Classroom Mathematics

# California

# Teacher Toolbox

## Resource Sampler

GRADE

8

by i-Ready

# Engaging Resources to Drive Student Growth

The Teacher Toolbox for *Classroom Mathematics California* is an important part of your digital experience and companion to your Teacher's Guide, as it houses many of the resources you need to deliver effective core mathematics instruction. You'll see references to specific Teacher Toolbox resources throughout the Teacher's Guide, pointing you to materials you can use for whole class instruction and small group differentiation. The Teacher Toolbox resources are accessible through the Teacher Digital Experience via i-ReadyConnect.com.

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

- Activity Sheets E/S
- Assessments *(Lesson Quizzes, Assessment Notes Recording Sheet, and Unit Assessments—Forms A and B)* E/S
- Centers Library E/S
- Cumulative Practice E/S
- Digital Math Tools Powered by Desmos
- Graphic Organizers E/S
- Games *(Unit Level for Grades K–8 and Grade Level for Grades K–2)* E/S
- Enrichment Activities E/S
- Family Letters E/S
- Fluency and Skills Practice E/S
- Implementation Support
- Interactive Tutorials E/S
- Literacy Connection Activities E/S
- Learning Activities *(On Level, Below Level, and Above Level)* E/S
- Student Worktext PDFs E/S
- PowerPoint® Slides E/S
- Teacher's Guide PDFs E/S
- Tools for Instruction E/S
- Unit Flow & Progression Videos (closed captioned in English and Spanish)

E/S = Available in English and Spanish

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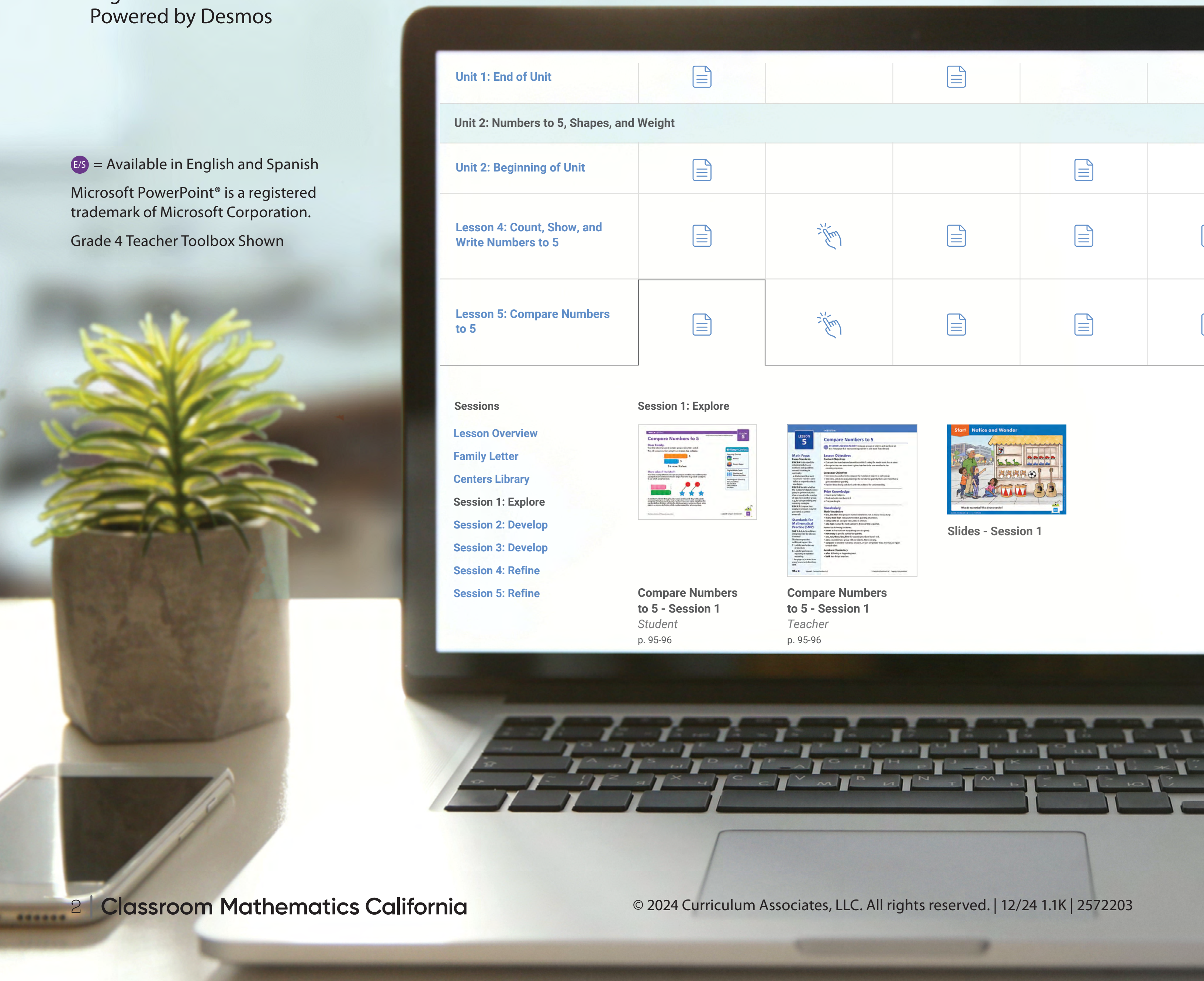
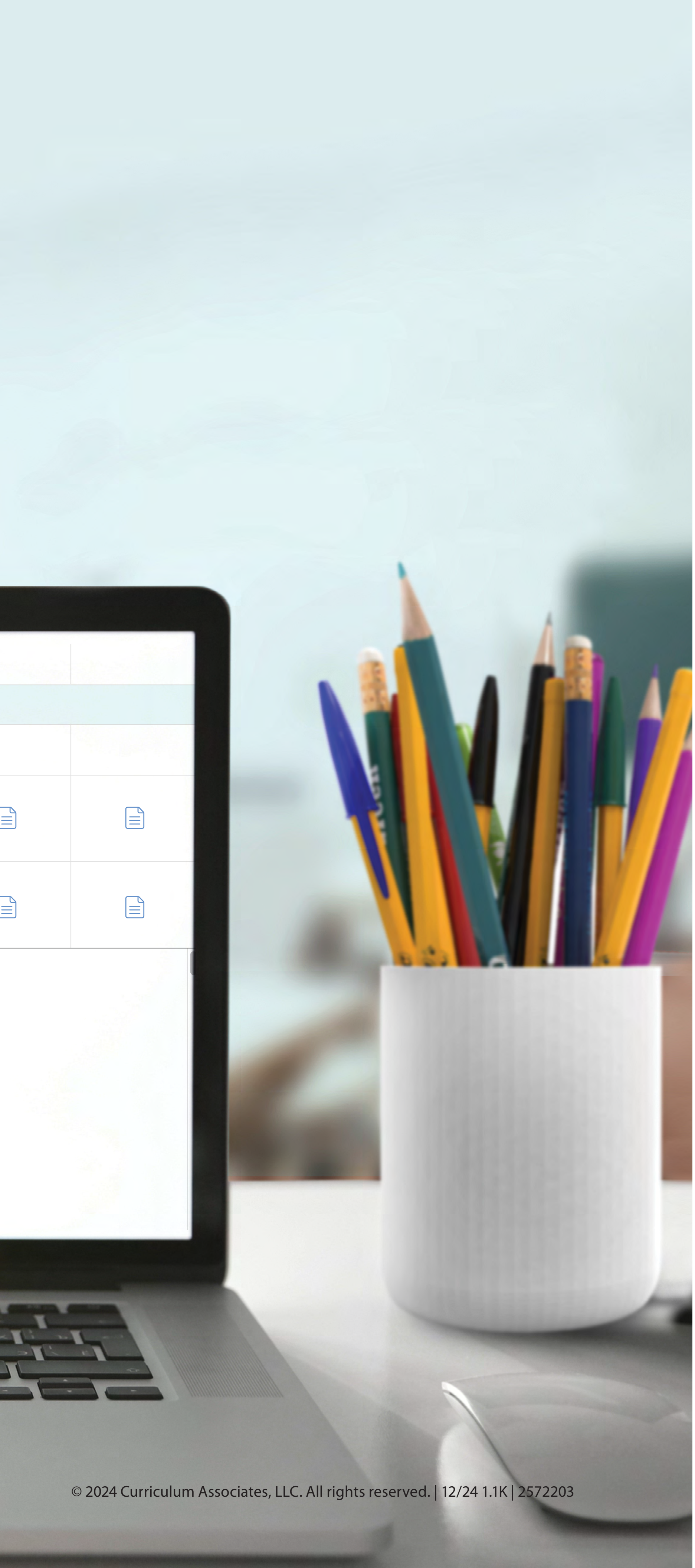
Grade 4 Teacher Toolbox Shown





# Table of Contents

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

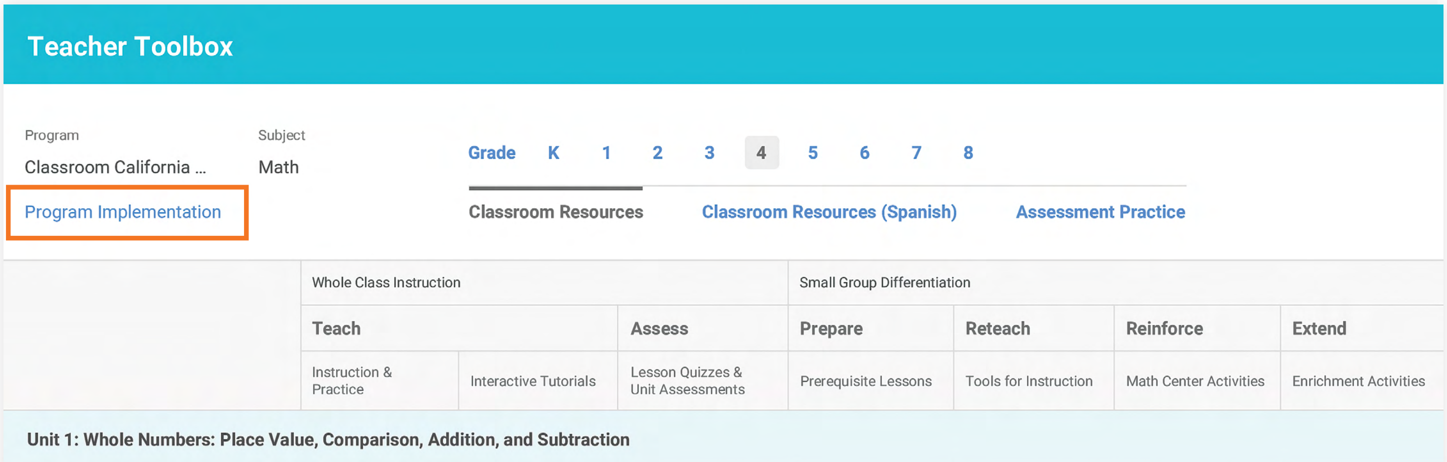


**Check out the Teacher Digital Experience Walkthrough to see more digital resources!**

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

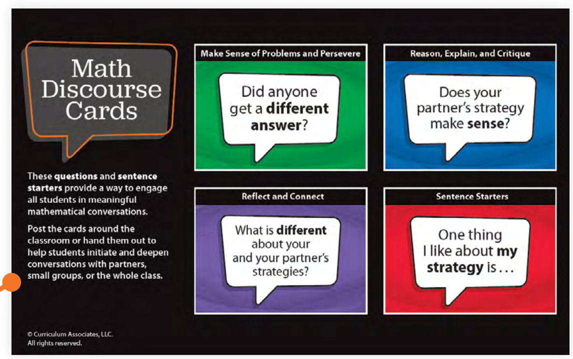
# Program Implementation Support

A wealth of resources to help California educators implement *Classroom Mathematics California* as a core program, including digital versions of support found in your Teacher's Guide, plus Try–Discuss–Connect instructional framework details, pacing and correlations resources, Digital Math Tools powered by Desmos, Data Talk Displays, and more

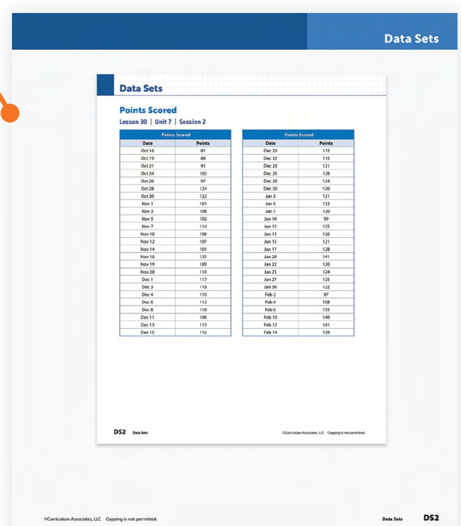



## Teaching and Learning Resources

- Digital Math Tools Powered by Desmos and Supporting Videos
- **Discourse Cards and Discourse Cube** E/S
- Activity Sheet Resources E/S
- **Data Sets** E/S
- Graphic Organizer Resources E/S




Discourse Card Example Shown

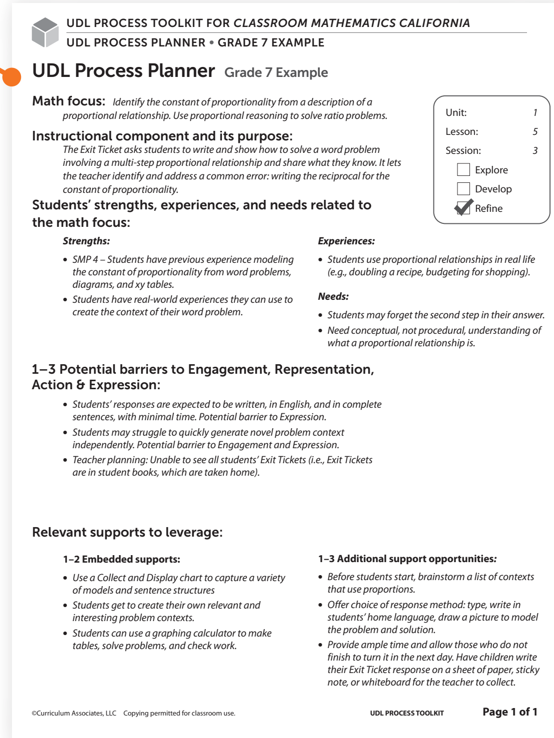



Grade 6 Data Sets Example Shown

E/S = Available in English and Spanish

## Implementation Support

- **UDL Process Toolkit**
- Integrating Prerequisites into Grade-Level Instruction
- Student Handbook E/S
- Multilingual Glossary
- Bilingual Glossary
- Spanish Glossary
- Academic Vocabulary Glossary E/S
- **Data Science Resources**
- Manipulative Lists
- Digital Resource Correlations
- Comprehension Check Correlations
- Spiral Review and Cumulative Practice Correlations
- Try–Discuss–Connect Framework Resources E/S
- Positive Learning Habits



UDL PROCESS TOOLKIT FOR *CLASSROOM MATHEMATICS CALIFORNIA*
UDL PROCESS PLANNER • GRADE 7 EXAMPLE

### UDL Process Planner Grade 7 Example

Unit: *1*
Lesson: *5*
Session: *3*
☐ Explore
☐ Develop
☑ Refine

**Math focus:** *Identify the constant of proportionality from a description of a proportional relationship. Use proportional reasoning to solve ratio problems.*

**Instructional component and its purpose:**
*The Exit Ticket asks students to write and show how to solve a word problem involving a multi-step proportional relationship and share what they know. It lets the teacher identify and address a common error: writing the reciprocal for the constant of proportionality.*

**Students' strengths, experiences, and needs related to the math focus:**

***Strengths:***
- *SMP 4 – Students have previous experience modeling the constant of proportionality from word problems, diagrams, and xy tables.*
- *Students have real-world experiences they can use to create the context of their word problem.*

***Experiences:***
- *Students use proportional relationships in real life (e.g., doubling a recipe, budgeting for shopping).*

***Needs:***
- *Students may forget the second step in their answer.*
- *Need conceptual, not procedural, understanding of what a proportional relationship is.*

**1–3 Potential barriers to Engagement, Representation, Action & Expression:**
- *Students' responses are expected to be written, in English, and in complete sentences, with minimal time. Potential barrier to Expression.*
- *Students may struggle to quickly generate novel problem context independently. Potential barrier to Engagement and Expression.*
- *Teacher planning: Unable to see all students' Exit Tickets (i.e., Exit Tickets are in student books, which are taken home).*

**Relevant supports to leverage:**

**1–2 Embedded supports:**
- *Use a Collect and Display chart to capture a variety of models and sentence structures*
- *Students get to create their own relevant and interesting problem contexts.*
- *Students can use a graphing calculator to make tables, solve problems, and check work.*

**1–3 Additional support opportunities:**
- *Before students start, brainstorm a list of contexts that use proportions.*
- *Offer choice of response method: type, write in students' home language, draw a picture to model the problem and solution.*
- *Provide ample time and allow those who do not finish to turn it in the next day. Have children write their Exit Ticket response on a sheet of paper, sticky note, or whiteboard for the teacher to collect.*

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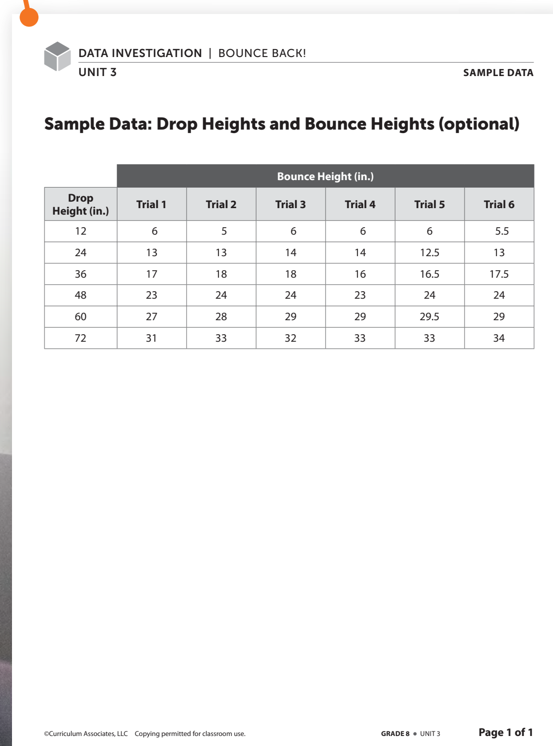
Grade 7 UDL Process Toolkit Shown



DATA INVESTIGATION | BOUNCE BACK!
UNIT 3 SAMPLE DATA

**Sample Data: Drop Heights and Bounce Heights (optional)**

| Drop Height (in.) | Bounce Height (in.) | | | | | |
|---|---|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | Trial 4 | Trial 5 | Trial 6 |
| 12 | 6 | 5 | 6 | 6 | 6 | 5.5 |
| 24 | 13 | 13 | 14 | 14 | 12.5 | 13 |
| 36 | 17 | 18 | 18 | 16 | 16.5 | 17.5 |
| 48 | 23 | 24 | 24 | 23 | 24 | 24 |
| 60 | 27 | 28 | 29 | 29 | 29.5 | 29 |
| 72 | 31 | 33 | 32 | 33 | 33 | 34 |

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Grade 8 Data Investigation Example Shown

# Lesson-Level Resources

**Lesson 12: Understand Systems of Linear Equations in Two Variables**

## Additional Practice



## Differentiation



## Assessment



## Support



FLUENCY AND SKILLS PRACTICE | Name: ____________

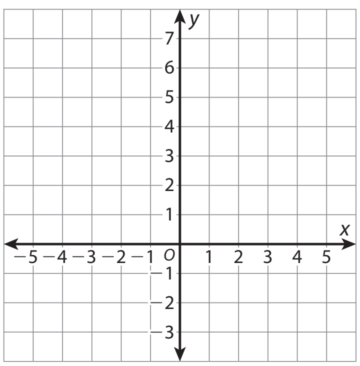
LESSON 12

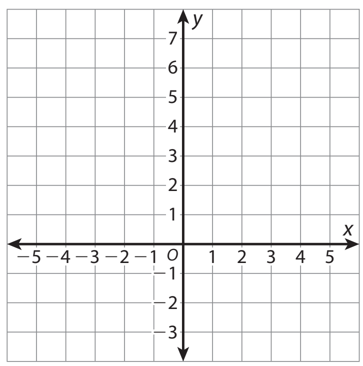
# Understanding the Number of Solutions to a System of Linear Equations

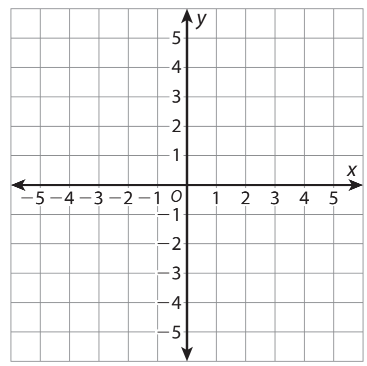
➤ **Solve each problem.**

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.

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

____________ ____________ ____________

# 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?* Say: *Since the two lines intersect at one point, this system has one solution.* Ask: *Do all lines intersect? Explain.* 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. Ask: *If two lines intersect, do they always intersect at exactly one point? Explain.* 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.

## 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?* *How do you know that two lines are parallel without graphing them?* Ask: *Are all lines with the same slope parallel? Explain.*

*If a system is made of two lines with the same slope and same y-intercept, how many solutions does it have?*

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.*

Present the following systems of equations to the student and have them determine the number of solutions in each system:

| | | |
|---|---|---|
| $y = 3x - 7$ | $2x + y = 3$ | $y - 4x = 16$ |
| $y = -3x - 7$ | $y = -2x + 3$ | $2y = 8x + 16$ |

## Check for Understanding

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

$y = 5x - 4$

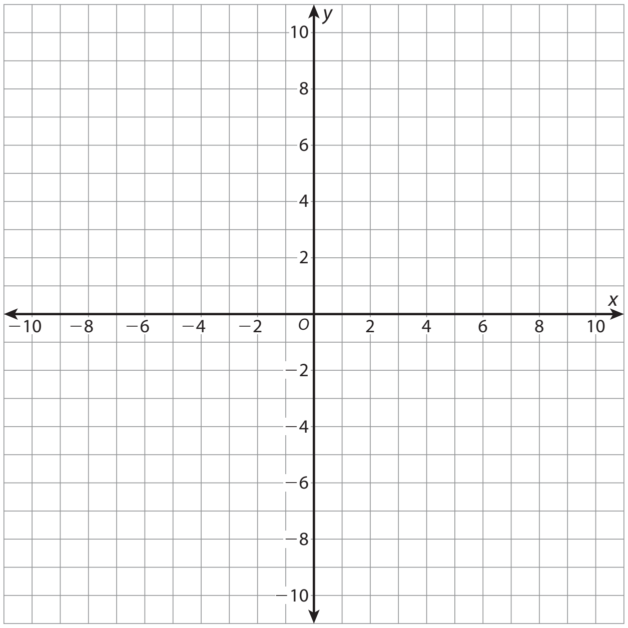
$y + 5x = -4$

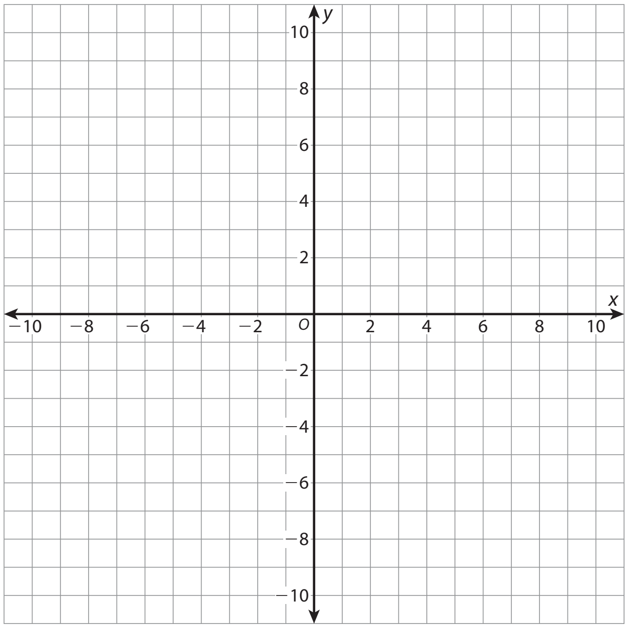
For the student who struggles, use the chart below to help pinpoint where extra help may be needed.

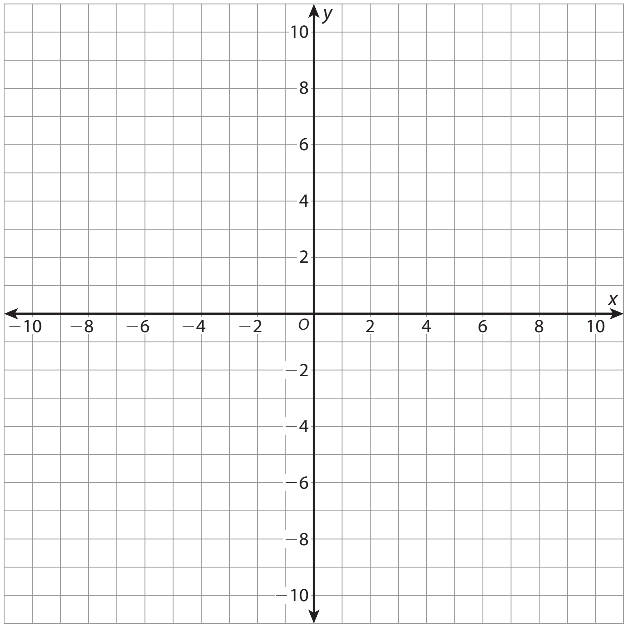
| If you observe… | the student may… | Then try… |
|---|---|---|
| the student struggles to identify the slopes and *y*-intercepts of the equations | not have a strong grasp of slope-intercept form. | reminding the student that an equation in slope-intercept form is of the form $y = mx + b$, where $m$ 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. |

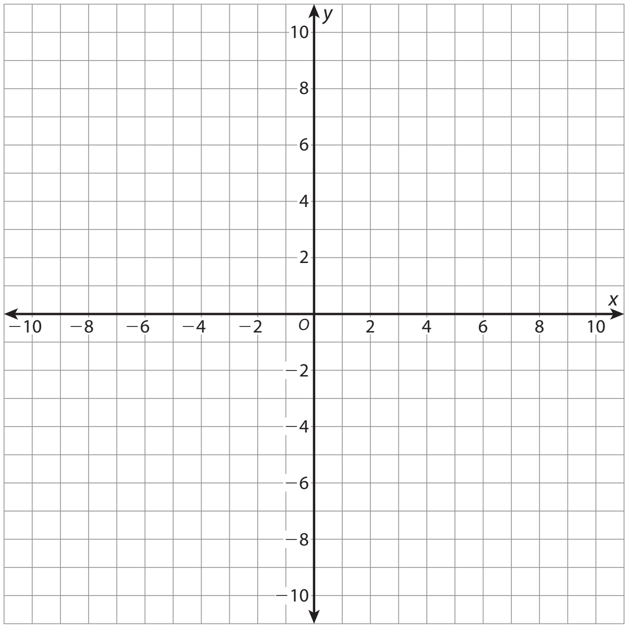
Name________________________________

# Coordinate Planes









CENTER ACTIVITY ●● Names:

LESSON 12

On Level 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 | $y =$ ______ $x +$ ______<br>$y =$ ______ $x +$ ______ | |
| 2 | $y =$ ______ $x +$ ______<br>$y =$ ______ $x +$ ______ | |
| 3 | $y =$ ______ $x +$ ______<br>$y =$ ______ $x +$ ______ | |
| | **Total Score:** | |

## Team B

| System | Equations | Points |
|---|---|---|
| 1 | $y =$ ______ $x +$ ______<br>$y =$ ______ $x +$ ______ | |
| 2 | $y =$ ______ $x +$ ______<br>$y =$ ______ $x +$ ______ | |
| 3 | $y =$ ______ $x +$ ______<br>$y =$ ______ $x +$ ______ | |
| | **Total Score:** | |

CENTER ACTIVITY ● Names:

LESSON 12

Below Level 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.

$y = 7x$

$-y = -7x$

## 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 | $y =$ ______ $x +$ ______ <br> $y = 2x +$ ______ | |
| 2 | $y =$ ______ $x$ <br> $y =$ ______ $x$ | |
| 3 | $y =$ ______ $x +$ ______ <br> $y =$ ______ $x + 3$ | |
| | **Total Score:** | |

## Team B

| System | Equations | Points |
|---|---|---|
| 1 | $y =$ ______ $x +$ ______ <br> $y = 2x +$ ______ | |
| 2 | $y =$ ______ $x$ <br> $y =$ ______ $x$ | |
| 3 | $y =$ ______ $x +$ ______ <br> $y =$ ______ $x + 3$ | |
| | **Total Score:** | |

CENTER ACTIVITY ●●● Names:

LESSON 12

Above Level 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.

$y = 2(x + 3)$

$-2x + y = 3$

## 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 | $y =$ ________ $x +$ ________ <br> $y +$ ________ $x =$ ________ | |
| 2 | $y =$ ________ $(x +$ ________ $)$ <br> $y =$ ________ $x +$ ________ | |
| 3 | ________ $x + y =$ ________ <br> $y =$ ________ $(x +$ ________ $)$ | |
| | **Total Score:** | |

## Team B

| System | Equations | Points |
|---|---|---|
| 1 | $y =$ ________ $x +$ ________ <br> $y +$ ________ $x =$ ________ | |
| 2 | $y =$ ________ $(x +$ ________ $)$ <br> $y =$ ________ $x +$ ________ | |
| 3 | ________ $x + y =$ ________ <br> $y =$ ________ $(x +$ ________ $)$ | |
| | **Total Score:** | |

ENRICHMENT ACTIVITY | Name:

LESSON 12

# 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
LESSON 12

Name: ____________________

# 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: |

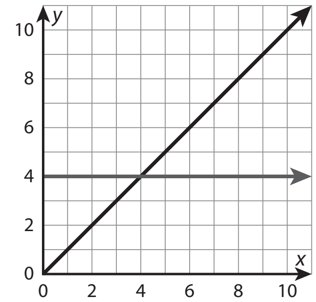
For each of the boxes above, how did you determine the equations for your lines? Explain.

## LESSON 12 • QUIZ

Name: ______________________________

➤ **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.

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

**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.

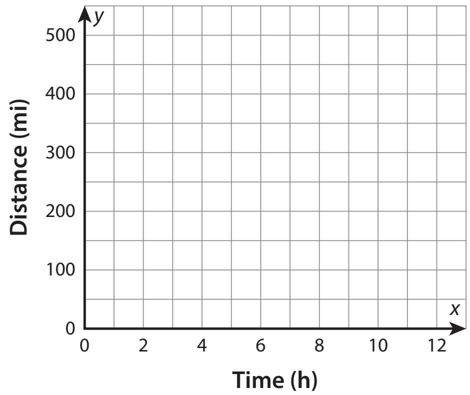
**PART A**

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** ______________________________

______________________________

______________________________

______________________________

______________________________

Support | Family Letter

LESSON 12

Math Tools

Graphing Calculator

## Understand Systems of Linear Equations in Two Variables

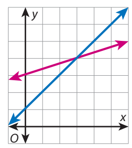
## Dear Family,

This week your student is exploring **systems of linear equations**. A system of linear equations is two or more related equations that are solved together to find a solution common to all the equations. This solution is the $(x, y)$ pair(s) that make all equations in the system true. On a graph, the solution is represented by the points(s) that the graphs of all the equations have in common. A system of linear equations can have one, zero, or infinitely many solutions.

Your student will first explore systems of linear equations by looking at their graphs. The following examples show the ways the graph of a system can tell you how many solutions the system has.

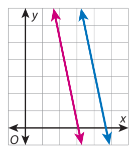
➤ **ONE WAY:** One solution

The lines in this graph intersect at one point. The $(x, y)$ pair for this point makes both equations in the system true.




➤ **ANOTHER WAY:** No solution

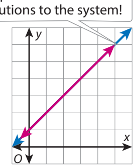
The lines in this graph do not intersect at all. There are no $(x, y)$ pairs that make both equations in the system true.




➤ **ANOTHER WAY:** Infinitely many solutions

The lines in this graph intersect at every point and represent the same line. The $(x, y)$ pairs for all the points on the line make both equations in the system true.

All points on the line are solutions to the system!




Use the next page to start a conversation about systems of linear equations.



SYSTEMS OF LINEAR EQUATIONS IN TWO VARIABLES

…g About Systems of

…to investigate
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…f, two
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…h up.

Can you think of some other real-world examples where solving a system of linear equations is helpful?

SESSION 1

## Explore Systems of Linear Equations in Two Variables

**Learning Targets**

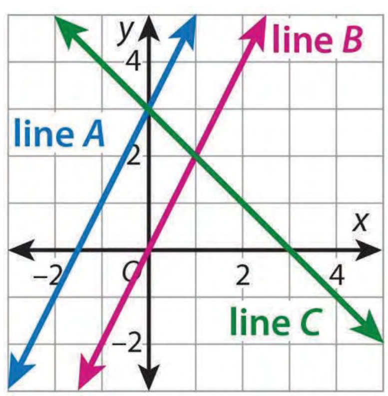
- Understand what it means to solve a system of equations.
- Use a graph or table to identify the solution to a system of linear equations.
- Use a graph to determine the number of solutions to a system of linear equations.

LESSON 12 • Understand Systems of Linear Equations



## Start

# Same and Different



# Unit-Level Resources

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

GAME | Name:

UNIT 3

# 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 | Name: Olive

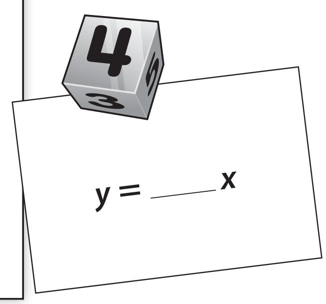
UNIT 3

### 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**

| | | |
|---|---|---|
| $y = \_\_\_\_ x$ | $y = \_\_\_\_ x + \_\_\_\_$ | $y = \_\_\_\_ x - \_\_\_\_$ |
| $y = \_\_\_\_ x$ | $y = \_\_\_\_ x + \_\_\_\_$ | $y = \_\_\_\_ x - \_\_\_\_$ |
| $y = \_\_\_\_ x$ | $y = \_\_\_\_ x + \_\_\_\_$ | $y = \_\_\_\_ x - \_\_\_\_$ |
| $y = \_\_\_\_ x$ | $y = \_\_\_\_ x + \_\_\_\_$ | $y = \_\_\_\_ x - \_\_\_\_$ |

# 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.



Source: *Ready Reading*, Grade 8, Lesson 3

**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
UNIT 3

Name:

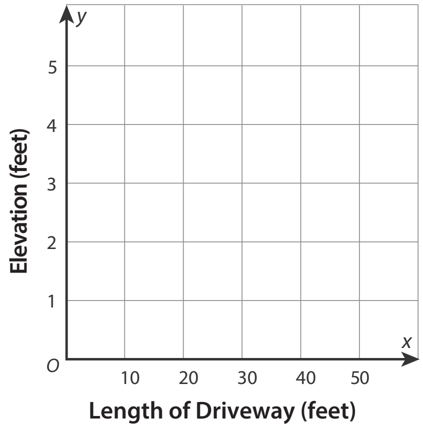
# *The Mysterious Marfa Lights*

## 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?

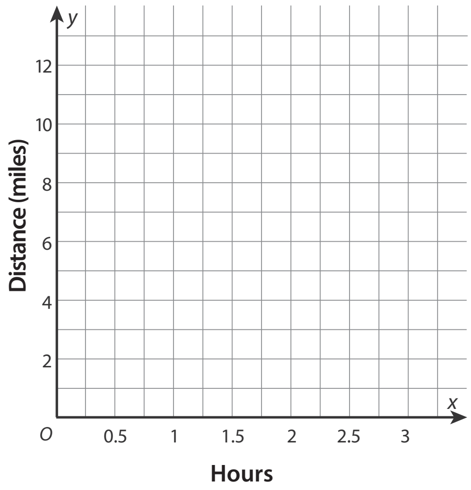
   **b.** The county inspectors recommend that driveways for small businesses like Ella's have a slope between 8 and 14% so that rainwater runs off. Does the slope of Ella's driveway meet the recommendation? Explain.

LITERACY CONNECTION Name:

UNIT 3

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

Name:

## FORM A

**Form A 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.

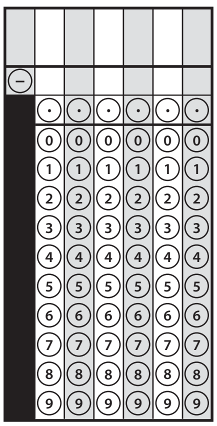
**B** The cost is $2 per T-shirt.

**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.

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



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

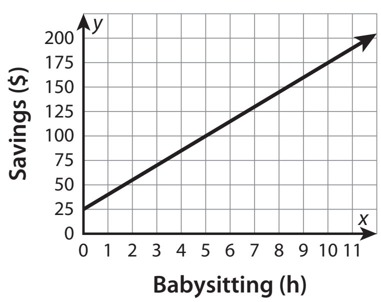
$y = 2x - 1$

$6x - 2y = 24$

| | |
|---|---|
| $6x - 2y = 24$ | $y = 2x - 1$ |
| $6x - 2(\underline{\qquad\qquad}) = 24$ | $y = 2(\underline{\qquad\qquad}) - 1$ |
| $6x - \underline{\qquad\qquad} + \underline{\qquad\qquad} = 24$ | $y = 22 - 1$ |
| $2x + 2 = 24$ | $y = 21$ |
| $2x = 22$ | |
| $x = 11$ | |

(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** ______________________________

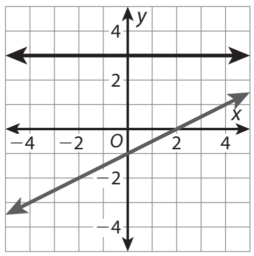
## UNIT 3 • UNIT ASSESSMENT

Name:

**FORM A** continued

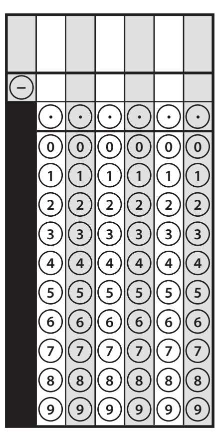
**7** The graph shows a system of linear equations. Decide if each statement about the lines in the system is true or false.

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.



**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** ____________________________________________



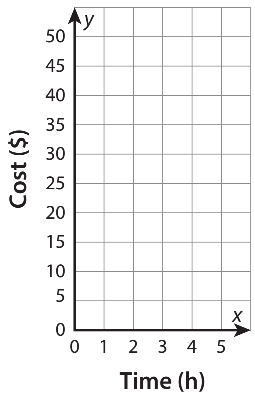
UNIT 3 • UNIT ASSESSMENT | Name:

**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** ______________________________

______________________________

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.** $-x - 8 = -x + 8$ | ○ | ○ | ○ |

# Notes

# Notes

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