Algebra II

Unit 1 Plan

Unit 1: Functions and Systems of Equations

ORANGE PUBLIC SCHOOLS 2014 - 2015

OFFICE OF CURRICULUM AND INSTRUCTION

OFFICE OF MATHEMATICS

Algebra 2 Unit 1

Unit Overview

Unit 1: Functions and Systems of Equations

Essential Questions

- How do variables help you model real-world situations and solve equations?
- What are functions and relations?
- What are the different forms of a linear equation and how do we use them?
- How does representing functions graphically help you solve a system of equations?
- How does writing equivalent equations help you solve a system of equations?
- When and how is mathematics used in solving real world problems?
- What characteristics of problems would determine how to model the situation and develop a problem solving strategy?

Enduring Understandings

- You can represent patterns using algebraic expressions and simplifying these expressions.
- You can represent some mathematical phrases and real-world quantities using algebraic expression.
- You can use the properties of equality and inverse operations to solve equations. Sometimes, not value of the variable makes an equation true. For identities, all values of the variable make the equation true.
- Sometimes it is possible to model data from a real-world situation with a linear equation. You can then use the equation to draw conclusions about the situation.
- A pairing of items from two sets is special if each item from one set pairs with exactly one item from the second set.
- Consider a line in the coordinate plane. If you move from any point on the line to any other point one the line, the ratio of the vertical change to the horizontal change is constant. That constant ratio describes the slope of the line.
- The slopes of two lines in the same plane indicate how the lines are related.
- To solve a system of equations, find a set of values that replace the variables in the equations and make each equation true
- You can solve a system of equations by writing equivalent systems until the value on one variable is clear. Then substitute to find the value(s) of the other variable
- A point of intersection (x,y) of the graphs of the functions f and g is a solution of the system y = f(x), y = g(x)
- Mathematics can be used to solve real world problems and can be used to communicate solutions to stakeholders

Common Core State Standards

- ***N.RN.3**: Explain why sums and products of rational numbers are rational, that the sums of a rational number and an irrational number is irrational, and that the product of a nonzero rational number and an irrational number is irrational.
- ***A-SSE-1a:** Interpret parts of an expression, such as terms, factors, and coefficients.
- **A.SSE.3**: choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression
- ***A.CED.1:** Create equations and inequalities in one variable and use them to solve problems
- ***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
- ***A.CED.4:** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations
- ***A.REI.1:** Explain each step in solving a simple equation as following from the equality of numbers

asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

- 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.7: Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
- 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-APR -7:** Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions
- ***F-IF-1:** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y = f(x).*
- ***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.
- **F-IF-4:** For a function that models a relationship between two quantities, and sketch graphs showing key features given a verbal description of a relationship.
- **F-IF-8:** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
- **F-IF-9:** Compare properties of two functions each represented in a different way (algebraically, numerically in tables, or by verbal descriptions
- ***F-LE-1.b**: Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

*: The standard will only be assessed in this unit.

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

Algebra 2 Unit 1

Calendar

September 2014						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
	1	**2**	**3**	**4**	**5**	**6**
7	**8** *First Day* *Establish routines and classroom rules*	**9** *Establish routines and classroom rules* *Unit 1 Diagnostic Test*	**10** *(L 1.1, 1.2) Expressions and properties of real numbers*	**11** *(L 1.3) Algebraic Expression*	**12** *(L 1.4) Solve equations*	**13**
14	**15** *Check up 1* *Reteach (Differentiated remediation)*	**16** *(L 2.1) Relation and Function*	**17** *(L 2.3) Linear function and slope-intercept form*	**18** *(L2.4) Linear function and point slope form*	*19* *(Linear Applications Lesson (Sample lesson plan)*	**20**
21	**22** *Check up 2* *Reteach (Differentiated Remediation*	**23** *(L3.1) Solving systems using tables and graphs (Day 1)*	**24 (half day)** *(L 3.1) Solving systems using tables and graphs (Day 2)*	**25** *(L 3.2) Solving systems algebraically*	**26** *(L 4.9,) Solving systems with a linear and a quadratic function (Day 1)*	**27**
28	**29** *(L 4.9) Solving systems with a linear and a quadratic function (Day 2)*	**30** *Check up 3* *Reteach*				

October 2014						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
			1 *Review*	**2** *Unit 1 Assessment*	**3** *Authentic Assessment* *(Flexible day)*	**4**
5	**6** *Reteach* *(Flexible day)*					

Scope and Sequence

Overview		
Lesson	Topic	Suggesting Pacing and Dates
1	Expressions and properties of real numbers	1 day
2	Algebraic Expressions	1 day
3	Solving equations	1 day
4	Relations and functions	1 day
5	Linear functions and slope-intercept form	1 day
6	Linear functions and point-slope form	1 day
7	Linear applications	1 day
8	Solving System Using Tables and Graphs	2 days
9	Solving Systems Algebraically (Substitution)	1 day
10	Solving Systems with a Linear and Quadratic Function	2 days

Assessment Framework

Assessment	CCSS	Estimated Time	Format	Graded
Diagnostic/Readiness Assessment (Beginning of Unit)	N.RN3, A.SSE 1 &3 A.CED 1, 2, &4 A.REI.1, I.IF.1, 2, 4, 8, &9 F.LE-1b, A-APR.7	½ Block	Individual	No
Assessment Check Up 1 Pearson Algebra II Chapter 1 quiz *p 53, question # 1 ~15 & #24 ~26* (After lesson 1.4)	A.SSE.3 , N.RN.3 A.APR 7, A.SSE 1 A.CED.1 & 4	½ Block	Individual	Yes
Assessment Check Up 2 Pearson Algebra II Chapter 2 quiz *P 127, question #1, 3, 8, 11, 12, 14, 17 &23* (After lesson 2.4)	F.IF. 1, 2, 4, 8, & 9 A.CED 2 F.LE.1b	½ Block	Individual	Yes
Assessment Check Up 3	A.CED.2, A.REI 6, 7, 11	½ Block	Individual	Yes
Unit 1 Assessment	N.RN3, A.SSE 1 &3 A.CED 1, 2, &4 A.REI.1, I.IF.1, 2, 4, 8, &9 F.LE-1b, A-APR.7	1 Block	Individual	Yes
Performance Task 1 -- Speeding Ticket Task --	N.RN3, A.SSE 1 &3 A.CED 1, 2, &4 A.REI.1, I.IF.1, 2, 4, 8, &9 F.LE-1b, A-APR.7	1 Block	Pair or Group	Yes

Lesson Analysis

Lesson 1: Expressions and Properties of Real Numbers

Objective

- Using variables and properties of real numbers, students will work (individually/in pair/in group) to create algebraic expressions to describe pattern correctly for 2 out of 3 questions on daily exit slip.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP3: Construct viable arguments and critique the reasoning of others.
- MP 7: Look for and make use of structure.

Vocabulary: variable, constant, numerical expression, algebraic expression, inverse, reciprocal, rational numbers, irrational numbers, integers, whole numbers, and natural numbers, counterexample.

Common Misconceptions:

- Reading a graph and identifying coordinate points incorrectly
- Misunderstanding of the use of "nth" term
- The difference between whole numbers and natural numbers
- A variable represents an unknown number
- Using a number line

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.SSE.3: choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression	***Review*** • Vocabulary (constant, variable ,numerical expression, algebraic expression) • A variable represents and unknown number ***New*** • Variables can be used to represent variable quantities in real world situations	***Review*** • Identify and describe a pattern **New** • Write an expression for a pattern, from a table, a graph, and situation given • Find the value of nth term of a pattern based on the expression created	Lesson 1-1	1 day	Math XL: mid-chapter practice and review exercise 1,2,3
N.RN.3: Explain why sums and products of rational numbers are rational, that the sums of a rational number and an irrational number is irrational, and that the product of a nonzero rational number and an irrational number is irrational.	***Review*** • Relationships among subsets of the real numbers ***New*** • Properties of real numbers are relationships that are true for all real numbers • Algebra involves using operations between all numbers, real and imaginary	***Review*** • Identify the subsets that a number belongs to • Classify appropriate subsets of real numbers for a variable for the context given ***New*** • Identify properties of real numbers as perform operations on numerical expressions	Lesson 1-2 Task: Kitchen Floor Tiles		

Lesson 2: Algebraic Expressions

Objective

- Using like terms and properties of real numbers, students will work (individually/in pair/in group) to simplify and evaluate algebraic expressions correctly for 3 out of 4 questions on the daily exit slip.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 3: Construct viable arguments and critique the reasoning of others.

Vocabulary: evaluate, term, coefficient, constant, like terms

Common Misconceptions:

- Errors with negative signs in front of a product
- Distributive property with a negative in front of the parenthesis (Ex. mistake: -2(3x +1) = -6x + 2)
- Like terms include having the same exponent along with the same variable (ex. Students will see $4x^2$, and 5x as like terms)
- The constant value is also a term of the expression

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A-APR -7: Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions	***Review*** • Algebraic expressions can be simplified, used to form equivalent expressions, and evaluated for given values of variables • Understanding order of operations ***New*** • The properties for real numbers apply to variables as well • Algebraic expression can be used to represent real life situations	***Review*** • Evaluating an expression for a specific value given to the variable • Using like terms to simplify expressions ***New*** • Using distributive property • Using algebraic properties to simplify and evaluate expressions	Lesson 1-3 Task: Animal Population Task: Delivery Trucks	1 day	Lesson check: pg 22; #'s 1, 3, 5, & 7
A-SSE-1a: Interpret parts of an expression, such as terms, factors, and coefficients	***Review*** • Like terms are used to simplify algebraic expressions • Order of operations • Terms of an expression are individual numbers or the product of a number and a variable	***Review*** • Identifying like terms • Using order of operations ***New*** • Identifying which property is being represented in an expression • Identify what variables are representing in real life situations			

Lesson 3: solving equations

Objective

- Using variables and inverse operations, students will work (individually/in pair/in group) to create and solve equations that can be used to represent real life situations correctly for at least 3 out of 4 questions on the exit slip.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 3: Construct viable arguments and critique the reasoning of others.
- MP 4: Model with mathematics.

Vocabulary: algebraic equation, solution, inverse operations, identity, literal equation, reflexive property of equality, symmetric property of equality, transitive property of equality, substitution property of equality, addition property of equality, addition/subtraction/multiplication/division property of equality.

Common Misconceptions:

- Errors with negative signs especially when distributing
- Incorrect use of inverse operations
- Errors in isolating the variable in an equation or formula with more than one variable

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 **A.CED.1:** Create equations and inequalities in one variable and use them to solve problems	***Review*** • Use the context of a problem to identify the formula needed to solve ***New*** • Literal equations are formulas which include more than one variable and the problem determines what variable to solve for • Variables are easier to solve for when they are isolated on one side of the equal sign	***Review*** • Identify and use common formulas to solve for real life situations ***New*** • Identify which variable is being asked about to determine what variable to solve for • Using inverse operations and like terms to rearrange equations	Lesson 1-4 Task: Harvesting the Field	1 day	Lesson Check pg. 30; #'s 2, 3, 6, & 9 Chapter 1 quiz (page 53, question # 1 ~15 & #24 ~26)
A.REI.1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	***Review*** • The difference between an equation and an expression • Inverse operations ***New*** • Properties of equality • An equation does not always have just one solution, it can have no solution or be true for every value of the variable	***Review*** • Isolate the variable in an equation to find the solution • Using inverse operations and like terms to solve equations ***New*** • Writing algebraic equations from real life situations • Solve equations and use properties of equality to justify each step.			

Lesson 4: Relations and functions

Objective

- Using different sets of relations, students will work (individually/in pair/in group) to identify if a relation is a function and write and evaluate functions using function notation correctly for at least 3 out of 4 on exit slip.

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 3: Construct viable arguments and critique the reasoning of others.
- MP 4: Model with mathematics.

Vocabulary: relation, function, domain, range, vertical-line test, function rule, function notation, independent variable, dependent variable, set notation.

Common Misconceptions:

- Using horizontal lines instead of vertical lines when determining if a graph is a function or a relation
- Omit parentheses when writing a relation as ordered pairs in set notation.
- Switching domain (input) with range (output) values

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
F-IF-1: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y = f(x).*	***Review*** • The difference between a function and relation • Domain and range • Input and output values • Independent and dependent variables ***New*** • Four ways to represent relations	***Review*** • Determine if a relation is a function from a table, mapping diagram, and set of ordered pairs Identifying domain and range from a given relation • Using vertical line test to determine if a relation is a function from a graph • Identify which variables are independent and which are dependent ***New*** • Use set notation to represent relation, domain, and range of a function.	Lesson 2-1 Task: Interpret function notation	1 day	Practice exercises; pg. 65 #'s 12, 14, 20, 26
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*** • The function rule is an equation that has an output value for all input values ***New*** • Function notation is used write a function rule • Evaluating functions is the same as evaluating algebraic expressions	***Review*** • Identifying input and output values for different function rules and real life situations ***New*** • Using function notation to write function rules from real life situations • evaluate a function for a given input value			

Lesson 5: Linear functions and slope- intercept form

Objective

- Using slope intercept form, students will work (individually/in pair/in group) to create equations of a line and graph linear function correctly for at least 4 out of 6 questions on the exit slip

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 3: Construct viable arguments and critique the reasoning of others.

Vocabulary: slope, linear function, linear equation, y-intercept, x-intercept, slope-intercept form

Common Misconceptions:

- X values as the numerator and y values as the denominator in the slope formula
- not correctly lining up the matching coordinate points when using the slope formula
- mislabeling axis on the coordinate graph and mixing up intercepts
- incorrectly graphing negative slopes
- mistakes with implied zeros when parts of an equation are not written (ex. difficulty: cannot find y-intercept or slope for the equations as: y = 3x or y = 4)
- have difficulty to find the slope for the equation has 1 as the coefficient of x

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
F-IF-4: For a function that models a relationship between two quantities, and sketch graphs showing key features given a verbal description of a relationship.	***Review*** • Linear functions are relationships between two quantities • The two variables in a linear function are input and output values • X-intercepts have a y value of zero, y-intercepts have an x value of zero	***Review*** • Identifying x and y intercepts of a linear function • Determining slope from a graph using rise over run method • Graph linear functions using key concepts of slope and intercepts	Lesson 2-3	1 day	Practice exercises; pg 78-79 #'s 8, 17, 26, 31, 46, & 58
A-CED-2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	***Review*** • Definition of slope • Comparing slopes of a line by looking at the graphs (positive/negative/ zero/undefined slope) • Independent and dependent values determine relationships between two variables in an equation • Linear equations are functions with two variables that create a graph of a straight line	***Review*** • Identifying slope of a function from an equation and using the slope formula • Identifying intercepts from a graph • Write slope and y-intercept into slope-intercept form of a linear equation • Using slope-intercept form to graph a line ***New*** • Find the slope and y-intercept from a linear equation which is not in slop-intercept form.			

Lesson 6: Linear functions and point-slope form

Objective

- Using point-slope form, students will work (individually/in pair/in group) to write equations of a line and graph linear function correctly for at least 4 out of 5 questions on the exit slip

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 7: Look for and make use of structure

Vocabulary: point – slope form, standard form, parallel lines, perpendicular lines

Common Misconceptions:

- X values as the numerator and y values as the denominator in the slope formula
- not correctly lining up the matching coordinate points when using the slope formula
- mislabeling axis on the coordinate graph and mixing up intercepts
- incorrectly graphing negative slopes
- incorrectly identifying parallel and perpendicular lines and their properties

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
F-IF-9: Compare properties of two functions each represented in a different way (algebraically, numerically in tables, or by verbal descriptions)	***Review*** • Parallel lines never touch • Perpendicular lines create a 90 degree angle • Parallel lines are equidistant and have the same slope • Perpendicular lines have negative reciprocal slopes	***Review*** • Identify parallel and perpendicular lines • Writing equations of parallel and perpendicular lines • Graph linear equations that are parallel and/or perpendicular with each other ***New*** • Compare properties of the functions each represent in different ways (see page 87, #48)	Lesson 2-4	1 day	Lesson check page 86; #'s 1, 3, 4, 6, & 9
F-IF-8: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	***Review*** • Slope formula • Standard form of a linear equation is: $Ax + By = C$ ***New*** • The three different ways to represent a linear equation are slope-intercept form, point –slope form, and standard form • Point – slope form of an equation is: $y-y_1 = m(x – x_1)$	***Review*** • Write a linear equation in standard form • Graph an equation in standard form using intercept method ***New*** • Write a linear equation in point slope form using a coordinate point and slope formula • Graph a linear equation from point-slope formula			

Lesson 7: Linear applications

Objectives

- Using multiple representation, students will work (individually/in pair/in group) to create, graph and solve linear equations to model real life situation with at lest a proficiency level on the task rubric.

Focused Mathematical Practices

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

Vocabulary:

Common Misconceptions:

- Incorrectly identifying where to place each piece of information in an equation
- Misreading and/or misunderstanding linear word problems

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A-CED-2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	***Review*** • Word problems have independent and depend variables ***New*** • Linear models are found often in real life situations	***Review*** • Writing linear equations • Graphing linear equations ***New*** • Identify variables for all the information from a word problem • Identify where each variable belongs in the equation		1 day	See sample lesson Exit Ticket
F-LE-1.b: Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	***Review*** • Slope is the rate of change of a function ***New*** • Linear equations have a constant change which means the slope is the same over the entire line	***Review*** • Using the slope formula • Identifying slope from graphs and equations ***New*** • Identifying the constant slope of a linear equation created from real life situations	*see sample lesson * Speeding Ticket Task		

Lesson 8: Solving Systems Using Tables and Graphs

Objectives

- Using a table or graph, students will work (individually/in pair/in group) to solve a linear system, as seeing by at least earning an 4 out of 6 of question on Lesson Check (Pg. 138: 1 – 6)

Focused Mathematical Practices

- MP 5:Use appropriate tools strategically

Vocabulary:

- system of equations, linear system, linear – quadratic system, solution of a system, inconsistent system, consistent system, independent system, dependent system,

Common Misconceptions:

- Graphing errors: can occur when graphs are not drawn carefully. Errors include incorrect sign on the slope, incorrectly graphed ordered pairs, straight edge not used to draw lines.
  (Strategy: remind students to substitute the solution value, which they got from graphing , into both equations to justify they solution)

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.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	Review • Linear equations can be graphed using either a table or equation in slope-intercept / point-slope form/standard form New • Linear systems of two equations can be analyzed using the nature of the solutions: one solution, infinitely many solutions, no solution • Solution to a system of linear equations is the point where the two graphs intersect System of two linear equations can be independent / dependent, inconsistent / consistent	***Review*** • Rearrange then graph a linear equation • Use a table to write an equation in slope-intercept form ***New*** • Identify solution (in coordinate pair form) to a system of two linear equations by locating the intersection of the two graphs • Use table and Intersect features on Ti-84 to solve system graphically • Classify a system without graphing	Textbook 3-1: online resources available such as practice problems, remediation worksheets, challenge problems, activities, games, etc. **Specifically: 3-1 Puzzle X Marks the Spot**	2 days	Lesson Check (Pg. 138: 1 – 6)
A.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales	Review: • Linear models are found often in real life situations	Review: • Write equation in slope intercept, and standard forms.			

Lesson 9: Solving Systems Algebraically (Substitution)

Objectives
- Using substitution method, students will work (individually/in pair/in group) to solve linear systems algebraically, as seeing by answering at least 3 out of 4 Lesson Check questions correctly (pg. 145: 1, 2, 7, 9)

Focused Mathematical Practices
- MP 2: Reason abstractly and quantitatively

Vocabulary: equivalent system

Common Misconceptions:
- Algebraic errors: in substitution or elimination include solving for a variable and substituting the value back into the same equation rather than into the other equation, failing to multiply through the entire equation when writing equivalent systems
- Procedure errors: students might stop their work after they get the value for one variable and do not realize that they need to find the value of all variables on the system.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
A.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	Review • Variables can represent unknown quantities for the situation given ***New*** • None	Review • Create equation for the situation given ***New*** • None	Textbook 3-2: online resources such as practice problems, remediation worksheets, challenge problems, activities, games, etc.	1 day	Lesson Check (pg. 145: 1, 2, 7, 9)
A.REI.6: Solve systems of linear equations exactly and approximately (e.g. with graphs), focusing on pairs of linear equations in two variables	**Review** • Property of equalities • Literal equations **New** • Equation that can be solved using the Properties of Equality is obtained by substitution method	**Review** • Solving for one variable in terms of another • Use distributive property to combine like terms **New** • Substitute a literal expression for a variable into an equation and solve for a second variable			

Lesson 10: Solving Systems with a Linear and Quadratic Function

Objectives

- Using graphing and substitution methods, students will work (individually/in pair/in group) to solve a linear-quadratic system, as seeing by correctly answering at least 3 out of 4 Lesson Check questions (Pg. 261: #1 by graphing, #2 by substitution, #7ab).

Focused Mathematical Practices

- MP 3:Construct viable arguments and critique the reasoning of others.

Vocabulary: no new vocabulary. See earlier systems lessons.

Common Misconceptions:

- Students may have trouble understanding the differences between systems that have one solution, no solutions, and infinitely many solutions in the context of the problem. Students may also have trouble understanding what the intersection truly means in the context of the problem.
- Students may have trouble grasping conceptual understanding of what a solution to a system of equations represents in all representations (graphic, numeric and algebraic).

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
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, or polynomial	***Review*** • Solution to a system of equations is the point where the two graphs intersect ***New*** • The solution of a system of linear-quadratic equations can be no solution, one solution, or two solutions.	***Review*** • Use Ti-84 to solve system graphically • Graph linear equation & quadratic equation • Identify solution(s) to system of equations ***New*** • Identify number of solution of system of linear-quadratic equation. • Use appropriate Window on the graphing calculator to find the solution(s)	• textbook Page 258, 259 & page 262 (select linear-quadratic system) • ELL support – Quadratic systems worksheet • Reteaching worksheet :quadratic systems	2 days *this lesson only focus on linear – quadratic system	Mid-Chapter Quiz (pg, 156: 1 – 9, 15, 17, 18) Lesson Check (Pg. 261: #1 by graphing, #2 by substitution, #7ab) Lesson quiz (Pg. 264)
A.REI.7: Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	***Review*** • Equation that can be solved using the Properties of Equality is obtained by substitution method **New** • None	**Review** • Solve literal equations • Solve **simply** quadratic equation by factoring **New** • Substitute one equation (linear) into another (quadratic) to determine the solution(s) to a system of equations	Task: A linear and quadratic system		

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 slip

Sample Lesson Plan 1

Lesson	7: Linear Applications	Days	1
Objective	Using multiple representations, students will work (individually/in pair/in group) to create, graph and solve equations to model real life problem with at lest a proficiency level on the task rubric.	CCSS	A-CED-2, F-LE-1.b

Learning activities/strategies

Do Now: (10 minutes)

Jenna works at a retail shop 8 hours per day. She makes $80 per day, plus $5 for each item she sells. Fill out the graphic organizer below: (students will complete their work on do now sheet)

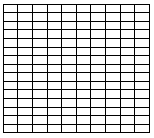
Graphic Organizer

Numerically
Money earned per day

Item sold	Money Earned
1	
3	
5	
7	
9	

Algebraically (Money earned function with x items sold (Use function notation)

Graphically



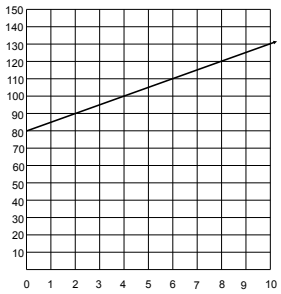
Function Domain & Range

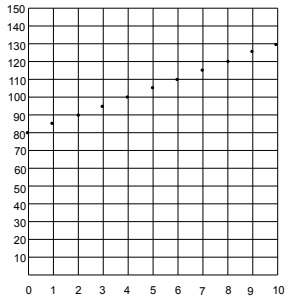
Domain: Range:

Go over the Do Now: (Prepare 4 pieces of poster, invite 4 students to write the answers on each part and share strategies for solving the problems)

Mini lesson: (Use the do now question)

- Table: Is the data showing on the table a linear relationship?
  How do you know? (review linear VS nonlinear from table ---- constant rate of change)
  What is the slope (rate of change)? What is the y-intercept?
- Algebraically: Is the function a linear relationship?
  How do you know from the equation/function rule?
  Can you find the slope and y-intercept from the function? How?
  Interpret the meaning of slope and y-intercept on the function in terms of context.
- Graph: How do you find the slope from the graph?
  What is the y-intercept on the graph?
  ** (Use the smartboard to show two graphs, one is a solid line and the other one is dash line)





Ask: Which graph makes more sense for the situation given? Explain.

What is the reasonable domain? Range? (Discuss it with students)
How to write down the domain and range? (set notation, verbal description, ….etc)

Starter/Launch:

- The teacher will open with questions related to the real world topic, the speeding ticket, such as:
  *Has your parents or a family member ever received a speeding ticket?
  *Have you ever been curious to how they are calculated?
  *Did you know different state's tickets are calculated differently?

  Today, we are going to learn how three states calculate tickets. Is there a pattern of the difference? We will use this information to create and solve linear equations numerically, verbally, and algebraically.

Class activities: (Partner work)

Guided Practice (use the Speeding Ticket Task Part A problem)

- Show **the slide** that has the task scenario and Part A question on smartboard, and ask students read it silently by themselves. (**Note**: **don't** ask any student read the question aloud for whole class, or the teacher read/explain the question for students)
  Give students about 2 minutes to read the questions.
- (***Mathematical Practice 1: Make sense of problems and persevere in solving them***)
  Turn and talk to your partner (1 or 2 minutes) :
  *Describe the problem in your own words.
  (the teacher needs to circulate the class to observe each pair conversation)
  Accountable talk (whole group)
  Ask: How would you describe the problem in your own words?
  What does the question on Part A (i) ask?
  What information is given in the problem?
  What math concept/skills might be useful for solving this question?
- Ask students work with their partner to finish Part A (10 minutes)
- Debrief: Go over the part A questions with whole class to make sure every student is on the right track.

Independent (partner) Practice: Complete the task

Direction:

- Students will work with their partners but need to complete his/her own task worksheet. (**This task will be one of the SGO portfolio assessment item)**
- Give students the task rubric to let them know how their work will be graded.

Closure:

Make predictions based off of graphs and completed worksheets.

- For each state, what is the relationship between the miles exceeding and the fine? How do you know that?
- For every 5 miles increased in speed, how much does the fine increase or decrease for each state?
- Which state do you think has the toughest speeding fines? Why do you think so?
- In closure, describe in words each state's formula and it's relation between the independent variable and dependent variable."

<table>
<tr><td></td><td>DOL (exit ticket):
• While the speed limit for rural state highways in New Jersey is 55 miles per hour. The table below shows the fine, f(x), for speeds over the 55 mph limit on the rural state highway. The fine is found by charging a fixed amount for each mile per hour the speeder exceeds the 55 mph limit, plus a $ 35 processing fee.
<table>
<tr><td>Speed exceeding 55 mph</td><td>5</td><td>7</td><td>9</td><td>10</td></tr>
<tr><td>Fine ($)</td><td>110</td><td>140</td><td>170</td><td>185</td></tr>
</table>
Part A: Plot the data on the coordinate plane provided.
Part B: Write the function of the speed and fine in f(m) = mx + b.
Part C: What is the meaning of the slope and y-intercept in terms of context?
Part D: Julie got a ticket for $200. What the speed that she drove?

Homework:</td></tr>
<tr><td>Differentiation</td><td>Possible differentiation strategies: (please design your own differentiation based on your students learning styles, academic level, strength and weakness,…..)
* Heterogeneous grouping to allow for peer mentoring during guided practice and independent practice
*graphic organizer from do now can be used for each state to provide a visual guide to complete the task for the students who still have difficulty to use multiple representation.
*Calculators will be provided</td></tr>
<tr><td>Assessment</td><td>Formative: *circulating throughout class during lesson,
*observe students which they are answering the questions, discussing with their partner, working on class work…etc.
*exit slip
* homework</td></tr>
<tr><td>Common Misconceptions/ Difficulty</td><td>Misconceptions:
• Switch independent and dependent variables
• Incorrectly identifying where to place each piece of information in an equation
• Misreading and/or misunderstanding linear word problems
Difficulty:
• Find the y-intercept from a table (if the table doesn’t provide it)
• Provide appropriate scale for the graph</td></tr>
</table>

Do Now Date Name:

Jenna works at a retail shop 8 hours per day. She makes $10 per hour, plus $5 for each item she sells. Fill out the graphic organizer below

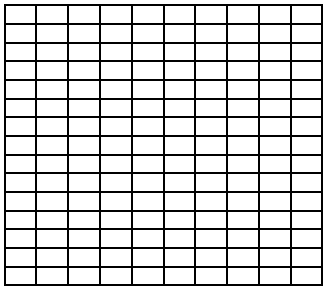
Graphic Organizer

Numerically
Money earned per day

Item sold	Money Earned
1	
3	
5	
7	
9	

Algebraically (Money earned function with x items sold (Use function notation)

Graphically



Function Domain & Range

Domain: Range:

The Speeding Ticket Task **Date** **Name**

The fine for speeding on the highways of most states is a function of the speed of the car. The speeding fine can be determined by a linear equation, where f(m) represents the fine in dollars and m represents the number of miles per hour (mph) the car is EXCEEDING the 70 mph speed limit.

In Connecticut, the speed limit on federal highways is 70 miles per hour (mph). The speeding fine has a flat fee $40 and plus $10 for each mph the car is exceeding the speed limit.

Part A: i) Write the rule for the f(m).

ii) What would your speeding fine be if you were traveling 78 mph? Show all work or explain in words how you arrived at your answer.

iii) Suppose you received a speeding ticket for $200. How fast were you going? Explain how your arrived at your answer.

Part B: i) Residents of Connecticut tell you that police officers usually don't bother pulling cars over for speeding, unless the penalty ticket would ab at least $90. What does this mean? Use the function that you created in Part A to explain your thinking.

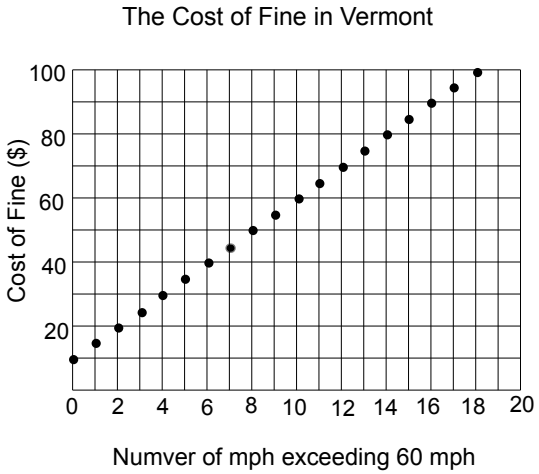
ii) The maximum speeding fine in Connecticut is $340. What speed corresponds to this fine? What does this mean in terms of context?

iii) What are the reasonable domain and range for the speeding fine function? Explain your reason.
Domain:

Range:

The Speeding Ticket Task

Part C: The line on the graph below represents the function of speeding ticket function in Vermon



i) Write a rule in function notation for the cost of fine in Vermont.

ii) Find the slope and y-intercept of the line. What are the meaning of the slope and y-intercept in terms of context?

Part D: What difference in the cost of a speeding ticket in Vermont and Connecticut for someone driving 85 mph? (show your work)

The Speeding Ticket Task

Part E: The speed limit on the Florida highway is 65 miles per hour.
The cost of fine is calculated by charging a fixed amount for each mile per hour the speeder exceeds the 65 mph limit, plus a fixed processing fee. The table below shows the fine, f(x), for speeds over the 65 mph limit on Florida highway.

Speed (exceeding 65mpr)	5	10	15	20	25
Fine ($)	60	87.5	115	142.5	170

i) What is the amount for each mile per hour the speeder exceeds the speed limit? (show your work)

ii) What is the additional fixed fee for cost of fine in Florida? Show your work.

iii) Write a rule for the cost of fine function on Florida highway.

iv) Jose got a $126 speeding ticket for speeding on Florida highway, how fast did he drive?

The Speeding Ticket Task

Part F: Susan was fined for traveling 78 mph.

Which state will have the most cost of fine for the speed? Which state will have the least cost of the fine for the same speed? Show your work or explain how do you arrive your answer.

Sample Lesson Plan 2

Lesson	Solving Systems Using Tables and Graphs (Day 1)	Days	2
Objective	Using a table or graph, students will work (individually/in pair/in group) to solve a linear system, as seeing by at least earning an 4 out of 6 of question on Lesson Check (Pg. 138: 1 – 6)	CCSS	A.CED 2 A.REI 6, 7

Learning activities/strategies

Do Now:

- Graph linear equation using table and interpret the graph in terms of context
  Question: You plant a 10-inch spruce tree that grows 2 inches per year and a 4-inch hemlock tree that grows 3 inches per year. (see Do Now sheet)
- Go over the do now: Show the graph on the smartboard, and ask students:
  Where is the point of intersection? What are coordinates of the point?
  What does the point represent in terms of context?

Starter/Launch: Getting Ready! Interactive Learning – Bike vs. Trike Example

Mini lesson:

- Define vocabulary
- Example One: -3x + 2y = 8 and x + 2y = -8

Note: the book does not show students HOW to graph these two linear equations, so this is a good opportunity to review graph equations.

Multiple strategies should be presented:

- strategy 1: put equations in slope-intercept form and then graph linear equations (solving literal equations)
- strategy 2: make tables and then graph the equations

Table 1: -3x + 2y = 8

x	y
0	4
1	5.5

run 1, rise 1.5

y-intercept: (0, 4)

slope-intercept form:
y = 1.5x + 5

Table 2: x + 2y = - 8

x	y
0	- 4
1	-4.5

run 1, rise -0.5

y-intercept: (0, -4)

slope –intercept form:
y = -0.5x - 4

Note:

- INM: solution to the system is the point where two lines intersect.
- Error Prevention: plug solution back into both equations to make sure that you solved the problem correctly (many mistakes can be made while graphing), make sure students use straightedge when graphing, and emphasize coordinate form is (x,y) – stress x- and y-axis
- INM: graphing calculator (use Ti 84 smart view software)
- CFU: Got it? #1 AND Pg. 138 # 7

Partner Activity:

- Work with a partner – partner A solves #1 by hand and #7 using Ti-84, partner B solves #1 using Ti-84 and #7 by hand. Check answers against each other and discuss mistakes as necessary.
- INM: Solving using a table – Problem #2
- CFU: Got it? #2 (2b – lead students as necessary by asking how much they expect to grow at

	age 30) **Class activities:** • Solving by graphing puzzle (online textbook resource): students may work together during this activity, but each student must graph on their own worksheet. Graph systems of linear equations to see where crewmates were sent on island. • Students who are struggling with graphing: 2-3 Reteaching worksheet (online textbook resource) provides steps for graphing a linear equation as well as an example and practice problems **Independent Practice:** • Pg. 138 #9 by hand (either graphing, or table), #12 using calculator **Closure:** • What does it mean to find the solution to a system of equations? (find the values for the variables that make the equations true) • From this lesson, what two methods can you use to find a solution to a system of equations (graphing and making a table) **DOL (exit ticket):** Lesson Check Pg. 138 #1, 2, 4
Differentiation	3: Enrichment assignment – online textbook resource (word problem worksheet) for Honors / high performing students. Worksheet may be completed for homework or additional in-class practice 2: 1: Reteaching worksheet available to students who need more practice with graphing linear equations
Assessment	Formative: Lesson Check, CFU, Station activity sheets Summative: Authentic:
Common Misconceptions	Graphing errors: can occur when graphs are not drawn carefully. Errors include incorrect sign on the slope, incorrectly graphed ordered pairs, straight edge not used to draw lines.

Do Now of Sample Lesson Plan 2

Do Now

You plant a 10-inch spruce tree that grows 2 inches per year and a 4-inch hemlock tree that grows 3 inches per year.

Part A: Complete the following tables

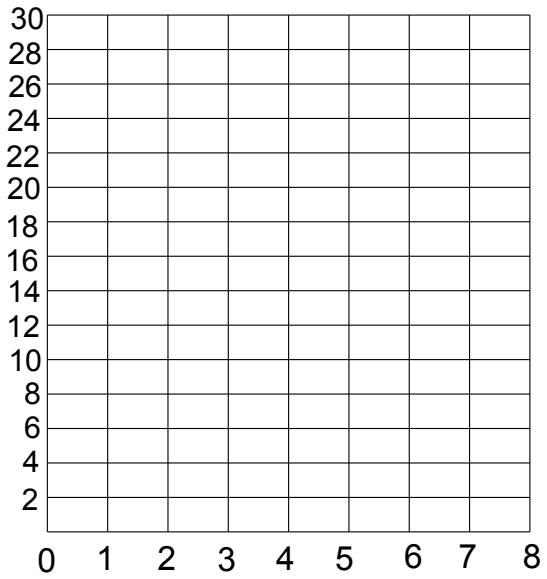
Table 1: The height of spruce tree

year	Height
0	10
1	
2	
3	
4	

Table 2: The height of hemlock tree

year	Height
0	4
1	
2	
3	
4	

Part B: Use the data from your table to graph the height of each tree on the coordinate plane below.



Part C: Will the two lines intersect with each other? If so, where is the point of intersection (write the coordinates of the point)?

Sample Lesson Plan 3

Lesson	Solving Systems Using Tables and Graphs (Day 2)	Days	2
Objective	Using a table or graph, students will work (individually/in pair/in group) to solve a linear system, as seeing by at least earning an 4 out of 6 of question on Lesson Check (Pg. 138: 1 – 6)	CCSS	A.CED 2 A.REI 6, 7
Learning activities/strategies	**Do Now:** • Practice solving one system by graphing – using Ti-84 (Two systems, both equations on the first system are in slope-intercept forms. On the 2nd system, at least one equation should be non-slope intercept form) **Starter / Launch:** Activity prompt questions • How do you solve systems of linear equations by graphing? • How do you know if a system of linear equations has infinite solutions? • How do you know if a system of linear equations has no solutions? • How can you use a graphing calculator to graph and solve systems of linear equations? • Give an example of a graph of a linear system that is used in the real world. **Mini lesson:** • Solving system of linear equations by graphing – (two guided examples) 1. Solve the system (use TI 84 to graph): x + 2y = -8, -2x – 4y = 4 Ask: What the graph look like? (Will these two lines intersect?) What is the slope of the line 1? What is the slope of the line 2? What do you notice? Explain it (if students say when the slope of two lines are the same then the two lines will not intersect, ask them to justify their conclusion by asking "Is it always true when two lines have the same slope, they will not intersect or they are parallel? " 2. Solve the system: 2x+ 6= y, 4x – 2y = -12 (since this is a dependent system, so ask students to graph the system by hand. It will be easier for students to figure out these two lines are coincide) Ask the same types of questions as the first system. • Debrief: (*Ask students to take notes)* *No solution*: the lines are parallel, the lines have the same slope with different y-Intercepts, … *Infinitely many solution*: the lines are the same line, the lines have the same slope and the same y-intercept, … *one solution*: the lines intersect at exactly one point, the lines have different slope, **Practice: (see the attached practice sheet)** • Students are in groups. Assign just one question to each student in the group. • Give just 3 minutes to ask students to finish the question assigned • Give 5 minutes to students to discuss their questions to the their group members. **Class activities: (Heterogeneous grouping is recommended)** • Station Activity: Solving systems by graphing (Station Activities for Solving System by Graphing. There are four station activities attached. If technology is available, one station		

	can use station to let students to do activity on netebooks or laptops.) • Students will stay on each station about 15-20 minutes. In each station, students will following the following procedure: 1. individual work (8-10 minutes) 2. group discussion to help group member (assigned a facilitator for each group to lead the discussion) 3. check work (Answer key will be provided in the station) **Closure:** • Use the starter questions to ask students summarize their finding. **DOL (exit ticket): Lesson Check Pg. 138 #3, 5, 6**
Differentiation	3: Enrichment assignment – online textbook resource (word problem worksheet) for Honors / high performing students. Worksheet may be completed for homework or additional in-class practice 2: If class time is not allowed to go through all 4 stations, focused on station 2 & 3 either in class or at home 1: If class time is not allowed to go through all 4 stations, must complete all questions on station 1 & 2 either in class or at home

Sample Lesson Plan 3: Lesson Practice Sheet

Practice Sheet

Without actually solve each system of equation, you are going to indicate each system of equations in the table below has no solution, one solution, or infinitely many solutions. Explain your reasoning.

System of Equations	Solution(s)	Reasoning
Question A: $\begin{cases} y = 1/3(18 - 6x) \\ y = 8 - 2x \end{cases}$	No solution One solution Infinitely many solution	
Question B: $\begin{cases} y = x + 16 \\ y = 16 + 2x - 3x \end{cases}$	No solution One solution Infinitely many solution	
Question C: $\begin{cases} 6x - 3 - y = 0 \\ y = 3/5(15x - 5) \end{cases}$	No solution One solution Infinitely many solution	
Question D: $\begin{cases} y = -(x - 1) \\ y = 1 - x \end{cases}$	No solution One solution Infinitely many solution	

Station materials for Sample Lesson Plan 3

Solving System of Equations by Using Tables and Graph

Station A: Using table to solve system of equations

Question 1:

Peter and Tom plan to hike on the Long Valley Trail, from their neighborhood to the lake. But Peter has to work at the gas station in the morning, so he texts Tom that he will start later and catch up on his bicycle. Peter leaves 4 hours after Tom. Tom hikes at 3 miles per hour, and Peter cycles at 7 miles per hour. When and where will Peter catch up with Tom?

Part A: Complete the following tables about Peter's and Tom's distance down trail.

Tom's Information

Time from Tom's start (hrs)	Distance down trail (miles)
0	0
1	3
2	
3	
4	
5	
6	
7	
8	

Peter's Information

Time from Tom's start (hrs)	Distance down trail (miles)
0	
1	
2	
3	
4	0
5	
6	
7	
8	

Part B: Use the information from the tables to answer the following questions.

1. At what time are Peter and Tom at the same distance down the Long Valley Trail?

2. What is their distance down the trail when they meet?

3. How can you identify the solution by looking at the two tables?

4. Why are the first four rows in the "Distance down trail" column of Peter's table? Explain how you decide the data for the four rows.

Question 2: (station A Page 2out of 2)

Your uncle needs the walls of his storage room painted. He is a smart shopper, so he asks his friends for recommendations of painters. He finds two he thinks will do a good job: Evelyn and Rico. Evelyn charges an initial fee of $80 for any job and $1.20 per square foot. Rico charges no initial fee, but charges $1.90 per square foot. Which painter's deal is better for your uncle?

Part A: Using the variables **c** for the total cost in dollars and a for the area in square feet, write rules for Evelyn and Rico's deals.

a. Evelyn:

b. Rico:

Part B: Use your rules for Evelyn and Rico's deals and your number sense to complete these tables

Area in square feet (a)	Evelyn's total cost in dollars(c)
0	
20	
40	
60	
80	
100	
120	
140	
160	

Area in square feet (a)	Rico's total cost in dollars(c)
0	
20	
40	
60	
80	
100	
120	
140	
160	

Part C: Use your tables to give your uncle specific advice about which painter to hire. For what wall area Would Evelyn's deal be better? For what wall area would Rico's deal be better? For what area would the costs be equal? Explain your reasoning.

Solving System of Equations by Using Tables and G (station B Page 1out of 1)

Station B: Solving system of equations by using graphing

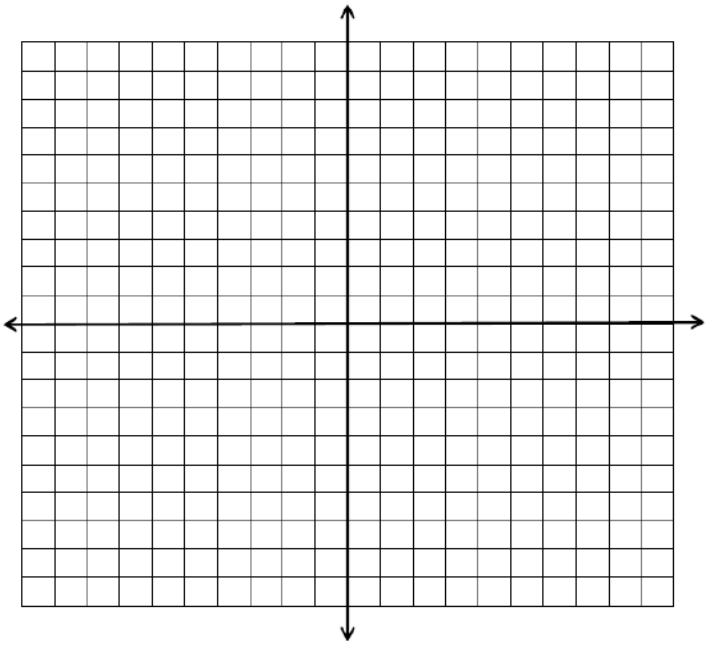
Question 1: $\begin{cases} y = x + 4 \\ y = -2x + 1 \end{cases}$ (Use Ti-84 to solve the problem)

Solution : _____

Justification:

Question 2: Graph the systems to find the solution and justify your solution.

$$\begin{cases} x + y = 3 \\ y = -\frac{1}{2}x + 2 \end{cases}$$



Solution: _____

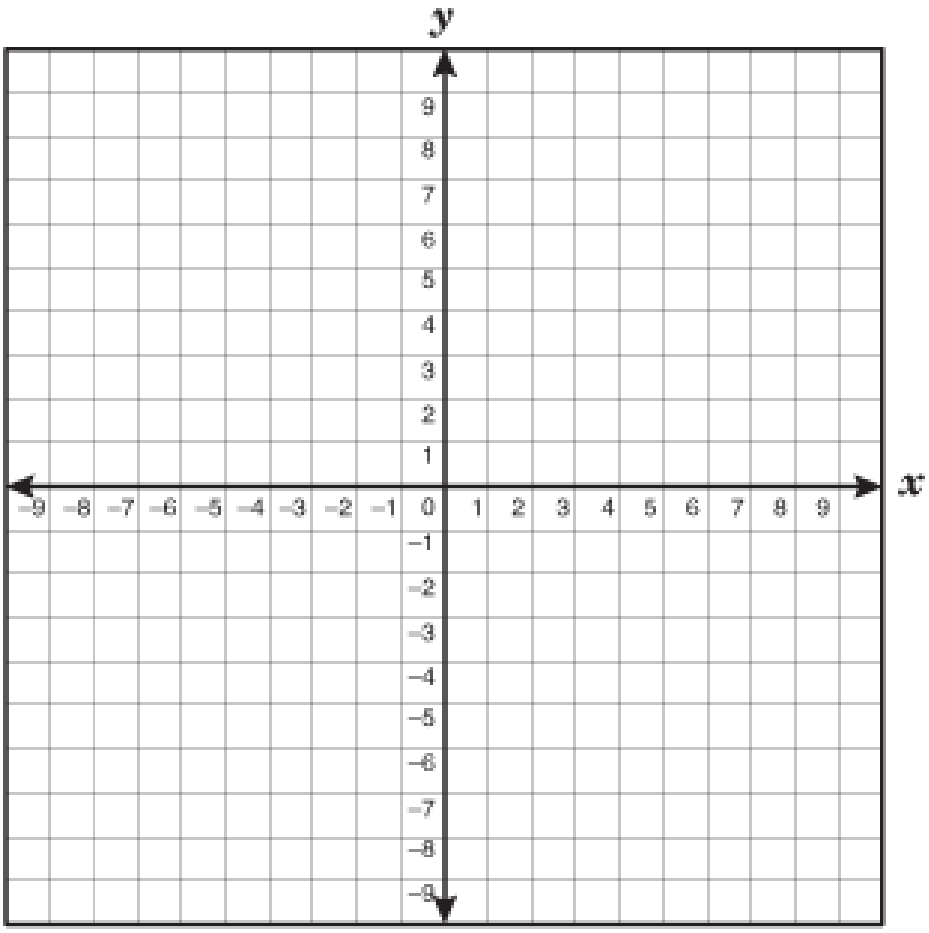
Justify your solution: (Show your work on the other side of the paper)

Solving System of Equations by Using Tables and Graph (station C Page 1 out of 2)

Station C: Create a system of equations based on the types of solutions.

Question 1:

The solution of a system of two linear equations is (-3, 1). On this coordinate grid, graph two lines so that could be the graphs of the two linear equations in the system.

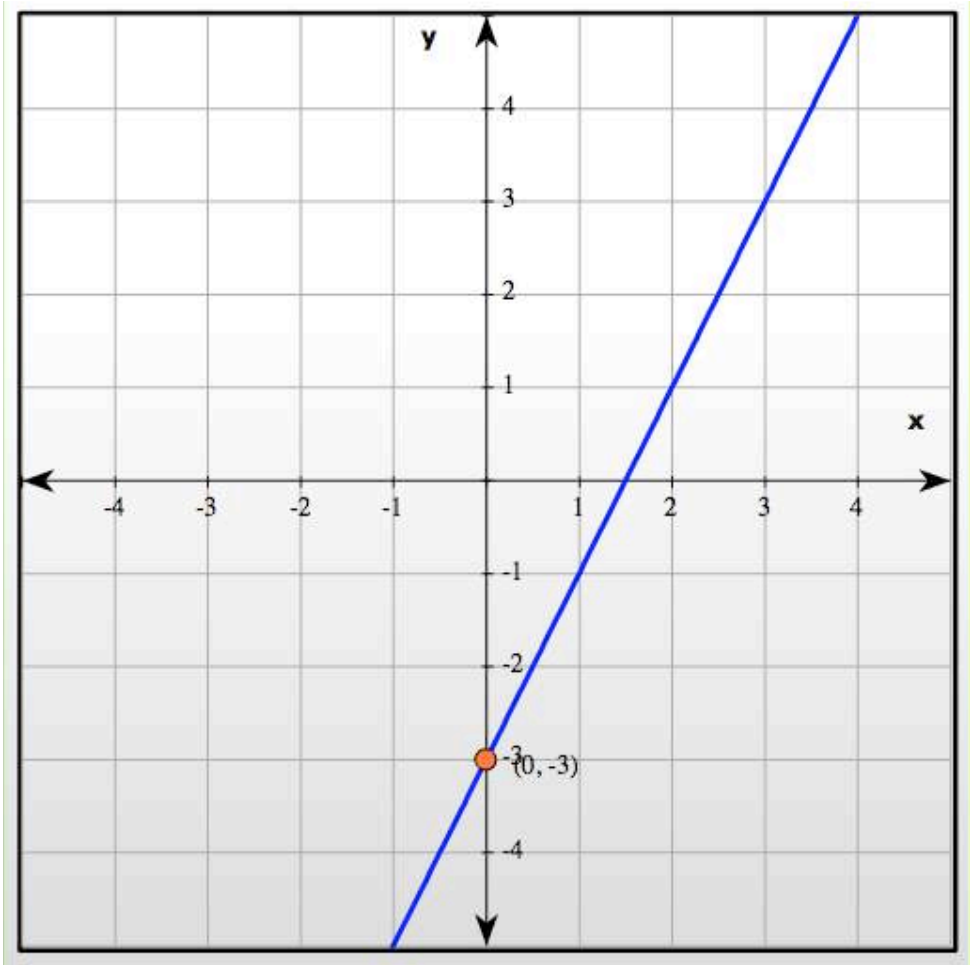


Part B:

What are equations of the system that you create?

Question 2:

- A linear system has no solution.
- One of the lines on the system shown on the graph below.



Part A: Graph a line that meets the criteria of the system on this question.

Part B: Write the equations of the system that you create on the graph.

Solving System of Equations by Using Tables and Graph (station D Page 1 out of 2)

Station D: Solving system of equations by graphing (Word Problems)

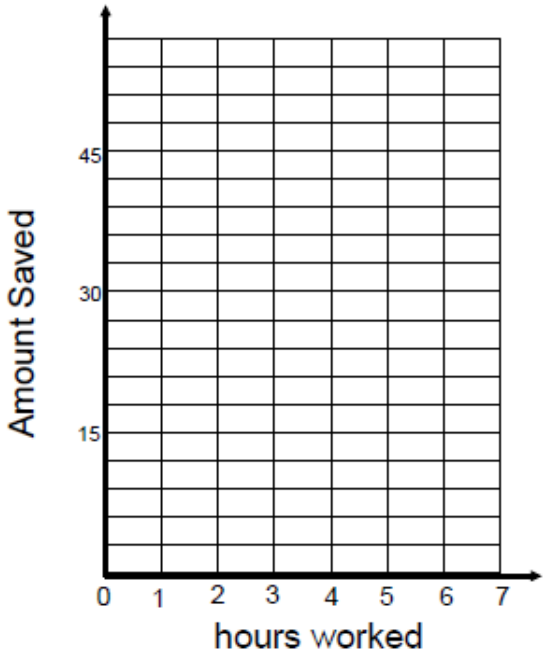
Question 1: Maryann and Carlos are each saving for new scooters. So far, Maryann has $9 saved, and can earn $6 per hour babysitting. Carlos has $3 saved, and can earn $9 per hour working at his family's restaurant.

Part A: Write equations for Maryann and Carlos to show the relation between the amount Saved and the hours worked.

Maryann:

Carlos:

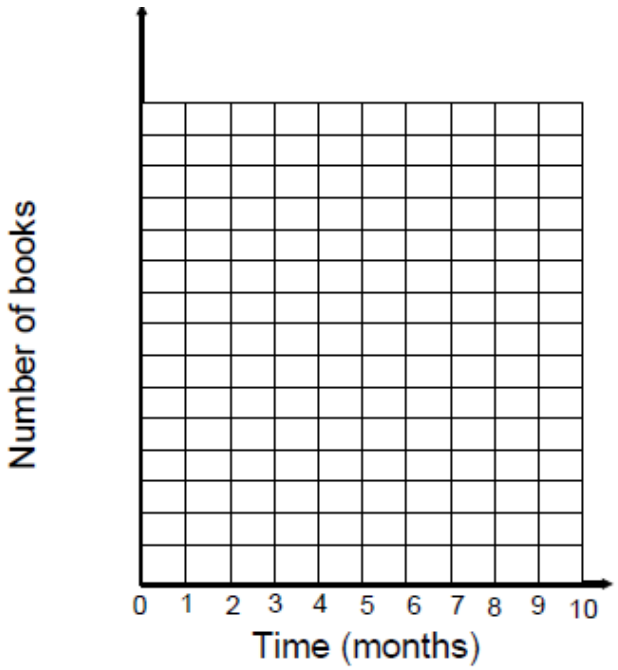
Part B: Graph the two equations that you created from Part A.



Part C: After how many hours of work will Maryann and Carlos have saved the same amount? What will that amount be? (Use completed sentence(s) to answer the question)

Part C: Use your equations to justify your answer. (Show your work)

Question 2: Julie currently has 5 comic books in his collection and has subscribed to receive 5 new comic books each month. His uncle has 145 comic books, but sends 5 to each of his 3 nieces each month. In how many months will they have the same number of comic books? How many books will that be? (Solve the problem by graphing, and choose appropriate scale to label the y axis)



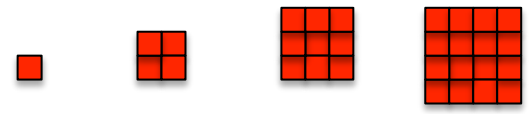
Supplemental Material

CCSS	Dropbox location and filename	Link (original task and answer key)
A-CEDA1 N-Q	Orange 9-12 Math > Algebra 2 > Unit 1 > Supplemental Material >**A-CED.& N-Q Task-i) Harvesting the Fields.pdf**	https://www.illustrativemathematics.org/illustrations/83
A-SSE.A1	Orange 9-12 Math > Algebra 2 > Unit 1 > Supplemental Material > **A-SSE Task-Delivery Trucks.pdf**	https://www.illustrativemathematics.org/illustrations/531
A-SSE.A1	Orange 9-12 Math > Algebra 2 > Unit 1 > Supplemental Material > **A-SSE Task-Kitchen Floor Tiles.pdf**	https://www.illustrativemathematics.org/illustrations/215
A-SSE.A1 A-SSE.A2	Orange 9-12 Math > Algebra 2 > Unit 1 > Supplemental Material > **A-SSE.A.1 & A-SSE.A2 Task-Animal population**	https://www.illustrativemathematics.org/illustrations/436
A-REI.C7	Orange 9-12 Math > Algebra 2> Unit 1 > Supplemental Material > **A.REI 7 A Task: A Linear and Quadratic System**	https://www.illustrativemathematics.org/illustrations/576
F.IF.A2	Orange 9-12 Math > Algebra 2> Unit 1 > Supplemental Material > **F-IF Task-Interpret function notation. PDF**	https://www.illustrativemathematics.org/illustrations/634
A.REI.6	Orange 9-12 Math > Algebra 2 > Unit 1 > Supplemental Material > **Algebra 2 solve system by substitution word problem**	None
A.CED 2 A.REI 6, 7	Orange 9-12 Math > Algebra 2> Unit 1 > Supplemental Material > **Algebra 2 Solving System by Graphing Station Activities**	None
A.REI.6	Orange 9-12 Math > Algebra 2 > Unit 1 > Supplemental Material > **Algebra 2 Solving System by substitution Station Activities**	None
A.REI.6	Orange 9-12 Math > Algebra 2 > Unit 1 > Supplemental Material > **Find a system**	https://www.illustrativemathematics.org/illustrations/1363

Multiple Representations

Patterns

- Concrete
- Pictorial/Verbal Description



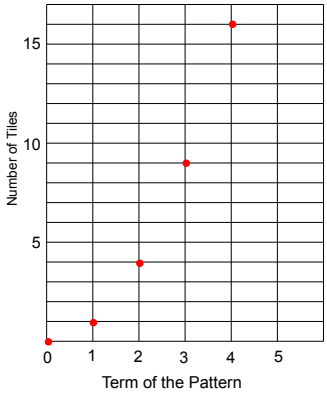
Term 1 Term 2 Term 3 Term 4

- Abstract/Symbols

Table

Term	Number of Tiles	
1	1	$\dashrightarrow 1^2$
2	4	$\dashrightarrow 2^2$
3	9	$\dashrightarrow 3^2$
4	16	$\dashrightarrow 4^2$
x		$\dashrightarrow x^2$

Graph



Equation

$a_n = n^2$

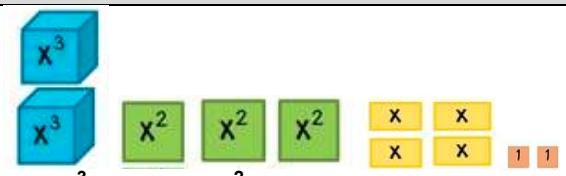
Function

$f(n) = n^2$

$y = x^2$ **(x: term of the pattern, y: number of tiles)**

Combine Like Terms

- Concrete (Algebra Tiles)



+

- Pictorial/Verbal Description

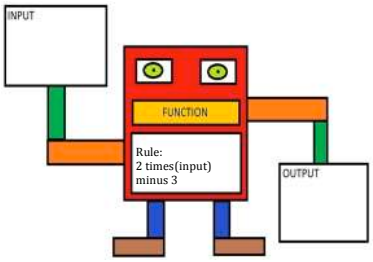
Like terms (*ex. $2x^3$ and x^3 are like terms, $2x^3$ and $2x^2$ are not like terms)* have the same variables raised to the same powers. You can simplify an expression or add/subtract expressions by **combining like terms.**

- Abstract/Symbols

$(2x^3 + 3x^2 + 4x + 2) + (x^3 + 2x^2 + 6x + 4)$
$= 3x^3 + 5x^2 + 10x + 6$

Function

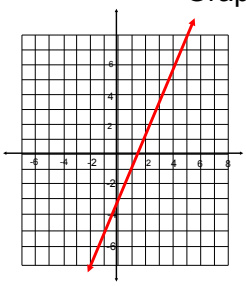
- Concrete (Function Machine)

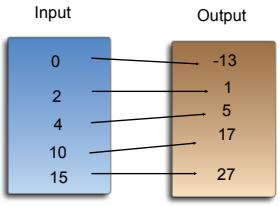


- Pictorial/Verbal Description

Table | Graph | Mapping Diagram

Input	Output
0	-3
2	1
4	5
10	17
15	27





Verbal Rule: 2 times a number minus 3

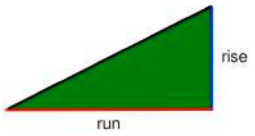
- Abstract/Symbols

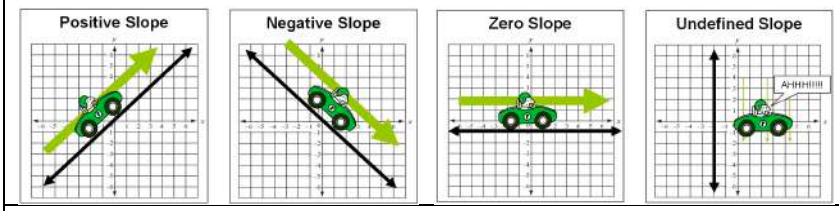
Function(Graph)
(x) = 2x + 3
Domain $[-\infty, \infty]$
Range: $[-\infty, \infty]$

Set Notation (table & Mapping Diagram)
$\{(0,-3),(2,1),(4,5),(10,17),(15,27)\}$
Domain: $\{0,2,4,10,15\}$
Range: $\{-3,1,5,17,27\}$

Slope

- Concrete

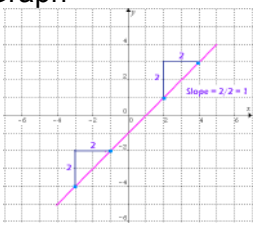




- Pictorial/Verbal Description (ratio table & slope triangle)

Table | Graph

	x	y	
+2	-2	-3	+2
+2	0	-1	+2
+2	2	1	+2
+2	4	3	+2
+2	6	5	+2



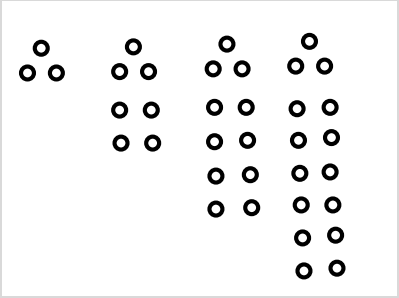
- Abstract/Symbols

Slope between (2, 1) and (4, 3)

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-1}{4-2} = \frac{2}{2} = 1$$

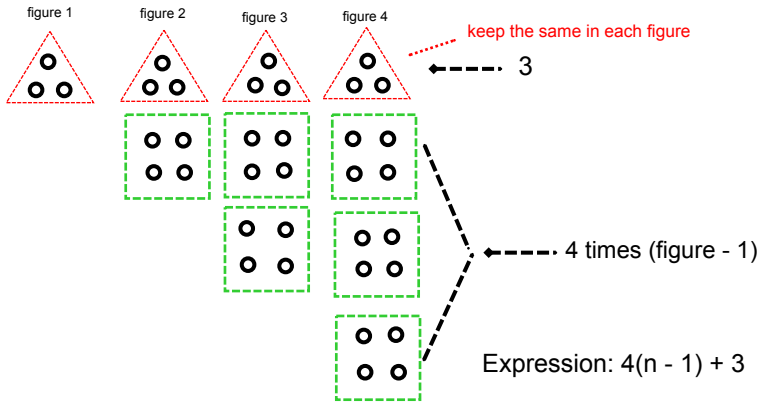
Solve problem using multiple strategies

Example: Write an expression for the number of circles in the n^{th} figure. (textbook: page 7 question # 15)



Strategies:

- Use concrete diagram



- Use table

Figure	# of Tiles
0	-1
1	3
2	7
3	11
4	15

y-intercept

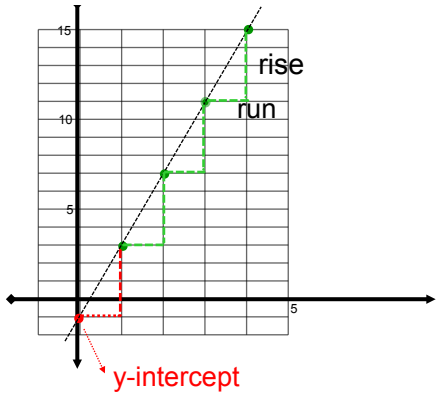
+1, +1, +1, +1

+4, +4, +4, +4

slope = $\frac{4}{1}$

Expression: 4n -1

- Use graph



Expression: 4n - 1

Solve problem using multiple strategies

Example: Convert linear standard form, 3x + 4y = 12, into slope intercept form.

Strategies:

- Use table (teaching for understanding by using the concepts of y-intercept and slope)

Make a table by chossing x value as 0 and 1

Tip: keep the fraction format, it will be easier to find the value of "rise" if any of the y value on the table is not integer.

y-intercept

x	y
0	12/4
1	9/4

run 1

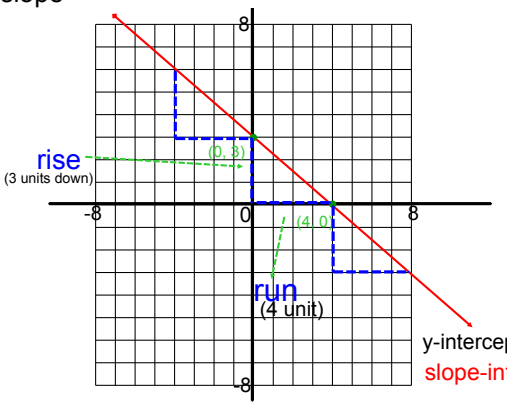
rise -3/4

y-intercept: 3 (simplify from 12/4) slope: rise/run = - 3/4

Slope-intercept form: y = -3/4x + 3

- Use Graph (teaching for understanding by using the concepts of y-intercept and slope)

Graph x and y intercepts of the equation, 3x + 4y =12, on a graph.
x-intercept: (4, 0) ,y-intercept: (0, 3) then using slope triangle to find the slope



y-intercept: 3 slope: rise/run = -3/4

slope-intercept form: y = -3/4x + 3

- Use symbolic representation (Method 1: teaching for procedural fluency
  Method 2: apply both conceptual understanding and procedural fluency)

Method 1: Solve for y (solve literal equation)

3x + 4y =12

-3x -3x

$\frac{4y}{4} = \frac{12 - 3x}{4}$

Note: some students might think about 4 divided by 4 is "cancel out", and will become "0". **Use correct math term "identity property of division", do not use "cancel out"**

Note: many students make mistake here by forgetting to distribute division on both terms

Slope-intercept form y = - 3/4 x+ 3

Method 2: Find the slope and intercept

Use "0" to substitute x in the equation to find the y-intercept

3(0) + 4y = 12 y = 3 coordinates: (0, 3) (x_1 y_1)

Use "0" to substitute y in the equation to find the x-intercept

3x + 4(0) = 12 x = 4 coordinates: (4, 0) (x_2 y_1)

Use slope formula $(y_1 - y_2)/(x_1 - x_2)$ to find the slope

Slope: (3 - 0) / (0 - 4) = - 3/4

Slope-intercept form y = - 3/4 x+ 3

Solve problem using multiple strategies

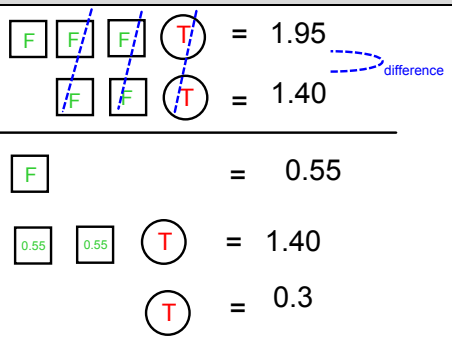
Example: The Fruit Emporium sells a dish of two flavors of yogurt with one serving of fruit toppings for $1.40. It also sells a dish of three flavors of yogurt with one serving of fruit toppings for $1.95.

a. How much is one flavor of yogurt with one serving of fruit toppings?

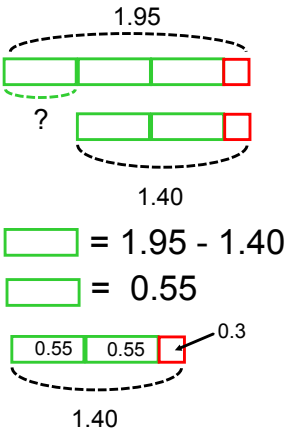
b. How much does a customer pay for the one serving of fruit toppings?

Strategies:

- Use concrete diagram and number sense



- Use bar model



- Use symbolic representation

Create system of equations

Let *f* represents number of flavors ,

t represents the number of topping

$$\begin{cases} 2f + t = 1.40 \\ 3f + t = 1.95 \end{cases}$$

substitution method

t = 1.40 – 2f

3f + (1.40 – 2f) = 1.95

f + 1.40 = 1.95

- 1.40 -1.40

f = 0.55

t = 1.40 – 2f

t = 1.40 -2 (0.55)

t = 0.30

elimination method

2f + t = 1.40

- (3f + t = 1.95)

- f = - 0.55

divided by -1 on both sides

f = 0.55

2 (0.55) + t = 1.40

1.10 + t = 1.40

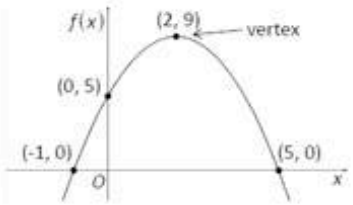
- 1.10 -1.10

t = 0.30

PARCC Sample Assessment

High School – Functions

A portion of the graph of a quardratic function $f(x)$ is shown in the xy - plane. Selected values of a linear function $g(x)$ are shown in the table.



x	g(x)
-4	7
-1	1
2	-5
5	-11

For each comparison below, use the drop-down menu to select a symbol that correctly indicates the realtionship betweeen the first and the second quantity.

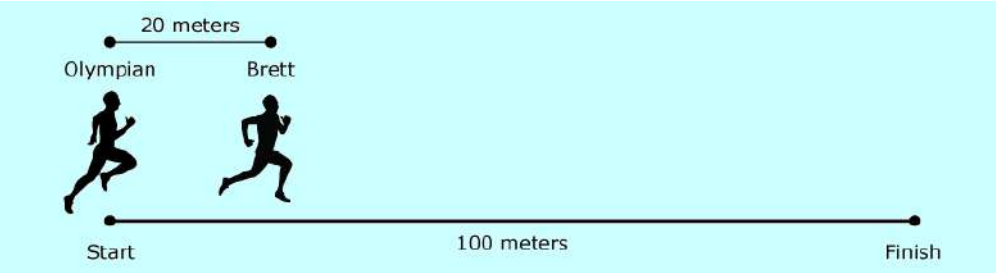
First Quantity	Comparison	Second Quantity
The y-coordinate of the y-intercept $f(x)$		The y-coordinate of the y-intercept $g(x)$
$f(3)$		$g(3)$
Maximum value of $f(x)$ on the interval $-5 \le x \le 5$		Maximum value of $g(x)$ on the interval $-5 \le x \le 5$
$\frac{f(5) - f(2)}{5 - 2}$		$\frac{g(5) - g(2)}{5 - 2}$

Item Analysis:

- Assessment Type: Type I, Claim A
- Most relevant CCSS: F-IF.9. Compare properties of two functions each represent in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- Most relevant CMP: MP.6 Attend to precision
- Item description and assessment qualities: This task requires an understanding of the function concept across representations, as well as a number of basic skills in functions. The multipart nature of the task allows for greater depth of comparison between the two functions than a one-point item would. Unlike traditional multiple choice, it is difficult to guess the correct answer or use a choice elimination strategy.
- Scoring: Full credit requires selecting the correct values from all of the drop-down menus. Partial credit can be given for each answer that is correct.

Brett's Race (High School Algebra)

Brett is on the high school track team and his coach surprises the team by having an Olympic track champion attend a practice. The Olympian challenges Brett to a 100-meter race. To make the race more interesting, the Olympian will not start the race until Brett reaches the 20 meter mark. Brett's average time in the 100-meter race is 12 seconds, while the Olympian's average time is 10 seconds. Assume that Brett and the Olympian run at a constant speed throughout the race.



part A: Based on each of the runner's average time, write an equation for each person that describes the relationship between his distance from the starting line, in meters, and time, in seconds.

Part B: Based on your equations in Part A, who will wine the race and by how much? Justify your answer.

Item Analysis:

- Question type: type III (3 points)
- Relevant CCSS: A-CED Creating equation,
- Most relevant CMP: MP 2, 4, &7
- Item description and assessment qualities:

Unit Authentic Assessment :

Performance Task			
CCSS	SMP	Dropbox location and filename	Link
A.REI.6. A.REI.7	MP1 MP2 MP3 MP4 MP5	Orange 9-12 Math > Algebra 2> Unit 1 > Authentic Assessments > **Systems of Equations Through the Lens of Art Integration**	None

Unit Assessment Question Bank*:*

Performance Task			
CCSS	SMP	Dropbox location and filename	Link
		Orange 9-12 Math > Algebra 2 > Unit 1 > Authentic Assessments **> Algebra 2 unit 1 question bank**	

Additional Resources

http://www.mathxlforschool.com/home_school.htm

http://www.pearsonschool.com/index.cfm?locator=PS13Dk

http://illustrativemathematics.org/standards/hs

http://www.cpalms.org/Public/PreviewResourceLesson/Preview/48701

Holt McDougal Mathematics Explorations in Core Math for Common Core (Algebra I)

Holt McDougal Mathematics Explorations in Core Math for Common Core (Algebra II)