Mathematics
Instructional Cycle Guide

Concept (A-REI.6)

Created by Amanda Johnson, 2014 Connecticut Dream Team teacher

CT CORE STANDARDS

This Instructional Cycle Guide relates to the following *Standards for Mathematical Content* in the *CT Core Standards for Mathematics*:

Solve systems of equations.
A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

This Instructional Cycle Guide also relates to the following *Standards for Mathematical Practice* in the *CT Core Standards for Mathematics*:

1: Make sense of problems and persevere in solving them.
4: Model with mathematics.
6: Attend to precision.

WHAT IS INCLUDED IN THIS DOCUMENT?

- A Mathematical Checkpoint to elicit evidence of student understanding and identify student understandings and misunderstandings **(page 2)**
- A student response guide with examples of student work to support the analysis and interpretation of student work on the Mathematical Checkpoint **(pages 3-6)**
- A follow-up lesson plan designed to use the evidence from the student work and address the student understandings and misunderstandings revealed **(pages 7-9)**
- Supporting lesson materials **(pages 10-26)**
- Precursory research and review of standard **A-REI.6** and assessment items that illustrate the standard **(pages 27-29)**

HOW TO USE THIS DOCUMENT

1) Before the lesson, administer the **(A Trip to NYC)** ***Mathematical Checkpoint*** individually to students to elicit evidence of student understanding.
2) Analyze and interpret the student work using the ***Student Response Guide***.
3) Use the next steps or ***follow-up lesson plan*** to support planning and implementation of instruction to address student understandings and misunderstandings revealed by the Mathematical Checkpoint.
4) Make instructional decisions based on the checks for understanding embedded in the follow-up lesson plan.

MATERIALS REQUIRED

- **Projector, whiteboard, or chart paper**
- **Dry erase markers**
- **Sets of Launch cards (see Supporting Lesson Materials)**
- **Sets of Checking for Understanding Part 1 cards (see Supporting Lesson Materials)**

TIME NEEDED

A Trip to NYC administration: **10 minutes**
Follow-Up Lesson Plan: **90 minutes**

Timings are only approximate. Exact timings will depend on the length of the instructional block and needs of the students in the class.

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Step 1: Elicit evidence of student understanding		
Mathematical Checkpoint		
Question(s)	**Purpose**	
I. The senior classes at Danbury High School and Henry Abbott Technical High School planned separate trips to NYC. The senior class at Henry Abbott Technical High School rented and filled 1 mini bus and 6 regular busses with 372 students. Danbury High School rented and filled 4 mini busses and 12 regular buses with 780 students. Each mini bus holds the same number of students. Each regular bus holds the same number of students. How many students can each type of vehicle hold? II. Solve with the most efficient method of solving. III. Explain why you think the method you chose was the most efficient.	**CT Core Standard:**	HSA-REI.C.6 – Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
	Target question addressed by this checkpoint:	*Can the student write a system of equations to represent the given scenario?* *Can the student identify the most efficient method of solving and explain why this method is the most efficient?* *Can the student answer the question in context of the problem?*

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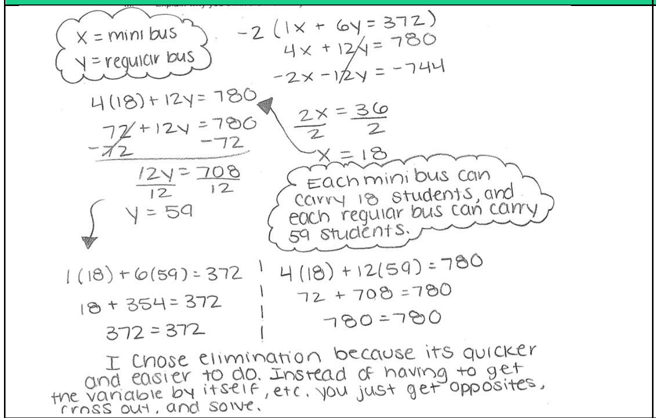
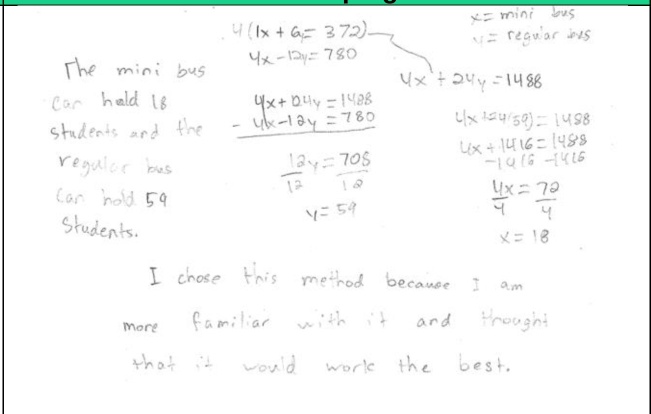
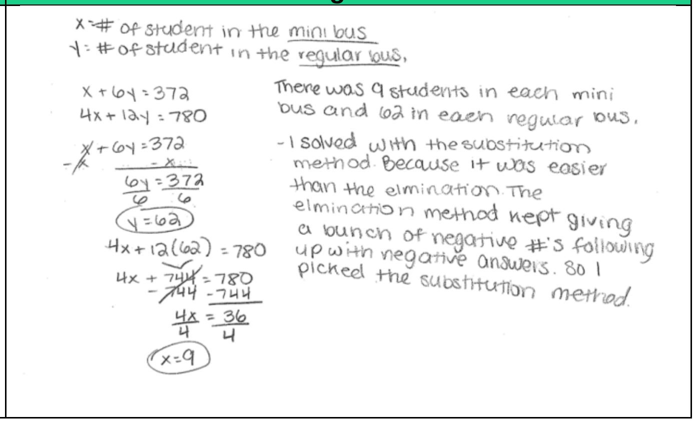
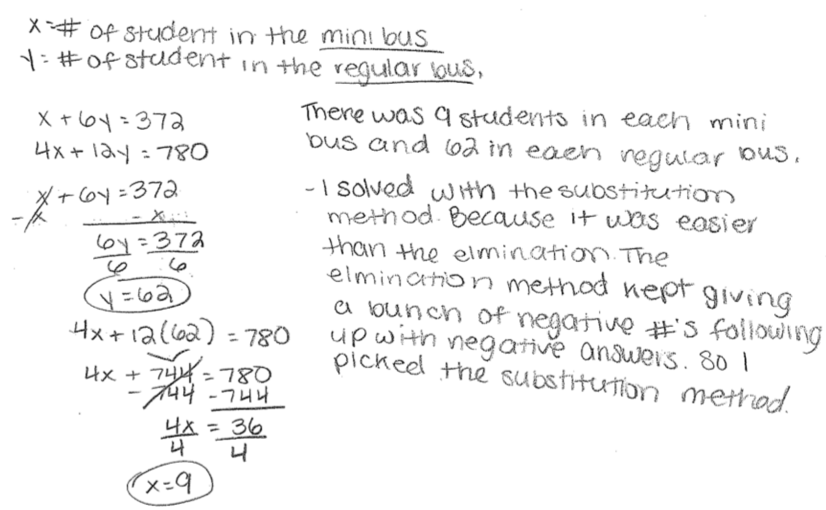
Step 2: Analyze and Interpret Student Work		
Student Response Guide		
Got It	**Developing**	**Getting Started**
		

Getting Started	
Student Response Example	**Indicators**
	• Student shows understanding of how to define variables. • Student shows an understanding of writing equations to represent real-life scenarios. • Student shows an understanding that the given problem should be solved using a system of equations. • Student does not understand how to solve a literal equation, as seen by deleting the x term that was subtracted from either side of the equation. • Student does not identify the most convenient variable to isolate. • Student does not show evidence of checking if their solution makes both equations true at the same time.
In the Moment Questions/Prompts	**Closing the Loop (Interventions/Extensions)**
Q: You made an error when solving for y; can you identify the error by looking over your work? **Q:** Why did you solve this system by substitution? Explain more clearly. **Q:** How can you check to see if your answer is correct? **P:** What are the other methods of solving? Would one of those methods be easier? Try applying it to this problem.	http://learnzillion.com/lessons/4048 Solve linear systems algebraically using substitution http://learnzillion.com/lessons/3321 Solve literal equations http://learnzillion.com/lessons/2755 Choose a method for solving a system of equations

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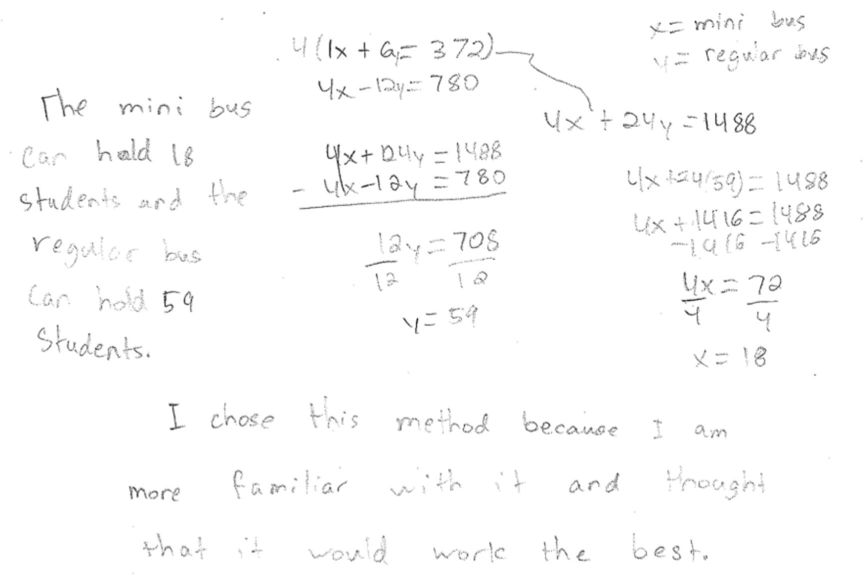
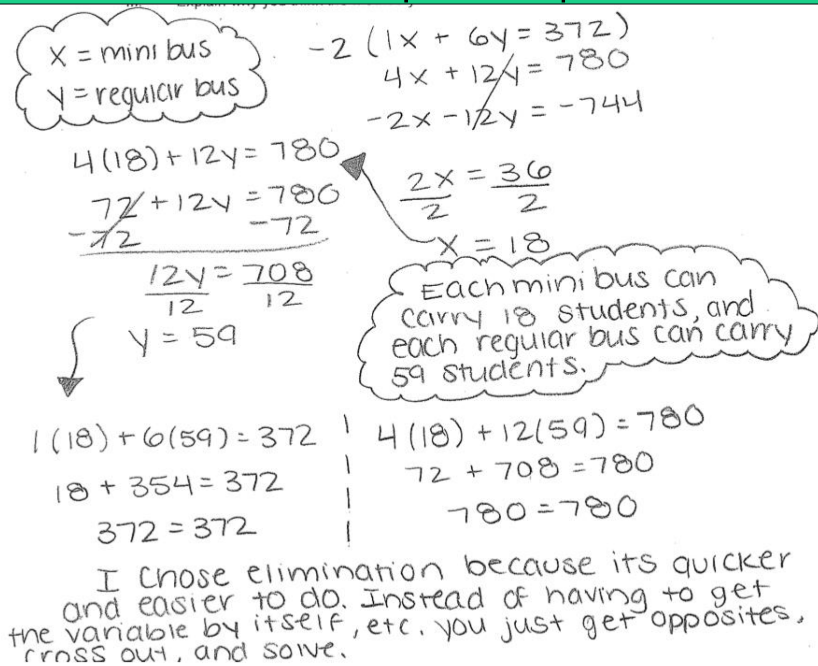
Developing

Student Response Example	Indicators
 *(Note: The student does recognize that one of the equations needs to have a negative x coefficient, but his work does not show evidence of distributing the negative to all terms in the equation.)*	• Student shows understanding of how to define variables. • Student shows an understanding of writing equations to represent real-life scenarios. • Student shows an understanding that the given problem should be solved using a system of equations. • Student does not choose to use an original equation to substitute into to find the other variable. • Student does not show a *clear* understanding of how to multiply one of the equations of the system by a constant to eliminate a variable because he multiplies the first equation by a positive number, which will result in two positive coefficients for the x terms. • Student does not show an understanding of how to determine the most efficient method of solving or does not know how to appropriately support his chosen method. • Student does not show evidence of checking if their solution makes both equations true at the same time.

In the Moment Questions/Prompts	Closing the Loop (Interventions/Extensions)
Q: When is solving by substitution the most efficient method? **Q:** When is solving by elimination the most efficient method? **Q:** How can you check to see if your answer is correct? **Q:** You made an error writing the second of your original equations; can you identify the error by looking over your work? **P:** Tell me about how you chose the constant you multiplied by in the first equation when solving.	http://learnzillion.com/lessons/260-solve-systems-of-equations-using-elimination-5 Solve systems of equations: using elimination http://learnzillion.com/lessons/718-show-a-pair-of-numbers-is-a-solution-by-testing-values Show a pair of numbers is a solution by testing values http://learnzillion.com/lessons/2755 Choose a method for solving a system of equations

Got it	
Student Response Example	**Indicators**
	• Student shows an understanding of how to define variables. • Student shows an understanding of writing equations to represent real-life scenarios. • Student shows an understanding that the given problem should be solved using a system of equations. • Student shows an understanding of how to solve a system of equations by elimination. • Student checks their solution by substituting their values back into the original equations that they wrote to model the scenario. • Student concludes that each mini bus can hold 18 students and each regular bus can hold 59 students. • Student supports their choice for method of solving the system of equations.
In the Moment Questions/Prompts	**Closing the Loop (Interventions/Extensions)**
Q: How do your variables and equations relate to the given scenario? **Q:** Why did you make “x” equal to “mini bus” and “y” equal to “regular bus?” **Q:** Would you still arrive at the same answer if you switched the variables that you defined? (ie: “y” is equal to “mini bus” and “x” is equal to “regular bus”) **Q:** Could you use substitution for this problem? What would be the advantages or disadvantages for that method?	http://learnzillion.com/lessons/4048 Solve linear systems algebraically using substitution http://learnzillion.com/lessons/2755 Choose a method for solving a system of equations http://learnzillion.com/lessons/3078 Graph systems of inequalities by shading their intersection

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Steps 3 and 4: Act on Evidence from Student Work and Adjust Instruction	
Lesson Objective:	Students will be able to write and solve a system of equations in the context of a real world scenario and explain why the method they chose is the most efficient.
Content Standard(s):	**A-REI.6:** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
Targeted Practice Standard :	MP1: Make sense of problems and persevere in solving them. MP4: Model with mathematics. MP6: Attend to precision.

Mathematical Goals	Success Criteria
• Understand that systems of equations often suggest a method of solving that is more efficient than others. • Understand the real world meaning of the solution point.	Student shows an understanding of how to define variables, write equations to represent real-life scenarios, solve a system of equations by the most efficient method, support their choice for method of solving the system of equations, check their solution by substituting their values back into the original equations and provide an answer in context of the problem.

Launch (Probe and Build Background Knowledge)

Purpose: ***Assess and activate background knowledge of the different methods of solving systems of equations.***

Provide students with a set of Launch cards (see Supporting Lesson Materials). Instruct the students to work with their partner to:

- determine which method would match up best for solving the given systems of equations.
- write a brief supporting statement for why they chose that method of solving.

Instructional Task

Purpose: ***Introduce the messy bill task and provide students time to model with math and problem-solve.***

Engage (Setting Up the Task)

1. Introduce the task by providing the students with a copy of the Instructional Task (see Supporting Lesson Materials).

2. Provide students with 3 minutes to think quietly and record ideas regarding the following questions:

- What are we trying to figure out?
- How could we use math to model this problem?
- Based on our mathematical model, what means of solving can we use?
- Is there any other information we need to know in order to solve this problem and if so, what?

Student trios, which may be designed with one student from each group of student work as defined above, will discuss the ideas that they recorded during the thinking time. Each student trio will make one comment on one of the questions (determined by the teacher). Ideas will be recorded on chart paper/white board/SmartBoard.

3. Allow student trios time to define variables and write equations to model this problem. In order to ensure all students in the group are participating, the teacher may recommend that one student is responsible for defining the variables and the other two students are responsible for each writing one of the equations of the system. Circulate to observe and provide guiding questions, some examples can be found below, to students who are struggling. In addition, inform students who have correctly defined the variables and written the equations to model the scenario.

Explore (Solving the Task)

4. Provide students time to work on the messy bill task in their trios. One student will be responsible for solving by graphing, one student will be responsible for solving by substitution and one student will be responsible for solving by elimination. After about 5 minutes, students should take a look at the other two methods of solving done by their trio members and make any comments or suggestions. Circulate to observe, question, and note students who are strategic candidates to share out responses, such as a student who has mastered solving by elimination or a student who has successfully isolated a variable before solving by substitution. Below are possible questions/prompts to ask as students engage in task:

Focusing Questions

- *What form should your equations be in in order to solve by graphing?*
- *What are the best scales for your axes?*
- *What does each of your axes represent?*
- *What form should your equations be in in order to solve by elimination?*
- *What form should your equations be in in order to solve by substitution?*

Probing Questions

- *As you were solving the system by the graphing/ substitution/ elimination method, what were some of the difficulties you came across?*
- *As you were solving the system by the graphing/ substitution/ elimination method, did you notice any benefits of your means of solving?*
- *How can you check your solution?*
- *How do your numerical answers answer the question(s) being asked in the original problem?*

Advancing Questions

- *What characteristic would you change to make this problem easier to solve by graphing?*

Elaborate (Discuss Task and Related Mathematical Concepts)

5. Call the class back together to facilitate a task discussion. Project or post the following questions for students to consider as others share their work.

- Did everyone in your group arrive at the same exactly solution?*
- *(If yes, why did that happen?)
- *(If not, what do you think is the reason for having different solutions?)
- Was there one group member's method that stood out as the easiest or most efficient method of solving?
- Was there one group member's method that stood out as being a more difficult or lengthy method of solving?
- Do you think there will always be **one** method that will be the most efficient? Why or why not?

Checking for Understanding

Purpose: ***Elicit evidence of students' understanding of writing systems of equations to model a scenario and determining the most efficient method of solving the system.***

6. Provide student trios with sets of Checking for Understanding Part 1 cards (see Supporting Lesson Materials). Students will use a dry erase marker to write a system of equations to model the scenario and then determine which method(s) of solving would be the most efficient for each of the three problems. They can check their answers by flipping over the card. When they are done, they will rotate the cards within the trio until all three students have completed all three problems. Students should then discuss what they chose for each and explain why. With any extra time, students can try solving the systems too, but this is not required for the purpose of the activity.

Common Misunderstanding

Purpose: ***Address a common misunderstanding students often have about selecting the most efficient method***

of solving for two equations in slope-intercept form.

Point out to students the two word problems that will elicit equations in slope-intercept form from the laminated cards activity. Though slope-intercept form generally suggests graphing as the most efficient method, it is important to look at the coefficient of the x term and constant to see if substitution would be more efficient. Graphing also may not produce the exact answer if the student it not precise with their graphing skills. Substitution maybe the most efficient method and this could be a good class discussion.

Checking for Understanding

Purpose: ***Elicit evidence of students' understanding of determining the most efficient method of solving the system, supporting their selection and providing an answer in context of the problem.***

Provide each student with Checking for Understanding Part 2 handout (see Supporting Lesson Materials).

Note to teacher: You may either insert your own two examples for John and Jessica based on common misconceptions in your classroom, or you can use the examples included.

Closure

Purpose: ***Allow students to reflect on their learning and their progress toward meeting the content standard.***

In your math journal or as an Exit Ticket, respond to 3 of the following 5 questions:

1) What method of solving systems of equations do you feel most comfortable using and why?
2) What method of solving systems of equations could you still use some help with?
3) When is it best to use the substitution method to solve a system of equations?
4) Why might I arrive at two different answers when I solve by substitution and graphing for the same problem?
5) What was your biggest "AH-HA!" moment in class today? Why?

Extension Task

Purpose: ***Provide an extension task for those students who are ready to deepen their understanding of determining the most efficient method of solving system of equations. This extension task requires higher-order thinking because the student will be creating the system AND solving it.***

Create your own word problem that could be solved using systems of equations. Define your variables and then use the most efficient method of solving. Defend your choice using precise mathematical vocabulary and be sure to answer your question in context of the problem.

Mathematical Checkpoint

Algebra I – Systems of Equations

The senior classes at Danbury High School and Henry Abbott Technical High School planned separate trips to NYC. The senior class at Henry Abbott Technical High School rented and filled 1 mini bus and 6 regular busses with 372 students. Danbury High School rented and filled 4 mini busses and 12 regular busses with 780 students. Each mini bus holds the same number of students. Each regular bus holds the same number of students. How many students can each type of vehicle hold?

Solve with the most efficient method of solving. Explain why you think the method you chose was the most efficient.

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Mathematical Checkpoint

Algebra I – Systems of Equations

The senior classes at Danbury High School and Henry Abbott Technical High School planned separate trips to NYC. The senior class at Henry Abbott Technical High School rented and filled 1 mini bus and 6 regular busses with 372 students. Danbury High School rented and filled 4 mini busses and 12 regular busses with 780 students. Each mini bus holds the same number of students. Each regular bus holds the same number of students. How many students can each type of vehicle hold?

Solve with the most efficient method of solving. Explain why you think the method you chose was the most efficient.

x = # of students on mini bus
y = # of students on regular bus

$-2(x + 6y = 372)$
$4x + 12y = 780$
$-2x - 12y = -744$

$2x = 36$
$x = 18$

$18 + 6y = 372$
$-18 \quad -18$

$\frac{6y}{6} = \frac{354}{6}$
$y = 59$

or

$x + 6y = 372$
$4x + 12y = 780$

$x = 372 - 6y$

$4(372 - 6y) + 12y = 780$
$1488 - 24y + 12y = 780$
$\frac{-12y}{-12} = \frac{-708}{-12}$
$y = 59$

$x + 6(59) = 372$
$x + 354 = 372$
$x = 18$

18 students fit on a mini bus and 59 students fit on a regular bus.

Launch

Algebra I – Systems of Equations

Solving by Graphing	$y = 4x + 3$ $y = -x - 2$
Solving by Elimination	$4x + 9y = 15$ $4x - 9y = 1$
Solving by Substitution	$x - 4y = 3$ $3y - 3x = 36$

Solving by Graphing	$\frac{1}{3}x - 3 = y$ $-\frac{5}{3}x + 3 = y$
Solving by Elimination	$2x + 3y = 12$ $-4x + 6y = 18$
Solving by Substitution	$y = 4x + \frac{1}{2}$ $4x + 4y = 22$

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Launch

Algebra I – Systems of Equations

Solving by Graphing	$y = 4x + 3$ $y = -x - 2$ Graphing/Substitution
Solving by Elimination	$4x + 9y = 15$ $4x - 9y = 1$ Elimination
Solving by Substitution	$x - 4y = 3$ $3y - 3x = 36$ Substitution

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Solving by Graphing	$\frac{1}{3}x - 3 = y$ $-\frac{5}{3}x + 3 = y$ Graphing/substitution
Solving by Elimination	$2x + 3y = 12$ $-4x + 6y = 18$ Elimination
Solving by Substitution	$y = 4x + \frac{1}{2}$ $4x + 4y = 22$ substitution

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Instructional Task

Algebra I – Systems of Equations

Amanda and her family went out to celebrate her cousin's acceptance into the Marine Corps. Fifteen people had a hibatchi chicken dinner and 5 people had a hibatchi shrimp dinner. The total bill was $546.55. Amanda was trying to determine how much everyone owed. The table next to Amanda's family had one hibatchi chicken dinner and one hibatchi shrimp dinner and the total bill was $56.25. What was the cost of one chicken dinner? What was the cost of one shrimp dinner?

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Instructional Task

Algebra I – Systems of Equations

Amanda and her family went out to celebrate her cousin's acceptance into the Marine Corps. Fifteen people had a hibatchi chicken dinner and 5 people had a hibatchi shrimp dinner. The total bill was $546.55. Amanda was trying to determine how much everyone owed. The table next to Amanda's family had one hibatchi chicken dinner and one hibatchi shrimp dinner and the total bill was $56.25. What was the cost of one chicken dinner? What was the cost of one shrimp dinner?

x = cost of chicken dinner

y = cost of shrimp dinner

$15x + 5y = 546.55$

$x + y = 56.25 \Rightarrow x = 56.25 - y$

$15(56.25 - y) + 5y = 546.55$

$843.75 - 15y + 5y = 546.55$

$-10y = -297.20$

$y = 29.72$

$x + 29.72 = 56.25$

$x = 26.53$

The cost of a chicken dinner is $26.53 and the cost of a shrimp dinner is $29.72.

Checking for Understanding Part 1

Algebra I – Systems of Equations

Rachel is older than Ken. The difference of their ages is 12 and the sum of their ages is 50. How old is Rachel? How old is Ken?	**x = Rachel's age** **y = Ken's age** $x - y = 12$ $x + y = 50$ **Rachel is 31 and Ken is 19.**

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Gino's Pizza Parlor charges \$11.55 flat fee to cover the party room and \$8.80 per mini pizza. The Venetian charges \$24.80 flat fee to cover the party room and \$6.15 per mini pizza. At what number of mini pizzas will the total cost of the party be the same at either place?	**x = # of mini pizzas purchased** **y = total cost** $y = 8.80x + 11.55$ $y = 6.15x + 24.80$ **At 5 mini pizzas purchased, both places will cost \$55.55 for the party.**

The Ives Concert Park is selling family four packs of tickets to a concert. During any concert, there are 24 people working at the event. The Comcast Theater is selling friends five packs of tickets to a concert. During any concert, there are 18 people working at the event. At what number of ticket packs will both venues have the same number of people present?	**x = # of ticket packs purchased** **y = total people** $y = 4x + 24$ $y = 5x + 18$ **At 6 ticket packs purchased, both venues will have 48 people present.**

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Checking for Understanding Part 1

Algebra I – Systems of Equations

Rachel is older than Ken. The difference of their ages is 12 and the sum of their ages is 50. How old is Rachel? How old is Ken?	**x = Rachel's age** **y = Ken's age** $x - y = 12$ $x + y = 50$ $2x = 62$ $x = 31$ $31 - y = 12$ $-31 \quad -31$ $y = 19$ **Rachel is 31 and Ken is 19.**

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Gino's Pizza Parlor charges $11.55 flat fee to cover the party room and $8.80 per mini pizza. The Venetian charges $24.80 flat fee to cover the party room and $6.15 per mini pizza. At what number of mini pizzas will the total cost of the party be the same at either place?	x = # of mini pizzas purchased y = total cost $y = 8.80x + 11.55$ $y = 6.15x + 24.80$ $8.80x + 11.55 = 6.15x + 24.80$ $2.65x = 13.25$ $x = 5$ $y = 8.80(5) + 11.55$ $y = 55.55$ At 5 mini pizzas purchased, both places will cost $55.55 for the party.

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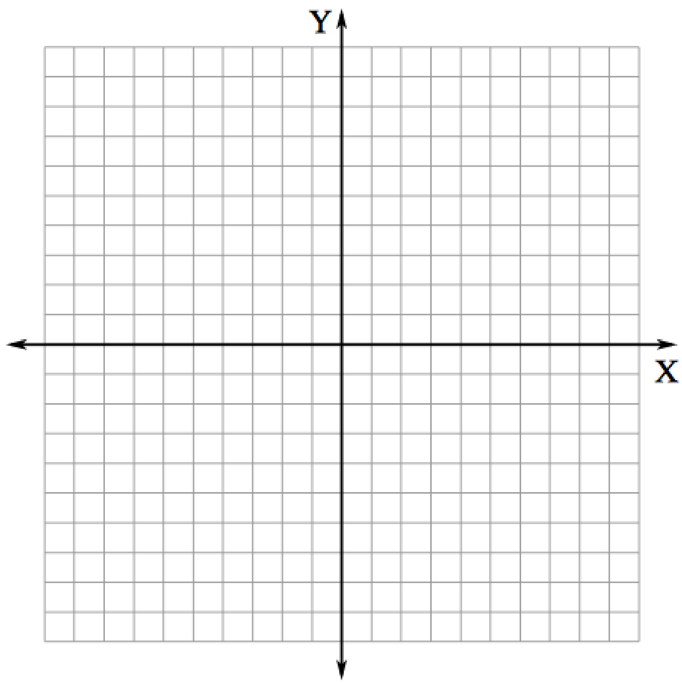
The Ives Concert Park is selling family four packs of tickets to a concert. During any concert, there are 24 people working at the event. The Comcast Theater is selling friends five packs of tickets to a concert. During any concert, there are 18 people working at the event. At what number of ticket packs will both venues have the same number of people present?	x = # of ticket packs purchased y = total people $y = 4x + 24$ $y = 5x + 18$ $4x + 24 = 5x + 18$ $x = 6$ $y = 4(6) + 24$ $y = 48$ At 6 ticket packs purchased, both venues will have 48 people present.

Checking for Understanding Part 2

Algebra I – Systems of Equations

The concession stand sells hot dogs and soda during football games. John bought 6 hot dogs and 4 sodas and paid $6.70. Jessica bought 4 hot dogs and 3 sodas and paid $4.65. What is the price of one hot dog? What is the price of one soda?

John thought…



Jessica thought…

Who do you agree with? Why?

Support your answer using precise mathematical language.

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Checking for Understanding Part 2

Algebra I – Systems of Equations

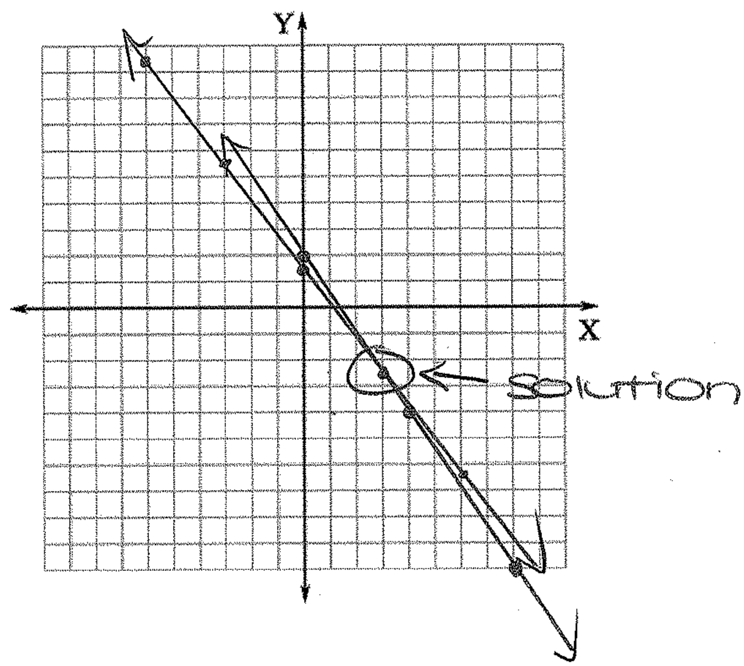
The concession stand sells hot dogs and soda during football games. John bought 6 hot dogs and 4 sodas and paid $6.70. Jessica bought 4 hot dogs and 3 sodas and paid $4.65. What is the price of one hot dog? What is the price of one soda?

John thought…

x = hot dog price
y = soda price

$(6x + 4y = 6.70)\,{-4}$
$(4x + 3y = 4.65)\,6$

$-24x - 16y = -26.80$
$24x + 18y = 27.90$
$2y = 1.10$
$y = \$0.55 \quad x = \$0.75$



Jessica thought…

x = hot dog price
y = soda price

$6x + 4y = 6.70$
$4y = -6x + 6.70 \qquad y = -6/4x + 1.675$

$4x + 3y = 4.65$
$3y = -4x + 4.65 \qquad y = -4/3x + 1.55$

(see graph above)

Who do you agree with? Why?

Support your answer using precise mathematical language.

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Checking for Understanding Part 2

Algebra I – Systems of Equations

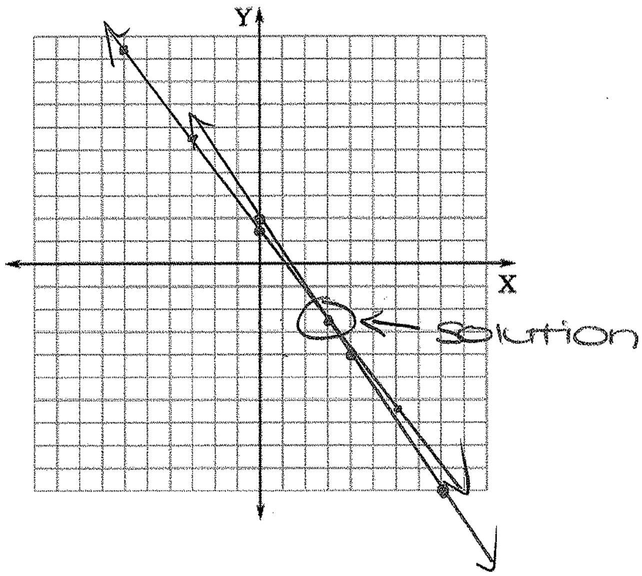
The concession stand sells hot dogs and soda during football games. John bought 6 hot dogs and 4 sodas and paid \$6.70. Jessica bought 4 hot dogs and 3 sodas and paid \$4.65. What is the price of one hot dog? What is the price of one soda?

John thought…

x = hot dog price
y = soda price

$(6x+4y=6.70)\,-4$
$(4x+3y=4.65)\,6$

$-24x-16y=-26.80$
$24x+18y=27.90$
$2y=1.10$
$y=\$0.55 \quad x=\$0.75$



Jessica thought…

x = hot dog price
y = soda price

$6x+4y=6.70$
$4y=-6x+6.70 \qquad y=-6/4x+1.675$

$4x+3y=4.65$
$3y=-4x+4.65 \qquad y=-4/3x+1.55$

(see graph above)

Who do you agree with? Why?

Support your answer using precise mathematical language.

I agree with John because one of the coordinates in Jessica's answer is negative which does not make sense in context of the problem.

<table>
<tr><th colspan="2">Research and Review of Standard</th></tr>
<tr><td>Content Standard(s):</td><td>Standard(s) for Mathematical Practice:</td></tr>
<tr><td>A-REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</td><td>1: Make sense of problems and persevere in solving them.
7: Look for and make use of structure.</td></tr>
<tr><td>Smarter Balanced Claim</td><td>Smarter Balanced Item</td></tr>
<tr><td>Claim 2: Problem Solving
Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</td><td>A restaurant serves a vegetarian and a chicken lunch special each day. Each vegetarian special is the same price. Each chicken special is the same price. However, the price of the vegetarian special is different from the price of the chicken special.
On Thursday, the restaurant collected $467 selling 21 vegetarian specials and 40 chicken specials.
On Friday, the restaurant collected $484 selling 28 vegetarian specials and 36 chicken specials.
What is the cost of each lunch special?</td></tr>
<tr><td>CPR Pre-Requisites
(Conceptual Understanding, Procedural Skills, and Representations)

Look at the Progressions documents, Learning Trajectories, LZ lesson library, unpacked standards documents from states, NCTM Essential Understandings Series, NCTM articles, and other professional resources. You'll find links to great resources on your PLC Platform.</td><td>Conceptual Understanding and Knowledge
Students must know that solutions to systems must satisfy all the equations or inequalities in that system.
Students must know that the goal of substitution or elimination is to create a one variable equation which they already have strategies to solve.
Students must be able to look at a graph of a system and identify the solution(s) if they exist.
Procedural Skills
Students must be able to write equations in two variables to model situations.
Students must be able to solve single-variable equations.
Students must be able to plot lines on a coordinate plane.
Students must be able to isolate a variable in order to solve using the substitution method.
Students must be able to identify a point of intersection on a graph.
Students must be able to identify parallel lines.
Students must be able to identify opposites to aid in solving by elimination.
Representational
Students must be able to solve a system using the graphing (tables), elimination and substitution methods.
Students must be able to transform equations to forms convenient for their solving method.
Students must be able to move between different orientations, for example, story, table, graph and equations.
Social Knowledge
Students must know terms: coefficients, variables, intersection, parallel, ordered pair, y-intercept, slope, slope-intercept form and general/standard form.
Students must know that solutions of systems of equations can exist as a point (one solution), no solution (null set), or infinitely many solutions.</td></tr>
</table>

Standards Progression **Look at LearnZillion lessons and expert tutorials, the Progressions documents, learning trajectories, and the "Wiring Document" to help you with this section*		
Pre-Requisite Standards	**Co-Requisite Standards**	**Future Standards**
6.EE.C.9: Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs, tables, and relate these to the equation. *7. EE.B.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations (and inequalities) to solve problems by reasoning about the quantities.* *a. Solve word problems leading to equations of the form px+q=r and p(x+q)=r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.* *8.EE.C.8: Analyze and solve pairs of simultaneous linear equations.* *a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.* *b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.* *c. Solve real-world and mathematical problems leading to two linear equations in two variables.*	*A-CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.* *A-CED.A.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.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.* *A-REI.B.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.* *A-REI.C.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-CED.A.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-REI.D.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. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic.*

Common Misconceptions/Roadblocks

What characteristics of this problem may confuse students?

- *There needs to be two variables defined and solved for to answer this problem.*
- *The x and y variables of our standard form equations will represent the prices of the special dishes versus the number of those dishes ordered.*

What are the common misconceptions and undeveloped understandings students often have about the content addressed by this item and the standard it addresses?

- *Some students may not be able to write equations to represent the relationship between two variables.*
- *For the graphing method of solving, some students may have difficulty scaling their axes for very large or very small numbers.*
- *For the elimination method of solving, some students add up the variables as they are, instead of making them cancel out.*
- *For the substitution method of solving, some students re-arrange the equation to solve for a variable and then substitute back into itself, instead of the other equation.*
- *Some students lose sight of what the solution to the system means in context of the problem.*
- *Some students may rely on one method of solving instead of using the best method for the given situation.*
- *Some students may not be able to approximate the solution from solving a system by graphing.*

What overgeneralizations may students make from previous learning leading them to make false connections or conclusions?

- *Some students may assume that the equations written for this problem should be in slope-intercept form, when the way in which the problem is written lends itself to writing equations in standard form.*