i-Ready Classroom Mathematics

OREGON EDITION

Oregon Teacher Toolbox

Resource Sampler

Grade 8

Engaging Resources to Drive

i-Ready Classroom Mathematics, Oregon Edition includes a wealth of resources to meet the needs of all learners. The Oregon Teacher Toolbox resources are accessible through the Teacher Digital Experience via i-ReadyConnect.com.

Easily Access All Grades K–8 Resources on the Oregon Teacher Toolbox:

- Oregon Enhancement Activities E/S
- Activity Sheets E/S
- Assessments *(Lesson Quizzes, Practice Tests, and Unit Assessments—Forms A and B)* E/S
- Cumulative Practice E/S
- Develop Session Videos
- Digital Math Tools Powered by Desmos
- Discourse Cards E/S
- Graphic Organizers E/S
- Games *(Unit Level K–8 and Grade Level K–2)* E/S
- Enrichment Activities E/S
- Family Letters E/S
- Fluency and Skills Practice E/S
- Implementation Support

E/S = Available in English and Spanish

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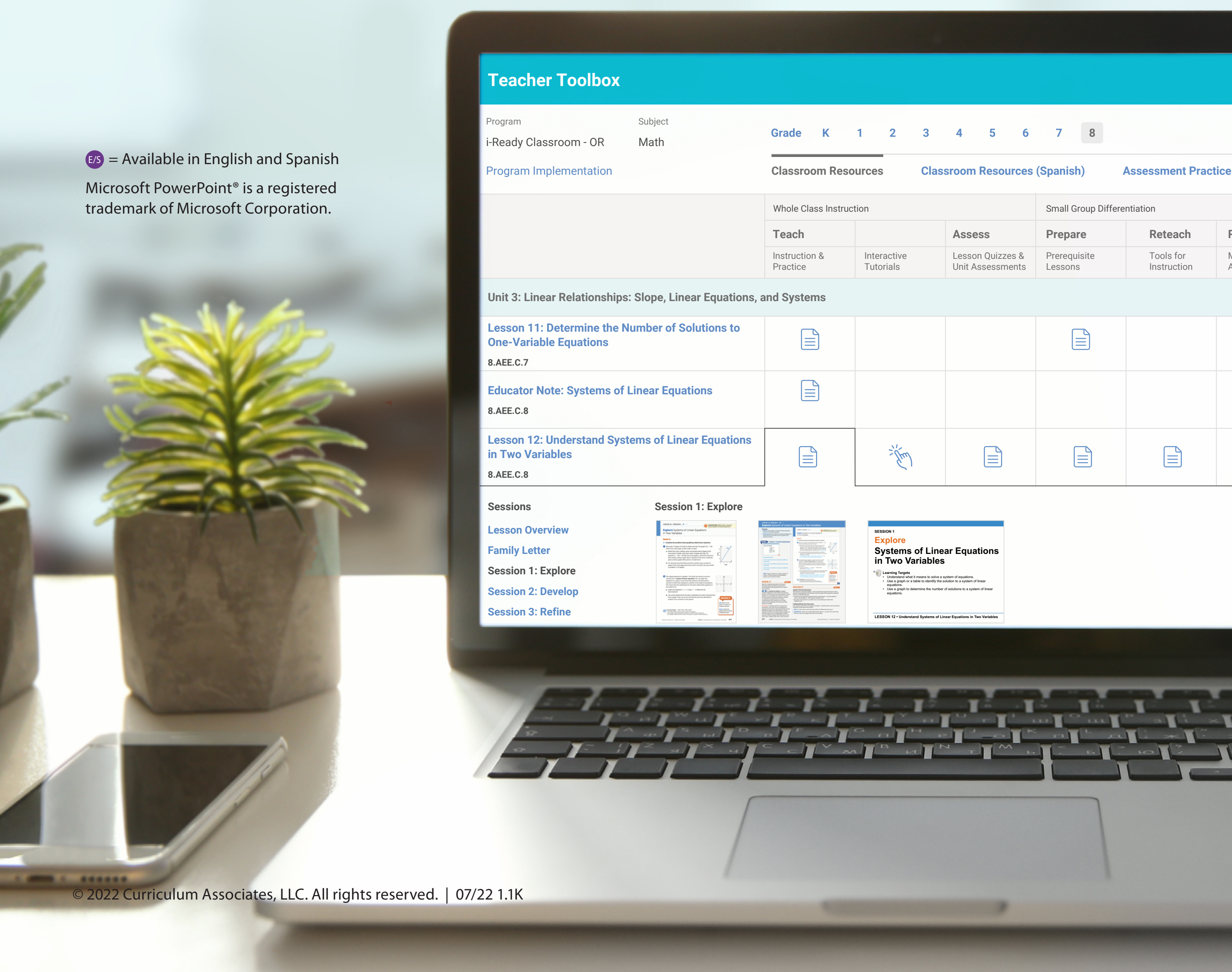
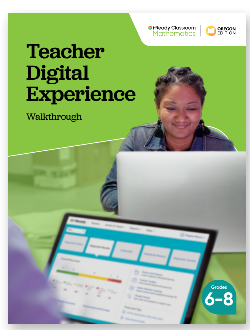


Student Growth

- Interactive Tutorials E/S
- Literacy Connection Activities E/S
- Math Center Activities *(On Level, Below Level, and Above Level)* E/S
- Student Worktext PDFs E/S
- PowerPoint® Slides *(Editable)* E/S
- Prerequisite Lessons E/S
- Professional Learning Videos
- Teacher's Guide PDFs
- Tools for Instruction E/S
- Unit Flow & Progression Videos *(Closed Captioned in English and Spanish)*

Table of Contents

This sampler includes some of the lesson- and unit-level resources available on Oregon Teacher Toolbox for **Unit 3: Linear Relationships: Slope, Linear Equations, and Systems, Lesson 12: Understand Systems of Linear Equations in Two Variables**.

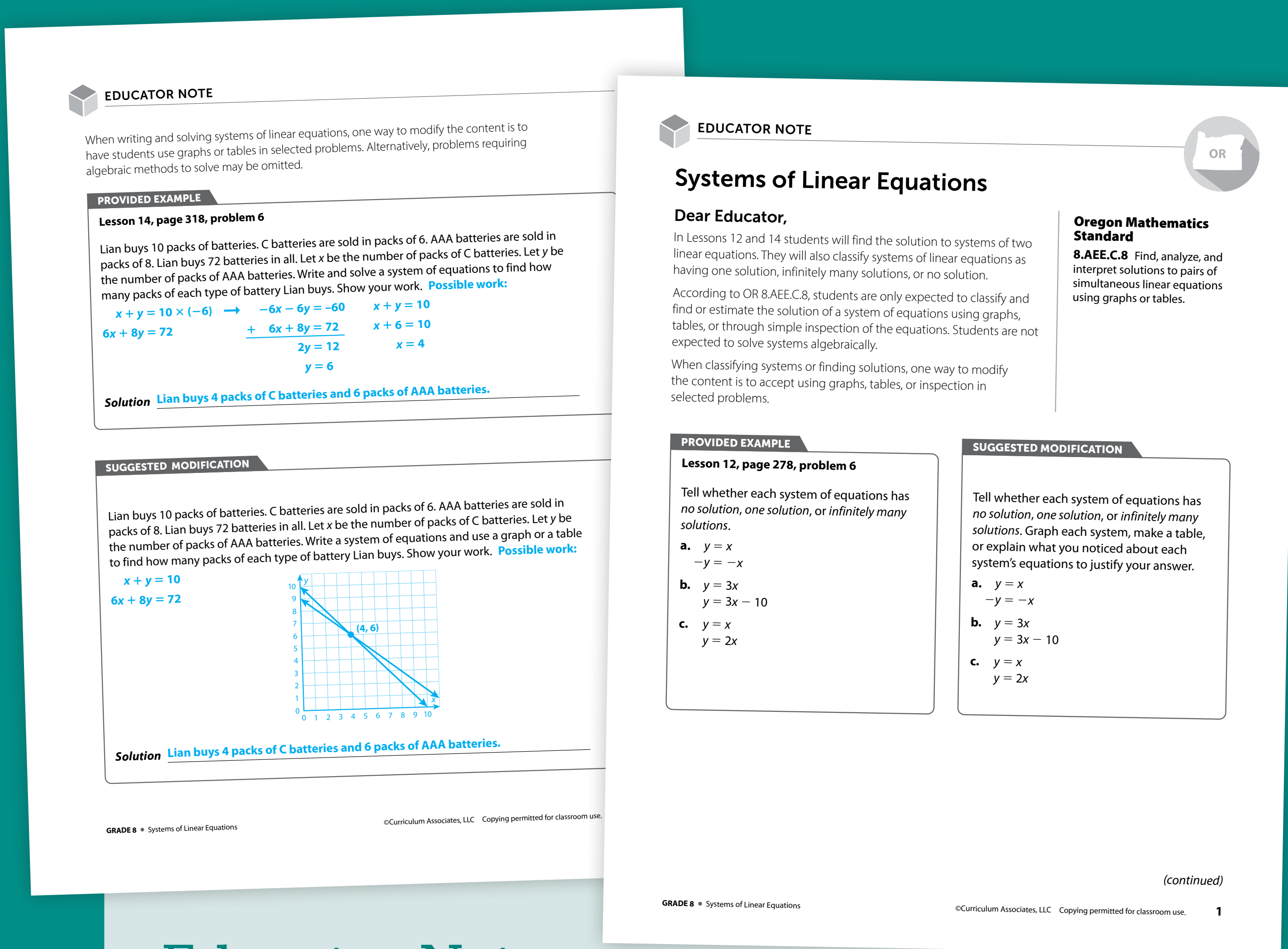


Check out the Teacher Digital Experience Walkthrough to see more digital resources!

Explore all Grades K–8 resources in your demo account. Review the Teacher Digital Experience Walkthrough to see how.

Oregon Enhancement Activities

Oregon Enhancement Activities provide additional notes and activities to ensure all the Oregon Mathematics Standards are addressed.



EDUCATOR NOTE

When writing and solving systems of linear equations, one way to modify the content is to have students use graphs or tables in selected problems. Alternatively, problems requiring algebraic methods to solve may be omitted.

PROVIDED EXAMPLE

Lesson 14, page 318, problem 6

Lian buys 10 packs of batteries. C batteries are sold in packs of 6. AAA batteries are sold in packs of 8. Lian buys 72 batteries in all. Let x be the number of packs of C batteries. Let y be the number of packs of AAA batteries. Write and solve a system of equations to find how many packs of each type of battery Lian buys. Show your work. **Possible work:**

$x + y = 10 \times (-6) \longrightarrow -6x - 6y = -60$

$6x + 8y = 72 \qquad + \; 6x + 8y = 72$

$2y = 12$

$y = 6$

$x + y = 10$

$x + 6 = 10$

$x = 4$

Solution Lian buys 4 packs of C batteries and 6 packs of AAA batteries.

SUGGESTED MODIFICATION

Lian buys 10 packs of batteries. C batteries are sold in packs of 6. AAA batteries are sold in packs of 8. Lian buys 72 batteries in all. Let x be the number of packs of C batteries. Let y be the number of packs of AAA batteries. Write a system of equations and use a graph or a table to find how many packs of each type of battery Lian buys. Show your work. **Possible work:**

$x + y = 10$

$6x + 8y = 72$

Solution Lian buys 4 packs of C batteries and 6 packs of AAA batteries.

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EDUCATOR NOTE

OR

Systems of Linear Equations

Dear Educator,

In Lessons 12 and 14 students will find the solution to systems of two linear equations. They will also classify systems of linear equations as having one solution, infinitely many solutions, or no solution.

According to OR 8.AEE.C.8, students are only expected to classify and find or estimate the solution of a system of equations using graphs, tables, or through simple inspection of the equations. Students are not expected to solve systems algebraically.

When classifying systems or finding solutions, one way to modify the content is to accept using graphs, tables, or inspection in selected problems.

Oregon Mathematics Standard

8.AEE.C.8 Find, analyze, and interpret solutions to pairs of simultaneous linear equations using graphs or tables.

PROVIDED EXAMPLE

Lesson 12, page 278, problem 6

Tell whether each system of equations has *no solution*, *one solution*, or *infinitely many solutions*.

a. $y = x$
$-y = -x$

b. $y = 3x$
$y = 3x - 10$

c. $y = x$
$y = 2x$

SUGGESTED MODIFICATION

Tell whether each system of equations has *no solution*, *one solution*, or *infinitely many solutions*. Graph each system, make a table, or explain what you noticed about each system's equations to justify your answer.

a. $y = x$
$-y = -x$

b. $y = 3x$
$y = 3x - 10$

c. $y = x$
$y = 2x$

(continued)

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Educator Notes

- Describe how the content in the *i-Ready Classroom Mathematics, Oregon Edition* instructional program varies from the expectations of the Oregon Mathematics Standards.
- Also include an example of how the content might be modified in order to better address the Oregon Mathematics Standards.

Educator Notes are provided when:

- Oregon Mathematics Standards require different content limits or vocabulary terms OR
- A clear modification can tailor the *i-Ready Classroom Mathematics, Oregon Edition* instructional program to address Oregon expectations

EDUCATOR NOTE

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Tell whether each system of equations has *no solution*, *one solution*, or *infinitely many solutions*. Graph each system, make a table, or explain what you noticed about each system's equations to justify your answer.

a. $y = x$
$-y = -x$

b. $y = 3x$
$y = 3x - 10$

c. $y = x$
$y = 2x$

(continued)

EDUCATOR NOTE

OR

Exponent Properties with Powers of 10

Dear Educator,

In this lesson students will learn the properties of integer exponents and use them to evaluate, simplify, and rewrite expressions.

According to OR 8.AEE.A.1, when introducing the properties of integer exponents, students should use powers of 10.

One way to modify the content to fully meet this standard is to update contexts and change exponents to powers of 10 in selected problems.

Oregon Mathematics Standard

8.AEE.A.1 Apply the properties of integer exponents using powers of 10 to generate equivalent numerical expressions.

PROVIDED EXAMPLE

Lesson 19, page 453, Try It

The population of a colony of single-celled bacteria doubles each day. On Day x, the population of the colony is 2^x. How many times as large is the population of the colony on Day 7 than on Day 4?

SUGGESTED MODIFICATION

The Richter scale is used to measure the strength of earthquakes. The strength of an earthquake is 10 times greater for every increase of 1 on the Richter scale. This means an earthquake that measures x on the Richter scale is 10^x times as powerful as an earthquake that measures 1 on the Richter scale. How many times more powerful is an earthquake that measures 7 on the Richer scale than an earthquake that measures 4 on the Richter scale?

EDUCATOR NOTE

OR

Perfect Squares up to 225

Dear Educator,

In Lessons 23 and 27 students will solve problems that involve finding the square root of a number.

According to OR 8.AEE.A.2, students are only required to know square roots of perfect squares up to 225.

To modify the content to fully meet this standard, accept answers in the form of square roots when a square is not perfect or when a perfect square is greater than 225. Alternatively, modify the numbers so squares are perfect and less than or equal to 225.

Oregon Mathematics Standard

8.AEE.A.2 Represent solutions to equations using square root and cube root symbols.

PROVIDED EXAMPLE

Lesson 23, page 568, problem 5

A square playground has an area of 10,000 ft^2. What is the side length of the playground? Show your work.

Possible work:

$$A = s^2$$

$$10{,}000 = s^2$$

$$\pm\sqrt{10{,}000} = s$$

Length cannot be negative, so $s = \sqrt{10{,}000}$.

$100^2 = 10{,}000$, so $s = 100$.

Solution **The side length is 100 ft.**

SUGGESTED MODIFICATION

A square playground has an area of 10,000 ft^2. What is the side length of the playground? Show your work.

Possible work:

$$A = s^2$$

$$10{,}000 = s^2$$

$$\pm\sqrt{10{,}000} = s$$

Length cannot be negative, so $s = \sqrt{10{,}000}$.

Solution **The side length is $\sqrt{10{,}000}$ ft.**

"I love the rigor of the program, and I love having access to all grade levels of the [Teacher] Toolbox. It allows me to differentiate instruction within each of my math groups."

—Mathematics Educator

Lesson-Level Resources

Lesson 12: Understand Systems of Linear Equations in Two Variables

Additional Practice

Differentiation

Assessment

FLUENCY AND SKILLS PRACTICE | Name:

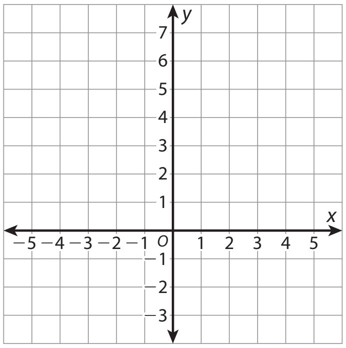
LESSON 12

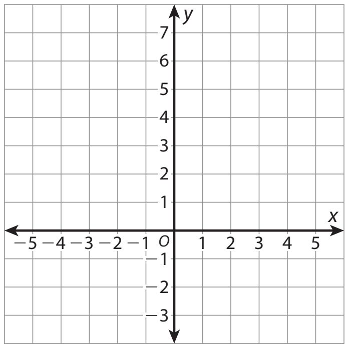
Understanding the Number of Solutions to a System of Linear Equations

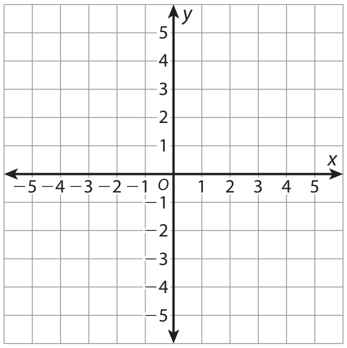
➤ **Solve each problem.**

1. Graph each system of equations in the same coordinate plane and determine the number of solutions for the system. If there is exactly one solution, write it as an ordered pair.

$y = 3x + 1$	$y - 2 = 3x$	$3y + 2x = 6$
$y = 2x + 2$	$y = 3x + 2$	$y = -\frac{2}{3}x + 3$







______________ ______________ ______________

2. Tell whether each system of equations has no solution, one solution, or infinitely many solutions.

$y = 5x + 11$	$y = 6x + 3$	$x + 4y = 8$
$y = 5x$	$y = 3x$	$y = -\frac{1}{4}x + 2$

______________ ______________ ______________

FLUENCY AND SKILLS PRACTICE | Name:

LESSON 12

Understanding the Number of Solutions to a System of Linear Equations *continued*

3 One equation in a system of equations is $y - 8x = 1$. Write a second equation so that the system of equations has the number of solutions stated.

no solution	one solution	infinitely many solutions
____________	____________	____________

4 Two runners are racing against each other. Jeri graphs a linear equation for each runner that shows the runner's distance from the starting line over time. The two equations form a system that has infinitely many solutions. Describe the intersection point(s) of the lines and explain what the solution means in this situation.

Tools for Instruction

Solutions of Systems of Linear Equations

Objective Determine the number of solutions to a system of equations.	**Materials** ruler, **Coordinate Planes** (page 3)

Students have previously graphed lines in the coordinate plane and identified the slope and *y*-intercept of linear equations. In this activity, students will determine whether a system of equations has one, zero, or infinitely many solutions. Students will graph and analyze the slopes and *y*-intercepts of lines to determine the number of solutions. They will develop the understanding that systems of equations of lines that intersect at one point have one solution, systems of equations of parallel lines have no solutions, and systems of equations of the same line have infinitely many solutions. Being able to determine the number of solutions to a system will help students check for reasonableness when finding the exact solutions to systems of equations.

Two Ways to Teach

Solve by Graphing 10–15 minutes

Tell the student that the solution to a system of equations is the ordered pair(s) that make all equations in the system true. Explain that one way to solve systems of equations is to graph the equations and find their point(s) of intersection. Provide the student with a ruler and a copy of **Coordinate Planes** (page 3). Present the following system of equations:

$y = 2x + 4$

$y = -2x - 3$

Guide the student through graphing the system on the first coordinate plane. Ask: *Do these two lines intersect? If so, how many times do they intersect?* (yes; one time) Say: *Since the two lines intersect at one point, this system has one solution.* Ask: *Do all lines intersect? Explain.* (No. Some lines are parallel.) Tell the student that if the lines in a system of equations are parallel, the system has no solution.

Present the following system of equations:

$y = 3x - 3$

$y - 3x = 3$

Give the student time to graph the system on the second coordinate plane and determine its number of solutions. (no solutions) Ask: *If two lines intersect, do they always intersect at exactly one point? Explain.* (No. If they are the same line, they intersect at every point on the line.) Tell the student that if the lines in a system of equations are the same line, the system has infinitely many solutions.

Present the following system of equations:

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

$2y = -x - 8$

Give the student time to graph the system on the third coordinate plane and determine its number of solutions. (infinitely many solutions)

Tools for Instruction

Support English Learners The student may think that the answer *one solution* indicates that the solution to the system is the value 1 and *no solutions* indicates that the solution to the system is the value 0. Help the student understand the meaning of each answer by using it in a sentence frame: *The system has one/no/infinitely many solution(s) because the lines intersect at one/zero/infinitely many point(s) on the coordinate plane.*

Analyze the Equations 10–15 minutes

Review with the student that if the lines in a system of equations intersect at one point, the system has one solution; if the lines do not intersect, the system has no solutions; and if the lines intersect at all points, the system has infinitely many solutions.

Ask: *How do you describe lines that represent a system with zero solutions?* (parallel lines) *How do you know that two lines are parallel without graphing them?* (They have the same slope and different y-intercepts.) Ask: *Are all lines with the same slope parallel? Explain.* (No. If lines have the same slope and the same y-intercept, then they are the same line.) *If a system is made of two lines with the same slope and same y-intercept, how many solutions does it have?* (infinitely many solutions)

Summarize that lines in a system of equations with the same slope and different y-intercepts have no solutions and lines in a system of equations with the same slope and the same y-intercept have infinitely many solutions. Ask: *How many solutions does a system of equations with two lines that have different slopes have? Explain.* (one solution; If the two lines have different slopes, then they intersect at only one point.) Present the following systems of equations to the student and have them determine the number of solutions in each system:

$y = 3x - 7$	$2x + y = 3$	$y - 4x = 16$
$y = -3x - 7$	$y = -2x + 3$	$2y = 8x + 16$
(one solution)	(infinitely many solutions)	(no solutions)

Check for Understanding

Have the student identify the number of solutions to the system of equations:

$y = 5x - 4$

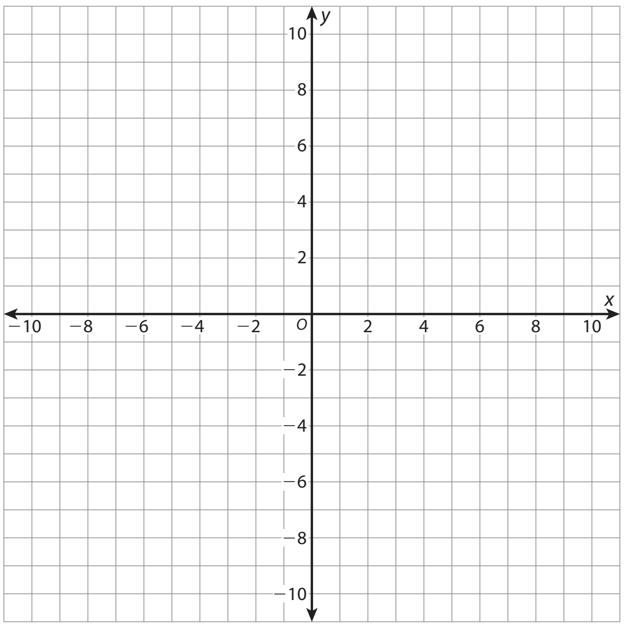
$y + 5x = -4$ (one solution)

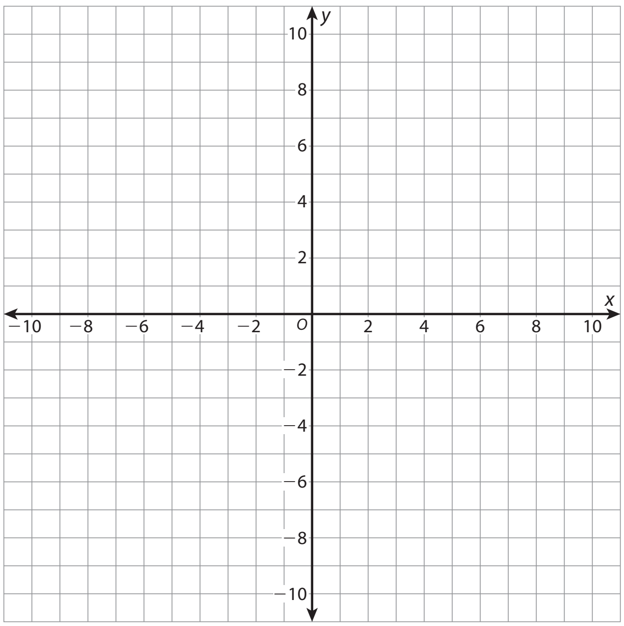
For the student who struggles, use the chart below to help pinpoint where extra help may be needed.

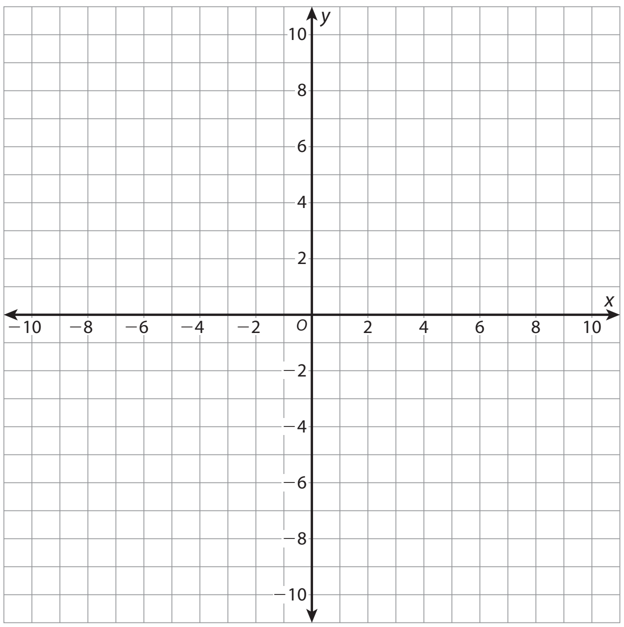
If you observe…	the student may…	Then try…
the student struggles to identify the slopes and y-intercepts of the equations	not have a strong grasp of slope-intercept form.	reminding the student that an equation in slope-intercept form is of the form $y = mx + b$, where m is the slope and b is the y-intercept.
the student struggles to identify the number of solutions to the system of equations	have difficulty determining how many times the two lines intersect.	having the student graph the lines to determine if they intersect at one, zero, or all points.

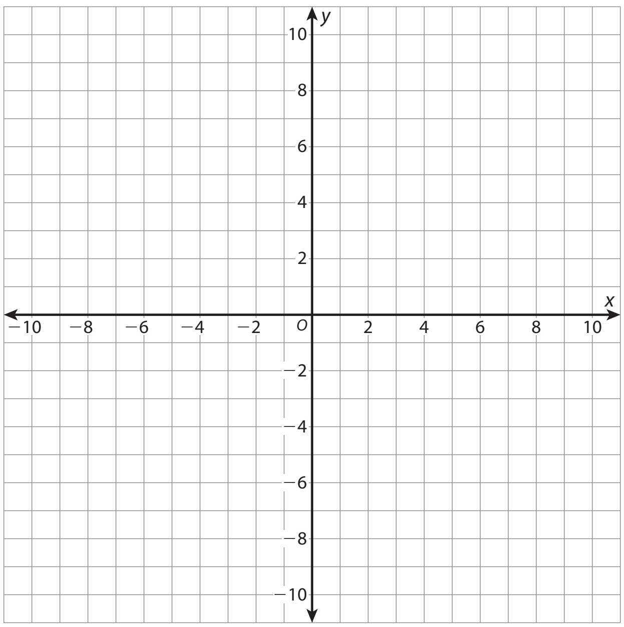
Name__________________________________

Coordinate Planes









CENTER ACTIVITY ●●
LESSON 12

Names:

On Level is shown here.

Make Systems of Equations

What You Need

- Recording Sheet
- number cube (1–6)

What You Do

1. Decide which players are on Team A and which players are on Team B. Teams will take turns.
2. Roll a number cube. Write the number you roll in your table on the **Recording Sheet**. You can write the number in any empty answer blank in any of your team's three systems of equations.
3. When both teams have completely filled in their three systems of equations, find the point value for each system.
   - Infinitely many solutions: 5 points
   - No solution: 3 points
   - Exactly one solution: 1 point
4. Add your team's points to find your team's total score. The team with the greater total score wins.

Check Understanding

Tell whether the system of equations has *no solution*, *one solution*, or *infinitely many solutions*. Explain how you know.

$y = 7x + 3$
$y = 7x + 4$

Go Further

Choose one number on your table in the **Recording Sheet** that you would like to change. Circle the number. Each team rolls the number cube until they get a new number to replace the circled number. Find the point value for the new system of equations. Who is the winner now?

CENTER ACTIVITY ●●
LESSON 12

Names:

Make Systems of Equations

RECORDING SHEET

Team A

System	Equations	Points
1	$y =$ ______ $x +$ ______ $y =$ ______ $x +$ ______	
2	$y =$ ______ $x +$ ______ $y =$ ______ $x +$ ______	
3	$y =$ ______ $x +$ ______ $y =$ ______ $x +$ ______	
	Total Score:	

Team B

System	Equations	Points
1	$y =$ ______ $x +$ ______ $y =$ ______ $x +$ ______	
2	$y =$ ______ $x +$ ______ $y =$ ______ $x +$ ______	
3	$y =$ ______ $x +$ ______ $y =$ ______ $x +$ ______	
	Total Score:	

CENTER ACTIVITY ●●● | Names:

LESSON 12

Make Systems of Equations

Above Level is shown here.

What You Need

- Recording Sheet
- number cube (1–6)

What You Do

1. Decide which players are on Team A and which players are on Team B. Teams will take turns.
2. Roll a number cube. Write the number you roll in your table on the **Recording Sheet**. You can write the number in any empty answer blank in any of your team's three systems of equations.
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   - No solution: 3 points
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4. Add your team's points to find your team's total score. The team with the greater total score wins.

Check Understanding

Tell whether the system of equations has *no solution*, *one solution*, or *infinitely many solutions*. Explain how you know.

$y = 2(x + 3)$

$-2x + y = 3$

Go Further

Choose one number on your table in the **Recording Sheet** that you would like to change. Circle the number. Each team rolls the number cube until they get a new number to replace the circled number. Find the point value for the new system of equations. Who is the winner now?

CENTER ACTIVITY ●●● | Names:

LESSON 12

Make Systems of Equations

RECORDING SHEET

Team A

System	Equations	Points
1	$y =$ ________ $x +$ ________ $y +$ ________ $x =$ ________	
2	$y =$ ________ $(x +$ ________ $)$ $y =$ ________ $x +$ ________	
3	________ $x + y =$ ________ $y =$ ________ $(x +$ ________ $)$	
	Total Score:	

Team B

System	Equations	Points
1	$y =$ ________ $x +$ ________ $y +$ ________ $x =$ ________	
2	$y =$ ________ $(x +$ ________ $)$ $y =$ ________ $x +$ ________	
3	________ $x + y =$ ________ $y =$ ________ $(x +$ ________ $)$	
	Total Score:	

CENTER ACTIVITY ● Names:

LESSON 12

Make Systems of Equations

Below Level is shown here.

What You Need

- Recording Sheet
- number cube (1–6)

What You Do

1. Decide which players are on Team A and which players are on Team B. Teams will take turns.
2. Roll a number cube. Write the number you roll in your table on the **Recording Sheet**. You can write the number in any empty answer blank in any of your team's three systems of equations.
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   - Exactly one solution: 1 point
4. Add your team's points to find your team's total score. The team with the greater total score wins.

Check Understanding

Tell whether the system of equations has *no solution*, *one solution*, or *infinitely many solutions*. Explain how you know.

$y = 7x$

$-y = -7x$

Go Further

Choose one number on your table in the **Recording Sheet** that you would like to change. Circle the number. Each team rolls the number cube until they get a new number to replace the circled number. Find the point value for the new system of equations. Who is the winner now?

CENTER ACTIVITY ● | Names:
LESSON 12

Make Systems of Equations

RECORDING SHEET

Team A

System	Equations	Points
1	$y =$ ________ $x +$ ________ $y = 2x +$ ________	
2	$y =$ ________ x $y =$ ________ x	
3	$y =$ ________ $x +$ ________ $y =$ ________ $x + 3$	
	Total Score:	

Team B

System	Equations	Points
1	$y =$ ________ $x +$ ________ $y = 2x +$ ________	
2	$y =$ ________ x $y =$ ________ x	
3	$y =$ ________ $x +$ ________ $y =$ ________ $x + 3$	
	Total Score:	

ENRICHMENT ACTIVITY
LESSON 12

Name:

System Solutions

Your Challenge

➤ **Use graphing technology to explore solutions to systems of linear equations.***

a. Open the graphing technology program.

b. Type in the first equation in the field where the equations are entered.

c. Type in the second equation in the field where the equations are entered.

d. Look at the graph to determine if the system of equations has a solution.

1. $y = x + 5$
   $y = x - 3$
   Does this system have a solution? If so, what is the solution? Explain.

2. $y = 2x - 1$
   $y = 9x + 6$
   Does this system have a solution? If so, what is the solution? Explain.

3. $y = 8x + 1$
   $2y = 16x + 2$
   Does this system have a solution? If so, what is the solution? Explain.

* You may need to adjust the steps depending on which calculator or graphing program you use. If needed, use Help or Support menus or online tutorials.

ENRICHMENT ACTIVITY | Name:

LESSON 12

System Solutions

e. Use the graphing technology program to graph a given line and then graph a line of your choice so that the system has either no solution, one solution, or infinitely many solutions.

4

No Solution	One Solution	Infinitely Many Solutions
Given line: $y = -4x + 6$	Given line: $y = -4x + 6$	Given line: $y = -4x + 6$
Your line: ___________	Your line: ___________	Your line: ___________

For each of the boxes above, did you type in the equation in the graphing technology program on the first try or did it take you several tries? Explain.

f. Use the graphing technology program to graph two lines of your choice that are different than the other lines in this activity so that the system has either no solution, one solution, or infinitely many solutions.

5

No Solution	One Solution	Infinitely Many Solutions
Line 1:	Line 1:	Line 1:
Line 2:	Line 2:	Line 2:

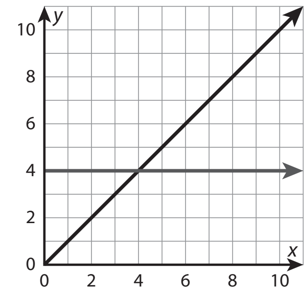
For each of the boxes above, how did you determine the equations for your lines? Explain.

LESSON 12 • QUIZ | Name:

Digital Comprehension Checks are also available.

Solve the problems.

1. The graph of a system of two linear equations is shown. How many solutions does the system of equations have?



A No solution **B** One solution

C Two solutions **D** Infinitely many solutions

2. A system of linear equations has infinitely many solutions. What is known about the slopes and y-intercepts of the graphed equations? Explain your reasoning.

SOLUTION ______________________

3. Use two of the equations below to write a system of equations with no solution.

$y = 3x + 1$ $y = 3x - 1$ $-y = -3x + 1$

Explain your reasoning.

SOLUTION ______________________

LESSON 12 • QUIZ | Name:

4 Kylie and Matt are driving out of town, leaving from the same house in different cars. Matt drives at a rate of 40 miles per hour. Matt drives 50 miles before Kylie begins traveling. Kylie drives at a rate of 50 miles per hour.

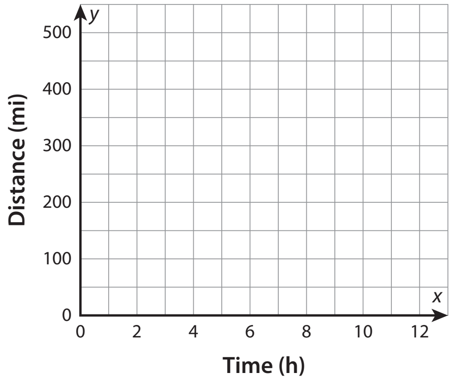
PART A

The system of equations represents the distance, *y*, from the starting point of each driver *x* minutes after Kylie starts driving.

$y = 40x + 50$

$y = 50x$

Graph the system in the coordinate plane and label each line with the driver it represents.



PART B

Describe a situation in which Kylie and Matt are traveling but are never the same distance from the starting point at the same time. Write a system of equations to model the situation. How many solutions does the system have? Explain your reasoning.

SOLUTION ____________________

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“I highly recommend the use of Teacher Toolbox beyond what words can even convey. Most importantly, the growth I see in students using the [Teacher] Toolbox resources is unmatched. And that’s what matters!”

—Mathematics Educator

Unit-Level Resources

Unit 3: Linear Relationships: Slope, Linear Equations, and Systems

GAME
UNIT 3

Name:

It's Systematic

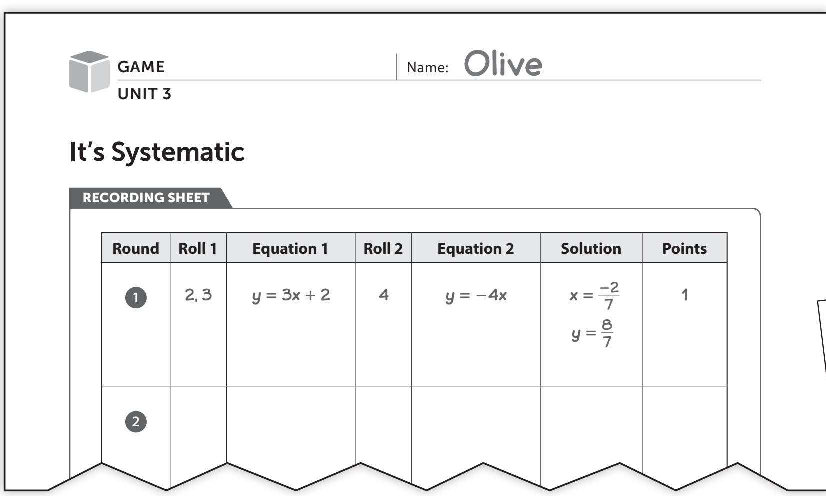
What You Need

- Recording Sheet (1 for each player)
- Equation Cards
- 2 number cubes (1–6)
- grid paper (optional)

Directions

- Your goal is to score points by making systems of linear equations that have one solution, no solution, or infinitely many solutions.
- Shuffle the cards and place them in a pile facedown. Players take turns.
- On your turn, pick a card. Roll one or two number cubes to fill in the blanks in the equation. You can choose to make a number positive or negative. Record the roll and the equation on your Recording Sheet.
- Pick a new Equation Card. Roll the number cube(s) again. Use the new number(s) and Equation Card to record a second equation.
- Use the equations to form a system of equations. Then solve the system of equations.
- The other player(s) check your solution. If you are correct, score as follows:
  - One solution = 1 point
  - No solution = 2 points
  - Infinitely many solutions = 5 points
- Play five rounds. The player with the most points wins.

Sample Recording Sheet

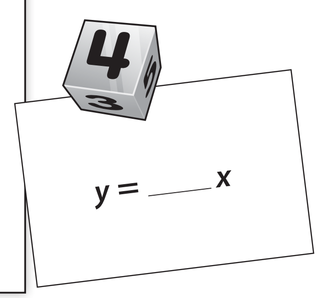

GAME
UNIT 3
Name: Olive

It's Systematic

RECORDING SHEET

Round	Roll 1	Equation 1	Roll 2	Equation 2	Solution	Points
1	2, 3	$y = 3x + 2$	4	$y = -4x$	$x = \frac{-2}{7}$ $y = \frac{8}{7}$	1
2						

KEEP IN MIND . . . You can solve a system of equations algebraically by using substitution or elimination.



GAME
UNIT 3

Name:

It's Systematic

RECORDING SHEET

Round	Roll 1	Equation 1	Roll 2	Equation 2	Solution	Points
1						
2						
3						
4						
5						
					Total Points:	

GAME

UNIT 3

Name:

EQUATION CARDS

$y = \underline{\qquad}\,x$	$y = \underline{\qquad}\,x + \underline{\qquad}$	$y = \underline{\qquad}\,x - \underline{\qquad}$
$y = \underline{\qquad}\,x$	$y = \underline{\qquad}\,x + \underline{\qquad}$	$y = \underline{\qquad}\,x - \underline{\qquad}$
$y = \underline{\qquad}\,x$	$y = \underline{\qquad}\,x + \underline{\qquad}$	$y = \underline{\qquad}\,x - \underline{\qquad}$
$y = \underline{\qquad}\,x$	$y = \underline{\qquad}\,x + \underline{\qquad}$	$y = \underline{\qquad}\,x - \underline{\qquad}$

The Mysterious Marfa Lights

by Rachel Bernstein

1 Near the little town of Marfa in western Texas is one of the most incredible sights in the United States: the Marfa lights.

What Are the Marfa Lights?

2 The Marfa lights are spheres of light the size of soccer balls in bright colors of red, orange, green, blue, white, or yellow. They appear only 10 to 20 times each year, in all seasons and any kind of weather. Sightings occur between dusk and dawn, lasting from a few seconds to several hours. The Marfa lights seem to occur more frequently during the second half of the lunar cycle, between the full moon and the next new moon.

3 The balls of light may remain motionless as they pulse on and off with intensity varying from faint to almost blinding radiance. Then again, they can zigzag far up in the air and dart across the desert against prevailing winds. The ghostly lights can move singly, in pairs, or in groups; they can split apart and merge, or sometimes vanish and then reappear. Their movements are unpredictable, and nobody has quite determined what they are or where they come from.

Who Has Seen Them?

4 Robert Ellison reported seeing the Marfa lights in 1883 while driving cattle through Paisano Pass. In 1885, Texas settlers Joe and Sally Humphreys encountered the lights. More recently, Kyle Miller, a local business owner, reported his encounter with the lights:

> *Late one night, I was driving home from a business meeting. Route 90 was deserted, except for a few armadillos crossing the road. I was listening to an awesome country song when a single green ball flashed in the distance. Unfortunately, it lasted only a few seconds, but I remember thinking I'd seen a glowing basketball frozen in midair. It was so shocking that I nearly jumped out of my seat, and the hair stood on the back of my neck. I've heard about the ghost lights my whole life, but I had never seen them before.*

These are just a few eyewitness reports. There are probably many people who have seen the lights but said nothing for fear of having their sanity doubted.

What Causes Them?

5 There are many theories about what causes the Marfa lights. In the past, superstitious locals thought they were the spirit of an Apache warrior. In 1883, a railroad engineer suggested they were kerosene lanterns at a nearby ranch. More recent proposals abound. Some investigators believe swamp gases cause them, while others believe they result from moonlight reflecting off the nearby Chinati Mountains. Still another hypothesis is that quartz crystals discharge static electricity when they warm in the daytime and cool at night.

6 Several studies have attempted to find the source of the Marfa lights. During World War II, pilots at Midland Army Air Field searched for a source from the air. In 1975, local pilot Fritz Kahl led one hundred observers on the "Marfa Ghost Light Hunt." Neither investigation proved successful.

7 In May 2004, a group of university physics students conducted a new study using high-tech equipment. After four days, the students concluded that automobile headlights from a nearby highway caused the Marfa lights. They attributed the strange appearance and movement of these lights to what is called the Fata Morgana mirage.

8 The Fata Morgana mirage is a superior mirage, which is characterized by multiple distortions. With superior mirages, what you perceive to be higher in the sky is really lower to the ground. Light bends downwards when it hits a layer of cold air, making it appear as if what is below your sight line is actually straight ahead or above because you are seeing the inverted image of what is on the horizon projected above it. A Fata Morgana mirage can make distant objects appear to hover in the air.

9 Does this mean that the mystery of the Marfa lights has been solved? The answer is not quite that simple. In his 2010 book *Hunting Marfa Lights*, engineer James Bunnell describes sightings of the lights he and others have witnessed that couldn't possibly have been caused by a superior mirage.

How Can You See Them?

10 With so many conflicting theories about the lights, people complain that there will never be a definitive answer about their origin. However, the local population has few complaints about the mysterious lights. The highway department has constructed an official viewing site near Marfa. And every Labor Day weekend, there is a Marfa Lights Festival held in celebration of the lights that includes a parade and other events. Marfa's economy booms as hotels fill up quickly and tourists spend their money on food, entertainment, and souvenirs.

11 If you want to attempt to see the Marfa lights, spend time between Marfa and Paisano Pass, south of Route 90. The most advantageous viewing spot is near U.S. Highway 67 on Mitchell Flat.

LITERACY CONNECTION | Name:

UNIT 3

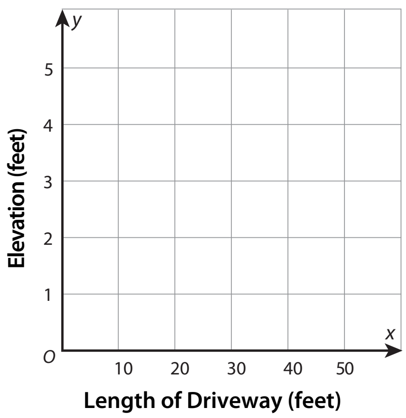
The Mysterious Marfa Lights

Systems of Linear Equations

➤ **Solve each problem. Show your work.**

1 Ella is developing plans for a Marfa Art League. The building is on a slight hill. The plans include a driveway that will climb the hill on a straight path.

The property survey shows the elevation (the distance the land rises) at the entrance to the driveway at (0, 0). The survey shows the elevation at the end of the driveway at (50, 4).



a. Graph the points on the graph. What is the slope of the driveway?

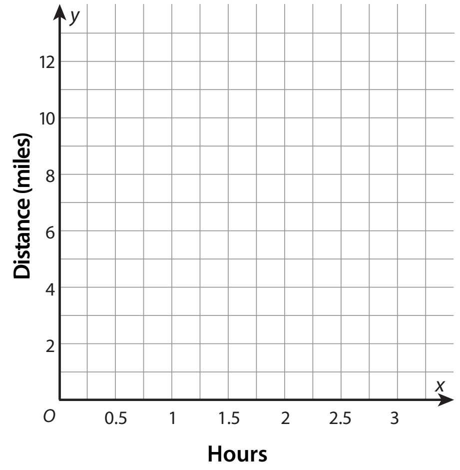
b. The county inspectors recommend that driveways for small businesses like Ella's have a slope between 8 and 14% so that rainwater runs off. Does the slope of Ella's driveway meet the recommendation? Explain.

LITERACY CONNECTION
UNIT 3

Name:

2 A film crew uses drones to record the Marfa lights from the air. The crew sets up two shots. The director has one drone operator stay with him and sends one drone operator 3 miles closer to the Marfa lights. The drones take off at the same time and fly toward the lights. The drone that started closer to the lights travels at 5 miles per hour, and the drone that started farther from the lights travels at 8 miles per hour.

a. Write an equation for each drone where *y* represents the distance in miles from the director and *x* represents the time in hours the drone travels. Graph the equations.



b. How long will it take for the second drone to catch up to the first drone? How far from the director will the drones be when this occurs?

3 Verona is an artist in Marfa, Texas, who paints the Marfa lights. She prints postcards of her paintings to sell to tourists. The cost to print postcards is a flat \$60 fee plus \$0.25 per postcard. She sells the postcards for \$1.25 each. Write an equation that represents Verona's costs and an equation that represents her earnings on sales. Verona earns a profit after she sells enough postcards to cover her cost to print them. How many postcards must she sell before she starts making a profit?

UNIT 3 • UNIT ASSESSMENT
FORM A

Name:

Form A is shown here. Digital Comprehension Checks and Form B are also available.

➤ **Solve the problems.**

1 Seth owns a printing shop that makes customized T-shirts. The cost to make T-shirts is proportional to the number of T-shirts he makes. Seth graphs a line that shows the cost per customized T-shirt. Two points on the line are (2, 8) and (4, 16). What does the slope of the line mean in this situation?

A The cost is \$0.25 per T-shirt.

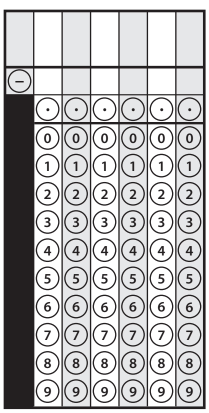
B The cost is \$2 per T-shirt.

C The cost is \$4 per T-shirt.

D The cost is \$8 per T-shirt.

2 What is the solution of the equation? Record your answer on the grid. Then fill in the bubbles.

$$\frac{1}{5}(4x - 2.5) = 5(0.4x + 10) + 3\frac{1}{2}$$



UNIT 3 • UNIT ASSESSMENT | Name: ______________________

FORM A continued

3 Show how to solve the system of equations by substitution. Write your answers in the blanks.

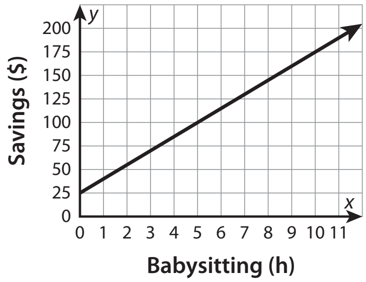
$y = 2x - 1$

$6x - 2y = 24$

$6x - 2y = 24$	$y = 2x - 1$
$6x - 2(\_\_\_\_\_\_\_\_) = 24$	$y = 2(\_\_\_\_\_\_\_\_) - 1$
$6x - \_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_ = 24$	$y = 22 - 1$
$2x + 2 = 24$	$y = 21$
$2x = 22$	
$x = 11$	

(11, 21)

4 Kaya babysits to add money to her savings. She draws a graph to show how much she can earn by babysitting. What is the equation of Kaya's line in slope-intercept form? What do the slope and *y*-intercept represent in this situation? Show your work.



SOLUTION ______________________

Name: ____________________

5 How many solutions does $3(4x - 8) = -24 + 12x$ have?

A no solution

B one solution

C two solutions

D infinitely many solutions

6 What is the value of m? Show your work.

$\frac{3}{4}(2m - 5) = 2(3m - 4) - \frac{5}{6}m$

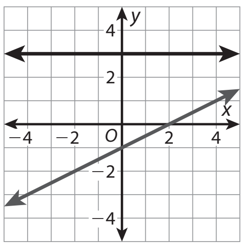
SOLUTION ____________________

UNIT 3 • UNIT ASSESSMENT | Name:

FORM A continued

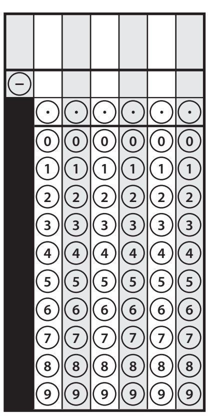
7 The graph shows a system of linear equations. Decide if each statement about the lines in the system is true or false.

Choose *True* or *False* for each statement.



	True	False
a. The lines are not parallel, so the system has one solution.	◯	◯
b. The lines do not intersect, so the system has no solution.	◯	◯
c. There is exactly one solution to the system of equations.	◯	◯
d. The slopes of the lines are different.	◯	◯

8 What is the *y*-intercept of a line that passes through the points (2, −2.5) and (4, −2)? Record your answer on the grid. Then fill in the bubbles.



UNIT 3 • UNIT ASSESSMENT

Name: ____________________

FORM A continued

9 Yuki and Roman are photographers for the school yearbook. Yuki starts with 20 photos. She then takes 60 photos each week. Roman starts with 110 photos. He then takes 35 photos each week. After how many weeks will Yuki and Roman have taken the same number of photos? Write a system of equations that can be used to solve the problem. Let *w* be the number of weeks and *p* be the number of photos. Write your answers in the blanks.

$p =$ ____________ $w +$ ____________

$p =$ ____________ $w +$ ____________

10 What is the solution to the system of equations? Show your work.

$2x - 2y = -2$

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

SOLUTION ____

UNIT 3 • UNIT ASSESSMENT

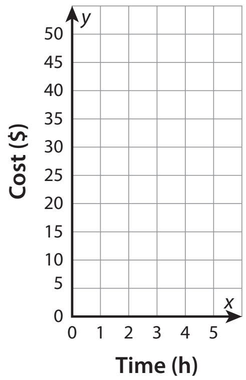
Name:

FORM A continued

11 Scooter Fun and Skoot Zoom are electric scooter rental companies. Scooter Fun charges an \$8 deposit plus \$6 per hour rental fee. Skoot Zoom charges a \$5 deposit plus \$9 per hour rental fee. The system of equations represents the cost, y, for renting a scooter for x hours. Graph the system and label each line with the scooter company it represents. What is the solution to the system of equations? What does it mean in the context of the problem? Explain your reasoning.

$y = 6x + 8$

$y = 9x + 5$



SOLUTION ____________________

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12 Decide if each equation has no solution, one solution, or infinitely many solutions.

Choose *No Solution*, *One Solution*, or *Infinitely Many Solutions* for each equation.

	No Solution	One Solution	Infinitely Many Solutions
a. $7x - 3 = 4x + 3$	○	○	○
b. $6x + 2 = 2 + 6x$	○	○	○
c. $4x - 5 = 4x - 5$	○	○	○
d. $-x - 8 = -x + 8$	○	○	○

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