Algebra 1 Unit Plan

Tier 1 Unit 2: Linear Functions, Systems, and Inequalities
November–December

ORANGE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

OFFICE OF MATHEMATICS

Contents

Curriculum Map

A STORY OF UNITS										
	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Alg1 Tier 1/2	QUANTITAIVE RELATIONSHIPS, GRAPHS,		LINEAR EQUATIONS, INEQUALITIES, FUNCTION	QUADRATIC RELATIONSHIPS AND FUNCTION		SOLVING QUADRATIC EQUATION		SEQUENCE AND EXPONENTIAL FUNCTION		
	Identify types of function with graphs and tables		Creating linear functions/equations and inequalities to model situation given and solve the problems	Identify quadratic functions, find key features for their graphs		Sove quadratic equations by graph, table, & algebraically		Identify exponential function, use the function to model situation given and solve problems		

Unit Overview

Unit 2: Linear Functions, Systems, and Inequalities
Essential Questions
➢ How can we use different tools and representations to solve problems? ➢ How can the same linear relationship be represented in multiple ways? ➢ When do we use systems of equations and inequalities to model real world problems? ➢ What are the different types of solutions that a system of equations can have? ➢ What is the best way to represent solutions to systems of inequalities?
Enduring Understandings
➢ Units can be used to describe and explain steps and solutions of problems that model a real world scenario. ➢ A linear function and a system of linear functions can be represented in multiple ways and can be used to model and solve problems in a real world context. ➢ A linear inequality and a system of linear equalities can be used to model and solve problems in a real world context. ➢ Solutions to inequalities and systems of inequalities are best represented graphically.
CCSS/NJSLS
1) A.REI.5: Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. 2) A.REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. 3) A.REI.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). 4) A.REI.11: Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. 5) A.REI.12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. 6) A.CED.1: Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*. 7) A.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. 8) A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*. 9) A.CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R*. 10) N.Q.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. 11) N.Q.2: Define appropriate quantities for the purpose of descriptive modeling. 12) F.IF.2: Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. 13) F.IF.4: For a function that models a relationship between two quantities, interpret key features of

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

14) F.IF.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**
15) F.IF.7a: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* Graph linear and quadratic functions and show intercepts, maxima, and minima.
16) F.BF.1a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
17) F.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
18) A.SSE.1: Interpret expressions that represent a quantity in terms of its context.
19) S.ID.6a: Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
20) S.ID.6b: Fit a linear function for a scatter plot that suggests a linear association.
21) S.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
22) S.ID.8: Compute (using technology) and interpret the correlation coefficient of a linear fit.

M : Major Content S: Supporting Content A : Additional Content

21st Century Career Ready Practice

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Calendar

November 2018						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

December 2018						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

Assessment Framework

Tests and Quizzes						
Assessment	CCSS	Estimated Time	Date	Format	SAP	Graded
Diagnostic/Readiness Assessment *Unit 2 Diagnostic*	All	<½ Block	10/5/14 or beginning of unit	Individual	No	No
Assessment Checkup #1 *Suggested: CL Chapter 3 End of Chapter Test #'s 7, 9* *CL Chapter 3 Standardized Test Practice #'s 5, 10*	A.SSE.1, F.LE.5, F.BF.1, F.IF.7, F.IF.2, F.IF.4, F.IF.5, A.CED.1, A.CED.2, A.REI.10, N.Q.1, N.Q.2	½ Block	10/14/14 or before lesson 3	Individual	Some tasks optional	Yes
Assessment Checkup #2	A.CED.3, A.REI.6, A.REI.11, N.Q.1, N.Q.2	½ Block	10/28/14 or before Lesson 7	Individual	Optional	Yes
Assessment Checkup #3 *CL Chapter 7 End of Chapter Test #'s 1-3, 7*	A.CED.3, A.REI.12, N.Q.1, N.Q.2	½ Block	11/4/14 or before Lesson 9	Individual	Some tasks optional	Yes
Unit 2 Assessment	All	1 Block	11/13/14	Individual	Some tasks optional	Yes

Tasks						
Assessment	CCSS	Estimated Time	Date	Format	SAP	Graded
Rich Task *Pumpkin Problem*	A.CED.2, A.CED.3, A.REI.6, N.Q.1, N.Q.2	½ Block	10/15/14 or as Lesson 3	Pair, or group	No	Optional
Reasoning Task *Reasoning with solutions to systems of linear inequalities task*	A.REI.5, A.REI.6, A.REI.11	½ Block	10/28/14 or before Lesson 7	Individual	Yes	Yes
Modeling Task *Fishing Adventures Task*	A.REI.12, A.CED.3	½ Block	11/11/14 or after Lesson 9	Individual	Yes	Yes

Scope and Sequence

Overview		
Lesson	Topic	Suggesting Pacing
1	Standard form of a linear function	3 days
2	Literal equations and slope-intercept form	3 days
3	Rich task (intro to systems of equations)	1 day
4	Least Squares Regression (Line of the best fit)	1 day
5	Correlation	1 day
6	Solving linear systems graphically and algebraically	3 days
7	Solving systems using linear combinations	3 days
8	Solving more systems	2 days
9	Graphing linear inequalities	2 days
10	Systems of linear inequalities	2 days
11	Systems with more than 2 inequalities	1-2 days

Summary:

1 reflection/diagnostic day
23 days spent on new content (9 lessons/topics)
2 task days
1 review day
1 test day
2 flex day

30 days in Unit 2

Lesson 1: Standard form of a linear function (day 1)

Objectives

- After investigating a problem on selling tickets, students will create and interpret a linear function written in standard form with at least ___ out of ___ parts answered correctly on an opened ended problem.

Focused Mathematical Practices

- MP 2: Reason abstractly and quantitatively
- MP 7: Look for and make use of structure

Vocabulary

- Standard form (may not be formally introduced until next day)

Common Misconceptions

- Be prepared to encounter confusion about function notation of a linear equation in standard form.

Lesson Clarifications

- This lesson uses pages 174 – 177 in CL ST 3.2
- Supplement #6 on page 175 with "Interpret what solution means in the context of the problem. Write your answer in a complete sentence."
- N.Q.2 is also a standard in this lesson; students should continuously be defining and using units as a way of descriptive modeling.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.CED.1: Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*. A.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. F.BF.1a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.	***Review*** • An equation can be created to solve problems involving a context • Variables can be used to represent unknown or changing quantities ***New*** • Linear equations can be written in several forms, including standard form, and can also represent relationships between quantities in a context.	***Review*** • Creating equations given a description of a problem situation • Solving problems given a description of a problem situation ***New*** • Creating linear equations in *standard form* given a description of a problem situation	CL ST 3.2 SR 1.1	1 day	CL ST pg. 185-186, #'s 1-5

F.IF.2: Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	***Review*** • Functions can be written using a specific notation • Function notation can reveal meaningful information about the inputs and outputs when it is modeling a problem in a context ***New*** • Linear functions in standard form can also be written using function notation and be interpreted in the context of the problem they model	***Review*** • Write and interpret functions in function notation that model a problem in a context ***New*** • Write and interpret linear functions in function notation written in *standard form* (also modeling a problem in a context)			
F.LE.5: Interpret the parameters in a linear or exponential function in terms of a context. A.SSE.1: Interpret expressions that represent a quantity in terms of its context.	***Review*** • Each part of a function that models a problem in a context has its own meaning and units ***New*** • In a context, each part of a linear function in standard form has its own meaning and units	***Review*** • Interpret parts of an expression/function that models a linear relationship ***New*** • Interpret parts of an expression/function that models a linear relationship in standard form			

Lesson 1: Standard form of a linear function (day 2)

Objectives

- After investigating a problem on selling tickets, students will graph and analyze a linear function in standard form by answering at least ___ out of ____ questions correctly on an exit ticket.

Focused Mathematical Practices

- MP 4: Model with mathematics

Vocabulary

- Standard form
- Slope-intercept form

Common Misconceptions

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Lesson Clarifications

- The focus of this lesson is to graph linear equations in standard form (by finding intercepts), however it also has opportunities to analyze the slope and intercepts in the context of a problem. Lesson also focuses on converting a linear equation from standard form to slope-intercept form.
- Lesson will need to be supplemented with additional practice on graphing linear equations
- Lesson should use pages 178 – 181 (on up to #11 on page 181)

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
F.IF.7a: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* Graph linear and quadratic functions and show intercepts, maxima, and minima.	***Review*** • ***New*** •	***Review*** • Graph a linear equation ***New*** • Determine x and y intercepts of a linear function in standard form and slope-intercept form • Use intercepts to graph a linear equation	CL ST 3.2	1 day	CL SP 3.2 #'s 26, 27 (also supplement with converting an equation in standard form to slope-intercept form)
A.CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	***Review*** • Properties of equality and inverse operations can be applied to solve for an unknown value (an equation with 1 variable) ***New*** • Properties of equality and inverse operations can be applied to solve for a specified variable (an equation with 2 variables)	***Review*** • Solving equations ***New*** • Transforming a linear equation in standard form into slope-intercept form			

Lesson 1: Standard form of a linear function (day 3)

Objectives

- After investigating a problem on selling tickets, students will analyze and identify the units being used in parts of a linear function by answering at least ___ out of ____ questions correctly on an exit ticket.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them

Vocabulary

- Standard form
- Slope-intercept form

Common Misconceptions

- This may be the first time students have seen something like this, and may take additional time to process it.

Lesson Clarifications

- The focus of this lesson is to analyze the units of a linear function in a context. Students should understand the units of each individual variable, coefficient, and expression that makes up the function, and how the units change (but stay balanced) when it is transformed into slope-intercept form
- Lesson should start with #12 on page 181 and go to #15 on page 184

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
N.Q.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	***Review*** • Knowing the resulting sign of any product ***New*** • Units are a way to understand and explain how an equation is transforming • The units of a function stay balanced even when it is transformed	***Review*** • Identify the units of variable quantities in a linear function ***New*** • Identify the units of each variable, coefficient, and expression within a linear function	CL ST 3.2	1 day	
F.LE.5: Interpret the parameters in a linear or exponential function in terms of a context. A.SSE.1: Interpret expressions that represent a quantity in terms of its context.	***Review*** • Each part of a function that models a problem in a context has its own meaning and units ***New*** •	***Review*** • Interpret parts of an expression/function that models a linear relationship ***New*** •			

Lesson 2: Literal Equations

Objectives

- Using the formula for degrees Celsius as an example, students will transform formulas by solving for a specified variable and by answering at least ___ out of ____ questions correctly on an exit ticket.

Focused Mathematical Practices

- MP 2: Reason abstractly and quantitatively
- MP 7: Look for and make use of structure

Vocabulary

- Literal equation

Common Misconceptions

- Students will struggle going from something that is already abstract (solving equations) to something that is even more abstract (solving equations with only variables). Be prepared to use multiple representations.

Lesson Clarifications

- Day 1 should use pages 188 – 192 and should include practice on converting back and forth from standard form and slope-intercept form and finding the intercepts and slopes of each. This is an opportunity to incorporate a mini lesson on operations with fractions (#8, pg 190). If time permits, also supplement with additional practice on graphing linear equations (no context).
- Day 2 should use pages 193 – 194 and should be supplemented with additional practice on transforming formulas.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	***Review*** • Properties of equality and inverse operations can be applied to solve for a specified variable (an equation with 2 variables) ***New*** • Properties of equality and inverse operations can be applied to solve for a specified variable (an equation with 2 or more variables)	***Review*** • Solving equations • Transform a linear equation in standard form into slope-intercept form ***New*** • Rearrange any formula/equation to highlight a quantity of interest (solve for a specified variable)	CL ST 3.3	3 days	Day 1: CL SP 3.3 #10, 15 (supplement with graphing each problem) Day 1: CL SP 3.3 #20, 23

Lesson 3: Rich Task (Pumpkin problem)

Objectives

- By working in pairs on a rich task, students will solve a system of linear equations using multiple representations by achieving a score of ___ on a rubric.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 2: Reason abstractly and quantitatively
- MP 4: Model with mathematics
- MP 7: Look for and make use of structure

Vocabulary

- System of equations

Common Misconceptions

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Lesson Clarifications

- The task itself will serve as the assessment checkpoint. Although it can be done in small groups, it serves as an introductory/diagnostic task for the systems of equations topic.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. A.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.	***Review*** • Equations can be used to model relationships between quantities ***New*** • Equations can be used to model a system of equations and/or to represent constraints • Solutions to a system of equations are the values that make both equations (or constraints) true.	***Review*** • Create equations to model a problem in a context ***New*** • Create equations to model a system of equations in a context • Solve a system of equations • Interpret solutions as being viable or non-viable • Verify if a set of values is a solution to a system of equations (or constraints)	Pumpkin Problem (located in SR)	1 day	The task itself will serve as the assessment checkpoint.

Lesson 4: Least Squares Regression (Line of best fit)

Objectives

- By working on a real –world problem, students will
  * learn the skill to create scatter plot on a graphing calculator
  * decide the least squares regression (line of the best fit) to model the problem data
  * interpret the equation of the line of best fit in terms of the problem situation
  * Use the best fit line equation to do interpolation and extrapolation to estimate data

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 2: Reason abstractly and quantitatively
- MP 4: Model with mathematics

Vocabulary

- Scatter plot, Linear egression, Least squares regression, Interpolation, Extrapolation

Common Misconceptions

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Lesson Clarifications

- The main concept of the lesson is "we can use a mathematical model to represent data on two quantitis"
- Students will use GRAPHING calculator to create scatter plot, find the line of best fit (not spend time to plot the points manually)

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
S.ID.6a: Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. S.ID.6b: Fit a linear function for a scatter plot that suggests a linear association. S.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data	***Review*** • Equations can be used to model relationships between quantities • Understand the meaning of rate of change (slope) for a situation given ***New*** • If there is a linear association between the independent and dependent variables of a data set, you can us a linear regression to make predictions within the data. • Understand the concept of interpolation and extrapolation	***Review*** • Evaluate linear expression for a given value • Solve linear equations ***New*** • Use graphing calculator to create a scatter plot, find the line of best fit • Use the line regression line (line of the best fit) to predict data • Interpret meaning of slope and intercept for the linear regression line in terms of context given	CL ST9.1 Note: Skip Problem 2 (P527 - 529) Use Problem 1 as investigation & mini lesson/guided practice Problem 3 as individual practice	1 day	CL TE (Check for understanding) page 532A (students practice sheet can be printed from online "warm up" resource

Lesson 5: Correlation

- Student will
  * understand the meaning of correlation for a linear regression line
  * use graphing calculator to fine the correlation coefficient or a linear regression
  * interpret correlation coefficient for a data set

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 2: Reason abstractly and quantitatively
- MP 4: Model with mathematics

Vocabulary:
Positive association, Negative association, No association, correlation, correlation coefficient

Common Misconception:
* Student might think about the positive correlation coefficient always has stronger correlation than negative correlation coefficient (Teaching strategy: when comparing the correlation with two linear regression, indicate the absolute value of the correlation coefficient closer to 1 is stronger)
* Students might think the coefficient of x on the equation is correlation coefficient

Lesson clarification:

- In this lesson, student will NOT be requested to use formula to find the correlation coefficient. Students will use graphing calculator to find it ONLY.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
S.ID.6a: Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. S.ID.6b: Fit a linear function for a scatter plot that suggests a linear association. S.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S.ID.8: Compute (using technology) and interpret the correlation coefficient of a linear fit.	New • Meaning of correlation coefficient • Compare two variables can show a positive association, negative association, or no association • Correlation coefficient closer to 1 or -1 means the regression line has stronger correlation	New • Determine correlation coefficient of a regression line by using graphing calculator • Using correlation coefficient to determine if a linear regression equation would best describe the situation	CL ST 9.2	1 day	CL TE (Check for understanding) page 540A (students practice sheet can be printed from online "warm up" resource

Lesson 6: Solving systems algebraically and graphically

Objectives

- After investigating several real world examples, students will solve systems of equations graphically and algebraically by scoring ____ out of ____ correctly on an exit ticket.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 4: Model with mathematics

Vocabulary

- System of equations
- Substitution method
- Consistent systems
- Inconsistent systems

Common Misconceptions

- Students may struggle with contextualizing each problem. Be prepared to provide strategies for student's ability to do MP 1. Also look for opportunities to make connections to the Pumpkin Problem.

Lesson Clarifications

- It is suggested to break up the three days by the three problems in this section.
- These lessons provide opportunities to incorporate a mini lesson on fractions and decimals.
- Split the Assessment Checkpoint up over 3 days, as necessary.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.REI.5: Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. A.REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. A.REI.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve	***Review*** • Equations can be used to model a system of equations and/or to represent constraints. • Graphs represent all solutions of the function they represent. ***New*** • The point of intersection of a system of equations represents the solution and can be verified algebraically • Using the transitive property, part of one equation of a system can be substituted into the other in order to solve for a single variable • A system of equations	***Review*** • Graph linear equations • Create equations to model a problem in a context • Solve equations ***New*** • Solve a system of equations by graphing • Solve a system of equations algebraically • Classify systems of equations by the nature of their solutions	CL ST 6.1	3 days	CL SP 6.1 #'s Vocab, 2, 14, 15, 17

(which could be a line). A.REI.11: Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.	with infinite solutions is just two equations that are multiples of one another.				

Lesson 7: Solving systems using linear combinations

Objectives

- After investigating a problem about vacation packages, students will create and solve systems of equations that model a problem situation by scoring ____ out of ____ correctly on an exit ticket.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 4: Model with mathematics

Vocabulary

- Linear combinations method (elimination)

Common Misconceptions

- Students will struggle with this if they don't have strong skills in solving equations and properties of equality. Be prepared to incorporate a quick review before this lesson. (i.e. does the equality of an equation change if I multiply both sides by a certain value?)

Lesson Clarifications

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CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.	***Review*** • Equations can be used to model a system of equations and/or to represent constraints. ***New*** • A system of equations can be manipulated (using operations such as multiplication and division) in order to be added or subtracted with one another. This process can eliminate variables and make it possible to find the value of a single variable	***Review*** • Create equations to model a problem in a context • Solve systems of equations by graphing or substitution ***New*** • Solve a system of equations using linear combinations	CL ST 6.2	3 days	Day 1: CL SA 6.2 Day 2: CL SP 6.2 #'s 8, 14

Lesson 8: Solving more systems

Objectives

- After investigating several real world problems, students will create and solve systems of equations that model a problem situation by scoring ____ out of ____ correctly on an open-ended task.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 4: Model with mathematics

Vocabulary

- Linear combinations method (elimination)

Common Misconceptions

- Students may continue to struggle with tacking problems with decimals and fractions. Continue to build in a review and/or a mini lesson on this.

Lesson Clarifications

- This lesson is very similar to the previous lesson, but gives students further practice. It also contains opportunities for students to reflect and compare on all methods that can be used to solve systems.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.	***Review*** • Equations can be used to model a system of equations and/or to represent constraints. • A system of equations can be manipulated (using operations such as multiplication and division) in order to be added or subtracted with one another. This process can eliminate variables and make it possible to find the value of a single variable ***New*** •	***Review*** • Create equations to model a problem in a context • Solve systems of equations by graphing or substitution • Solve a system of equations using linear combinations ***New*** • Compare the differences between the three methods for solving systems	CL ST 6.3	2 days	CL SA 6.3 #1

Lesson 9: Graphing inequalities

Objectives

- Using a basketball problem as launch, students will create linear inequalities and represent/interpret their solutions on a coordinate plane and will score ___ out of ____ correctly on an exit ticket.

Focused Mathematical Practices

- MP 4: Model with mathematics

Vocabulary

- Half plane, linear inequality

Common Misconceptions

- Students may struggle with understanding the different/similarities between a linear equation and a linear inequality
- Students may struggle with knowing which half plane to shade

Lesson Clarifications

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CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.REI.12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.	***Review*** • Graphs represent all solutions of the function they represent. ***New*** • Solutions to linear inequalities are represented by a half-plane and sometimes include the boundary line (defined by the inequality sign) • Certain problems in a context are best represented as a linear inequality	***Review*** • Graph linear equations ***New*** • Graph linear inequalities • Interpret and understand solutions to linear inequalities • Create a linear inequality to model a problem situation	CL ST 7.1	2 days	CL SP 7.1 #'s 2, 9, 11, 22, 25, 28

Lesson 10: Systems of linear inequalities

Objectives
- Using a basketball problem as launch, students will represent and interpret solutions to linear inequalities on a coordinate plane and will score ___ out of ____ correctly on an exit ticket.

Focused Mathematical Practices
- MP 4: Model with mathematics

Vocabulary
- Half plane, linear inequality, constraints, solution of a system of linear inequalities

Common Misconceptions
- Students may struggle with understanding how the graph of a system of inequalities represents the solution (i.e. they may not make the connection between the overlapping shaded areas and all (x,y) pairs that make the system true)

Lesson Clarifications
- It is suggested to break up the lesson into one problem each day (Problem 1: pgs420 – 424 on day 1, Problem 2: pgs 425 – 429 on day 2)

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.REI.12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*	***Review*** • Solutions to linear inequalities are represented by a half-plane and sometimes include the boundary line (defined by the inequality sign) • Certain problems in a context are best represented as a linear inequality ***New*** • The solutions to a system of linear inequalities is the intersections of the corresponding half-planes • Systems of linear inequalities can model problems and/or constraints in real world contexts	***Review*** • Graph linear inequalities • Interpret and understand solutions to linear inequalities • Create a linear inequality to model a problem situation ***New*** • Graph systems of linear inequalities • Interpret and understand solutions to systems of linear inequalities • Create a system of linear inequalities to model a problem in a context	CL ST 7.2	2 days	CL SP 7.2 #'s vocab, 2, 8, 9, 15

Lesson 11: Systems with more than two linear inequalities

Objectives

- By investigating a real world problem, students will create and graph systems of linear inequalities from a context and will score ___ out of ____ points on an extended constructed problem.

Focused Mathematical Practices

- MP 4: Model with mathematics

Vocabulary

-

Common Misconceptions

-

Lesson Clarifications

- This lesson should contain at least pages 432 – 434 and use pages 435 – 436 as the class activity. Continue with problems from pages 437 – 438 if time permits.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.REI.12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. A.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.	***Review*** • The solutions to a system of linear inequalities is the intersections of the corresponding half-planes • Systems of linear inequalities can model problems and/or constraints in real world contexts ***New*** • Systems of more than two linear inequalities can model problems and/or constraints in real world contexts	***Review*** • Graph systems of linear inequalities • Interpret and understand solutions to systems of linear inequalities • Create a system of linear inequalities to model a problem in a context ***New*** • Graph, interpret, and create systems with more than two linear inequalities from a context	CL ST 7.3	1-2 days	CL SP 7.3 #'s 2, 7

Ideal Math Block

The following outline is the department approved ideal math block for grades 9-12.

1) Do Now (7-10 min)
    a. Serves as review from last class' or of prerequisite material
    b. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

2) Starter/Launch (5 min)
    a. Designed to introduce the lesson
    b. Uses concrete or pictorial examples
    c. Attempts to bridge the gap between grade level deficits and rigorous, on grade level content
    d. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

3) Mini-Lesson (15-20 min)
    a. Design varies based on content
    b. May include an investigative approach, direct instruction approach, whole class discussion led approach, etc.
    c. Includes CFU's
    d. Anticipates misconceptions and addresses common mistakes

4) Class Activity (25-30 min)
    a. Design varies based on content
    b. May include partner work, group work/project, experiments, investigations, game based activities, etc.

5) Independent Practice (7-10 min)
    a. Provides students an opportunity to work/think independently

6) Closure (5-10 min)
    a. Connects lesson/activities to big ideas
    b. Allows students to reflect and summarize what they have learned
    c. May occur after the activity or independent practice depending on the content and objective

7) DOL (5 min)
    a. Exit ticket

Sample Lesson Plan

Lesson	Lesson 1: Standard form of a linear equation (Day 1)	**Days**	1
Objective	After investigating a problem on selling tickets, students will **create and interpret** a linear function written in standard form with at least ___ out of ___ parts answered correctly on an opened ended problem.	**CCSS**	A.CED.1, A.CED.2, F.BF.1a, F.IF.2, F.LE.5, A.SSE.1
Learning activities/strategies	**Do Now:** • Students complete problems 1-2 on Notebook slide #1. **Starter/Launch:** • Students work on the Let's Get Started using Notebook slide #3. They answer simple questions that give context to the upcoming problem situation. **Mini lesson (CL ST 3.2, pg 174):** • Teacher models 1a using the Notebook slide #4. Students complete 1b-1c exactly the same way. • Students complete #'s 2-3 in their books. Teacher calls on several students to answer #4 verbally. • Student reads aloud the example on page 175. • Teacher writes down "guesses" for the answer to #5, and then demonstrates how the units of f(s, a) are dollars (break down each part of 5s + 10a to show this) on Notebook slide #5. After demonstration, students then write down their complete answer/explanation to #5. • Teacher models #6a using Notebook slide #6. Students complete 6b-6d exactly the same way. • Students do a think-pair-share for #'s 7-8. Teacher calls on several pairs to share their response to #8. **Class activities:** • Students work in pairs or small groups to complete #'s 1-4. (some groups may require extra assistance) • Teacher has groups periodically go up to the SMART board to fill out parts of #3 using Notebook slide #7. • Teacher emphasizes that #4 requires a logical, clear explanation that is supported by mathematical evidence and reasoning. Teacher provides feedback to answers that may not be incorrect, but could be improved with more evidence/reasoning. • Teacher preselects 2-3 students to share their exemplary answer to #4, and uses a document camera to display their write up. **Independent Practice:** • Students work on the extended problem on page 185, #'s 1-5 (#'s 4 and 5 may be modified) • Students work independently and quietly, as this also serves as the assessment checkpoint. Teacher provides assistance only where really needed, and communicates to students that part of this lesson is working on MP 1. **Closure:** • How is today's lesson different and similar to past lessons where we looked at linear relationships?		

	• What are some skills that you learned or practice from today's lesson? **DOL (exit ticket):** • The assessment checkpoint will occur during the independent practice • HW is CL SP 3.2, #'s 8-10 and 14-16
Differentiation	3: 2: 1:
Assessment	Formative: Exit ticket and CFU's Summative: Unit 2 Assessment and Checkup #1 Authentic:
Common Misconceptions	

Lesson #	Dropbox location and filename	Description
1	Orange 9-12 Math > Algebra 1 > Unit 2 > Supplemental Resources > **AR 1.1**	Lesson 1, Day 1 Notebook slides
2	Orange 9-12 Math > Algebra 1 > Unit 2 > Supplemental Resources > **Pumpkin Problem**	Pumpkin problem task presentation to be used for Lesson 3
3	Orange 9-12 Math > Algebra 1 > Unit 2 > Supplemental Resources > **Reasoning with a system of linear equations task**	Required reasoning task to be used during Lesson 7
4	Orange 9-12 Math > Algebra 1 > Unit 2 > Supplemental Resources > **Fishing Adventures**	Required modeling task to be used during Lesson 11

Supplemental Material

ELL/SWD supplement link

http://nlvm.usu.edu/en/nav/vlibrary.html
http://www.explorelearning.com/index.cfm?method=cResource.dspBrowseCorrelations&v=s&id=USA-000
http://www.thinkingblocks.com/

Additional Resources

Performance Tasks				
CCSS	SMP	Dropbox location and filename	SAP	Link (original task and answer key)
		Orange 9-12 Math > Algebra 1 > Unit 2 > Supplemental Material > **Quinoa task**	Optional	https://www.illustrativemathematics.org/illustrations/936

Collaborative Activities				
CCSS	SMP	Dropbox location and filename	SAP	Link
A.REI.6 A.REI.12 A.CED.3	MP 1 MP 2 MP 3 MP 4	Orange 9-12 Math > Algebra 1 > Unit 2 > Supplemental Material > **Boomerang Activity** & **Boomerang Slides**	No	http://map.mathshell.org.uk/materials/download.php?fileid=1241 (Lesson plan materials)
A.REI.6 A.CED.3	MP 2 MP 3	Orange 9-12 Math > Algebra 1 > Unit 2 > Supplemental Material > **Boomerang Activity** & **Boomerang Slides**	No	http://map.mathshell.org.uk/materials/download.php?fileid=669 (Lesson plan materials)

Unit Assessment/PARCC aligned Tasks					
#	Dropbox location and filename	Task Type	SAP	CCSS	SMP
1	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.1**	I (1 pt)			
2	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.2**	I (1 pt)			
3	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.3**	I (1 pt)			
4	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.4**	I (1 pt)			
5	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.5**	I (2 pts)			
6	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.6**	I (2 pts)			
7	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.7**	I (2 pts)			
8	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.8**	I (4 pts)			
9	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.9**	II (3 pts)			
10	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.10**	II (4 pts)			
11	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.11**	III (3 pts)			
12	Orange 9-12 Math > Algebra 1 > Unit 2 > Additional Resources > **Task 2.12**	III (6 pts)			

Appendix A – Acronyms

#	Acronym	Meaning
1	AA	Authentic Assessment
2	AM	Agile Minds
3	AR	Additional Resources
4	CCSS	Common Core State Standards
5	CFU	Check for understanding
6	CL	Carnegie Learning
7	CL SA	Carnegie Learning Student Assignments
8	CL SP	Carnegie Learning Skills Practice
9	CL ST	Carnegie Learning Student Text
10	EOY	End of Year (assessment)
11	MP	Math Practice
12	MYA	Mid-Year Assessment (same as PBA)
13	PBA	Problem Based Assessment (same as MYA)
14	PLD	Performance Level Descriptors
15	SAP	Student Assessment Portfolio
16	SMP	Standards for Mathematical Practice