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EXEMPLAR

Units & Lessons

MATHEMATICS

Grade 8

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Lesson 3: Types of Solutions to Systems of Equations

Focus Standard(s): 8.EE.8a, 8.EE.8b

Additional Standard(s): 8.EE.5, 8.EE.6, 8.EE.7a, 8.EE.7b, 8.F.1, 8.F.2, 8.F.3

Standards for Mathematical Practice: SMP.2, SMP.3, SMP.7

Estimated Time: 40 minutes

Resources and Materials:

- Dry erase markers
- Large coordinate plane
- Markers
- Mini white boards
- Poster paper
- Rulers
- Sticky notes
- Handout 3.1: Working with Linear Equations
- Handout 3.2: Gallery Walk
- Math Shell: http://map.mathshell.org/lessons.php?unit=8220&collection=8

Lesson Target(s):

- Students will analyze different representations of systems of equations.
- Students will create systems of equations to meet solution criteria.

Guiding Question(s):

- What do the different types of solutions to systems of equations represent?

Vocabulary

Academic Vocabulary:	Instructional Strategies for Academic Vocabulary:
• Infinite solutions	☐ Introduce words with student-friendly definitions and pictures ☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Create pictures/symbols to represent words ☐ Write/discuss using the words ☐

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will identify systems of equations with infinite solution through inspection of equations. Students will determine the number of solutions in a system of equations during a Gallery Walk analyzing graphical and algebraic representations.

Anticipatory Set/Introduction to the Lesson: Sticky Notes
Note: Prior to lesson, create enough sticky notes for each student to receive a system of equations that has either one solution or no solutions. Create a two-column chart for students to categorize their system by the number of solutions.

Distribute sticky notes to students as they enter the classroom.

- Students will place sticky notes in the appropriate column on the anchor chart (SMP.2).

Monitor progress and provide feedback as needed.

- ✓ Distribute **Handout 3.1: Working with Linear Equations**. Allow students approximately 15 minutes to complete handout.

Activity 1: Modeling

Display a large coordinate plane. Write $y = 2x + 3$ on the board and ask for a volunteer to graph the line.

S: Graph line on large coordinate plane using a marker.

Write $y - 2x = 3$ on the board and ask for a volunteer to graph the line.

S: Graph line on large coordinate plane using a marker.

Have students Turn and Talk about the prompting questions to make connections between the number of solutions and the system of equations.

Prompting Questions:

- How is the second equation different from the first equation?
- How would the equation look in slope-intercept form?
- What do you notice about these two lines?
- What do you notice about the equations when both are in slope-intercept form (SMP.7)?

Distribute white boards and dry erase markers. Present a system of equations, not necessarily in slope-intercept form. Students will predict whether there will be one solution, no solutions, or infinite solutions (SMP.7). Model graphing another system and discuss the solution. Repeat with different systems of equations.

Activity 2: Gallery Walk

Distribute **Handout 3.2: Gallery Walk.** The students will walk quietly around the gallery analyzing each portrait. The students will fill in the portrait number and list whether the system has one solution, no solutions, or infinite solutions on their handouts (SMP.8).

Note: Prior to class the teacher will post pictures of systems of equations throughout the classroom. Systems will be represented graphically and algebraically.

For students who are EL, have disabilities, or perform well below grade level:

- Give students a check list on solving for a specified variable:
  - Which variable do I want to solve for to make graphing easier?
  - How can I move the other variable?
  - How do I simplify to find the value of 1y?

Extensions for students with high interest or working above grade level:

- Challenge the students who complete the Gallery Walk in a short amount of time to find the solutions of the systems with one solution.

Reflection and Closing: Whole Group Discussion

Facilitate a whole group discussion on how to determine the number of solutions in a system by allowing students to justify their answers (SMP.3).

Prompting Questions:

- Which pictures from the gallery walk had one solution? How did you know?
- Which pictures from the gallery walk had no solutions? How did you know?
- Which pictures from the gallery walk had infinite solutions? How did you know?
- What's the difference between systems of equations with no solution and infinite solutions, when looking at the algebraic representation?

Homework

T: Write the following on the board:

1. Given $y = 4x + 3$, write an equation to complete a system with no solutions.
2. Given $y = -x + 3$, write an equation to complete a system with infinite solutions.
3. Given $y = x + 1$, write an equation to complete a system with one solution.

Homework Key:

1. Any equation with a slope of 4.
2. $y = -x + 3$
3. Any equation that does not have a slope of 1.

Handout 3.1: Working with Linear Equations

Name: _____Date: _____

x	-3	2	3
y	-3	7	9

A

x	0	2	4
y	5	7	9

B

x	-1	0	2
y	5	1	7

C

x	-1	0	2
y	1	3	7

D

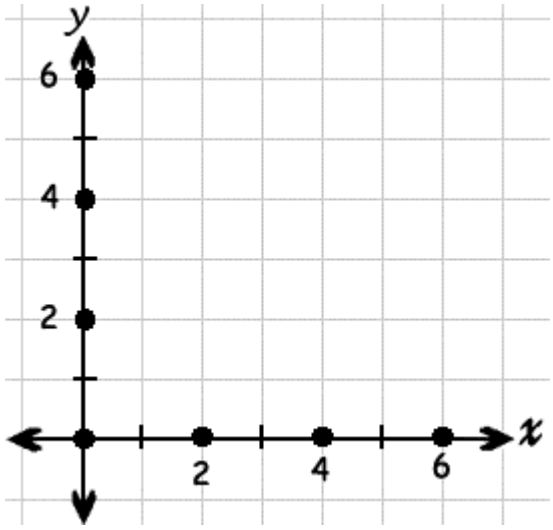
1a. Which of these tables of values satisfy the equation $y = 2x + 3$? Explain how you checked.

_____

_____

_____

b. By completing the table of values, draw the lines $y = 2x + 2$ and $x = 1 - 2y$ on the grid.



$y = 2x + 2$

x	-2	0	
y			5

$x = 1 - 2y$

x	0		5

y		0	

c. Do the equations $y = 2x + 3$ and $x = 1 - 2y$ have one common solution, no common solutions, or infinitely many common solutions? Explain how you know.

_____

_____

2. Draw a straight line on the plane that has no common solutions with the line $y = 2x + 3$. What is the equation of your new line? Explain your response.

_____

Handout 3.2: Gallery Walk

Name: _____ Date: _____

Directions: Walk quietly around the gallery. Analyze each portrait. Fill in the portrait number and list whether the system has one solution, no solutions, or infinite solutions.

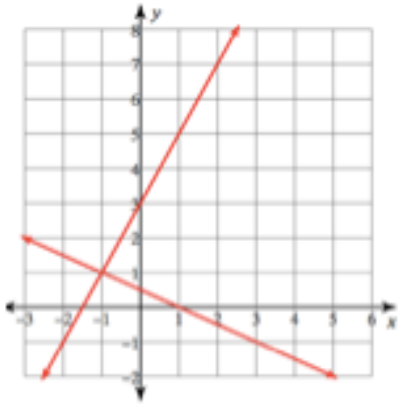
Portrait #	Type of Solution

Handout 3.1: Working with Linear Equations Answer Key

1a. **Which of these tables satisfy the equation $y=2x+3$? Explain how you checked.**

A and D. Answers may vary.

1b. **By completing the table of values, draw the lines $y=2x+3$ and $x=1-2y$ on the grid.**



$y=2x+3$

x	-2	0	1
y	-1	3	5

$x=1-2y$

x	0	1	5
y	½	0	-2

1c. **Do the equations $y=2x+3$ and $x=1-2y$ have one common solution, no common solutions, or infinitely common solutions? Explain how you know.**

The equations have one common solution because they only intersect at one point.

2. **Draw a straight line on the grid that has no common solutions with the line $y=2x+3$. What is the equation of the new line? Explain your answer.**

Answer may vary. All lines parallel to y=2x+3 are correct.

For training or questions regarding this unit, please contact:

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