Algebra II (Tier 1)

Unit 1 Plan

Unit 1: Preparation Unit (Linear Functions)

2015-2016

ORANGE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

OFFICE OF MATHEMATICS

Algebra 2 (Tier 1) Unit 1

Unit Overview

Unit 1: Preparation Unit (Linear Functions)

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

- ***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.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. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

- **S.ID.6:** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
  a. fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or chooses a function suggested by the context.
  b. Informally assess the fit of a function by plotting and analyzing residuals.
  c. Fit a liner function for a scatter plot that suggests a linear association.
- **F.BF.3:** Identify the effect of the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x+k) for specific values of k (both positive and negative) find the value of k given the graph.

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

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

Calendar

September 2015						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
		1	2	3	4	5
6	7	8 *Establish routines and classroom rules*	9 *Diagnostic Assessment Day 1 review solving equations*	10 *Day 2 review: solving equations*	11 *Day 3 review: solving equations*	12
13	14 Using Liner Models (2-5)	15 *Using Liner Models (2-5)*	16 *Families of Functions (2-6)*	17 *Check up Revisiting lesson*	*18* *Solving Systems Using Tables and Graphs (3-1)*	19
20	21 Solving systems Using Tables and Graphs(3-1)	22 *Solving Systems algebraically (3-2)*	23 *Solving systems Algebraically (3-2 & supplement 3 variables system)*	24 *Solving systems Algebraically (3-2 & supplement 3 variables system)*	25 *Performance assessment (Unit assessment Review)*	26
27	28 *Unit Assessment Review*	29 Unit Assessment	*30*			

Scope and Sequence

Overview		
Lesson	Topic	Suggesting Pacing and Dates
1	Solving Linear Equations	3 day
2	Using Linear Models	2 day
3	Family of Functions	1 day
4	Solving System of Equation Using Table & Graph	2 day
5	Solving System Algebraically	3 day

Daily fluency Practice: Solve linear equations (5 minutes Class work, 5 minutes Homework throughout the entire unit)

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	A.CED.4 A.CED.2 A.CED.1 A.REI. 1 F.BF.3 S.ID.6	½ Block	Individual	Yes
Unit 1 Assessment	A.CED.4 A.CED.2 A.CED.1 A.REI. 1, 6, 11 F.BF.3 S.ID.6	1 Block	Individual	Yes
Performance Task 1 -- Speeding Ticket Task --		1 Block	Pair or Group	Yes

Lesson Analysis

Lesson 1: 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	2 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 2: Using Liner Models

Objective

- Using technology, students will fit a linear function for a scatter plot that suggests a linear association with __ out of ___ question correctly in the exit ticket or class work.
- Using the line of best fit, students will estimate an unknown quantity for a real life situation with __ out of __ questions correctly in the exit ticket or class work.

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.
- MP 5:Use appropriate tools strategically

Vocabulary: Scatter plot, correlation, line of best fit, linear regression, correlation coefficient

Common Misconceptions:

- It is a common mistake to conclude that because two events are correlated, one must be the cause of the other. It is possible, however, for two events to be correlated, even strongly correlated, without one event causing the other. It may be the case that a third event is the common cause of the correlated events. For example, houses and mild do seem to cost more as time goes by. However, time itself does not cause these prices to go up; rather, other factors like inflation and demand, which change over time, are the cause.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
S.ID.6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or chooses a function suggested by the context. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a liner function for a scatter plot that suggests a linear association.	***Review*** • When data from a real-word situation can be written as a set of ordered pairs. ***New*** • You can use various types of regression equations as models to model the data from a real-word situation. • Yu can use a scatter plot to determine the strength of the relations, or correlation between data sets. • The trend line that gives the most accurate model of related data is the line of best fit. • The correlation coefficient, r, indicates th strength of the correlation.	***Review*** • Plot points on a coordinate plane • Sketch a trend line. • Create a linear equation for a set of given points ***New*** • Use TI-84 STAT feature to enter sets of given data • Use TI-84 LinReg feature to find the linear regression line of best fit for the data	Lesson 2-5 Day 1: Focused on *describe correlation, & write the equation of a trend line (manually) Day 2: Find the line of best fit (TI-84)	2 day	Practice exercises; See **SAMPLE LESSON PLAN**

Lesson 3: Families of Functions

Objective:

Use parent functions, students will identify and analyze the effect on the graph by transformations of function with __ out __ questions correctly in exit ticket or class work.

Focused Mathematical Practices

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

Vocabulary: Rigid transformation , Parent function, transformation, translation, reflection, vertical stretch, vertical c compression

Common Misconceptions:

- Students might think all transformation are translations. Make sure use graph to help students understand that translations are a type of transformations. Rigid transformations (also called isometries) do not change the shape, only the location. Non-rigid transformation includes stretches, compressions, and dilations.

CCSS	**Concepts** What students will know	**Skills** What students will be able to do	Material/ Resource	Suggested Pacing	Assessment Check Point
F.BF.3: Identify the effect of the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x+k) for specific values of k (both positive and negative) find the value of k given the graph	***Review*** • There are sets of functions, called families, in which each function is a transformation of a special function called the parent. • A parent function is the simplest form of a set of functions that form a family. New • Understand how the graph of the parent function vertical/horizontal shifts related to the constant k, as the y=f(x)±k or y=f(x±k). • Understand how the graph of the parent function vertical stretches and compressions related to the constant k, as the y=kf(x) or f(kx). •	***Review*** • Sketch a graph for a function given and show the key features New: • Identify the transformation of the parent function from graph. • Create equation for a given function graph based on it's parent function and the transformation shown on the graph	Lesson 2-6 Note: *questions on this unit for creating equations only limited on linear function. * Test or practice questions in this unit related to other types of function will be multiple choice or match question types. NOTE: Students have learned this standard in Algebra I	1 day	Lesson check: page 103 #1 ~ 6

Lesson 4: 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 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	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	Review: • Linear models are found often in real life	Review: • Write equation in slope intercept, and standard			

represent relationships between quantities; graph equations on coordinate axes with labels and scales	situations	forms.			

Lesson 5: Solving Systems Algebraically

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. 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 • Variables can represent unknown quantities for the situation given • Property of equalities • Literal equations **New** • Equation that can be solved using the Properties of Equality is obtained by substitution method	Review • Create equation for the situation given • 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 • Solve system of linear equations with three variables	Textbook 3.2, 3.5 3-2: online resources such as practice problems, remediation worksheets, challenge problems, activities, games, etc. NOTE: Use day 3 to introduce how to solve linear system with 3 variables	3 day	Lesson Check (pg. 145: 1, 2, 7, 9)

Ideal Math Block

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

1) Fluency Skill Practice (5 min)

2) 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

3) 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

4) 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

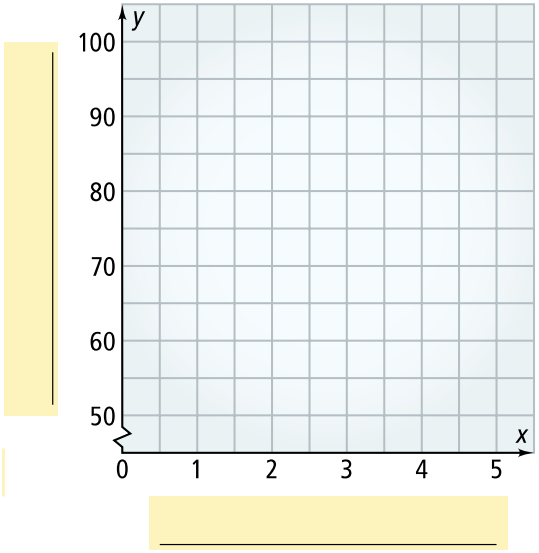
5) Class Activity (25-30 min)
    a. Design varies based on content
    b. May include partner work, group work/project, experiments, investigations, game based activities, etc.

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

7) 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

8) DOL (5 min)
    a. Exit slip

Sample Lesson Plan 1

<table>
<tr><td>Lesson</td><td>Lesson 2: Using Linear Models (Day 1)</td><td>Days</td><td>1</td></tr>
<tr><td>Objective</td><td>For given data sets, students will
• make a scatter plot
• identify the how strong of the correlation between data sets
• create trend line for the data sets
• compare different trend lines to choose the line of best fit</td><td>CCSS</td><td>S-ID-6</td></tr>
<tr><td>Learning activities/strategies</td><td colspan="3">Fluency Practice: Solving linear equations (5 minutes)
Do Now: (10 minutes)
Question: The table shows the number of hours students spent online the day before a test, and the scores on the test.
Computer Use and Test Scores
Number of Hours Online 0 0 1 1 1.5 1.75 2 2 3 4 4.5 5
Test Score 100 94 98 88 92 89 75 70 78 72 57 60
Part A: Make a scatter plot on the graph below.
 

Part B: What trend do you see about the relationship between data sets?

Go over the Do Now:
(Check students' graph to make sure each student has basic still required for making scatter plot while students are working on the do now)
* Whole group discussion about what trend that students see between data sets

Mini lesson: (Use the do now question) – Whole group instruction
• Introduce the vocabulary "CORRECTION"
• Use textbook page 92 graphs to explain positive/negative correlation and no correlation.
• Ask students to decide what type of correlation is on the Do Now question, and explain why.

Practice: Pair work – MP 3
(prepare 2-3 graphs on the smartboard to ask student discuss with their partners to decide what</td></tr>
</table>

types of correlation on the graphs)

Mini lesson: (Use page 94 example 2) --- MP 4

- Use do now question to model how to make a TREND LINE for the data sets
- Introduce the meaning of LINE of best fit.
- Model how to make a trend line and determine the Line of best fit.
- Review how to create an equation for the line of the best fit. (using slope intercept form, point-slope form….etc)

Practice: Group/Pair/individual work

- Ask student to -- MP 3, 4
  - create their trend line for the Do Now question (individually)
  - Create an equation for the trend line (individually)
  - Compare the trend line with their partner to see who's line fit the data better (pair work), and why.

(Teacher can use cell phone "scan" apps to scan student works and project to the smartboard)

- Whole group discussion: MP 3
  - Project some students' works and discuss which line is the line of best fit and why.

Closure: (note taking time)

Ask:

- What have you leaned from today's class? (Students might give some terms such as corrections, positive correction…. Trend line, line of best fit..)
- What does correction/…/trend line/line of best fit mean?
- How can we know if the line is the best fit?
  (while students are giving inputs of their discussion, teacher can record/type the information on the white board/smartboard to help student organize their notes)
  After discussion, give 3-5 minutes to students for taking their notes.

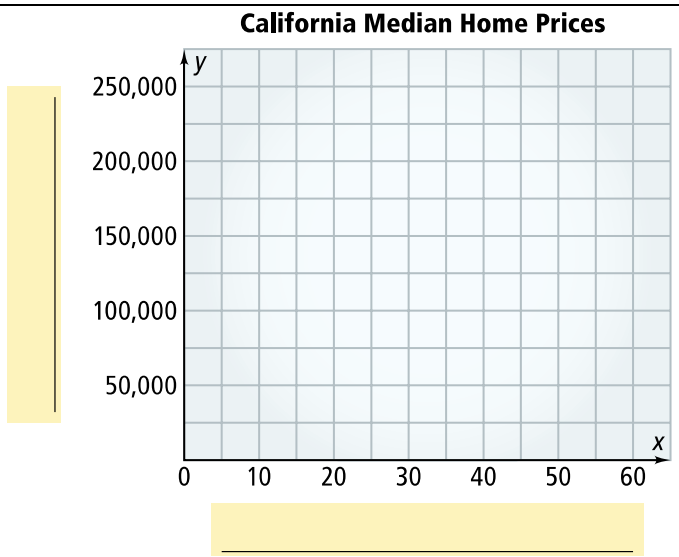
DOL (exit ticket):

Question:

The table shows median home prices in California.

California Median Home Prices							
Year	1940	1950	1960	1970	1980	1990	2000
Median Price ($)	36,700	57,900	74,400	88,700	167,300	249,800	211,500

Part A: Graph the data on the coordinate plane below. (Hint: Use 0 to represent 1940)

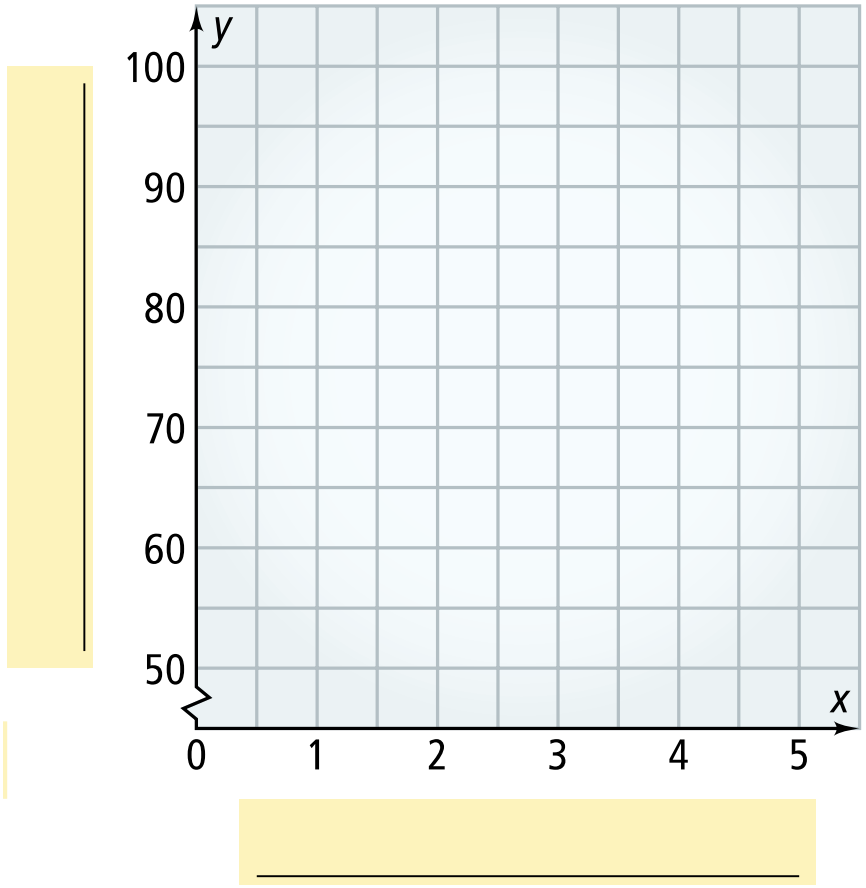
	 Part B: Draw a trend line and write the equation for the line that you draw. Part C: Describe the correlation **Homework:** **Ask students choose 3 questions from page 96 # 7 ~ 11**
Differentiation	***Possible differentiation strategies: (please design your own differentiation based on your students learning styles, academic level, strength and weakness,…..)*** • Process differentiation: For students have difficulties to provide appropriate scale for the question given, the teacher can group them together and work with them to discuss how to set up an appropriate scale for the graph; or provide the graph with scale has been set up. If some students have difficulty to create an equation for the line on the graph, pair those students with the strong students and do peer tutoring. • Product differentiation: Provide different types of real life problems to ask student work on the content learned today, students can choose which data sets that they would like to work on based on their interests.
Assessment	Formative: *circulating throughout class during lesson • Use do now question to assess students' prior basic skill (make a graph for a data sets) • Use questions to assess students' understanding for the new lesson during mini lesson Session • Listen/observe student discussion during pair/group activities to see the depth of understand of new concept. • Look at student exit ticket/home work to see if student reach today's objective and use the data to modify tomorrow's lesson
Common Misconceptions/ Difficulty	Misconceptions: *It is a common mistake to conclude that because two events are correlated, one must be the cause of the other Difficulty: * Students might have difficulty to decide which trend line will be the line of best fit without using graphing calculator. Reduce student's frustration by telling them that they will learn how to use graphing calculator to find the line of best fit to overcome this difficulty.

Linear Model (Day 1) Do Now

The table shows the number of hours students spent online the day before a test, and the scores on the test.

Computer Use and Test Scores												
Number of Hours Online	0	0	1	1	1.5	1.75	2	2	3	4	4.5	5
Test Score	100	94	98	88	92	89	75	70	78	72	57	60

Part A: Make a scatter plot on the graph below.



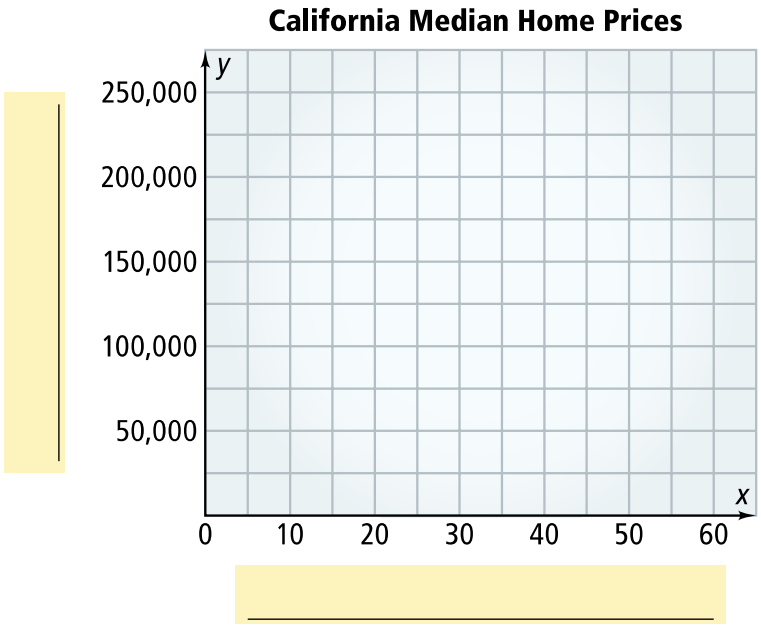
Part B: What trend do you see about the relationship between data sets?

Linear Model (Day 1) Exit Ticket **Name:**

The table shows median home prices in California.

California Median Home Prices							
Year	1940	1950	1960	1970	1980	1990	2000
Median Price ($)	36,700	57,900	74,400	88,700	167,300	249,800	211,500

Part A: Graph the data on the coordinate plane below. (Hint: Use 0 to represent 1940)



Part B: Draw a trend line and write the equation for the line that you draw.

Part C: Describe the correlation

Sample Lesson Plan 2

Lesson	Lesson 4: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: MP 4

- 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: **MP 1**

- 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: *circulating throughout class during lesson • Use do now question to assess if student can make connection between graph and context • Use questions to assess if students are willing to take risk to use different strategies to solve provlem • Listen/observe student discussion during pair/group activities to see if students can use technology to solve problem • Look at student exit ticket/home work to see if student reach today's objective and use the data to modify tomorrow's lesson Lesson Check, CFU, Station activity sheets
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.

Lesson 4:Solving Systems Using Tables and Graphs (Day 1)

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

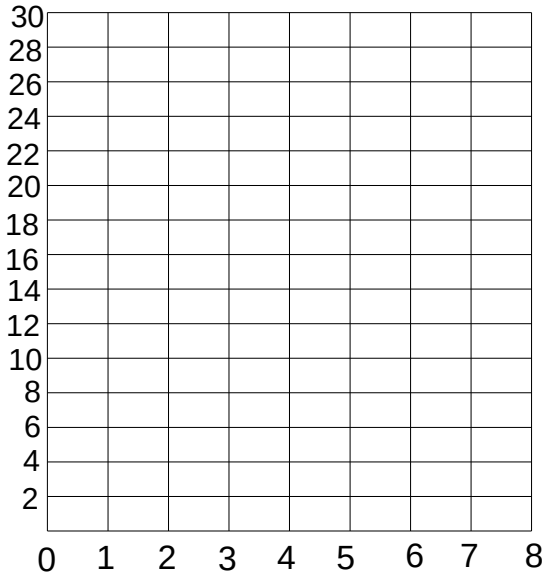
Table 1: The height of spruce tree

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

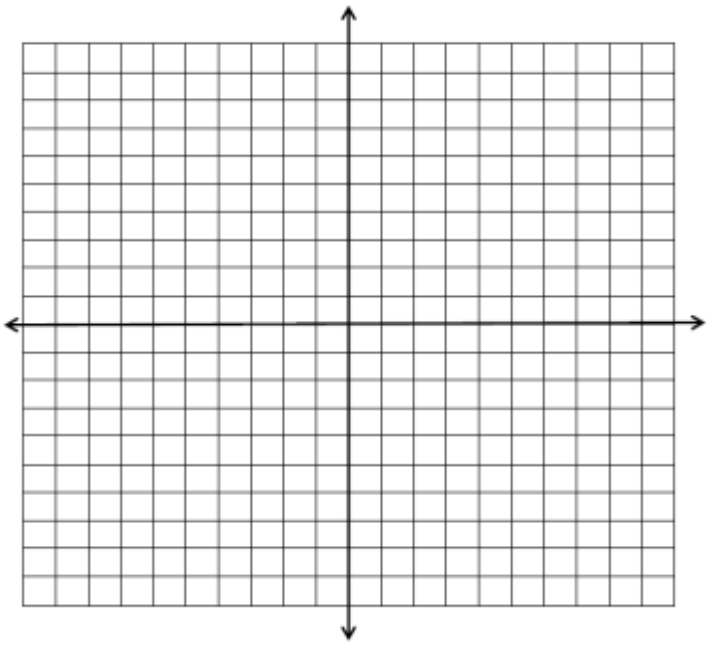
Question 1: $\begin{cases} y = x + 4 \\ y = -2x + 1 \end{cases}$ (Use Ti-84 to solve the problem)

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: _____

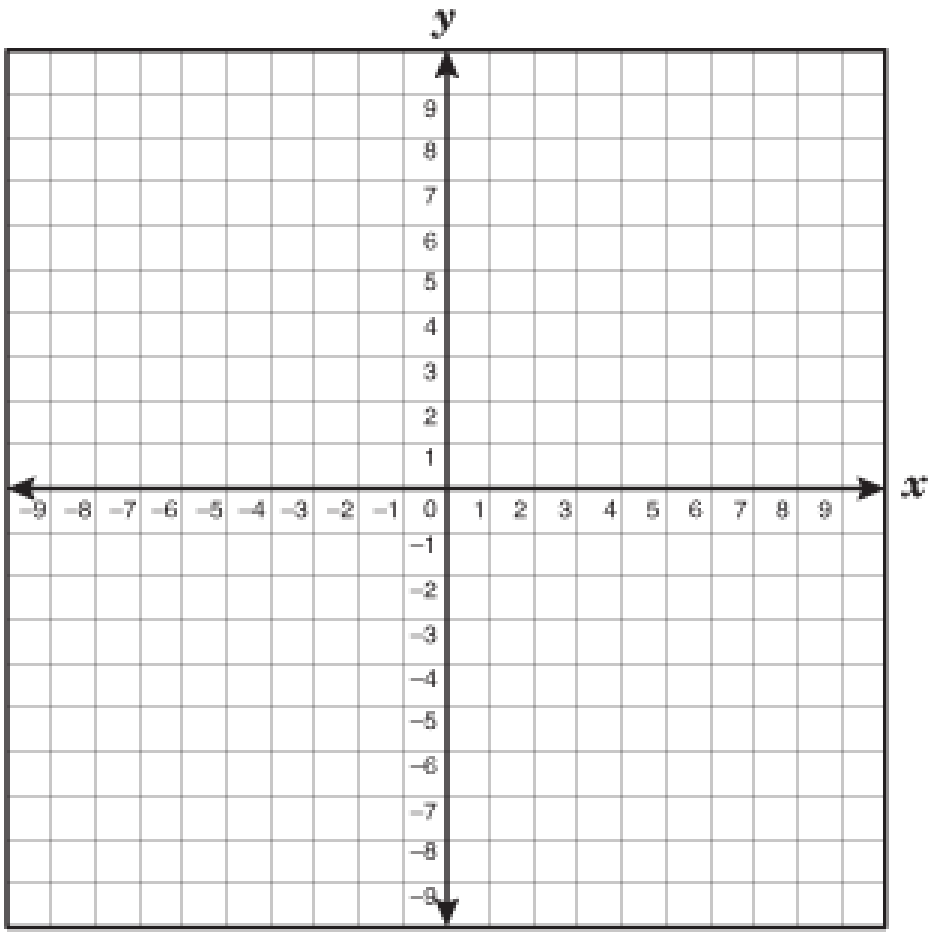
Justify your solution: (Show your work on the other side of the paper)

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.

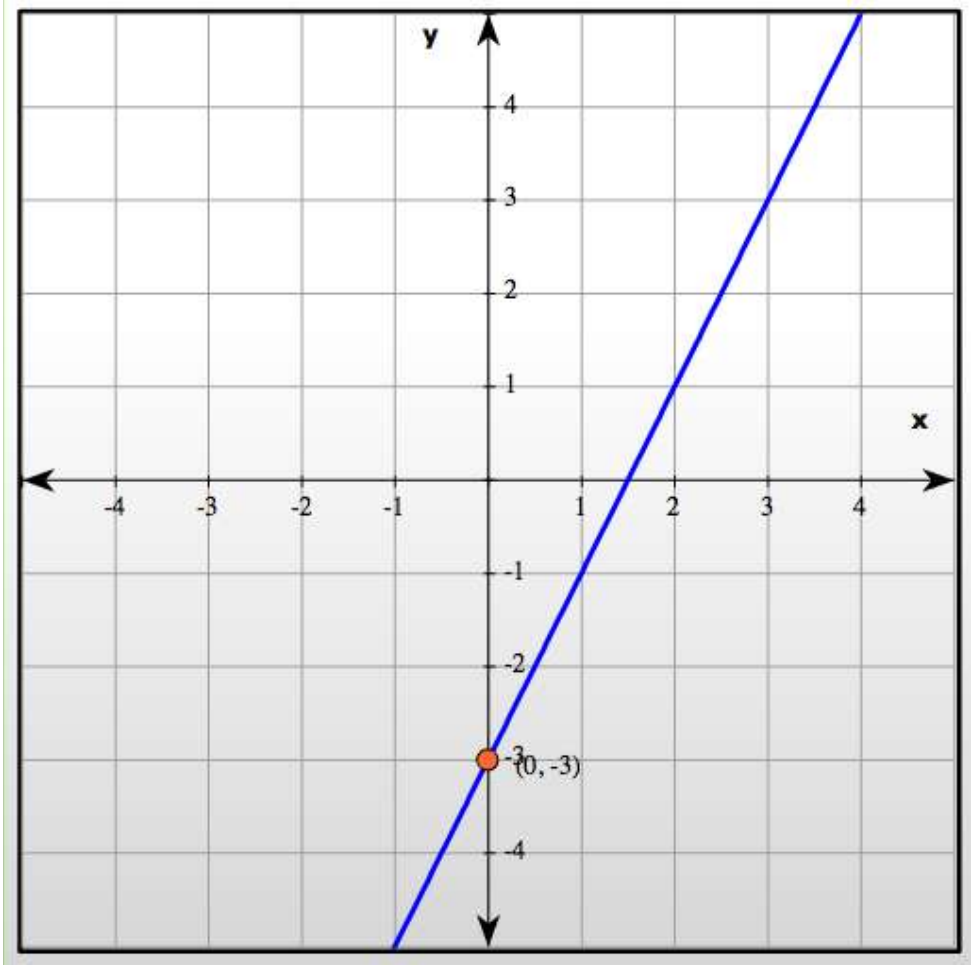


Part B:

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: Solving system of equations by graphing (Word Problems)

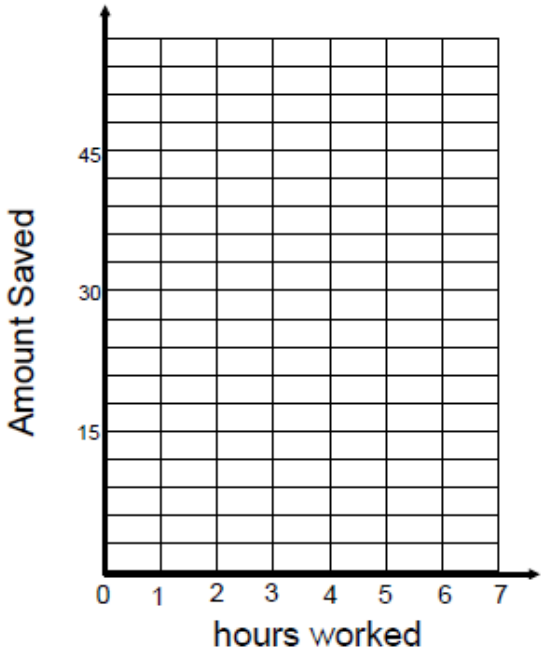
Question 1: Maryann and Carlos are each saving for new scooters. So far, Maryann has $9 saved, and can earn $6 per hour babysitting. Carlos has $3 saved, and can earn $9 per hour working at his family's restaurant.

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

Maryann:

Carlos:

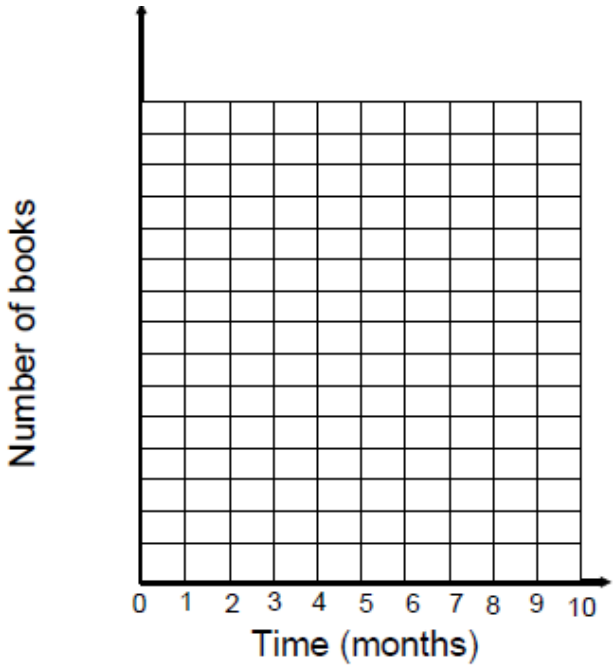
Part B: Graph the two equations that you created from Part A.



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)



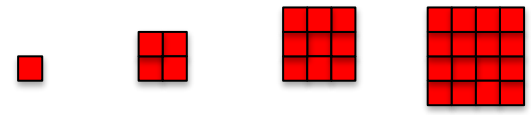
Supplemental Material

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



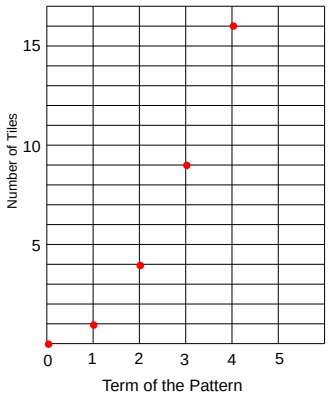
Term 1 Term 2 Term 3 Term 4

- 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

$\mathbf{a_n = n^2}$

Function

$\boldsymbol{f}\ \mathbf{(n) = n^2}$

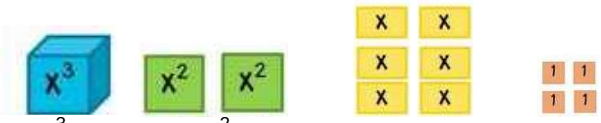
$y = x^2$ (x: term of the pattern, y: number of tiles)

Combine Like Terms

- Concrete (Algebra Tiles)

$2x^3$ $3x^2$ 4x 2

+



x^3 $2x^2$ 6x 4

- Pictorial/Verbal Description

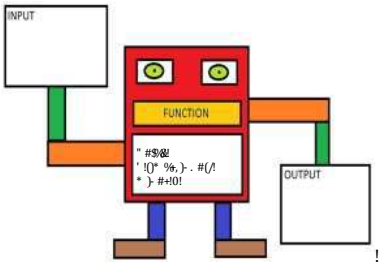
Like terms (*ex. $2x^3$ and x^3 are like terms, $2x^3$ and $2x^2$ are not like terms)* have the same variables raised to the same powers. You can simplify an expression or add/subtract expressions by **combining like terms.**

- Abstract/Symbols

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

Function

- Concrete (Function Machine)

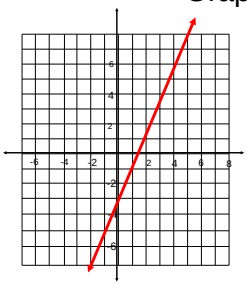


- Pictorial/Verbal Description

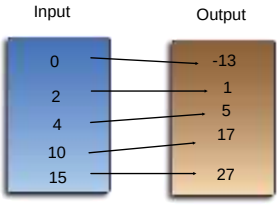
Table

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

Graph



Mapping Diagram



Verbal Rule: 2 times a number minus 3

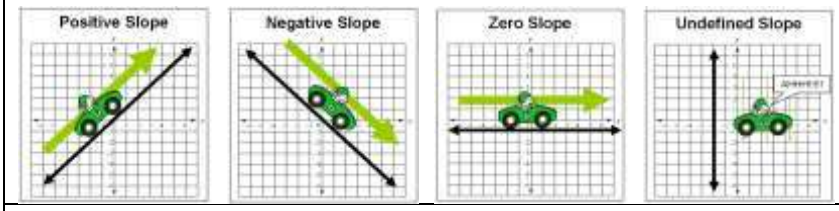
- Abstract/Symbols

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

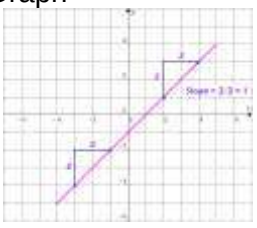


- Pictorial/Verbal Description (ratio table & slope triangle)

Table

! "	#"
$%'	$&"
' "	$("
%'	("
) "	&"
* "	+"

Graph



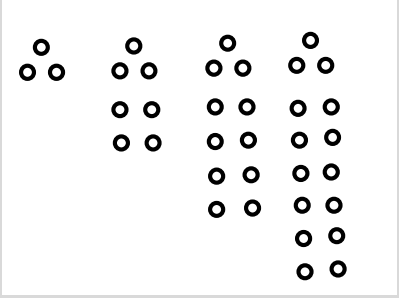
- Abstract/Symbols

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

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

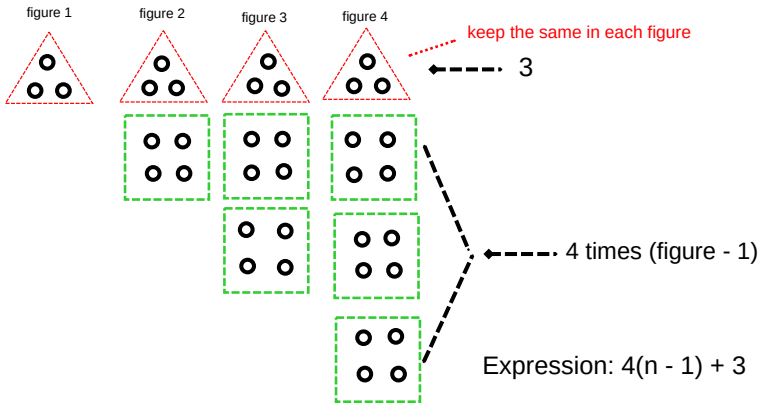
Solve problem using multiple strategies

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

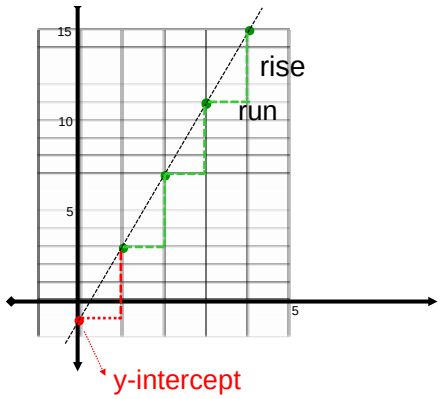
+1, +1, +1, +1

+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 choosing 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

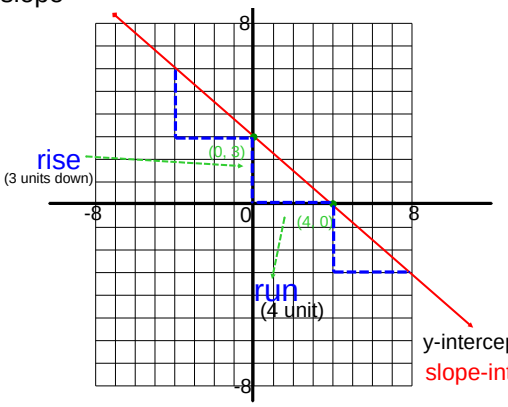
rise -3/4

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

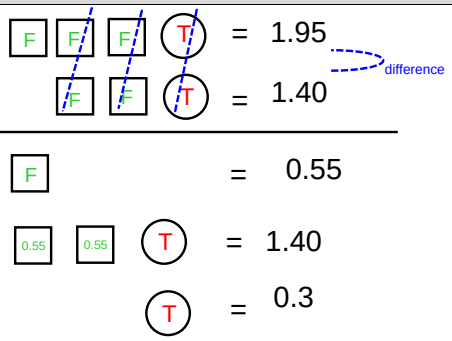
Example: The Fruit Emporium sells a dish of two flavors of yogurt with one serving of fruit toppings for $1.40. It also sells a dish of three flavors of yogurt with one serving of fruit toppings for $1.95.

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

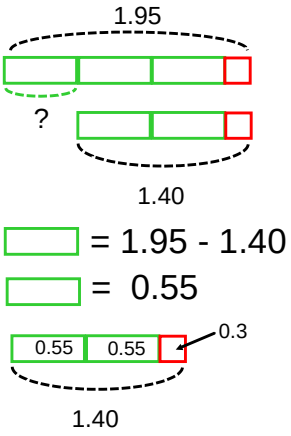
b. How much does a customer pay for the one serving of fruit toppings?

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

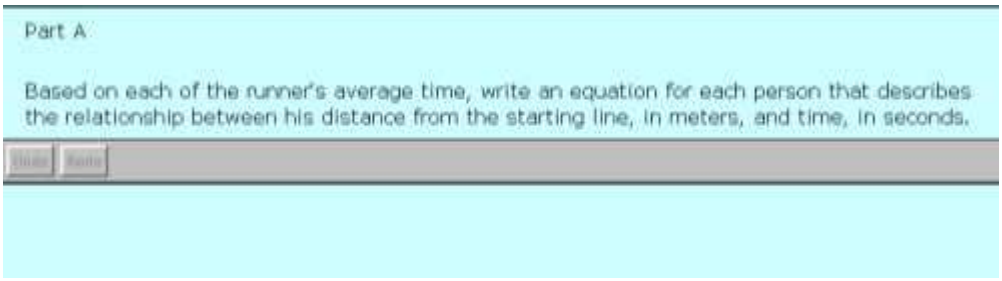
- 1.10 -1.10

t = 0.30

PARCC Sample Assessment

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:

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)