simplify numerical expressions, by applying the product rule of exponents ($a^x \cdot a^y = a^{x+y}$) 8.EE.1.6 Simplify numerical expressions, by applying the quotient rule of exponents ($a^x / a^y = a^{x-y}$) 8.EE.1.7 Simplify numerical expressions, by applying the negative rule of exponents ($a^{-x} = 1/a^x$) 8.EE.1.8 Simplify numerical expressions, by applying the power rule of exponents ($(a^x)^y = a^{x \cdot y}$) 8.EE.1.9 Classify expression according to whether or not they are equivalent w/	**Comments** Modeling mathematics (**MP.4**) with radicals, integer exponents, and scientific notation requires that students attend to precision (**MP.6**) and look for and express regularity in repeated reasoning (**MP.5**). Students will also need to use appropriate tools strategically since some calculations can be completed more easily through visual inspection than with a calculator (**MP.5**).	

	one property, two properties, or three properties.		
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 x 10^8 and the population of the world as 7 x 10^9, and determine that the world population is more than 20 times larger*.	8.EE.3.1 Write numbers in scientific notation 8.EE.3.2 Apply the laws of exponents to the power of 10. 8.EE.3.3 Use scientific notation to estimate very large quantities. 8.EE.3.4 Use scientific notation to estimate very small quantities. 8.EE.3.5 Use scientific notation to determine how many times as large one number is in relation to another. 8.EE.3.6 Convert numbers from scientific notation to standard form 8.EE.3.7 Convert numbers from standard to scientific notation.		
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.4.1 Perform operations with numbers expressed in scientific notation without technology (Ex. $120 + 3 \times 10^4$). 8.EE.4.2 Use scientific notation and choose for measurements of appropriate size of very large quantities. 8.EE.4.3 Use scientific notation and choose for measurements of appropriate size of very small quantities.		
Common Core State Standards for Mathematical Practice 4. Model with mathematics.			

5. Use appropriate tools strategically. 6. Attend to precision. 8. Look for and express regularity in repeated reasoning.	8.EE.4.4 Interpret scientific notation that has been generated by technology (ex. Recognize 3.7E-2 (or 3.7e-2) from technology as 3.7×10^{-2}). 8.EE.4.5 Perform operations with numbers expressed in scientific notation with technology (Ex. $120 + 3 \times 10^4$).		

Common Core Math Units
Grade 8

Unit 13: Geometric relationships Suggested number of days: 13	I Can Statements	Notes/Comments	Unit Materials and Resources
This unit builds on students' work in Grade 7 with angle relationships **(7.G.A.2, 7.G.B.5)** as they work with angle relationships in triangles and investigate parallel lines cut by a transversal.			
Common Core State Standards for Mathematical Content **Geometry — 8.G** A. Understand congruence and similarity using physical models, transparencies, or geometry software. 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.5.1 Find the measures of missing angles 8.G.5.2 Make conjectures about relationships between angles 8.G.5.3 Determine the relationship between two angles when given parallel lines and a transversal. 8.G.5.4 Construct parallel lines and transversal to examine the relationships between created angles 8.G.5.5 Explore and justify relationships that exist between angles created when parallel lines are cut by a transversal 8.G.5.6 Apply my knowledge of vertical, adjacent, and supplementary angles to identify other pairs of congruent angles 8.G.5.7 Find the missing angle of a triangle. 8.G.5.8 Find the exterior angle of a triangle 8.G.5.9 Find the missing angle measure when given two similar triangles. 8.G.5.10 Construct various triangles and find the measures of interior and exterior angles 8.G.5.11 Explore and justify relationships that exist between angle sums and exterior angle sums of triangles 8.G.5.12 Explore and justify relationships that exist between the angle – angle criterion for similarity of triangles	**Comments** **B.A.A.5**The angle-angle criterion for similarity of triangles was investigated in unit 3. Students use tools strategically (**MP.5**) as they investigate angle relationships and generate or critique informal arguments (**MP.3**) to establish facts about angle relationships.	

Common Core State Standards for Mathematical Practice 3. Construct viable arguments and critique the reasoning of others. 5. Use appropriate tools strategically.	8.G.5.13	Construct various triangles and find measures of the interior and exterior angles		
	8.G.5.14	Form a hypothesis about the relationship between the measure of an exterior angle and the other two angles of a triangle		
	8.G.5.15	Construct triangles having line segments of different lengths but with two corresponding congruent angles		
	8.G.5.16	Compare ratios of sides to find a constant scale factor of similar triangles		

Common Core Math Units
Grade 8

Unit 14: Volume of cones, spheres, and cylinders Suggested number of days: 12	I Can Statements	Notes/Comments	Unit Materials and Resources
In Grade 7, students solved real-world problems involving surface area and volume of prisms and pyramids. In this unit, those understandings are extended to include problem solving with cylinders, cones, and spheres.			
Common Core State Standards for Mathematical Content **Geometry — 8.G** C. 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. **Common Core State Standards for Mathematical Practice** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	8.G.9.1 Identify the shapes of cones, cylinders, and spheres 8.G.9.2 Use appropriate formulas for volume of cones, cylinders, and spheres in mathematical and real-world situations	**Comments** As students model geometric relationships with formulas to solve problems (**MP.1**) involving 3-dimensional figures, they reason both abstractly and quantitatively (**MP.2**).	