MISSISSIPPI DEPARTMENT OF EDUCATION

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MISSISSIPPI

EXEMPLAR Units & Lessons

MATHEMATICS

Grade 8

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MISSISSIPPI DEPARTMENT OF EDUCATION

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Introduction

Mission Statement

The Mississippi Department of Education (MDE) is dedicated to student success, including the improvement of student achievement in English Language Arts (ELA) and mathematics in order to produce citizens who are capable of making complex decisions, solving complex problems, and communicating fluently in a global society. The Mississippi College- and Career-Readiness Standards (MS CCRS) provide a consistent, clear understanding of what students are expected to know and be able to do by the end of each grade level or course. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that students need for success in college and careers and to compete in the global economy. The goal of the MDE is to provide educators with the training and resources to understand and implement the MS CCRS effectively.

Purpose

In efforts to facilitate implementation and promote understanding of the MS CCRS for ELA and mathematics, the W. K. Kellogg Foundation generously awarded the MDE a grant to secure a cadre of effective educators to develop the MS CCRS Exemplar Units for teachers. Specifically, a group of highly-effective Mississippi educators developed exemplar instructional units and lessons aligned to the MS CCRS for ELA and mathematics. The MS CCRS Exemplar Units address difficult-to-teach standards as determined by teachers and are designed to serve as exemplar models for instructional units, lessons, and resources. The MS CCRS Exemplar Units have been vetted through nationally renowned vendors to ensure exemplar quality.

Design Overview

The MS CCRS Exemplar Units for ELA and mathematics address grade-level specific standards for Pre-Kindergarten-8th grade, as well as for Algebra, English I, and English II. The overall unit plan is described in the first section of the ELA and math units. This section includes the unit title, a suggested time frame, the grade level MS CCRS addressed and assessed, a unit overview with essential questions and a summary of lesson tasks, and the culminating/performance task description and rubric.

Though the math and ELA overall unit plan designs are very similar, some design aspects differ in order to accommodate the respective requirements of each content area. For mathematics, the first section also provides a segment designated for the Standards for Mathematical Practices (SMPs) addressed in the unit. For ELA, the first section also includes a text set with links to texts (if in the public domain) and a fresh/cold-read task.

The second section of each unit includes lesson plans. Within the lesson plans, provided are lesson-specific MS CCRS, suggested time frames, learning targets, guiding questions, required resources and materials, vocabulary terms and instructional strategies, teacher directions, instructional supports for students, enrichment activities, student handouts, assessments (formative, summative, pre-, and self-), and additional resources to aid in the implementation of the lessons.

Implementation

The intention of the MS CCRS Exemplar Units for ELA and mathematics is to provide educators with resources to understand and implement the MS CCRS effectively. The implementation of the MS CCRS Exemplar Units for ELA and mathematics is voluntary. Additionally, the MDE will provide ongoing support for implementation of the MS CCRS Exemplar Units with initial regional trainings followed by site-specific support through our regional service delivery model. For regional and site-specific training, please contact the MDE Office of Professional Development.

Grade Level	Unit Title	Duration
8	Systems of Equations	10-13 11-12 days

Mississippi College- and Career-Readiness Standards for Mathematics	Standards for Mathematical Practice
Focus: **8.EE.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. *For example, 3x+2y=5 and 3x+2y=6 have no solution because 3x+2y cannot simultaneously be 5 and 6.* ***c.*** Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.* **Additional:** **8.EE.5** Graph proportional relationships. Compare two different proportional relationships represented in different ways. **8.EE.6** Derive the equation *y=mx+b* for a line intercepting the vertical axis at *b*.	**SMP.1** Make sense of problems and persevere in solving them. **SMP.2** Reason abstractly and quantitatively. **SMP.3** Construct viable arguments and critique the reasoning of others. **SMP. 4** Model with mathematics. **SMP.5** Use appropriately tools strategically. **SMP.6** Attend to precision. **SMP.7** Look for and make use of structure. **SMP.8** Look for and express regularity in repeated reasoning.

8.EE.7 Solve linear equations in one variable. **a.** Give examples of linear equations in one variable with one solution, infinitely many solutions, or not solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form *x=a, a=a, or a=b* results (where *a* and *b* are different numbers). **b.** Solve linear equations and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms. ***8.F.2*** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.* ***8.F.3*** Interpret the equation *y=mx+b* as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A=s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* **8.F.4** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	

Unit Overview

In this unit, students will graph systems of linear equations on the coordinate plane and identify the number of solutions for a system of equations. Using multiple representations, students will use a variety of strategies to solve systems of equations. Applying their conceptual understanding of systems of equations, students will analyze problems and real-world scenarios to determine the most effective method to solve the problem and the number of solutions.

Essential Questions:

- How can systems of equations be used to solve real world problems?
- What can we infer by the number of solutions a system of equations produces?

Lesson Tasks

Lesson 1: Introduction to Systems of Equations
Students will be introduced to systems of equations. Students will explore whether two lines graphed on a coordinate plane will intersect and the significance of the point of intersection.

Lesson 2: These Lines Don't Touch!
Students will use spaghetti noodles to demonstrate some systems of equations do not have a solution. Students will graph systems and using sticky notes will create an anchor chart to organize the evidence of how the same rate of change in parallel lines can help determine the number of solutions.

Lesson 3: Types of Solutions to Systems of Equations
Students will discover that a system of equations that graphs the same line has an infinite number of solutions. Students will discuss common traits of each line. Students will complete a gallery walk to identify the number of solutions for systems.

Lesson 4: Classifying Solutions to Systems of Equations
Students will complete a card sort activity to classify the number of solutions in a system of equations.

Lesson 5: Mid-Unit Assessment on Solving Systems of Equations
Students will demonstrate mastery of solving systems of equations graphically.

Lesson 6: Introduction to Substitution
Students will use algebra tiles as an introduction to solving systems of equations through the substitution method.

Lesson 7: More Substitution
Students will extend their understanding of solving systems of equations through the substitution method and complete a mathematical task to demonstrate comprehension.
Lesson 8: Elimination
Students will solve systems of equations using linear combinations or the elimination method.
Lesson 9: Interpreting Real World Examples
Students will create and solve real world scenarios dealing with systems of equations.
Lesson 10: Systems Centers
Students will work in centers based on data from previous formative assessments allowing students time to practice solving systems of equations demonstrating an understanding of all methods introduced in the unit.
Lesson 11: Performance Task
Students will demonstrate their comprehension of solving using multiple methods and determining the number of solutions in systems of by completing and presenting the performance task.

Performance/Culminating Task

Wireless Debate

For the performance task, students will work in pairs to analyze cellular services. The students will create a presentation containing a persuading proposal and a response to the proposal. Students must apply their knowledge of systems of equations to mathematically support both sides of the debate.

Standard(s) Assessed: 8.EE.8a, 8.EE.8b, 8.EE.8c

Rubric for Performance/Culminating Task

Rating	4	3	2	1
Evaluative Criteria				
Create a system of equations from a real-world problem.	Students correctly create equations for all three scenarios.	Students correctly create equations for two scenarios.	Students correctly create an equation for one scenario.	Students do not correctly create equations any equations.
Solve systems through graphing.	Students correctly label the graph the system of equations and correctly identify the point of intersection.	Students correctly graph the system of equations, but does not correctly identify the point of intersection.	Students correctly graph one linear equation of the system of equations.	Students do not correctly the system of equations.
Solve systems of equations using substitution.	Students accurately solve the system of equations using substitution.	Students use correct procedures in solving the system but simple arithmetic mistakes are made.	Students do not solve the system of equations accurately.	Students do not attempt to solve the system of equations using substitution.
Construct viable arguments for scenarios.	Students produce arguments that are accurate and persuasive for both scenarios. Student extension is accurate.	Students produce arguments that are accurate and persuasive, but do not attempt extension.	Students produce one argument that is accurate and persuasive.	Students do not produce an argument to represent a scenario.

Lesson 1: Introduction to Systems of Equations

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

Additional Standard(s): 8.EE.5, 8.EE.6, 8.EE.7a, 8.EE.7b, 8.F.2, 8.F.3, 8.F.4

Standards for Mathematical Practice: SMP.2, SMP.3, SMP.4

Estimated Time: 50 minutes

Resources and Materials:

- Ball
- Mini whiteboards
- Dry erase markers
- Overhead projector transparencies
- Rulers
- Handout 1.1: Transparency Graphs
- Handout 1.2: It's Transparent

Lesson Target(s):

- Students will apply their understanding of graphing linear equations to systems of equations.
- Students will represent the solution to a system of equations as an ordered pair.

Guiding Question(s):

- What is a system of equations?
- What does the point where two lines intersect represent?

Vocabulary

Academic Vocabulary:	Instructional Strategies for Academic Vocabulary:
• Coordinate plane • Ordered pair • System of equations	☐ 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 play a game to demonstrate their understanding of graphing linear equations in slope-intercept form. Students will be introduced to systems of equations and how they relate to linear equations.

Anticipatory Set/Introduction to the Lesson: Show Me

Distribute whiteboards and dry erase markers. Instruct students to write responses to teacher prompts on white boards and only display when instructed.

T: "Find two numbers whose sum is 5."
S: Write response on whiteboard.
T: "Show me." Write $x + y = 5$ on the board.
✓ S: Show response.

Note: Student responses will vary but must have a sum of 5.

T: "Find two numbers whose difference is 1."
S: Write response on whiteboard.
T: "Show me." Write $x - y = 1$ on the board.
✓ S: Show response.

Note: Student responses will vary but must have a difference of 1.

Challenge students to identify two different numbers whose sum is 5 and difference is 1. Actively monitor students and provide appropriate support.

Prompting Questions:

- When there was just one rule, how many possible answers could there be?
- How many possible answers are there with two rules?
- Why do you think it may be more difficult to find a pair of numbers that satisfies two rules instead of one?

Return class to whole group to explain and define systems of equations. Ask students to make connections between the Show Me Challenge and systems of equations.

Activity 1: Pair-Share Learning

Pair students up with their Elbow Buddy. Distribute a coordinate plane transparency and a ruler to each student. Assign $y = x + 5$ to one partner and $y = 2x + 3$ to the other. Instruct students to write the assigned equation on the white boards and graph it on the transparency coordinate plane.

Prompting Questions:

- Will your lines intersect?
- At what point will your lines intersect?

- How would you write the point of intersection as ~~a~~ an ordered pair?
- Does the order you write the numbers of your pair matter?

Instruct students to write the point of intersection on their whiteboards. Guide students in discovering the point of intersection is the only solution to the system. No other pair of numbers can be substituted into ~~the~~ both equations to yield true sentences (SMP.2).

Prompting Questions:

- How are coordinate points represented alphabetically?
- What do you notice about our equations?

Model substituting coordinate points into systems of equations as students follow along with mini whiteboards. Write original system of equations with dry erase markers. Erase variables and replace with numerical values from the point of intersection. Teacher and students simplify.

Prompting Question:

- Is the final statement true or false?
- How do you know?
- What does this mean?

If true, relate the understanding that coordinate points satisfy both equations at the same time. If false, guide students into finding possible mistakes.

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

- Student circle y-intercept in linear function, and plot point on y-axis. Student highlights slope in function, then "move" from y-intercept according to slope.

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

- Students write a statement to describe why the solution is the only pair that will satisfy the system. Students create a system of equations for a set of ordered pairs.

Activity 2: Guided Practice

✓ Distribute **Handout 1.2: It's Transparent** (SMP.4). Instruct one student to graph the first linear equation and the other to graph the system. Students check the work of their partner before putting transparencies together to determine the solution.

Prompting Questions:

- What does the y-intercept tell you?
- How should you move from the y-intercept? What number tells you that?

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

- Change linear equations to include integers, not fractions.

Reflection and Closing: Share Out

T: "What is one word that relates to systems of equations?" Give a student a ball.
S: Say Response. Give the ball to another student who then shares and explains.

Repeat game until several students have shared out.

Reflect on how well the students could answer the essential question by examining evidences of student learning.

Homework

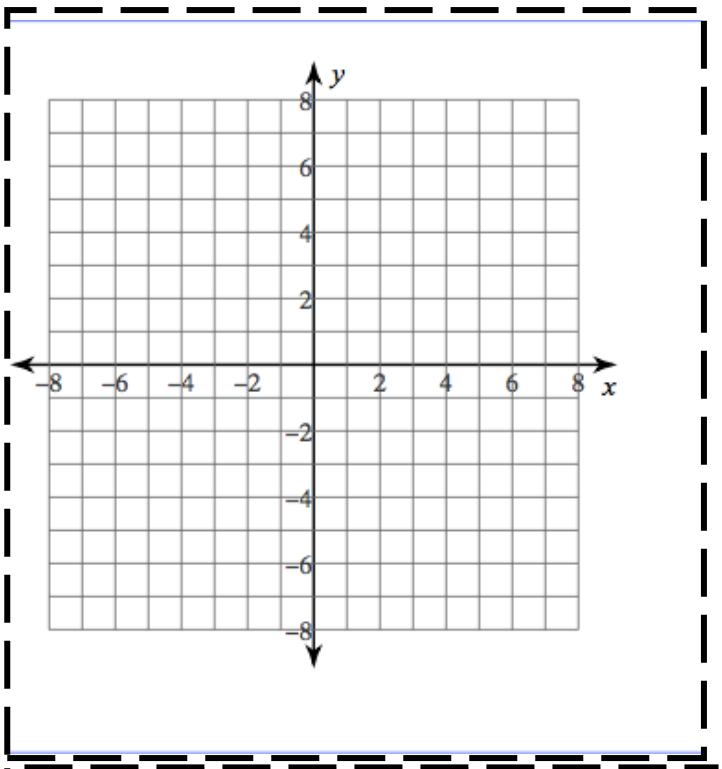
T: Write the following equations on the board:

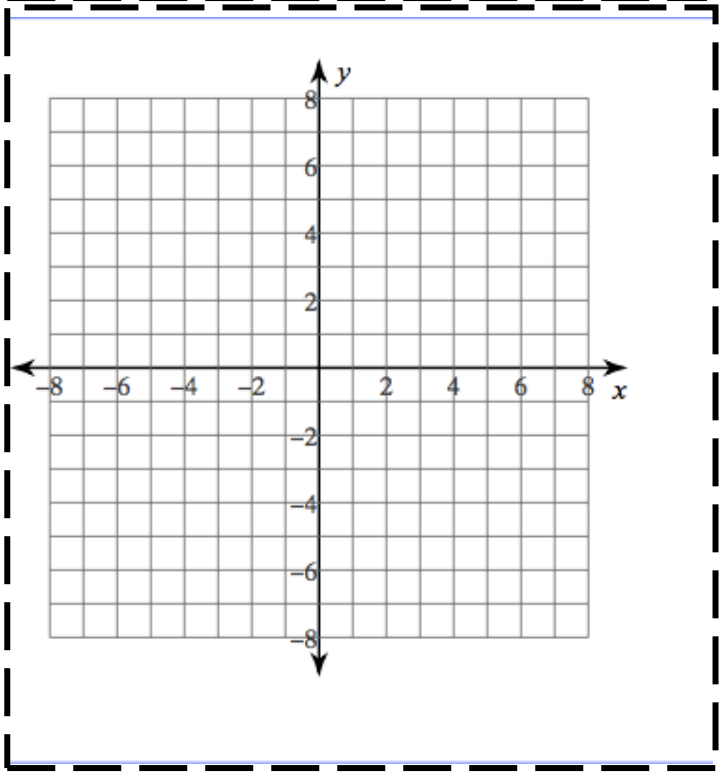
1. $y = 5x + 4; y = x - 2$
2. $x = 2; y = \frac{3}{2}x - 1$
3. $y = x + 3; y = 8x - 4$
4. $y = \frac{1}{3}x + 2; y = \frac{4}{3}x - 3$
5. $y = \frac{1}{4}x - 1; y = \frac{3}{2}x + 4$

S: Graph the systems of equations on graph paper.

Handout 1.1: Transparency Graph

Name:_____ **Date:** _____





Handout 1.2: It's Transparent

Name:_____ **Date:** _____

Directions: Complete the chart using your systems of equations.

1) $y = x + 4$

$y = -2x + 1$

2) $y = -\frac{3}{2}x + 4$

$y = \frac{1}{2}x - 4$

3) $y = \frac{3}{2}x + 2$

$y = \frac{1}{2}x - 2$

4) $y = \frac{1}{4}x - 2$

$y = \frac{5}{4}x + 2$

5) $y = -\frac{2}{3}x + 1$

$y = -2x - 3$

6) $y = \frac{5}{4}x + 4$

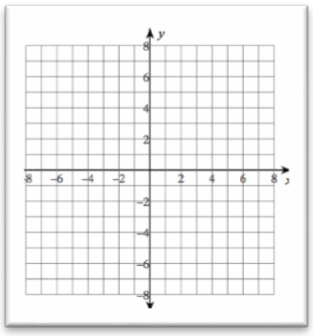
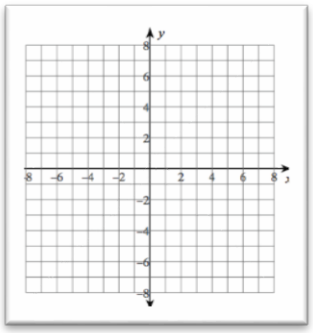
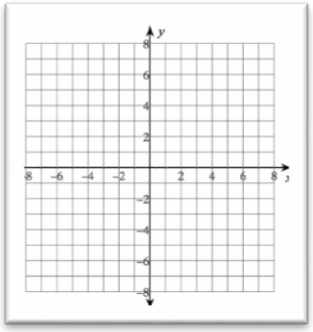
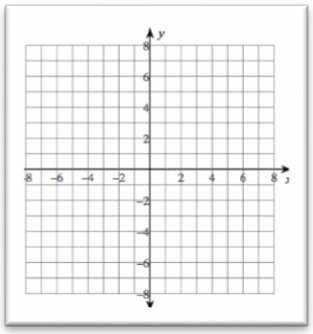
$y = -\frac{3}{4}x - 4$

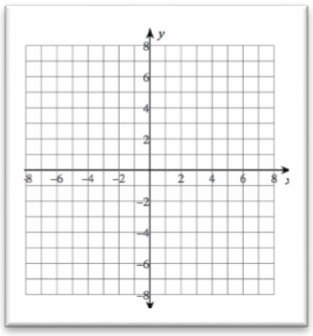
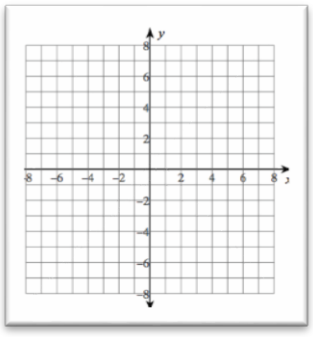
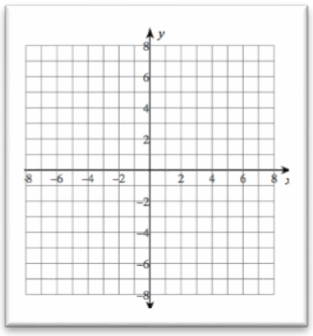
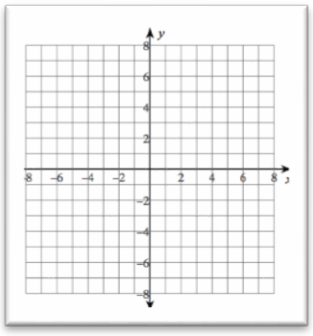
7) $y = \frac{5}{2}x + 3$

$y = \frac{1}{2}x - 1$

8) $y = 2x + 2$

$y = \frac{2}{3}x - 2$

System of Equations	**Sketch of graph**	**Solution *(x,y)***
		
		
		
		

System of Equations	**Sketch of graph**	**Solution *(x,y)***
		
		
		
		

Handout 1.2: It's Transparent!

Answer Key

System of Equations	Sketch of graph	Solution *(x,y)*
$y = x + 4$ $y = -2x + 1$		**(-1, 3)**
$y = -\frac{3}{2}x + 4$ $y = \frac{1}{2}x - 4$		**(4, -2)**
$y = \frac{3}{2}x + 2$ $y = \frac{1}{2}x - 2$		**(-4, -4)**
$y = \frac{1}{4}x - 2$ $y = \frac{5}{4}x + 2$		**(-4, -3)**
$y = -\frac{2}{3}x + 1$ $y = -2x - 3$		**(-3, 3)**
$y = \frac{5}{4}x + 4$ $y = -\frac{3}{4}x - 4$		**(-4 -1)**
$y = \frac{5}{2}x + 3$ $y = \frac{1}{2}x - 1$		**(-2, -2)**
$y = 2x + 2$ $y = \frac{2}{3}x - 2$		**(-3, -4)**

Homework Answer Key

1) $y = -5x + 4$
$y = x - 2$
$(1, -1)$

2) $x = 2$
$y = -\frac{3}{2}x - 1$
$(2, -4)$

3) $y = x + 3$
$y = 8x - 4$
$(1, 4)$

4) $y = \frac{1}{3}x + 2$
$y = -\frac{4}{3}x - 3$
$(-3, 1)$

5) $y = \frac{1}{4}x - 1$
$y = \frac{3}{2}x + 4$
$(-4, -2)$

Lesson 2: These Lines Don't Touch

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, 8.F.4

Standards for Mathematical Practice: SMP.3, SMP.5, SMP.7, SMP.8

Estimated Time: 50 minutes

Resources and Materials:

- Glue
- Graph paper
- Index Cards
- Red and blue colored pencils
- Rulers
- Uncooked spaghetti noodles
- Handout 2.1: Do Now
- Handout 2.2: Spaghetti
- Handout 2.3: Color by Solution
- Khan Academy Homework: https://www.khanacademy.org/math/algebra-basics/core-algebra-systems/core-algebra-systems-tutorial/e/graphing_systems_of_equations

Lesson Target(s):

- Students will identify the number of solutions to systems of equations through their understanding of slope.
- Students will analyze graphs to determine the number of solutions in a system of equations.

Guiding Question(s):

- How can knowing the rate of change help determine the number of solutions in a system of equation?

Vocabulary	
Academic Vocabulary: • Parallel lines • Rate of change	**Instructional Strategies for Academic Vocabulary:** ☐ 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 ☐ 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 graph systems of equations to demonstrate their understanding of how the rate of change can be used to determine the number of solutions.

Anticipatory Set/Introduction to the Lesson: Do Now
Distribute **Handout 2.1: Do Now.** Instruct students to draw a line to match each system of equations to its graph. Select students to report out upon completion of work. Have students share how the method used for matching the system with the solution. Expect students to use graphing for a solution and evaluation using the point of intersection as strategies at this time (SMP.8).

Activity 1: Spaghetti
Distribute **Handout 2.2: Spaghetti**, graph paper, glue, and uncooked spaghetti**.** Pair students together to graph the system of equations on one coordinate plane (SMP.5).

✓ Actively monitor students using graph paper, glue, and spaghetti to graph the systems of equations.

Construct a chart on the board with three columns: System, Sketch, and Solution. Select students to write system, sketch the graph, and identify the solution to the system on the board.
Once all students have participated, facilitate a whole group discussion using prompting questions.

Prompting Questions:

- What do you notice about all the lines graphed?
- What do you notice about all the equations?
- Where is the solution to these systems?

Instruct students to Turn and Talk to share which terms in the equations impacts the number of solutions and why they believe this to be true (SMP.3).

Select several pairs share discussions. Guide whole group conversation toward an understanding of rate of change determining whether lines will intersect.

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

- Have students who have not made the connection of no solution to a system (parallel lines) sharing a common rate of change highlight the rate of change in the equation.

Activity 2: Color by Solution

Distribute **Handout 2.3: Color by Solution** and colored pencils.

T: Locate the equation number and its corresponding shape.
S: Color the systems of equations with no solution red. Color the system of equations with one solution blue (SMP.7).

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

- Have students who have not made the connection of no solution to a system (parallel lines) sharing a common rate of change highlight the rate of change in the equation.

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

- Students write a statement to explain the number of solutions without graphing.

Reflection and Closing: Share Out

On an index card, students will answer the following questions and turn in as they exit the classroom.

- ✓ **Exit Ticket:**
- What do systems with one solution have in common with systems with no solutions?
- How are systems with one solution different than systems with no solution?

Homework

Students will complete and record three problems from the Khan Academy Homework.

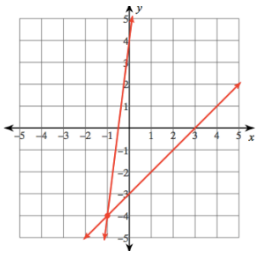
Handout 2.1: Do Now

Name:_____ **Date:** _____

Directions: Draw a line from each system of equations to its graph.

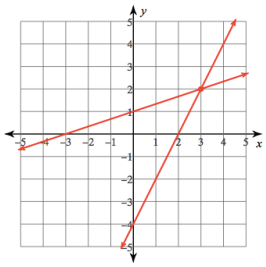
$y = 2x - 4$

$y = \frac{1}{3}x + 1$



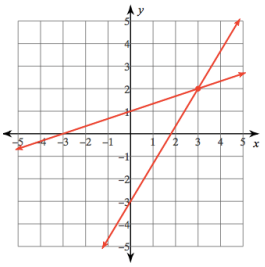
$y = 8x + 4$

$y = x - 3$



$y = \frac{5}{3}x - 3$

$y = \frac{1}{3}x + 1$



Handout 2.2: Spaghetti

Name:_____ **Date:** _____

Directions: For each set of equations, draw the line for each equation on the same graph. Then glue spaghetti pieces on top of the two lines to represent each system.

1. $y = -x + 2$
   $y = -x + 1$

2. $y = 7x + 3$
   $y = 7x + 2$

3. $y = 5x + 3$
   $y = 5x + 4$

4. $y = \frac{3}{2}x + 1$
   $y = \frac{3}{2}x - 4$

5. $y = 6x - 2$
   $y = 6x - 4$

6. $y = -8x + 4$
   $y = -8x - 1$

7. $y = 2x - 3$
   $y = 2x + 4$

8. $y = -\frac{1}{3}x + 3$
   $y = -\frac{1}{3}x - 2$

9. $y = -\frac{2}{3}x - 1$
   $y = -\frac{2}{3}x - 4$

10. $y = 7x - 4$
    $y = 7x - 3$

11. $y = 7x - 4$
    $y = 7x - 3$

12. $y = -\frac{2}{3}x - 4$
    $y = -\frac{2}{3}x + 2$

13. $y = -\frac{7}{3}x + 4$
    $y = -\frac{7}{3}x + 2$

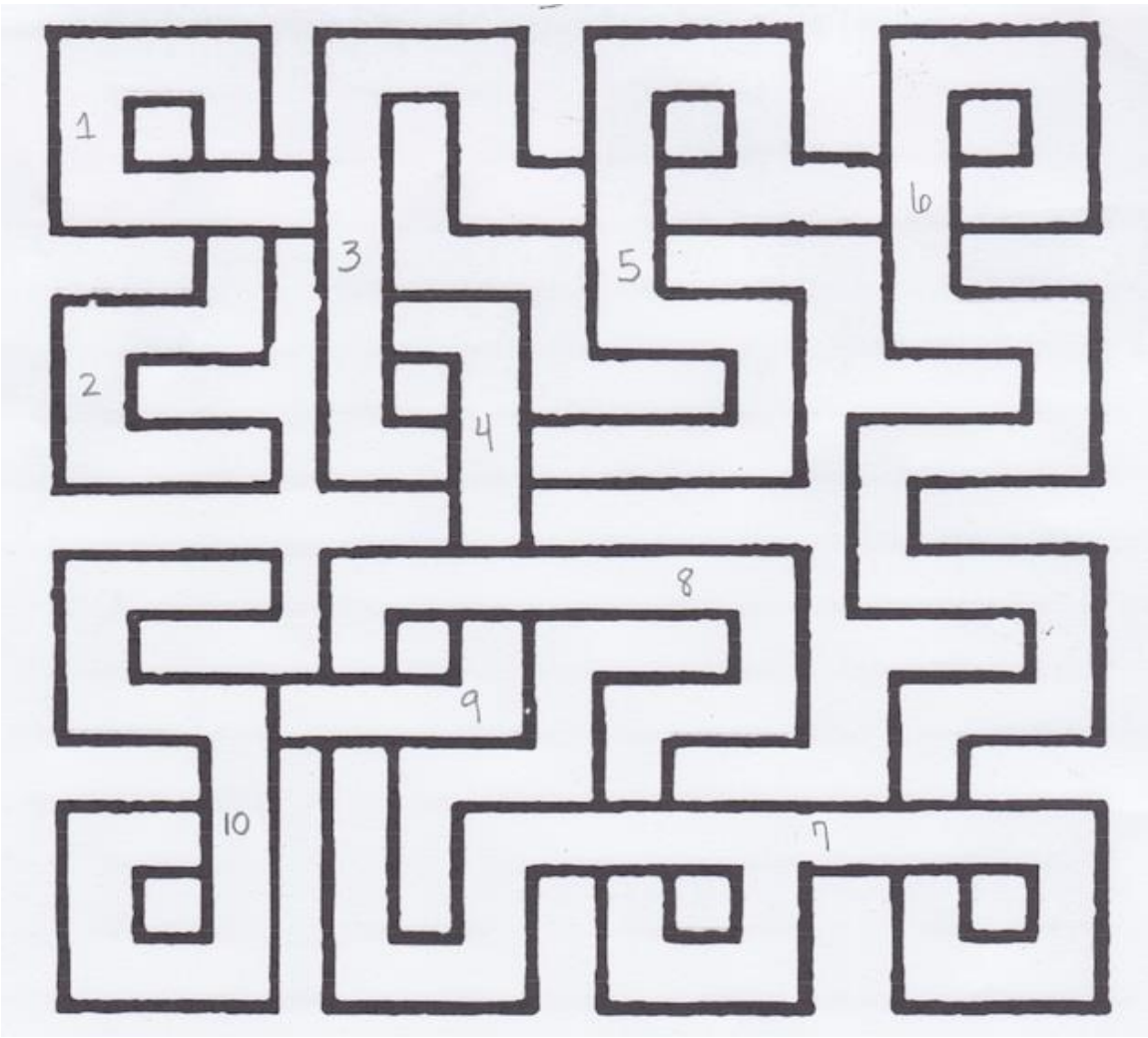
14. $y = -x + 1$
    $y = -x + 2$

15. $y = 2x - 1$
    $y = 2x + 4$

Handout 2.3: Color by Solution

Name:_____ **Date:** _____

Directions: **Locate the equation number and its corresponding shape. If the system of equations has no solution, color the shape red. If the system of equations has one solution, color the shape blue.**



1. $y = \frac{1}{3} - 1$
   $y = \frac{1}{4}x + 3$

1. Yes, intersect at (48,15)

2. $y = 2x$
   $y = 2x + 3$

No solution (same slope)

3. $x + y = 8$
   $y = -x - 7$

No solution (same slope)

4. $y = 4$
   $2x + y = 9$

Yes, intersect at (2.5, 4)

5. $y = 5x - 3$
   $y = 5x + 3$

No solution (same slope)

6. $x = y + 2$
   $y = x + 2$

No solution (same slope)

7. $y = x$
   $y = x - 5$

No solution (same slope)

8. $y = -4x + 2$
   $4x = y + 5$

Yes, intersect at (0.875, -1.5)

9. $y = 5x - 1$
   $y = \frac{1}{4}x + 3$

Yes, intersect at (0.842, 3.211)

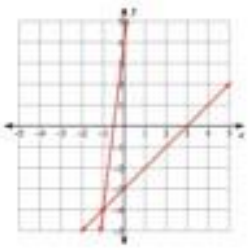
10. $\boldsymbol{y} = \frac{1}{2}x + 3$
    $y = \frac{1}{2}x + 4$

Handout 2.1: Do Now Answer Key

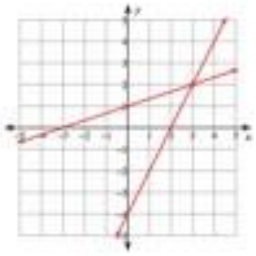
Do Now

Directions: Draw a line from each system of equations to its graph.

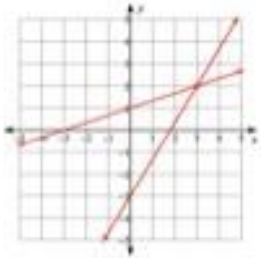
$y = 2x - 4$
$y = \frac{1}{3}x + 1$



$y = 8x + 4$
$y = x - 3$

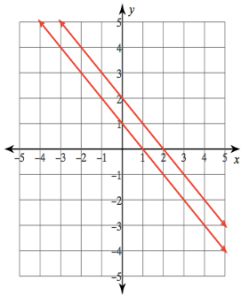


$y = \frac{5}{3}x - 3$
$y = \frac{1}{3}x + 1$



Handout 2.2: Spaghetti Answer Key

1)



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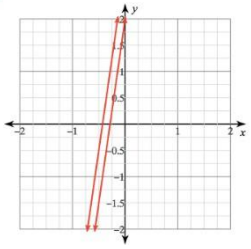
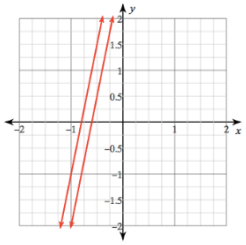
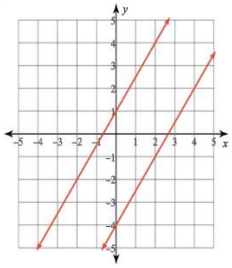


3)



4)



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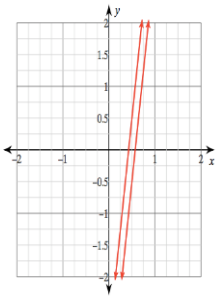

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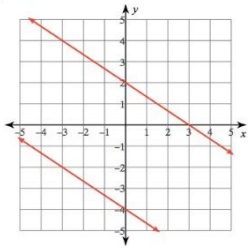

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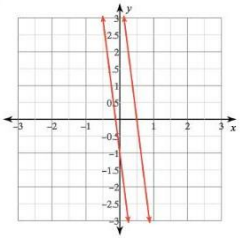

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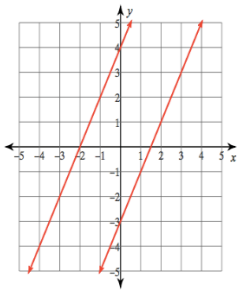
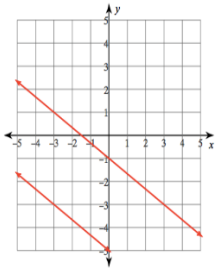
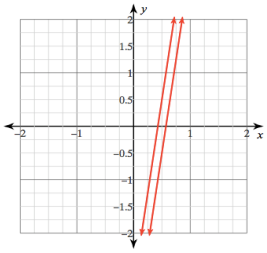


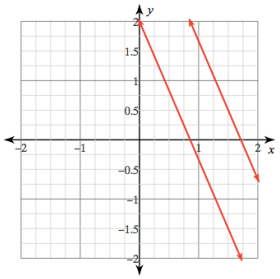
11)



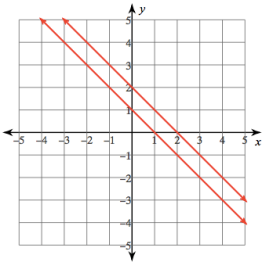
12)



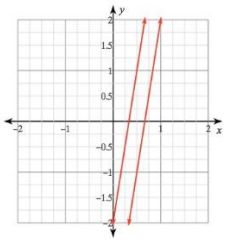
13)



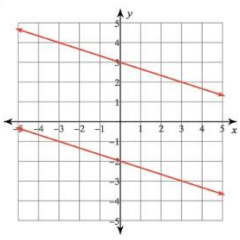
14)



5)



10)



Handout 2.3: Color by Solution Answer Key

1. $y = \frac{1}{3}x - 1$

   $y = \frac{1}{4}x + 3$

One Solution

2. $y = 2x$

   $y = 2x + 3$

No solutions

3. $x + y = 8$

   $y = -x - 7$

No solutions

4. $y = 4$

   $2x + y = 9$

One solution

5. $y = 5x - 3$

   $y = 5x + 3$

No solution

6. $x = y + 2$

   $y = x + 2$

No solution

7. $y = x$

   $y = x - 5$

No solutions

8. $y = -4x + 2$

   $4x = y + 5$

One solutions

9. $y = 5x - 1$

   $y = \frac{1}{4}x + 3$

One solution

10. $y = \frac{1}{2}x + 3$

    $y = \frac{1}{2}x + 4$

No solution

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 50 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 (I could not locate the "portraits" for the 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 on chart paper 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)?
- How can two equations have all of their solutions be the same?

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 except for $y = 4x + 3$ 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

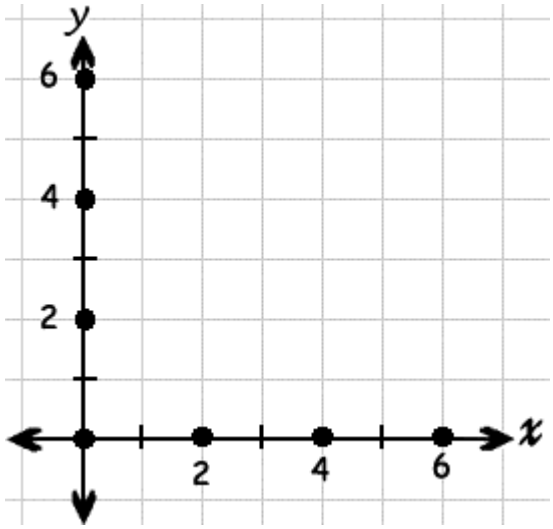
1a. Which of these tables of values satisfy the equation $y = 2x + 3$? Explain how you checked.

_____

_____

_____

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		0
y		5	

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.

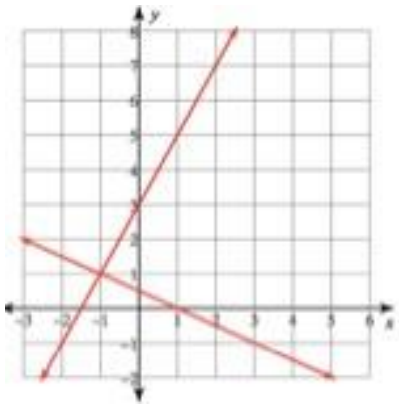
Portrait #	Type of Solution

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.

Lesson 4: Classifying 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.1, SMP.3, SMP.6

Estimated Time: ~~Approximate Time in~~ 50 minutes

Resources and Materials:

- Dry erase markers
- Glue sticks
- Mini whiteboards
- Poster paper
- Transparency pens
- Handout 4.1: Card Set A: Equations, Tables, & Graphs
- Handout 4.2: Card Set B: Arrows
- Classifying Solutions to Systems of Equations: http://map.mathshell.org/lessons.php?unit=8220&collectiono=8

Lesson Target(s):

- Students will continue to make connections between the rate of change and the number of solutions in a system of equations.
- Students will organize different types of representations and solutions to systems of equations.

Guiding Question(s):

- How can systems of equations be classified by their graphical representations?

Vocabulary

Academic Vocabulary:	Instructional Strategies for Academic Vocabulary:
• Infinite solutions • Parallel lines • Rate of change • Systems of equations	☐ 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 ☐ Act out the words or attach movements to 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 discover how systems of equations can be classified by graphical representations during a collaborative card sort activity.

Anticipatory Set/Introduction to the Lesson: Whole Class Discussion
Distribute mini whiteboards and dry erase markers.

T: Write $y = 3x + 2$ on the board. "If $x = 5$, what does y equal?"
S: Write answers on whiteboards.
T: Have volunteers to explain how they arrived at their answers (SMP.3).

✓ Continue using the following equations to evaluate student understanding of linear equations when only one variable is present:

- If $x = -1$, what does y equal?
- If $y = 8$, what does x equal?
- If $y = 0$, what does x equal?

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

- Take time to discuss the zero property with students and how it is possible for a linear equation to not include both variables ~~a variable~~.

Activity 1: Fill in the Blank

Distribute **Handout 4.1: Card Set A: Equations, Tables, & Graphs.**

✓ Have students work in pairs to complete the missing information on Card Set A (SMP.6).

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

- Students will focus on cards C4 and C5 first.

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

- Provide students with cards in Standard form to provide students the opportunity to convert linear functions.

Instruct pairs to compare responses with another pair to verify missing information.

Activity 2: Collaborative Card Sort

Distribute **Handout 4.2: Card Set B: Arrows**, poster paper, transparency pens, and glue sticks.

Students will create a matrix with the cards from **Handout 4.1: Card Set A: Equations, Tables, & Graphs.** Instruct students to glue ~~them~~ Card Set A to poster paper leaving space between cards.

Tell students to link cards with one of the arrows from **Handout 4.2: Card Set B: Arrows** (SMP.1)**.** The cards will have one solution, no solutions, or infinitely many solutions. If the cards have one solution, complete the arrow with the values of *x* and *y* where one solution occurs. Instruct students to make connections between as many cards as possible.

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

- Students will make connections between 2 or 3 cards instead of all 4.

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

- Students will provide a brief statement to explain each connection made between cards.
- Encourage students to make connections diagonally in addition to horizontally and vertically.

Activity 3: Whole Class Discussion

Display completed posters from Activity 2. Select one or two groups to explain how they completed the task. As groups explain their strategies, encourage the whole group to ask questions (SMP.3). Distribute mini white boards and dry erase markers. Instruct students to answer the following:

- Show two equations with one common solution.
- Show two equations with no common solutions.
- Show two equations with infinitely many solutions.

Reflection and Closing:

- ✓ **3-2-1 Exit Ticket:**
  List 3 types of solutions a system can have.
  List 2 things to look for to determine the number of solutions.
  List 1 system of equations that would have infinite solutions.

Homework

No homework assigned.

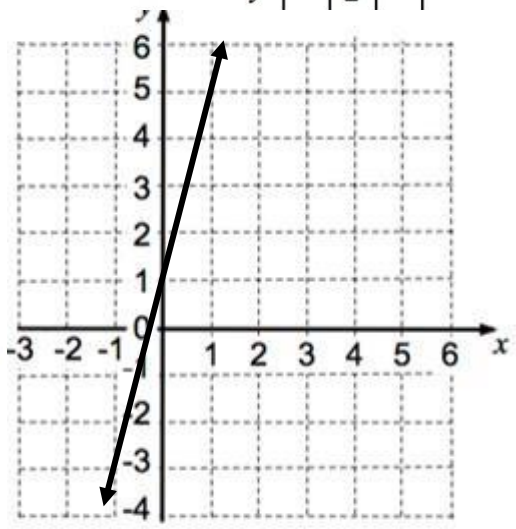
Handout 4.1: Card Set A: Equations, Tables, & Graphs

Name:_____ **Date:** _____

C1

$y =$ _____

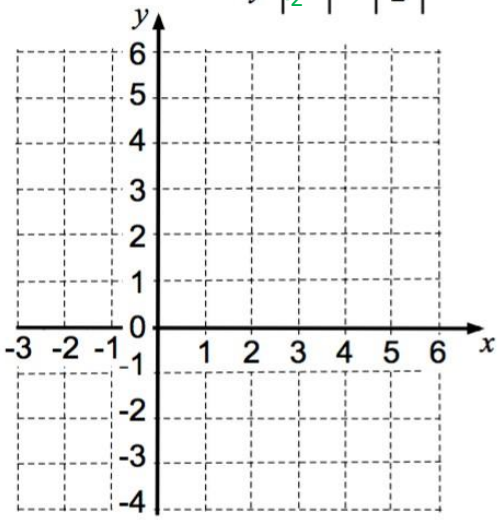
x	-3		1
y		2	



C2

x + 4y = - 8

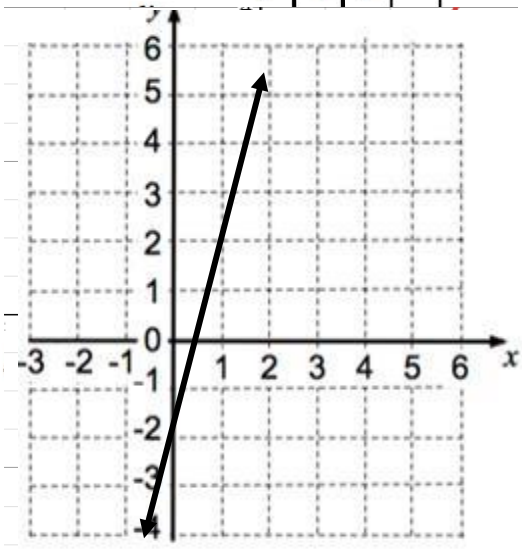
x	0	2	
y	-2		2



C3

$y =$ _____

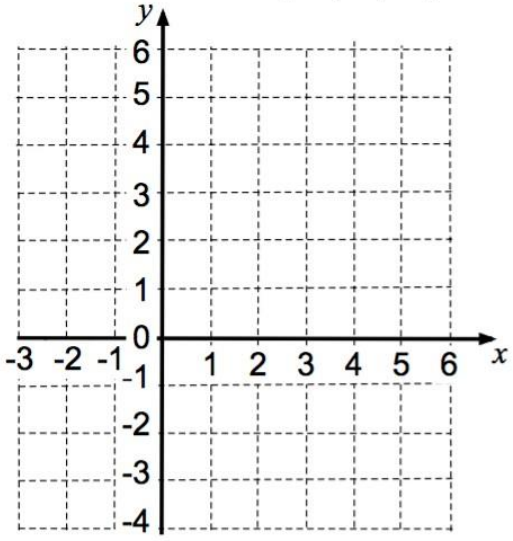
x	0		3
y	-2	3	



C4

-4(4x - y) = 4

x		-2	
y	-2		6



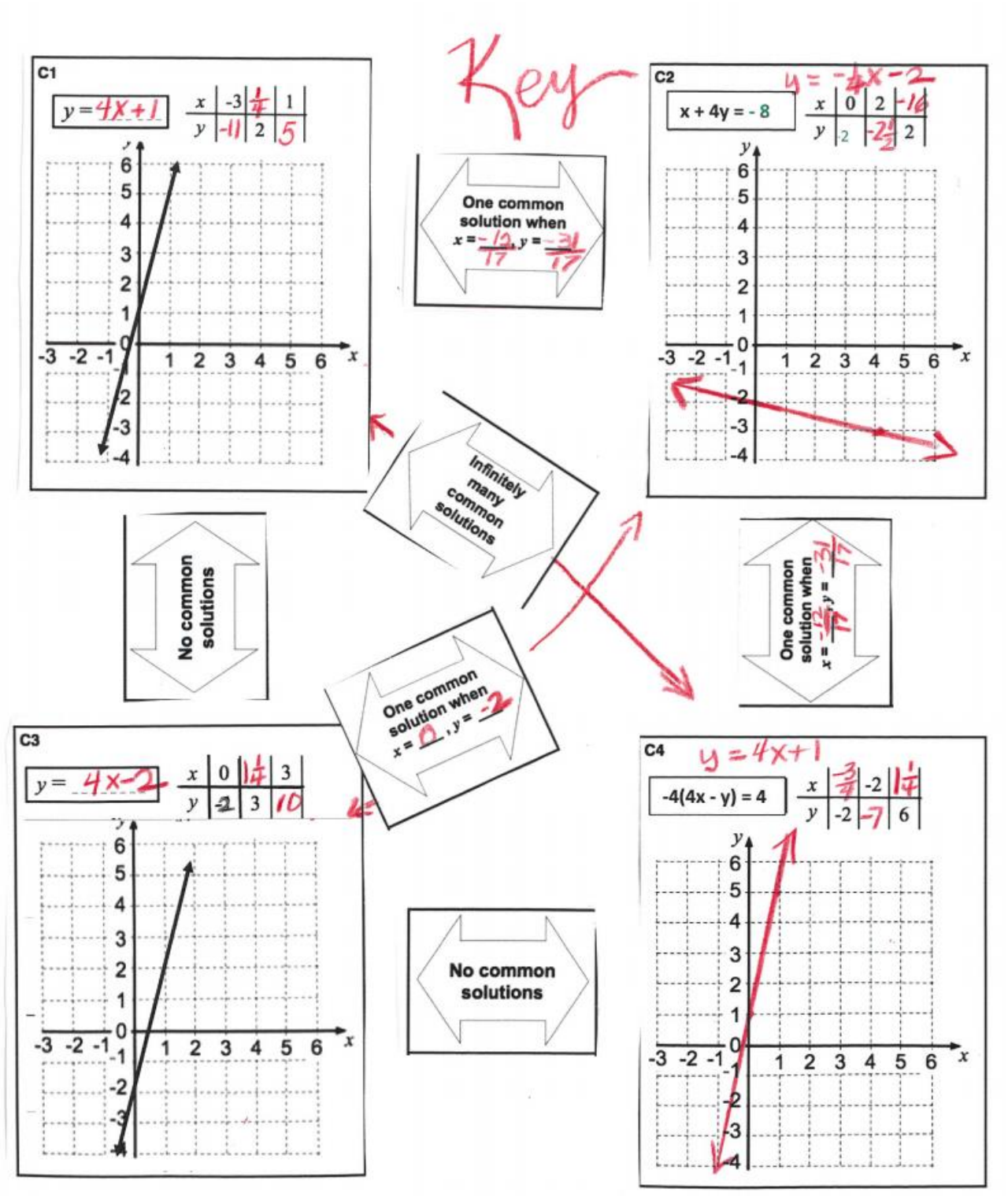
Handout 4.3: Card Set B: Arrows

Name:_____ **Date:** _____

No common solutions	No common solutions	Infinitely many common solutions	Infinitely many common solutions
One common solution when $x =$ ___ , $y =$ ___	One common solution when $x =$ ___ , $y =$ ___	One common solution when $x =$ ___ , $y =$ ___	One common solution when $x =$ ___ , $y =$ ___
One common solution when $x =$ ___ , $y =$ ___	One common solution when $x =$ ___ , $y =$ ___	One common solution when $x =$ ___ , $y =$ ___	One common solution when $x =$ ___ , $y =$ ___

Handout 4.1: Card Set A: Equations, Tables, & Graphs KEY

Name:_____ **Date:** _____



Lesson 5: Mid-Unit Assessment on Solving Systems Algebraically

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.1, SMP.2, SMP.4, SMP.6, SMP.7, SMP.8

Estimated Time: 55 50 minutes

Resources and Materials:

- Handout 5.1: Mid-Unit Assessment

Lesson Target(s):

- Students will understand how systems produce different numbers of solutions.
- Students will analyze different types of representations and solutions to systems of equations.

Guiding Question(s):

- What do the different numbers of solutions to systems of equations represent?
- How can systems of equations be classified by their graphical representations?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Infinite solutions • Parallel lines • Systems of equations	☐ 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 ☐ 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 independently demonstrate understanding of graphing systems of equations.

Anticipatory Set/Introduction to the Lesson: Whole Class Discussion
Open the class by having students write one sentence summarizing the standards that have been addressed thus far and report out in a whole group discussion.

Activity 1: Mid-Unit Assessment

- ✓ Distribute **Handout 5.1: Mid-Unit Assessment.** Monitor student progress.

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

- Provide transparency graph to students who need assistance locating the point of intersection.
- Ask the following prompting questions:
  - What might your final answer look like?
  - What do you know about equations with no or infinite solutions?

Reflection and Closing:
Reflect on student progress as demonstrated on Mid-Unit Assessment.

Homework

Students will solve equations for a specified variable (SMP.4).

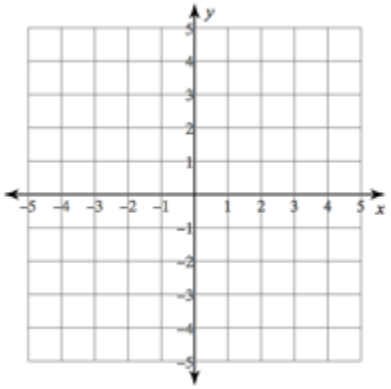
1. $2x + y = 4; for\ y$
2. $7 = 5a + b;\ for\ a$
3. $\frac{1}{2}bh = A;\ for\ h$

Handout 5.1: Mid-Unit Assessment

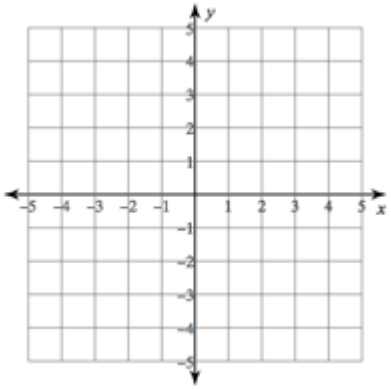
Name:_____ Date: _____

Directions: Solve each system by graphing. Be sure to list the point of intersection.

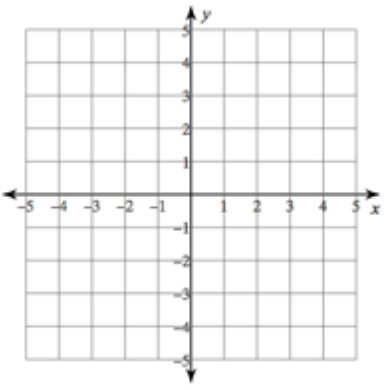
1) y = 2x + 3
   y = 4x – 1
   Point of Intersection:



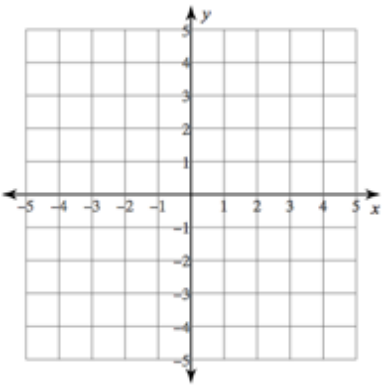
2) y = $\frac{1}{2}x + 3$
   2y = x – 6
   Point of Intersection:



3) x = 2
   y = $-\frac{3}{2}x + 1$
   Point of Intersection:



4) y = 4x + 8
   y = 4 (x + 2)
   Point of Intersection:



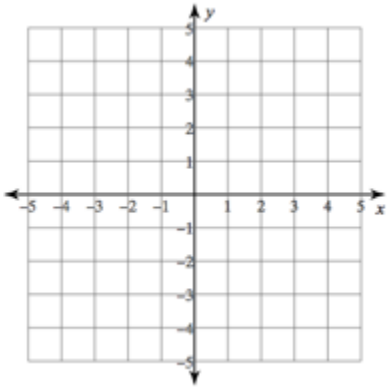
Write an equation so the system has one solution.

5) y = x + 1 _____

What is the solution? _____

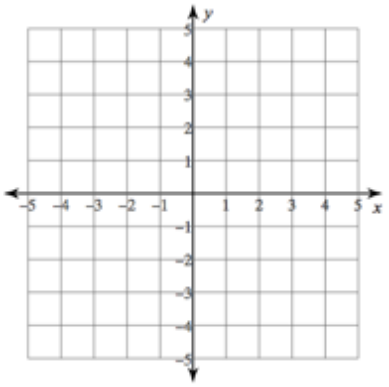
Write an equation so the system has no solution. Graph the system to prove.

6) 2x + y = 3



Write an equation so the system has infinite solutions. Graph the system to prove.

7) 3x - y = 6



Mid-Unit Assessment Rubric

	4	**3**	**2**	**1**
Question 1 **(2, 7)**	Student graphed both equations correctly and listed the solution.	Student graphed both equations correctly but did not correctly list solution	Student graphed one equation correctly.	Student did not graph equations correctly.
Question 2 **No Solution**	Student graphed both equations correctly and listed the solution.	Student graphed both equations correctly but did not correctly list solution	Student graphed one equation correctly.	Student did not graph equations correctly.
Question 3 **(2, -2)**	Student graphed both equations correctly and listed the solution.	Student graphed both equations correctly but did not correctly list solution.	Student graphed one equation correctly.	Student did not graph equations correctly.
Question 4 **Infinite Solutions**	Student graphed both equations correctly and listed the solution.	Student graphed both equations correctly but did not correctly list solution.	Student graphed one equation correctly.	Student did not graph equations correctly.

Question 6 **Equation should have different slope**	Student provided correct equation and correct point of intersection.	Student provided correct equation but no point of intersection.	Student did not provide a correct equation.	Student did not provide an equation.
Question 7 **Equation should have same slope, but different y-intercept.**	Student provided correct equation and correctly graphed the system.	Student provide correct equation but did not correctly graph the system.	Student did not provide correct equation but attempted graph.	Student did not provide correct equation and did not attempt graph.
Question 8 **Equation should have same slope and same y-intercept.**	Student provided correct equation and correctly graphed the system.	Student provide correct equation but did not correctly graph the system.	Student did not provide correct equation but attempted graph.	Student did not provide correct equation and did not attempt graph.

Lesson 6: Introduction to Substitution

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

Additional Standard(s): 8.EE.7a, 8.EE.7b

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP.5, SMP.6, SMP.7, SMP.8

Estimated Time: 55 minutes

Resources and Materials:

- Algebra Tiles
- Graph paper
- Rulers
- Handout 6.1: Equation Mat
- Interactive Algebra Tiles: http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html

Lesson Target(s):

- Students will demonstrate the concept of substitution using Algebra Tiles.
- Students will utilize the substitution method to solve a system of equations.

Guiding Question(s):

- How can a system of equations be solved when the point of intersection is not a lattice point?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Substitution	☐ 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

	☐ 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 recognize that graphing systems is not always the most efficient method of solving. Students will use Algebra Tiles to develop a conceptual understanding of solving a system of equations using the substitution method.

Anticipatory Set/Introduction to the Lesson: Do Now
Distribute graph paper. Instruct students to graph to solve the system $y = 3x - 2$ and $y = 5x + 1$. Tell students to Turn and Talk to share the solution to the system (SMP.3).
Note: The solution to the system is not easily seen from a graph. Allow students time to productively struggle in finding an accurate solution (SMP.1)

Explain that sometimes graphing isn't the best method for solving systems because if the point of intersection is not on a lattice point, the solution may not be accurate. Also, if the point of intersection is not at a point on the grid (for example, (25, 76), the grid may not contain the point. Introduce substitution as an alternative method that may be used to find the exact solution to systems of equations (SMP.6)

Activity 1: Substitution using Algebra Tiles
Note: If Algebra Tiles are unavailable, teacher may print tiles on cardstock and allow students time to cut out their own set of Algebra Tiles or Interactive Algebra Tiles can be found online.

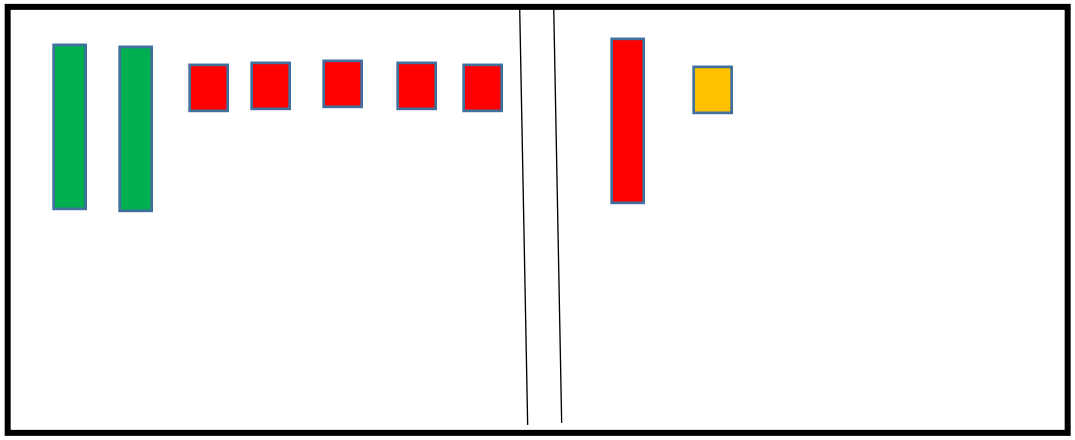
Distribute Algebra Tiles and **Handout 6.1: Equation Mat.** Model solving equations using the equation mat with algebra tiles (SMP.5). Write the following systems on the board: $y = 2x - 5$ and $y = -x + 1$.

Ask students what the two equations have in common. Guide students to discuss that they are both in slope-intercept form, ~~therefore both equations are indicating what *y* equals (SMP.2). Have student highlight what *y* equals in each of the equations.~~

$y = 2x - 5$ and $y = -x + 1$

Facilitate a conversation detailing how *y* can be substituted with an expression it is equivalent to. Tell students that since y is equivalent to *2x – 5* and *-x +1*, that those two expressions are equivalent to one another. Discuss real-world examples of the transitive property such as: "My lunch is right after my 3rd block class. My 3rd block class is Spanish. So, my lunch is right after Spanish." It is not necessary to focus on the name of the property. (SMP.8)

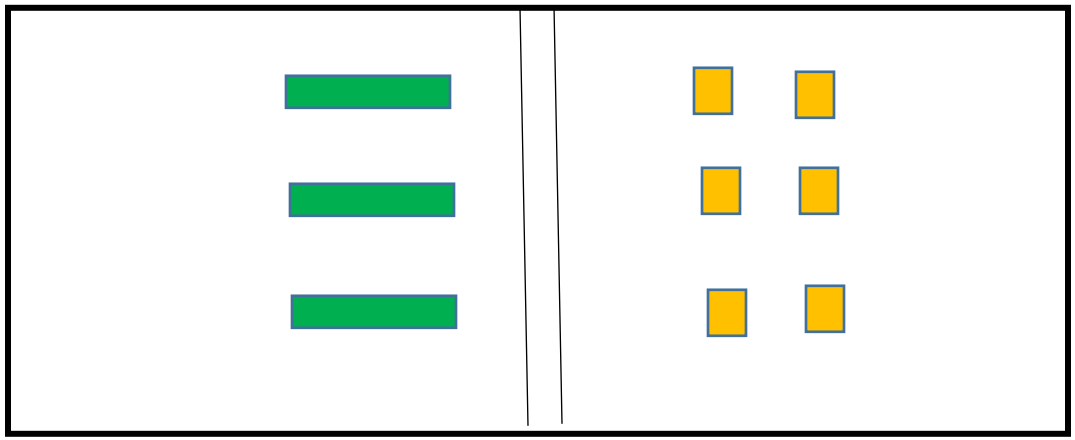
Model the equation with Algebra Tiles and algebraically, having students follow along (SMP.4).



$2x - 5 = -x + 1$

Solve for *x* by putting all *x* tiles on one side of the double lines and all square tiles on the other. Remind students they made add an equal number of tiles to each side to create zero pairs or "flip" over the double line (SMP.7).

Continue solving for *x* using Algebra Tiles. Students will distribute the square tiles evenly to each *x* tile.



$3x = 6$

$x = 2$

Ask students what a solution of a system of equation is and to Turn and Talk about whether they believe the process of solving using substitution is complete and why (SMP.3).

Reemphasize that a solution to a system is an ordered pair and has an *x* and *y* value and represents the point of intersection for the two lines. Have students share ideas for how we can find the *y*-value for the system using substitution now that we have an *x*-value. Allow students time to substitute the *x*-value to solve for the *y*-value. Provide students several examples to practice substituting using Algebra Tiles. Ensure students are representing their work algebraically as well.

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

- Provide students with a list of rules and visual examples for solving equations with Algebra Tiles.

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

- Encourage students to first solve algebraically and then verify solution with Algebra Tiles.
- Ask students to make predictions about what systems with no solution or infinite solutions would look like with Algebra Tiles.

Note: Teacher may want to use the "Checkpoint System" in which students complete one step and waits until teacher checks for comprehension and accuracy. For example,

- Students use tiles to represent the next system.
- Teacher assesses student progress.
- Students use tiles to substitute.
- Teacher assesses student progress.
- Students use tiles to solve.
- Teacher assesses student progress.

✓ Display three more systems for students to work on independently. Monitor student progress for comprehension.

Reflection and Closing:

✓ **Exit Ticket:** Students write down pros and cons of using graphing and substitution methods.

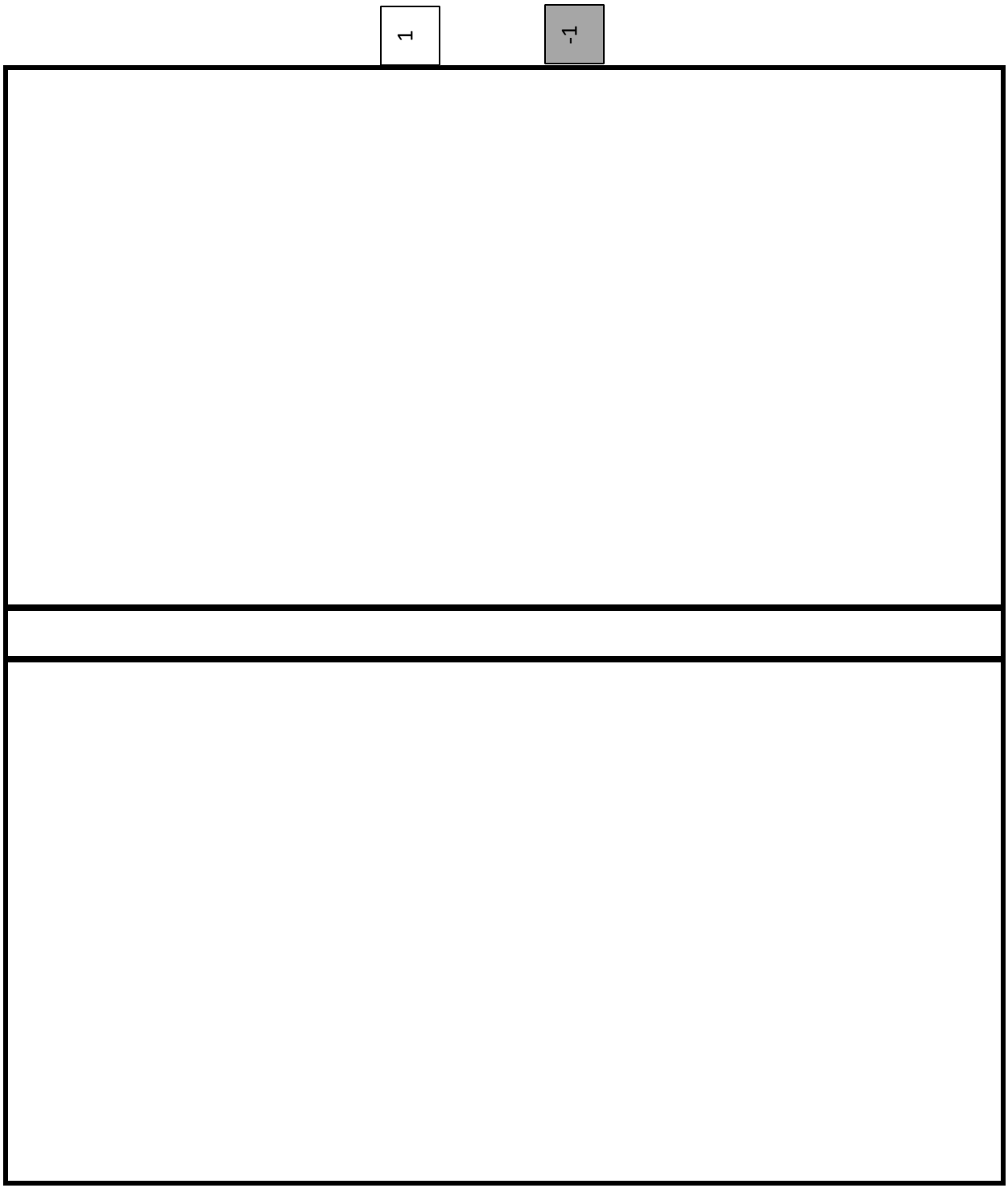
Homework

Students will draw a representation of the following systems using algebra tiles (SMP.4).

1. $y = 4x + 3; y = 2x - 4$
2. $2x + y = 6; y = 5 - 2x$
3. $7 - 2y = x; x + 2y = 3$

Handout 6.1: Equation Mat

Name:_____ Date: _____



Lesson 7: More Substitution

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

Additional Standard(s): 8.EE.7a, 8.EE.7b

Standards for Mathematical Practice: SMP.3, SMP.4, SMP.6. SMP.7

Estimated Time: 50 minutes

Resources and Materials:

- Colored pencils
- Document camera
- Highlighters
- Handout 7.1: Buying Chips and Candy
- Handout 7.2: Lesson 7 Homework

Lesson Target(s):

- Students will understand the relationship between linear equations in two variables and lines in a plane.
- Students will be able to understand the relationship between equivalent forms of linear equations.

Guiding Question(s):

- How can systems of equations be solved algebraically?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Substitution	☐ Introduce words with student-friendly definition and pictures ☐ Model how to use the words in discussion ☐ Read and discuss the meanings of words in a mathematical context

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 use colored pencils to make connections between equivalent values and how they may be used in solving systems through substitution. Students will understand that substitution is useful because it eliminates one variable so the value of the other variable can be defined. Students will solve a real-world scenario using any method.

Anticipatory Set/Introduction to the Lesson: Making Connections
Instruct students to solve the following multi-step equations with variables on both sides (SMP.4, SMP.6).

1. $2x = 2x - 5$
2. $4y + 6 = 2y - 4$
3. $5 (x - 3) = 3x + 8$

Ask students how this relates to our previous lesson on solving systems of equations using substitution.

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

- Provide graph paper to aid in solving one-variable equations. Each term gets a square. Highlight equal sign and squares below.
- Allow students to use Algebra Tiles to solve equations.

Activity 1: Substitution with Colored Pencils
Distribute two different colored pencils to each student. Using a document camera, model solving the following system using substitution.

$x + 3y = 2$
$y = 3x + 4$

Instruct students to highlight the isolated variable: $y = 3x + 4$

Writes systems using colored pencils: both *y*-values in one color, the rest of the equation in the other. For example, notate 'x+3' using green, 'y' using purple, '=2' using green as shown: x + 3y = 2.

Have students copy equation in their notes and independently write the second equation using colored pencils (SMP.7).

Model re-writing the first equation, but inform students that only one color should be used (in this case, green).

Model solving for *x* using green pencil, substituting *3x+4* for the *y* in the first equation.

Students copy as teacher solves. Students will re-write second equation using purple for *y = 3*, green pencil for the value of *x* and *+ 4* using purple pencil. Students solve for *y* using purple.

Repeat this process with examples of no solution and infinite solutions and try to keep one equation in standard form and one equation solved for a variable (SMP.7).
Note: When substituting, watch for students failing to use parentheses or needing remediation with the Distributive Property.

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

- Students may want to highlight the what *y* equals in one equation and the *y* in the second equation that it will replace.

Activity 2: Show Time
Distribute **Handout 7.1: Show Time** to each student pair.

- ✓ Allow students to work in pairs to complete the task (SMP.1, SMP.2, and SMP.4).

Prompting Questions:

- What variables are needed to write a system for this scenario?
- What would the variables represent?
- What are some other ways to solve this besides substitution or graphing?

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

- Encourage students to make tables of the scenarios and look for a common point on the tables.

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

- Have students justify their responses using multiple representations.

Activity 3: Ambassador

One student from each pair of students will share their findings from Activity 2 with another group. Throughout this process, students may make changes to their original responses.

Facilitate a whole group discussion by asking students about changes, if any, that were made to the task after the walk-around and which method was the most efficient to work with(SMP.3).

Homework

Distribute **Handout 7.2: Lesson 7 Homework** and instruct students to complete the assignment independently overnight.

Handout 7.1: Show Time

Name:_____ Date: _____

Movie tickets at the local theater cost $6 for adults and $2 for children under 12. If 175 tickets were sold, with cash receipts of $750, how many children's tickets were sold?

Reflection:

What was the best method to solving the system? Why was this the most efficient way to solve?

Handout 7.2: Lesson 7 Homework

Name:_____ Date: _____

Solve each system using substitution. Show your work. List your solution as a coordinate pair.

1. $\boldsymbol{x - \frac{y}{2} = -1}$

$\boldsymbol{x + y = -7}$

2. $\boldsymbol{x = 3 + 3y}$

$\boldsymbol{2x + 9y = 11}$

Handout 7.2: Lesson 7 Homework KEY

Name:_____ **Date:** _____

Solve each system using substitution. Show your work. List your solution as a coordinate pair.

1. $x - \frac{y}{2} = -1$

$x + y = -7$

(-3, -4)

2. $x = 3 + 3y$

$2x + 9y = 11$

(4, 1/3)

Lesson 8: Elimination

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

Additional Standard(s): 8.EE.7a, 8.EE.7b, 8.EE.8a

Standards for Mathematical Practice: SMP.4, SMP.6. SMP.7, SMP.8

Estimated Time: 50 minutes

Resources and Materials:

- Document camera
- Highlighters
- Red pen or pencil
- Handout 8.1: Magic Boxes
- Handout 8.2: Elimination

Lesson Target(s):

- Students will understand the relationship between linear equations in two variables and lines in a plane.
- Students will understand the relationship between equivalent forms of linear equations.

Guiding Question(s):

- How can linear combinations be used to solve systems of equations algebraically?
- How can elimination be used in solving systems of equations?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Coefficient • Constant • Elimination • Inverse • Variable	☐ Introduce words with student-friendly definition and pictures ☐ Model how to use the words in discussion ☐ Read and discuss the meanings of words in a mathematical context

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 solve Box Puzzles to strengthen addition of integers to prepare for the elimination method of solving systems of equations. Teacher will model how to use elimination and students will work with groups in an assembly line to solve systems using the elimination method.

Anticipatory Set/Introduction to the Lesson:
Note: The purpose for the box puzzles is to allow students the opportunity to see the elimination process without the confusion of the variables.

Distribute **Handout 8.1: Box Puzzles** and allow students time to analyze the first box puzzle that is already filled in completely (SMP.8). After students have sufficient time to identify the structure, have them complete the box puzzle activity. Facilitate a whole group discussion about the completion using prompting questions to guide the discussion.

Prompting Questions:

- Did anyone find the pattern?
- What did you notice about the last two puzzles?
- What two methods have we used to solve systems of equations?

Explain to the class that we will now learn an additional method for solving systems of equations called the elimination method.

Activity 1: Modeling
Distribute and project a copy of **Handout 8.2: Elimination**. Call attention to the first problem. Ask students to find two terms that are inverses of one another?
Students and teacher highlight *3y* and *-3y.*

$$\begin{aligned} 2x + 3y &= 5 \\ 4x - 3y &= 1 \end{aligned}$$

Prompting Questions:

- What happens when we add these two terms?
- Our coefficient becomes zero. What is zero times *y*?

Explain to learners that the term "eliminates" through addition, but that if those terms get added, the other like-terms must as well.

Teacher and students use a red pen to mark through the *y* terms.

$$2x + 3y = 5$$
$$4x - 3y = 1$$

Model the addition of the other terms and how to solve for *x*.

Prompting Questions:

- What can we do with the value we found for *x*?
- What method does replacing *x* in one equation remind you of?
- Do you think we should substitute in the first equation or the second?

Have two student volunteers to solve for *y* through substitution on the board with each student solving one of the equations.

Prompting Questions:

- Did our volunteers get different values for *y*?
- What conjecture can we make about which equation to use for substituting *x* to solve for *y*?
- Why do you think this method is referred to as the elimination method?
- In what ways is this similar/different from substitution?

Ask half the class to substitute the solution into the first equation and the other half to substitute the solution into the second equation. Discuss the final solution. Explain to students that this is a 'self-check' process that will help them in the future. Repeat the modeling process with problem number 2. Discuss why it must make both equations true.

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

- Distribute pre-solved documents to learners and allow them to trace with a pen rather than take notes.

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

- Students can solve the problem using the substitution method and compare the solutions to those using elimination method.

Activity 2: Assembly Line

Distribute a blank piece of paper to each student sitting in the first row.
Explain that students sitting in the first row will copy the problem and pass the paper to the student sitting behind them. Students sitting in the second seat will highlight inverse terms and pass the paper to the student sitting behind them. Students sitting the third seat will use a red pen to show elimination and add the other two terms, or eliminate. Students sitting in the fourth seat will solve for 'x'
Students sitting in the fifth seat will substitute and solve for 'y' then run to the board and write the solution.

First team finished gets 5 points, second team 4 points, etc…

Discuss the problem.

Students move to the seat behind them. Students in the back move to the front. If time allows, play the game until all learners have completed each step.

Note: Once students have played a few rounds, some may be tempted to simply solve the entire system and just pass the paper back. It is important that each student get a chance to complete each step of the solving process. Monitor student progress closely during this activity. If needed, give each student in the group different colors of pencils. (SMP.4)

Reflection and Closing:

- ✓ Remind students of the three methods of solving equations. Students write in journal as teacher discusses the following points. (SMP.7)
  - **Graphing:** best used when both equations are in slope-intercept form and when solutions are integers ~~solution is an integer~~.
  - **Substitution:** best used when one variable in isolated in an equation

- **Elimination:** best used when both equations in standard form

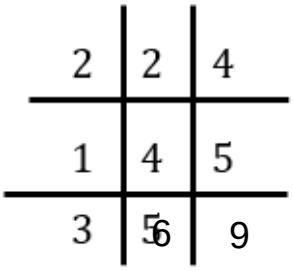
Homework

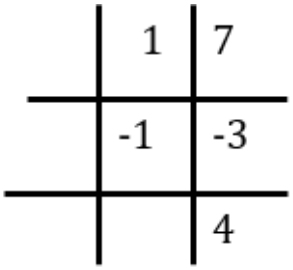
Instruct students to complete **Handout 8.2: Elimination** and instruct students to complete overnight.

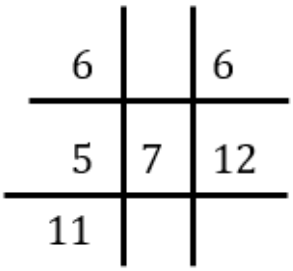
Handout 8.1: Box Puzzles

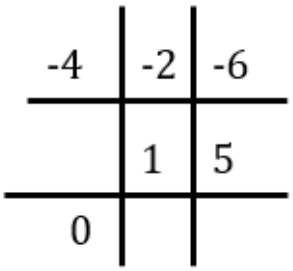
Name:_____ Date: _____

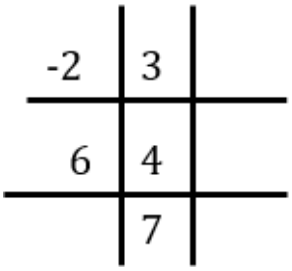
Directions: Find a pattern to complete each box. The first one has been done for you. Use the last one to create your own.

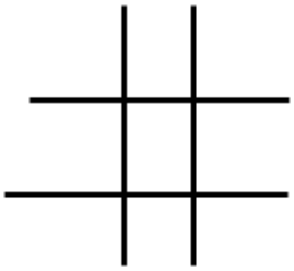












Handout 8.1: Box Puzzles KEY

Name:_____ Date: _____

Directions: Find a pattern to complete each box. The first one has been done for you. Use the last one to create your own.

2	2	4
1	4	5
3	6	9

6	1	7
-2	-1	-3
4	0	4

6	0	6
5	7	12
11	7	18

-4	-2	-6
4	1	5
0	-1	-1

-2	3	1
6	4	10
4	7	11

Handout 8.2: Elimination

Name:_____ **Date:** _____

Directions: Solve each system of equations using elimination, or linear combinations. Remember to list your solution as a coordinate pair.

1. $2x + 3y = 5$
   $4x - 3y = 1$

2. $3x + 5y = -9$
   $-6x - 5y = 18$

3. $x + y = -3$
   $2x - y = -3$

4. $x - 4y = -18$
   $-x + 3y = 11$

5. $2x - 5y = -24$
   $-2x - 3y = -16$

6. $5x - 3y = 2$
   $-5x + 3y = 8$

7. $-2x + 7y = 3$
   $-4x + 14y = 6$

Handout 8.2: Elimination KEY

Name:_____ **Date:** _____

Directions: Solve each system of equations using elimination, or linear combinations. Remember to list your solution as a coordinate pair.

1. $2x + 3y = 5$
   $4x - 3y = 1$

   (1, 1)

2. $3x + 5y = -9$
   $-6x - 5y = 18$

   (-3, 0)

3. $x + y = -3$
   $2x - y = -3$

   (-2, -1)

4. $x - 4y = -18$
   $-x + 3y = 11$

   (10, 7)

5. $2x - 5y = -24$
   $-2x - 3y = -16$

   $(\frac{1}{2}, 5)$

6. $5x - 3y = 2$
   $-5x + 3y = 8$

   No Solution

7. $-2x + 7y = 3$
   $-4x + 14y = 6$

   Infinite Solutions

Lesson 9: Interpreting Real-World Situations

Focus Standard(s): 8.EE.8c

Additional Standard(s): 8.EE.7a, 8.EE.7b, 8.EE.8a, 8.EE.8b,

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP.7

Estimated Time: 50 minutes

Resources and Materials:

- Document camera
- Highlighters
- Handout 9.1: Real-World Examples

Lesson Target(s):

- Students will analyze the relationship between the dependent and independent variables.
- Students will use variables to represent two quantities in a real-world problem.

Guiding Question(s):

- How can systems of equations be used to solve real world examples?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
● Algebraic equation	☐ Introduce words with student-friendly definition and pictures ☐ Model how to use the words in discussion ☐ Read and discuss the meanings of words in a mathematical context

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 be able to write an algebraic equation to express one quantity in terms of the other quantity. Students will be able to represent proportional relationships by equations.

Anticipatory Set/Introduction to the Lesson: Whole Group Discussion
Begin the lesson by reviewing homework from Lesson 7. Attend to any misconceptions students might have as well questions students may pose. Explain to learners that today's lesson is not only about solving systems of equations, but also creating them.

Activity 1: Real-World Examples
Distribute **Handout 9.1 Real-World Examples** and a highlighter to each student. Using a document camera, model finding information relevant to setting up a system of equations from a real-world example. The following should be highlighted from the first problem:

- 11 vehicles
- 9 students
- 50 students
- 222 students
- How many vehicles did the class use?

To encourage defining the variables, guide learning by prompting students finding the question in the problem. Explain that usually the variables will answer the question. In this case, let x=number of buses and y=number of vans. Students will replace the word 'bus' with an *x* and the word 'van' with a *y* in the real-world example.
Guide students in creating the following system:

$x + y = 11$
$2x + 50y = 222$

Possible prompts could be:

- In writing the sentence algebraically, what words represent our unknowns?
- Where should the equal sign be placed in the algebraic sentence?

The goal in this activity is for students to make sense of real world examples, not necessarily solve (SMP.1). Teacher will solve during lesson closure.

Allow students a few minutes to work independently on the second example (SMP.2). Students self-assess their system as teacher models writing the equations in the same manner as example 1.

Allow students a few minutes to work independently writing the system from the third example. Give students one minute to compare their system with another student in the classroom (SMP.3). Students may make changes if necessary (SMP.7).

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

- Students may need to use the 'erase and replace' method on mini whiteboards to keep their thinking organized.
- Provide students with sentence frames to fill in missing values.

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

- Students may determine the solutions to the real- world examples.

Activity 2: Students Write a Real-World Situation

Students will work in pairs to create a real-world example and illustrate (SMP.1).

Reflection and Closing:

- ✓ Revisit example one from **Handout 9.1: Real-World Examples**. Model solving the system that was created. Encourage students to use graphing, substitution, guess and check, and/or tables to solve. Have students explain their solution in the context of the problem.

Homework

Students will complete and solve **Handout 9.1: Real World Examples** (SMP.4).

Handout 9.1: Real-World Examples

Name:_____ **Date:** _____

Directions: For each real-world example, define a variable, create a system of equations, and solve. State your answers using complete sentences.

1. A class used vans and buses to go on a field trip. They used 11 vehicles to go on the trip. Each van holds nine students and each bus holds fifty students. If 222 students went on the trip, then how many of each type of vehicle did the class use?

2. Jenny spent $270 on pairs of pants. Dress pants cost $90 and jeans cost $30. If she bought a total of 5 pairs of pants, then how many of each kind did she buy?

3. Sara has agreed to help with her younger sister's science fair experiment. Her sister planted string beans in two pots. She is using a different fertilizer in each pot to see which one will grow the tallest plant. Currently, plant A is 4 inches tall and grows $\frac{2}{3}$ Inch per day, while plant B is 9 inches tall and grows $\frac{1}{2}$ inch per day. If the plants continue growing at these rates, in how many days will the two plants be the same height?

4. To rent a jet ski at Sam's costs $25 plus $3 per hour. At Claire's, it costs $5 plus $8 per hour. At how many hours will the rental cost at both shops be equal? What will the cost be for the rentals when they are the same?

5. Post Falls High School in Idaho has 1160 students and is growing by 22 students per year. Richmond High School in Indiana has 1900 students and is shrinking by 15 students per year. When will the student population be the same? How many students will there be at each school at that time?

Handout 9.1: Real-World Examples KEY

Name:_____ **Date:** _____

Directions: For each real-world example, define a variable, create a system of equations, and solve. State your answers using complete sentences.

1. A class used vans and buses to go on a field trip. They used 11 vehicles to go on the trip. Each van holds nine students and each bus holds fifty students. If 222 students went on the trip, then how many of each type of vehicle did the class use?

   The class used 3 buses and 8 vans for the field trip.

2. Jenny spent $270 on pairs of pants. Dress pants cost $90 and jeans cost $30. If she bought a total of 5 pairs of pants, then how many of each kind did she buy?

   Jenny bought 2 pairs of dress pants and 3 pairs of jeans.

3. Sara has agreed to help with her younger sister's science fair experiment. Her sister planted string beans in two pots. She is using a different fertilizer in each pot to see which one will grow the tallest plant. Currently, plant A is 4 inches tall and grows $\frac{2}{3}$ Inch per day, while plant B is 9 inches tall and grows $\frac{1}{2}$ inch per day. If the plants continue growing at these rates, in how many days will the two plants be the same height?

   The plants will be the same height in 30 days.

4. To rent a jet ski at Sam's costs $25 plus $3 per hour. At Claire's, it costs $5 plus $8 per hour. At how many hours will the rental cost at both shops be equal? What will the cost be for the rentals when they are the same?

   After 4 hours, both shops will charge $37 for a Jet Ski rental.

5. Post Falls High School in Idaho has 1160 students and is growing by 22 students per year. Richmond High School in Indiana has 1900 students and is shrinking by 15 students per year. When will the student population be the same? How many students will there be at each school at that time?

   The population will be the same after 20 years. The population at both schools will be 1600 students.

Lesson 10: Small Group Remediation

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

Additional Standard(s): 8.EE.5, 8.EE.6, 8.EE.7a, 8.EE.7b, 8.F.1, 8.F.2, 8.F.3, 8.F.4

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP.6, SMP.7, SMP.8

Estimated Time: 50 minutes

Resources and Materials:

- Handout 10.1: Matching with Graphs
- Handout 10.2: Linear Equations with Two Variables
- Handout 10.3: Comic Strip
- Systems of Equations with Substitution: https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-systems-topic/cc-8th-systems-with-substitution/e/systems_of_equations_with_substitution

Lesson Target(s):

- Students will understand the relationship between linear equations in two variables and lines in a plane.
- Students will understand the relationship between equivalent forms of linear equations.
- Students will analyze the relationship between the dependent and independent variables.

Guiding Question(s):

- What strategies are helpful in solving systems of equations?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Algebraic equation • Coefficient • Constant • Elimination • Substitution	☐ Introduce words with student-friendly definition and pictures ☐ Model how to use the words in discussion ☐ Read and discuss the meanings of words in a mathematical context

• Variable	

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 work in small groups to apply the methods for solving systems of equations.

Anticipatory Set/Introduction to the Lesson: Review
Teacher will do a quick homework check for completion. Students will compare homework with a partner then submit (SMP.3).

Activity 1: Small Group Remediation
Note: Use formative assessments throughout the unit to determine which groups students will be most beneficial for supporting students.

- ✓ Group 1: Teacher Assisted

Note: Students in this group almost have the concept of solving systems of equations algebraically and need a little extra help.

Give each student a system of equations printed on colored paper, *e.g, y = 2x + 4* on red paper and y = 4x + 3 on blue paper. Have the equations cut so that *y* is its own square, the equal sign is its own square, and *2x+4* is its own square.

Guide students into setting up the system according to color. Have students rearrange equations so that y=y and 2x+4=4x +3. Give students graph paper to record 2x+4=4x+3 so each term gets its own square. Have students highlight the square with the equal sign and the squares below. Guide students in solving the system. (SMP.4, SMP.6)

✓ Group 2: Independent

Note: Students in this group need help with graphing systems of equations. Prior to lesson, cut out the cards on the handout and clip together.

Distribute the cards from **Handout 10.1: Matching with Graphs.** Instruct students to read the directions card before they begin the activity. Students in this group will use the handout to match graphs to systems of equations. (SMP.2)

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

- If these students finish early, they can either play again or list the coordinate point that solves each system.

✓ Group 3: Independent

Note: Students in this group need practice solving systems of equation algebraically.

Allow students need to watch the video on Systems of Equations with Substitution. Instruct students to complete and record their work (SMP.2).

✓ Group 4: Independent with teacher observation

Note: Students in this group need basic remediation in comprehension of equations.

Distribute **Handout 10.2: Liner Equations with Two Variables**. Have students ~~compete~~ complete the handout and use whiteboards and markers to substitute numerical values in equations. Ask students to determine whether a point is a solution to a two-variable equation. (SMP.6)

✓ Group 5: Independent

Note: Students in this group have a good grasp of the concept of solutions to systems of equations.

Distribute **Handout 10.3: Comic Strip**. Have students write a word problem to correspond with the word problem. The word problem must be a system that can be solved using substitution. Students will swap comic strips and solve the equations. (SMP.1, SMP.2, SMP.4)

Reflection and Closing:

✓ Students will write and complete the following sentence on a piece of paper:

*"When we first started working with systems I was confused about*_____*but now I know*_____*."*

Homework
No homework assigned.

Handout 10.1: Matching with Graphs

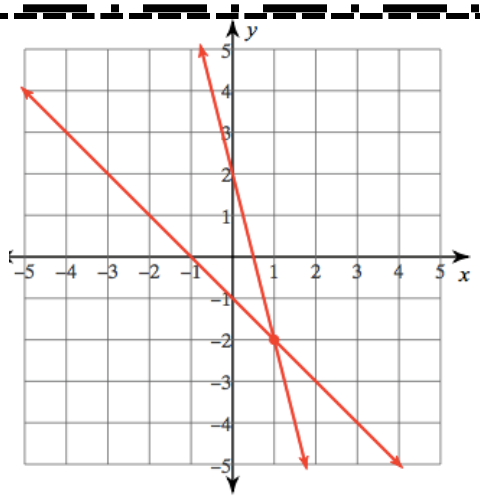
Name:_____ Date: _____

Matching with Graphs

Directions: Place all cards face down on a desk. Assign a student monitor who has a list of the correct matches. The student with the closest birthday goes first. Flip two cards over. A match is made when the system of equations and its correct graph are face-up. If a match is made, collect the cards. If a match is not made, flip the cards back to original position. Play will rotate clockwise.

$$y = -4x + 2$$
$$y = -x - 1$$

A

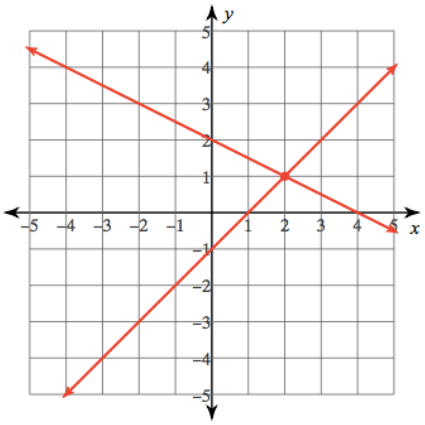


5

B

$$y = -x - 4$$

$$y = \frac{3}{2}x + 1$$

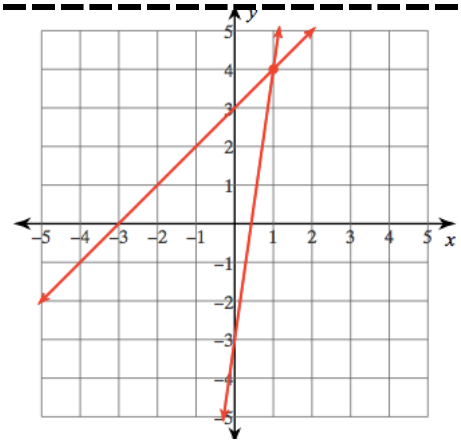


4

C

$$y = x - 1$$

$$y = -\frac{1}{2}x + 2$$

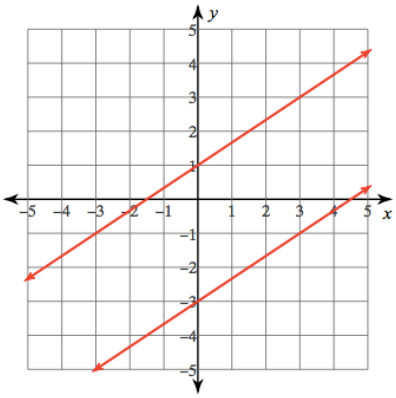


3

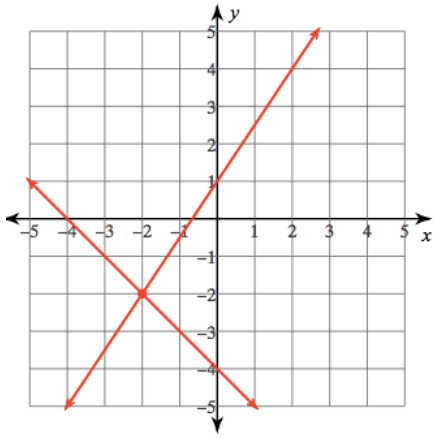
D

$$y = 7x - 3$$

$$y = x + 3$$



2

$y = \frac{2}{3}x + 1$ $y = \frac{2}{3}x - 3$	
E	1

Correct Matches: A5, B1, C4, D3, E2

Handout 10.2: Liner Equations with Two Variables

Name:_____ Date: _____

Cut and give one to each student.

Name/Date _____

Linear Equations and Inequalities in Two Variables

Determine if each ordered pair is a solution of the equation $x + 3y = 12$.

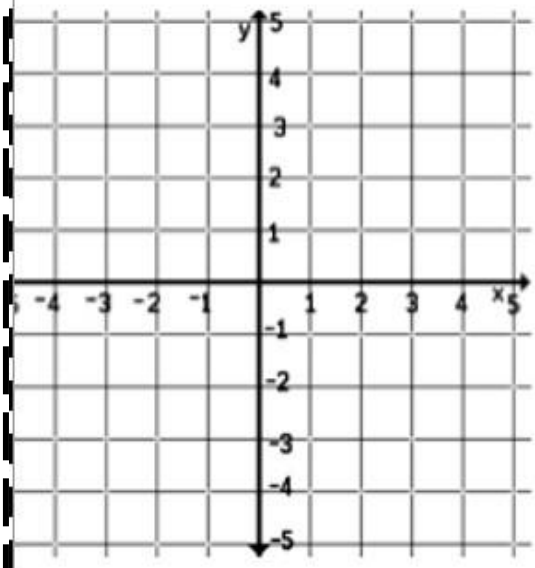
a. (0, 4) _____

b. (-3, 5) _____

c. (2, 3) _____

d. (3, 3) _____

e. (-3, 3) _____



Name/Date _____

Linear Equations and Inequalities in Two Variables

Determine if each ordered pair is a solution of the equation $x + 3y = 12$.

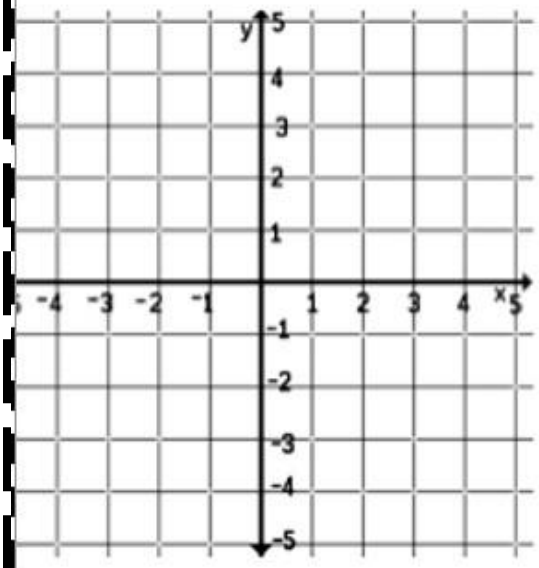
a. (0, 4) _____

b. (-3, 5) _____

c. (2, 3) _____

d. (3, 3) _____

e. (-3, 3) _____



Handout 10.3: Comic Strip

Name:_____ Date: _____

Directions: Work with a partner. Choose one of the following comics. Create a story that includes a real-life example that can be solved using a system of equations. Be sure to include an "answer key" that show the system and its solution.

Lesson 11: Wireless Debate

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

Additional Standard(s): 8.EE.7b, 8.F.4

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP.5, SMP.6, SMP.7, SMP.8

Estimated Time: 50 minutes (another 50 minutes may be required depending on class size, group size, and discussion depth)

Resources and Materials:

- Digital presentations (if available)
- Poster paper
- Markers
- Handout 11.1: Wireless Debate
- Handout 11.2: Wireless Debate Rubric
- Handout 11.3: Sample Student Presentation

Lesson Target(s):
Students will be able to use algebraic and mathematical reasoning to solve pairs of simultaneous linear equations using various methods such as substitution, elimination, and graphing.

Guiding Question(s):

- How can solutions to systems of equations be justified in different ways?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Algebraic equation • Coefficient • Constant • Elimination • Substitution • Variable	☐ Introduce words with student-friendly definition and pictures ☐ Model how to use the words in discussion ☐ Read and discuss the meanings of words in a mathematical context

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 create a proposal to demonstrate understanding of systems of equations in multiple representations as it relates to real-world scenarios. Students will present their proposal to the class.

Activity 1: Task
Distribute **Handout 11.1: Wireless Debate** and **Handout 11.2: Wireless Debate Rubric**. Read, explain, and discuss the task and the expectation.

- ✓ Students pair up to create the presentation.

Note: Provide a variety of mediums for presenting (posters, PowerPoint, Prezi, video, etc.). It may be helpful to break the time for work into two days to allow for student reflection.

Activity 2: Presenting the Task
Allow time for pairs to present their proposals and responses to the class.

Homework

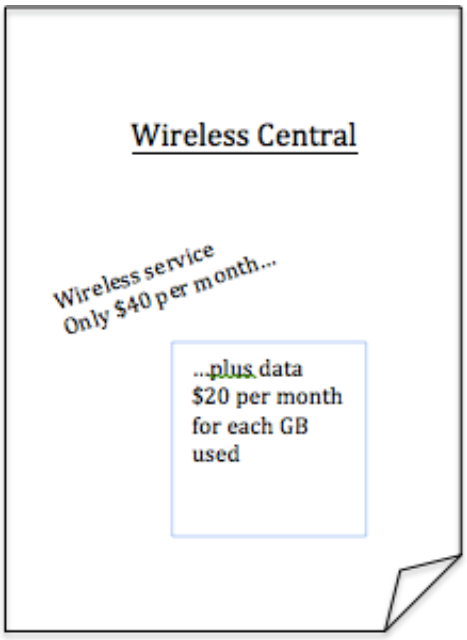
Instruct students to reflect on the lesson and the proposal they created for the performance task.

Handout 11.1: Wireless Debate

Name:_____ Date: _____

Directions: Your task is to create a presentation. Your presentation must include each of the following components:

- Equations
- Graphs
- Substitution
- Proposal
- Response Letter



Child Proposal:

You have finally saved enough money to buy your very own cell phone! Unfortunately, you must rely on your parents to provide wireless service for the phone. Your parents want to use Wireless Central for your cell service. You want your parents to use Totally Wireless. Create a proposal to persuade your parents to use Totally Wireless for wireless service. Use your knowledge of systems of equations to prove to your parents that Totally Wireless is the better deal.

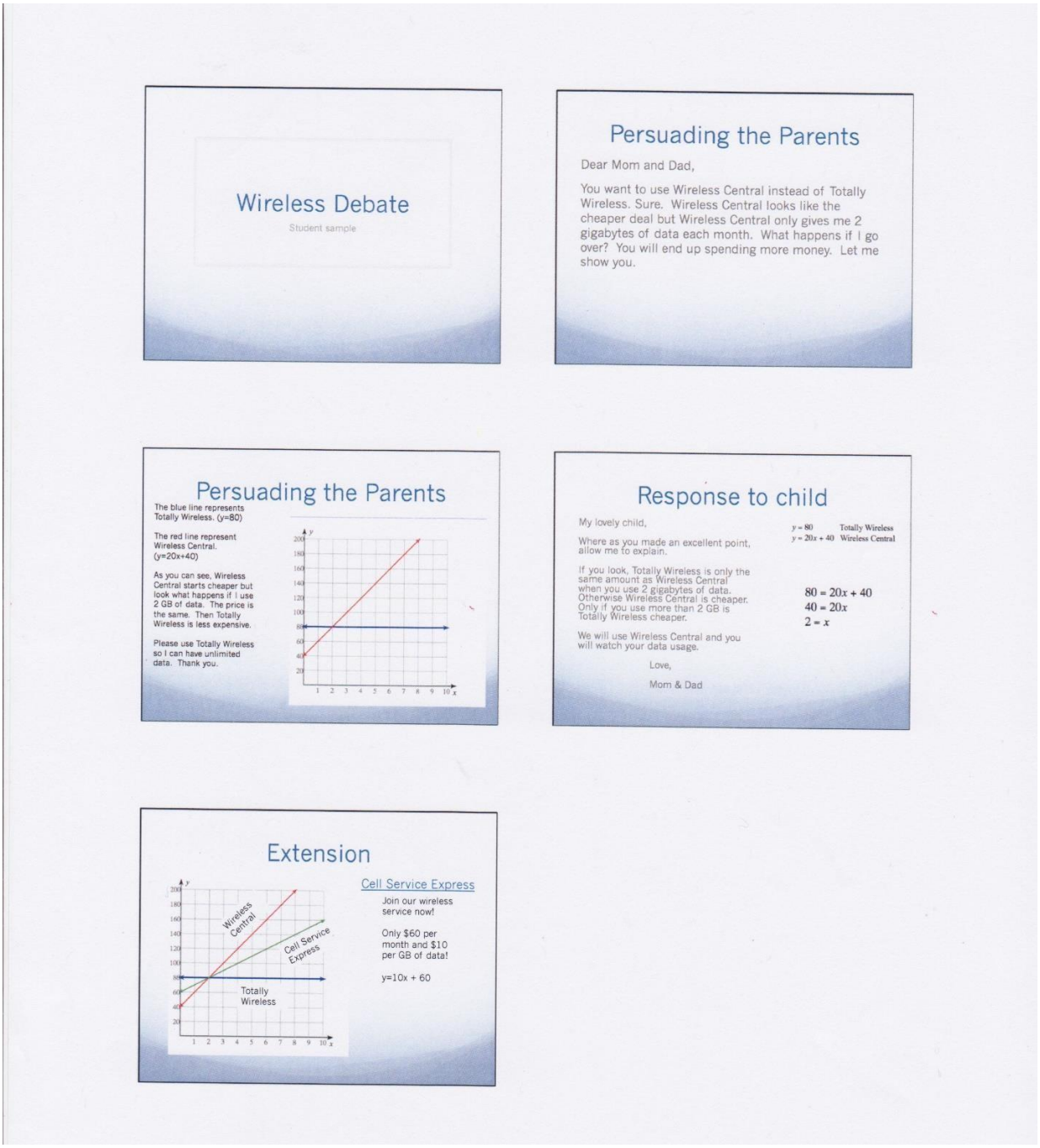
Parent Letter:

Your child bought a cell phone and expects you to pay for wireless service. Your child wants you to use Totally Wireless, but you would rather use Wireless Central. Write a response to your child's proposal. Use your knowledge of systems of equations to prove to your child that Wireless Central is the better deal.

Handout 11.2: Wireless Debate Rubric

Rating	**4**	**3**	**2**	**1**
Evaluative Criteria				
Create a system of equations from a real-world problem.	Students correctly create equations for all three scenarios.	Students create equations for two scenarios.	Students create an equation for one scenario.	Students do not create equations.
Solve systems through graphing.	Students correctly label the graph the system of equations and correctly identify the point of intersection.	Students correctly graph the system of equations, but does not correctly identify the point of intersection.	Students correctly graph one linear equation of the system of equations.	Students do not correctly the system of equations.
Solve systems of equations using substitution.	Students accurately solve the system of equations using substitution.	Students use correct procedures in solving the system but simple arithmetic mistakes are made.	Students do not solve the system of equations accurately.	Students do not attempt to solve the system of equations using substitution.
Construct viable arguments for scenarios.	Students produce arguments that are accurate and persuasive for both scenarios. Student extension is accurate.	Students produce arguments that are accurate and persuasive, but do not attempt extension.	Students produce one argument that is accurate and persuasive.	Students do not produce an argument to represent a scenario.

Handout 11.3: Sample Student Presentation



For training or questions regarding this unit, please contact:

exemplarunit@mdek12.org