Common Core Math 8



Proportional Relationships and Linear Equations Involving Bivariate Data and Solution of Simultaneous Equations



COMMON CORE MATH 8 – UNIT 2

Understanding of the connections between Proportional Relationships and Linear Equations Involving Bivariate Data and Solution of Simultaneous Equations

Students understand the connections between proportional relationships and linear equations involving bivariate data. Students will analyze and solve linear equations and pairs of simultaneous linear equations. Students use similar triangles to explain why the slope is the same between two distinct points on a non-vertical line in the coordinate plane as well as derive the equation of a line.

CLUSTER	COMMON CORE STATE STANDARDS
Understand the connections between proportional relationships, lines and linear equations.	8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. <i>For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</i>
	8.EE.6 Use similar triangles to explain why the slope <i>m</i> 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 <i>b</i> .
Investigate patterns of association in bivariate data.	8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. <i>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.</i>
Analyze and solve linear equations and pairs of simultaneous linear equations.	8.EE.7 Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where <i>a</i> and <i>b</i> are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
	8.EE.8 Analyze and solve pairs of simultaneous linear equations.a. Understand that solutions to a system of two linear equations in two variables

CLUSTER	COMMON CORE STATE STANDARDS
	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.
MATHEMATICAL PRACTICES	LEARNING PROGRESSIONS
1. Make sense of problems and persevere	http://ime.math.arizona.edu/progressions/#committee.
in solving them.	
	CDE Progress to Algebra K-8
2. Reason abstractly and quantitatively.	www.cde.ca.gov/be/cc/cd/documents/updateditem12catt3.doc
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.	

	ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
•	Students compare proportional relationships	How can I determine, when analyzing the motion of	Axis, <i>x</i> -axis, <i>y</i> -axis, origin
	using a variety of representations of these	two objects, which object has the greater speed?	Bivariate
	relationships (graph, table, symbols).		Coefficient
•	Students understand and represent slope as a	What is the meaning of the slope and intercept of a	Coordinate plane
	unit rate, and apply their knowledge of right	line, in the context of the situation?	Data
	triangles to represent slope. Students relate the		Distributive property

LAUSD Secondary Mathematics

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
slope with its concept as a rate and its visual	How may I use similar triangles to show that the	Equation
representation as a set of right triangle that are	slope is the same, given two distinct sets of points	Equivalent
similar for each line.	on a graph?	Estimate
• Students interpret slope and intercept using real		Graph
world applications (e.g. bivariate data).	How will I explain how I know that a pair of linear	Horizontal
• Students create equivalent equations to solve for	equations has one solution, no solutions, or	Intercept/point of interception
an unknown.	infinitely many solutions?	Point
• Students employ graphical, tabular and		Proportion
symbolic representations to express linearity and	Is the slope between any two points on the same line	Rate
determine the number of solutions.	the same? Explain your reasoning.	Slope
• Students interpret a linear equation in a real		Solution
world application by deriving the equation.	How can I create an equation with given information	Solve
	from a table, graph, or problem situation?	Symbol
		Triangle
	How can mathematics be used to provide models	Variable
	that helps us interpret data and make predictions?	Vertical

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
Inside Mathematics	• Identify cases in which a system of two	Formative Assessment
8.EE.7: Squares and Circles	equations in two unknowns has no solution,	SBAC - http://www.smarterbalanced.org/,
8.EE.8: Problem of the Month, "On Balance	an infinite number of solutions.	http://sampleitems.smarterbalanced.org/itemprevie
	• Solve a system of two equations (linear) in	w/sbac/index.htm
Mathematics Assessment Project	two unknowns algebraically.	Item #'S 42906 8 NS1-2, 8 EE 1-2,
8.EE.7: Solving Linear Equations in One Variable	• Estimate the point(s) of intersection for a	43056 8 EE 7 "Expressions and Equations 3"
8.EE.8: <u>Classify Solutions to Systems of Equations</u>	system of two equations in two unknowns	Sample Items:
8.EE.8c: Problem Solving Lesson, Solving Real Life	by graphing the equations.	8 EE 7: MAT.08.SR.1.000EE.D.201
Problems: Baseball Jerseys	• Use graphs of experiences that are familiar	8 EE 8: MAT.08.TE.1.000EE.C.200
	to students to increase accessibility and	MAT.08.TE.1.000EE.D.147
LAUSD Concept Lesson	supports understanding and interpretation of	SBAC Content Specs:
8.SP.3: <u>Tying the Knot</u>	proportional relationship. Students are	http://www.smarterbalanced.org/wordpress/wp-
8.SP.3: <u>Cal's Dinner Card Deals</u>	expected to both sketch and interpret	content/uploads/2011/12/Math-Content-
	graphs.	Specifications.pdf
Statistics: Investigate patterns of Association in		<u>8 EE 8: CR 8: Taxi Cabs</u>
Bivariate Data	For 8.EE.6 use this example to introduce it:	LAUSD Assessments
I AUGD A dearted Treath a day and Day and	• Explain why $\triangle ACB$ is similar to $\triangle DFE$.	District assessments can be accessed through:
LAUSD Adopted Textbooks and Programs		http://achieve.lausd.net/math
• Houghton Mittlin Harcourt, 2013 Go Math!	and deduce that AB has the same slope as	http://achieve.lausd.net/ccss

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT	
 McGraw-Hill, 2013, California Math, Courses 3 College Preparatory Mathematics, 2013, Core Connections, Courses 3 Pearson, 2013, Common Core System of Courses 	\overline{BE} . Express each line as an equation.	Use your Single Sign On to access the Interim Assessments State Assessments California will be administering the SMARTER Balance Assessment as the end of course for grades 3-8 and 11. There is no assessment for Algebra 1. The 11th grade assessment will include ítems from Algebra 1, Geometry, and Algebra 2 standards. For examples, visit the SMARTER Balance Assessment at: <u>http://www.smarterbalanced.org/</u>	
LANGUAGE GOALS for low achieving, high achieving, students with disabilities and English Language Learners			
Students will compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.			
<i>Example</i> : The difference between a distance-time graph and	nd a distance-time equation in terms of speed is	·	
Students will explain in writing how to derive the equation $y = mx$ for a line through the origin. <i>Example</i> : The <i>m</i> in the equation $y = mx + b$ for a line intercepting the vertical axis at <i>b</i> is because			
Students will identify the solution(s) to a system of two linear equations in two variables as the point(s) of intersection of their graphs. <i>Example</i> : To identify the solution(s) of a system of two linear equations in two variables, I will			
Students will describe the point(s) of intersection between two lines as points that satisfy both equations simultaneously. <i>Example</i> : $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because be and 6.			

DIFFERENTIATION 🚇		
UDL/ FRONT LOADING	ACCELERATION	INTERVENTION
Have students analyze the relationship between the	Acceleration for high achieving students:	Intervention for low achieving students and students
dependent and independent variables using graphs		with disabilities:
and tables, and relate these to the equation. Use	Explain that the connection between the unit rate in	
square tiles to construct different patterns that are	a proportional relationships and the slope of its	Use blocks or virtual manipulative to build patterns.
growing with constant amount to introduce	graph depends on a connection with the geometry of	Have the students work in groups to construct a
proportional relationship.	similar triangles. Explain to the students that the fact	table based on the growing pattern. Then have them
	that a line has a well-defined slope-that the ratio	explain how the patterns translate to the numbers

LAUSD Secondary Mathematics

DIFFERENTIATION 🚇			
UDL/ FRONT LOADING	ACCELERATION	INTERVENTION	
UDL/ FRONT LOADING Explain that the connection between the unit rate in a proportional relationships and the slope of its graph depends on a connection with the geometry of similar triangles. Explain to the students that the fact that a line has a well-defined slope—that the ratio between the rise and run for any two points on the line is always the same—depends on similar triangles.	ACCELERATIONbetween the rise and run for any two points on theline is always the same—depends on similartriangles.Have students use equations in two variables toexpress relationships between two quantities thatvary together.When they construct an expression like 10 - p torepresent a quantity, students can choose a variablesuch as C to represent the calculated quantity andwrite $C=10 - p$ to represent the relationship. Thisprepares students for work with functions in latergrades.	INTERVENTION they have on the table of values and subsequently have then graph the values.	
	prepares students for work with functions in later grades.		

References:

- 1. National Governors Association Center for Best Practices, Council of Chief State School Officers. (2010). *Common Core State Standards (Mathematics)*. Washington D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.
- 2. McCallum, W., Zimba, J., Daro, P. (2011, December 26 Draft). *Progressions for the Common Core State Standards in Mathematics*. Cathy Kessel (Ed.). Retrieved from http://ime.math.arizona.edu/progressions/#committee.
- 3. Engage NY. (2012). New York Common Core Mathematics Curriculum. Retrieved from <u>http://engageny.org/sites/default/files/resource/attachments/a-story-of-ratios-a-curriculum-overview-for-grades-6-8.pdf</u>.
- 4. Mathematics Assessment Resource Service, University of Nottingham. (2007 2012). Mathematics Assessment Project. Retrieved from http://map.mathshell.org/materials/index.php.
- 5. Smarter Balanced Assessment Consortium. (2012). Smarter Balanced Assessments. Retrieved from http://www.smarterbalanced.org/.
- 6. Partnership for Assessment of Readiness for College and Career. (2012). PARCC Assessments. Retrieved from http://www.parcconline.org/parcc-assessment.
- 7. California Department of Education. (2013). Draft Mathematics Framework Chapters. Retrieved from http://www.cde.ca.gov/be/cc/cd/draftmathfwchapters.asp.
- 8. National Council of Teachers of Mathematics (NCTM) Illuminations. (2013). Retrieved from <u>http://illuminations.nctm.org/Weblinks.aspx</u>.
- 9. The University of Arizona. (2011-12). Progressions Documents for the Common Core Math Standards. Retrieved from http://ime.math.arizona.edu/progressions.