Linear Systems: Using Algebra   Student Worksheet

Overview

The **Overview** introduces the topics covered in **Observations** and **Activities**. Scroll through the **Overview** using ▶ (◀ to review, if necessary). Read each screen carefully. Look for new terms, definitions, and concepts.

Observations

Scroll through the **Observations** using ▶ (◀ to review, if necessary). Read each screen carefully. When you come to a **Write an Observation** screen, stop and write the answers to the questions on your worksheet.
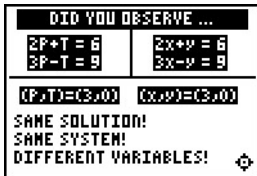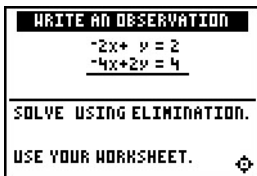

Observation 1

Find the solution of each system shown on the screen. Use either the substitution or elimination method.
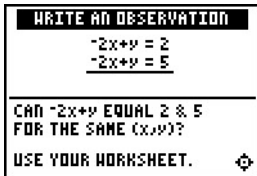
Observation 2

For the system of equations shown on the screen, can the expression $-2x + y$ equal 2 and 5 for the same (x, y)?

Observation 3

Solve the given system using the elimination method.

Activities

The **Activities** help you practice using algebra to solve linear systems. You can select from two different activities—**What Am I?** and **Balloon Ride**. Follow these steps to play the activities and complete your worksheet.

1. Make sure you are in the **Activities** for this section.

2. Highlight an activity using ▲ or ▼ and press ENTER.

```
SELECT AN ACTIVITY
1  WHAT AM I?
2  CONSISTENT?
         DEPENDENT?
 INDEPENDENT?
      INCONSISTENT?
SELECT & PRESS [ENTER]
```

Scoring: You get one attempt to pick the correct classification of the system. You get 2 points for a correct choice and 1 point for a correct choice if you press ⟨HINT⟩ to see the graph.

Four systems are given for a maximum score of 8 points.

What Am I?

1. Highlight a level (silver = less difficult; gold = more difficult), and press ENTER to select it.

2. Look at the system of equations and decide if the system is consistent & independent, consistent & dependent, or inconsistent.

    Press ⟨**HINT**⟩ if you need to see the graph. You only get 1 point for the problem if you press ⟨**HINT**⟩.

    Press ▲ or ▼ to cycle through the choices and then press ENTER to select the correct answer. The correct answer and graph are displayed if the incorrect answer is chosen. You must press a key to continue play.

3. In the space below, write out the algebraic steps (using elimination or substitution) for each problem or explain why you knew the correct answer.

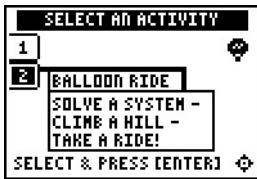4. What level did you play? _____

5. What was your score? _____

Problem 1:

Problem 2:

Problem 3:

Problem 4:

Name

Date

Activities (continued)

```
┌─────────────────────┐
│ SELECT AN ACTIVITY  │
├─┬───────────────────┤
│1│                 🎈 │
├─┴───────────────────┤
│█ BALLOON RIDE       │
│  SOLVE A SYSTEM –   │
│  CLIMB A HILL –     │
│  TAKE A RIDE!       │
├─────────────────────┤
│SELECT & PRESS [ENTER] ✧│
└─────────────────────┘
```

Scoring: You get two attempts to pick or input the correct solution to the system of equations. You get 2 points for a correct choice or input on the first try, and 1 point for a correct choice or input on the second try.

There are 4 problems for a maximum score of 8 points.

Balloon Ride

1. Highlight a level (silver = less difficult; gold = more difficult), and press ENTER to select it.

2. Look at the system of equations and solve using the algebraic methods of substitution or elimination.

   Silver level: Press ▲ or ▼ to cycle through the solutions to choose from, and then press ENTER to select the solution. You must press a key to continue play.

   Gold level: Use ▲ or ▼ to select an answer or to get to the input box. Select or input your answer and press ENTER. (Press (-) to enter negative numbers.) You must press a key to continue play.

3. As you play, write out the algebraic steps (using elimination or substitution) for each problem or explain why you knew the correct answer in the space below.

4. What level did you play? _____

5. What was your score? _____

Problem 1:   **Problem 2:**

Problem 3:   **Problem 4:**

Extra Practice: Using Substitution or Elimination

1. Cathy found a part-time job for the summer. Each week, when she works up to 10 hours, she
    earns a regular hourly wage. If she works more than 10 hours each week, she earns more money
    per hour for the overtime hours. She worked 14.5 hours during the first week. Her paycheck,
    before taxes and deductions, was $93.75. The second week, she worked 12 hours and her
    paycheck, before taxes and deductions, was $75.00. Cathy's boss had told her what her hourly
    and overtime rates were, but Cathy was so excited to get the job that she couldn't remember
    what she was told.

    - Write a system of equations for Cathy's hourly and overtime pay rates. Clearly define the
      variables and their meanings.

    - Solve the system of equations using substitution. Show your work and explain the steps you
      used to solve the system of equations. Show the check of your solution.

    - Write a sentence explaining Cathy's pay rate. _____

      _____

      _____

      _____

2. Cathy decides to spend some of her earnings from her new job, so she and her friend Brenda go to the mall. Their favorite store has blouses and jeans on sale. A variety of blouses is on one rack and are all the same price. A variety of jeans is on another rack and are all the same price. The price tags are not on the clothes but Cathy and Brenda know that the store's prices are usually within their budgets.

Cathy picks out 3 blouses and 2 pairs of jeans from the sale racks. At the checkout, she sees that her total bill is $57.00. Brenda picks out 4 blouses and 3 pairs of jeans from the sale racks. Her total bill is $81.00. They are shopping in the state of Delaware where there is no sales tax.

To find the cost of one blouse or one pair of jeans, Cathy and Brenda could just look at the sales receipt. Instead, they try to figure out the prices themselves.

- Write the system of equations that Cathy and Brenda need to solve. Clearly define the variables and their meaning.

- Solve the system of equations using elimination. Show your work and explain the steps you used to solve the system of equations. Show the check of your solution.

  Hint: You can multiply both equations by a factor to avoid working with fractions!

- Write a sentence explaining the price Cathy and Brenda paid for each top and each pair of jeans.

  Remember: You always have a choice of picking the method that you think will be easiest to perform when solving systems of equations. In the problems above, you are asked to use a specific method.

  _____

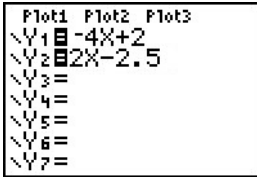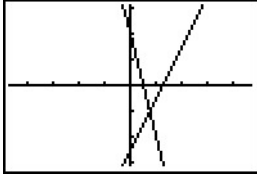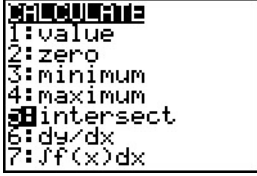 _____

  _____

⊞ **Try-It!™ on Your TI‑83 Plus or TI‑73**
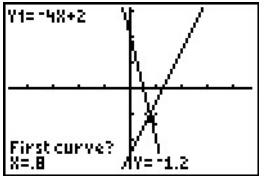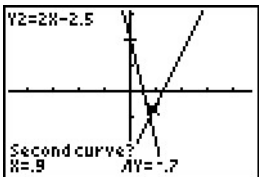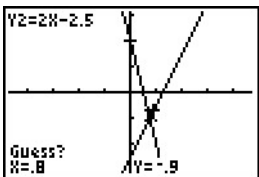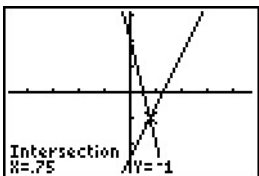
You will:

- Graph two lines of a system of equations.
- Use) to locate the intersection of the lines.
- Use the intersect feature to find the solution to a system of equations.
- Check the solution on the home screen using STO▸.

Find the solution of the system: Y1 = ⁻4X + 2
                                     Y2 = 2X −2.5

Notice that these equations are already in the form of y = mx + b. They are in the form to enter into your calculator.

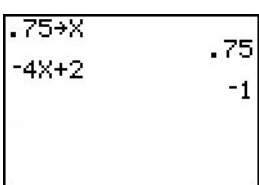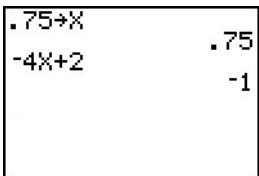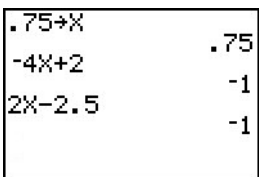| To Do This	Press	Display
1. Exit the Topics in Algebra 1 application and clear the Home screen.	2nd [QUIT] ⟨**EXIT**⟩ CLEAR	
2. First, enter ⁻**4X + 2** as **Y1** and **2X − 2.5** as **Y2** in the Y= editor. **Note**: See ⊞TIp™ 3: Graphing a Function in the Standard Window for more information.	Y= CLEAR (-) 4 X,T,Θ,n + 2 ▼ CLEAR 2 X,T,Θ,n − 2 . 5	Plot1 Plot2 Plot3 \Y1▪-4X+2 \Y2▪2X-2.5 \Y3= \Y4= \Y5= \Y6= \Y7=
3. Select the Zoom Decimal viewing window. **Remember**: You have to adjust the viewing window depending on the system of equations. You can see the intersection of the lines in the ZDecimal window for this example.	ZOOM **4:ZDecimal**	ZOOM MEMORY 1:ZBox 2:Zoom In 3:Zoom Out 4▪ZDecimal 5:ZSquare 6:ZStandard 7↓ZTrig
4. The graph displays. Since this system has one solution, you can find the numerical solution using the intersect feature. **Important Reminder:** Be sure to use your knowledge about the equations of lines to determine if the lines are parallel or the same line. When you use the intersect feature, an error displays if the lines are parallel. If the lines are the same line, the calculator shows ONLY one answer.		
5. Use the **CALCULATE** menu item called **intersect** to find the calculated numeric solution.	2nd [CALC] **5:intersect**	CALCULATE 1:value 2:zero 3:minimum 4:maximum 5▪intersect 6:dy/dx 7:∫f(x)dx

Name

Date

To Do This	Press	Display
6. You have to select a **First Curve** in order for the calculator to calculate the numerical solution. Notice the cursor is on the line Y1 = ⁻4X + 2.	ENTER	Y1=⁻4X+2 First curve? X=.8 Y=⁻1.2
7. You have to select a **Second Curve** in order for the calculator to calculate the solution. Notice the cursor is on the line Y2 = 2X − 2.5.	ENTER	Y2=2X-2.5 Second curve? X=.9 Y=⁻.7
8. The calculator now needs a close guess at the solution. Move the cursor closer to the intersection.	▶ or ◀	Y2=2X-2.5 Guess? X=.8 Y=⁻.9
9. The calculator uses a program to calculate the numerical solution. The numerical solution given is at (0.75, ⁻1). Check to see if this solution is the exact solution or an approximate value.	β	Intersection X=.75 Y=⁻1

10. Check the solution on the home screen. The value 0.75 is stored in the X variable in the calculator. X is fixed at 0.75 after you follow these steps.
 	
Important Reminder: The calculator always has a value stored in each variable. You must store the value you want in order to understand how the calculator interprets a variable expression.
	− [QUIT] CLEAR
	. **75**
	STO▶ X,T,Θ,*n* ENTER
		.75→X
		         .75
		-4X+2
		          -1

11. Enter ⁻4X + 2 to find the Y1 value at X = 0.75. Notice that the output is ⁻1.	(-) **4** X,T,Θ,*n* + **2** ENTER	.75→X
		         .75
		-4X+2
		          -1

12. Enter 2X − 2.5 to find the Y2 value at X = 0.75. Notice that the output is ⁻1 and Y1 = Y2 at X = 0.75.
 	
The solution is (0.75, ⁻1). Press ∗ to see if this agrees with the graph of the lines!
	2 X,T,Θ,*n* − **2** . **5**
	ENTER
		.75→X
		         .75
		-4X+2
		          -1
		2X-2.5
		          -1

Extra Practice: Using Your Calculator to Find Solutions

1. Use your calculator to find the solution to each system of equations. Write the solution and a description of how you used your calculator to find and verify the solution.

    Remember: You need to rewrite the equations in the form y = mx + b to work with your calculator.

    Note: If the calculator gives the value .6666666667 or X=.66666666666666 in Solver the exact answer is most likely $X = \frac{2}{3}$. Explain how you found the exact answer if the calculator only gave an approximate answer. Verify your answer!

    a. $y = {}^{-}1.2x + 3.725$

         $3x - y = 8.875$

    b. $3x + y = 6$

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

2. Solve each of the systems you found in **Extra Practice: Using Substitution or Elimination**, using your calculator. Write an explanation of how you used your calculator.

    a. Cathy's pay rate

    b. Cathy and Brenda's shopping trip

Challenge

Investigate using the Solver feature on the TI-83 Plus to find the solution! Find this feature in [MATH] **0:Solver**. It is best to use this feature if the system has <u>only one solution</u>.

Hint: Press [MATH] and select **0:Solver**. You have to enter the equation in the Solver as 0 = ⁻ 4X + 2 − (2X−2.5) to solve for the X value. You have to input a guess for the X solution. **bound = {⁻1E99, 1E99}** represents the real number line for the calculator. You can make the set smaller to find solutions in a particular interval. Then, use [ALPHA] [SOLVE] to find the calculator's numerical solution. See the TI-83 Plus guidebook for more details about the Solver feature.
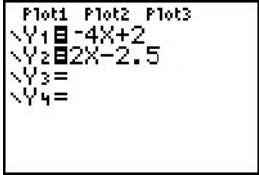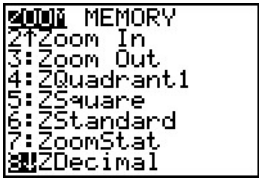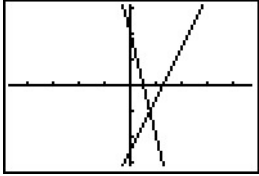
▦ Try-It!™ on Your TI-73
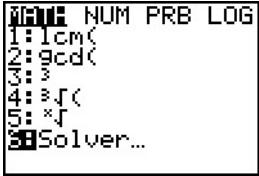
You will:
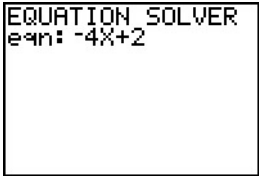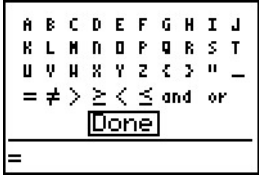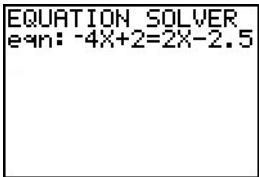
- Graph two lines of a system of equations.

- If the lines intersect, use the 1 feature Solver to find the X value of the solution to the system.

- Find the Y value by using Ξ on the home screen.

Find the solution of the system: $Y1 = {}^-4X + 2$

$Y2 = 2X - 2.5$

Notice that these equations are already in the form of y = mx + b. They are in the form to enter into your calculator.

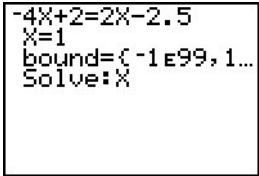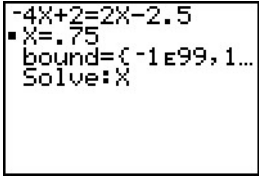| To Do This	Press	Display
1. Exit the Topics in Algebra 1 application and clear the Home screen.	[2nd] [QUIT] ⟨**EXIT**⟩ [CLEAR]	
2. It is good practice to look at the graph of the system before you use the Solver feature. Enter ⁻**4X + 2** as Y1 and **2X − 2.5** as Y2 in the Y= editor. **Note:** See ▦ TIp™ 3: Graphing a Function in the Standard Window for more information.	[Y=] [CLEAR] [(-)] **4** [x] [+] **2** [▾] [CLEAR] **2** [x] [-] **2** [.] **5**	Plot1 Plot2 Plot3 \Y1❚-4X+2 \Y2❚2X-2.5 \Y3= \Y4=
3. Select the Zoom Decimal viewing window. **Remember:** You will have to adjust the viewing window depending on the system of equations. You can see the intersection of the lines in the ZDecimal window for this example.	[ZOOM] **8:ZDecimal**	**ZOOM** MEMORY 2↑Zoom In 3:Zoom Out 4:ZQuadrant1 5:ZSquare 6:ZStandard 7:ZoomStat **8**ZDecimal
4. The graph displays. Since this system has one solution, find the numerical solution next using the **Solver** feature on the TI-73. **Important Reminder:** Before you use the intersect feature, use your knowledge about the equations of lines to determine if the lines are parallel or the same line.		
5. Use the [MATH] menu item called **Solver** to find the calculated numerical solution.	[MATH] **6:Solver**	**MATH** NUM PRB LOG 1:lcm(2:gcd(3:³ 4:³√(5:ˣ√ **6**Solver…

To Do This	Press	Display
6. To find the solution, you want to find when the two equations are equal. Find Y1 = Y2. You need to enter -4X + 2 = 2x − 2.5 on the **eqn:** line.	⌐ **4** I + **2**	EQUATION SOLVER eqn: -4X+2
7. Find the equal sign (=) in [2nd] [TEXT].	[2nd] [TEXT] ▼ ▼ ▼ [ENTER] ▼	A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ ] " _ = ≠ > ≥ < ≤ and or ⬛Done⬛ =
8. Finish entering the equation.	[ENTER] **2** [x] ⊟ **2** ⊡ **5**	EQUATION SOLVER eqn: -4X+2=2X-2.5
9. Enter a guess of X=1 as the solution. The calculator needs a starting value for its computation. **Hint:** bound = {-1E99, 1E99} represents the real number line for the calculator. You can make the set smaller to find solutions in a particular interval. See the TI-73 guidebook for more details.	[ENTER] [CLEAR] **1**	-4X+2=2X-2.5 X=1 bound={-1E99,1… Solve:X
10. Highlight **X** on the **Solve:X** line and the solution is given as ∎X=.75. Notice that ∎ appears after the calculator has computed the numerical solution.	▼ ▼ [ENTER]	-4X+2=2X-2.5 ∎X=.75 bound={-1E99,1… Solve:X
11. Find the Y1 and Y2 values on the home screen using [STO▸]. The value 0.75 will be stored in the X variable in the calculator. X is fixed at 0.75 once you follow these steps. **Important Reminder:** The calculator always has some value stored in each variable. You must store the value you want in order to understand how the calculator interprets a variable expression.	[2nd] [QUIT] [CLEAR] ⊡ **75** [STO▸] [x] [ENTER]	.75→X .75
12. Enter -4X + 2 to find the Y1 value. Notice that the output is -1.	⌐ **4** [x] + **2** [ENTER]	.75→X .75 -4X+2 -1

Name _____

Date _____

To Do This	Press	Display

13. Enter 2X – 2.5 to find the Y2 value. Notice that the output is ⁻1 and Y1 = Y2 at X = 0.75.
 	
 The solution is (0.75, ⁻1). Press GRAPH to see if this agrees with the graph of the lines!
	2 $\boxed{x}$ $\boxed{-}$ 2 $\boxed{.}$ 5 $\boxed{\text{ENTER}}$	```.75→X .75```
		```-4X+2 -1```
		```2X-2.5 -1```

Extra Practice: Using Your Calculator to Find Solutions

1. Use your calculator to find the solution to each system of equations. Write the solution and a description of how you used your calculator to find and verify the solution.

   Remember: You need to rewrite the equations in the form y = mx + b to work with your calculator.

   Note: If the calculator gives the value .6666666667 or X=.66666666666666 in Solver, the exact answer is most likely X = $\frac{2}{3}$.

   Explain how you found the exact answer if the calculator only gave an approximate answer. Verify your answer!

   a. y = ⁻1.2x + 3.725

      3x − y = 8.875

   b. 3x + y = 6

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

2. Solve each of the systems you found in **Extra Practice: Using Substitution or Elimination** using your calculator. Write an explanation of how you used your calculator.

    a. Cathy's pay rate

    b. Cathy and Brenda's shopping trip

Linear Systems: Using Algebra   Teacher Notes

Objectives

- To review the substitution method of solving a system of two linear equations in two variables.

- To review the elimination method of solving a system of two linear equations in two variables.

- To review the definitions of consistent (independent and dependent) and inconsistent systems.

- To associate the number of solutions of a system with the classification of consistent (independent and dependent) and inconsistent systems.

Math Highlights

In this section, students work with a linear system of equations with two equations and two variables and review the methods of substitution and elimination.

In the **Overview**, students associate the graphs of the lines of a system with the number of solutions of the system and the classification of the system as consistent and inconsistent (dependent and independent) systems. This was also covered at a lower level in Section 1: Using Graphs & Tables.

In the substitution example, caramel corn is sold as a class fundraiser, and the students need to know how many bags of caramel corn they need to sell to make a profit. A system of linear equations is written to model the costs of producing the caramel corn and the revenue earned from selling bags of caramel corn. Solving the system of equations gives the number of bags of caramel corn the students need to sell to make a profit. The term *profit* is used and should be discussed in the class. The terms *breakeven* and *loss* are not covered, but students would benefit from a complete classroom discussion of the problem, not just the profit point.

In the elimination example, Jon and Mia earn money by recycling cans and glass. The recycling center gives each of them one payment for both the cans and the glass. Jon and Mia want to know how much money they earned for each pound of cans and each pound of glass. A system of linear equations is written to model the amount of money that Jon and Mia earned for recycling. Solving the system of equations gives the prices per pound that they were paid for cans and glass. Students can eliminate either variable in the example.

The variables used in these problems are x and y; however, you should encourage students to use variables that make sense in the problem.

The ▦ Try-It!™ examples for the TI-83 Plus and the TI-73 are slightly different. They are printed on separate pages so that you can make copies of only the pages you need. Students can use either graphing calculator to complete the problems in the Student Worksheet.

Common Student Errors

- When they use the substitution method, students may make sign and division errors when they solve for one of the variables. They may also need to be reminded to use parentheses when needed. Students might incorrectly distribute expressions.

- When solving by substitution, students might solve one equation for y (or x) and substitute back into the <u>same</u> equation getting a result of 0 = 0, when they should have substituted back into the other equation.

- When they use the elimination method, students may miss multiplying every term in an equation by the appropriate constant.

- As they continue using the elimination method, many students subtract incorrectly. They usually subtract the first term correctly, but often forget to subtract the other terms. Encourage students to choose the multiplier so that they add the equations for the elimination rather than subtract them.

- When an algebraic solution results in a statement that is always true, such as 2 = 2 in a dependent system (coincident lines), or a statement that is never true, such as 2 = 4 in an inconsistent system (parallel lines), students may be unsure how to state the solution.

- Students often skip checking their solution. In addition to checking their solution by substituting it back into the original equations, they should also make sure that the solution is reasonable. For example, in the Student Worksheet problem where Cathy and Brenda are shopping for tops and jeans, the variable must be positive.

- Students should practice rewriting the system after each step to keep track of their manipulations.

Encourage students to create good math habits by doing the following.

- Pick the method—graphs, tables, substitution, or elimination—which is best for the system. First, look at the physical problem, if appropriate, or use geometry and number sense to analyze the system.

- Remember that for real problems (word problems), some solutions may need to be omitted. For example, if you need to find the quantity of an item, the solution must be positive.

- Notice when a system obviously has no solution because the lines have the same slope (i.e., parallel lines), and when a system has an infinite number of solutions because the lines are the same line.

- Rewrite the system after each step to keep track of the manipulations.

  Note: Students who can think through the steps in their mind tend to be impatient with recording each step. However, forming this habit now will help them in the future, especially when they learn how to solve systems using matrices.

- Write out the mathematics you use to solve the system. Also, write phrases or sentences that explain your steps. Draw graphs and tables to use as aids.

- Interpret what the solution means in real problems. For example, the recycling problem in the **Overview** subsection requires not only the numeric answer but also an explanation about what the numbers mean with respect to the price per pound.

  Tip: Have students look in newspapers and on the web for graphs and tables of information to show real examples of the importance of both computations and explaining what the computations mean.

Student Worksheet Notes with Answers

Overview

Tell students:

1. How to find the **Overview**, if necessary.

2. How to navigate the application, if necessary.

3. To scroll through the **Overview** on the graphing calculator. Point out new terms, definitions, and concepts, and tell students to look for them as they go through the **Overview**.

Observations

The **Observations** help students review substitution and elimination methods. If necessary, tell students how to find the **Observations**.
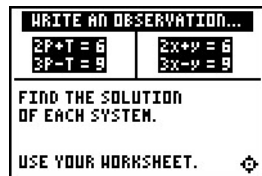
Observation 1

Students are asked to solve both systems using either the substitution method or the elimination method. The systems are identical except for the choice of variables. Students should become comfortable with a change in variables and should recognize that they do not have to do this calculation twice.

Observations (continued)

```
╔════════════════════════╗
║ ■WRITE AN OBSERVATION■  ║
║      ⁻2x+y = 2          ║
║      ⁻2x+y = 5          ║
║                         ║
║ CAN ⁻2x+y EQUAL 2 & 5   ║
║ FOR THE SAME (x,y)?     ║
║ USE YOUR WORKSHEET.  ⊕  ║
╚════════════════════════╝
```

Observation 2

Students are asked if the same left-hand sides of the equations can equal different right-hand sides. They should be able to reason this out using their number sense. They can then verify their answer using algebra. They will see the verification using the elimination method on the following screens in the application.

The second equation is multiplied by ⁻1 and then the equations are added. Multiplying by ⁻1 was chosen to avoid sign errors.

Some students will want to immediately subtract the two equations. This is also correct, but they need to be very careful to subtract each term!

```
╔════════════════════════╗
║  ■DID YOU OBSERVE ...■  ║
║      ⁻2x+y = 2          ║
║      2x−y =⁻5           ║
║           0 =⁻3 FALSE   ║
║   THERE IS NO SOLUTION! ║
║                         ║
║      INCONSISTENT    ⊕  ║
╚════════════════════════╝
```

```
╔════════════════════════╗
║ ■WRITE AN OBSERVATION■  ║
║      ⁻2x+ y = 2         ║
║      ⁻4x+2y = 4         ║
║                         ║
║ SOLVE USING ELIMINATION.║
║                         ║
║ USE YOUR WORKSHEET.  ⊕  ║
╚════════════════════════╝
```

Observation 3

Students see the elimination steps on the following screens in the application. The result screen is given below.

```
╔════════════════════════╗
║ ■WRITE AN OBSERVATION■  ║
║      4x−2y =⁻4          ║
║      ⁻4x+2y = 4         ║
║           0 = 0 TRUE    ║
║ SAME LINE! ANY POINT ON ║
║ ⁻4x+2y = 4 IS A SOLUTION!║
║ CONSISTENT & DEPENDENT ⊕║
╚════════════════════════╝
```

Activities

```
 SELECT AN ACTIVITY
[1] [WHAT AM I?]
[2] CONSISTENT?
        DEPENDENT?
INDEPENDENT?
    INCONSISTENT?
SELECT & PRESS [ENTER]  ⊕
```
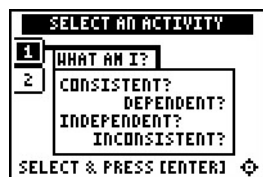
Scoring: Students get one attempt to pick the correct classification of the system. They earn 2 points for each correct choice, and 1 point for a correct choice if they press ⟨HINT⟩ to see the graph.

Four systems are given for a maximum score of 8 points.

What Am I?

Tell students to:

1. Highlight a level (silver = less difficult; form y = mx + b; gold = more difficult; mixed slope-intercept and standard forms), and press [ENTER] to select it.

2. Look at the system of equations and decide if the system is consistent & independent, consistent & dependent, or inconsistent.

3. Write out the algebraic steps to make this determination, except possibly at the silver level. Students could use their knowledge of the graph of y = mx + b in order to answer some problems.

4. Press ⟨**HINT**⟩ if they want to see a graph of the system. They will only get 1 point for the problem if they use the ⟨**HINT**⟩.

5. Press ▲ or ▼ to cycle through the choices and then press [ENTER] to select the correct answer. The correct answer and graph will show if the incorrect answer is chosen. They must press a key to continue play. As they play the activity, students should write an algebraic solution to the system on their worksheet.

6. Record the level they played.

7. Record their scores.

Activities (continued)

Scoring: Students get two attempts to pick or input the correct solution to the system of equations. They earn 2 points for a correct choice or input on the first try, and 1 point for a correct choice or input on the second try.

There are 4 problems for a maximum score of 8 points.

Balloon Ride

Tell students to:

1. Read the introduction screen and then highlight a level (silver = less difficult; gold = more difficult), and press [ENTER] to select it. Students answer multiple-choice problems in the silver level and they input their solution in the gold level.

   Silver Level: Press ▲ or ▼ to cycle through the solutions to choose from, and then press [ENTER] to select the solution. Students must press a key to continue play.

   Gold Level: Use ▲ or ▼ to select an answer or to get to the input box. Select or input your answer and press [ENTER]. (Press − to enter negative numbers.) Students must press a key to continue play.

3. As they play the activity, students should write their work using either elimination or substitution.

4. Record the level they played.

5. Record their scores.

Extra Practice: Using Substitution or Elimination

1. Cathy's pay rate can be determined by the following.

   Let S = hourly pay rate
   Let T = overtime pay rate

   Week 1: $10S + 4.5T = 93.75$
   Week 2: $10S + 2T = 75$ → $10S = 75-2T$

   To use substitution, the student could solve the Week 2 equation for 10S, $10S = 75-2T$. Then, the Week 1 equation becomes the following.

   $(75 - 2T) + 4.5T = 93.75$ → $2.5T = 18.75$ → $T = 7.5$

   Once T is known, substitute T into either equation and solve for S.

   $10S + 4.5(7.5) = 93.75$ → $10S = 60$ → $S = 6$

   Interpret the answer:

   S = $6.00 per hour
   T = $7.50 per hour

   Cathy earns $6.00 per hour for the first 10 hours and $7.50 per hour for any overtime.

2. Brenda and Cathy can figure out the cost of each top and pair of jeans purchased by the following.

Let T = price of one top
Let J = price of one pair of jeans

Cathy: 3T + 2J = 57

Brenda: 4T + 3J = 81

To use elimination, multiply Cathy's equation by 4 and Brenda's equation by -3.

Cathy: 12T + 8J = 228

Brenda: -12T – 9J = -243

Add the two equations to get:

-J = -15 → J = 15

Substitute this value for J into either equation to find T.

3T + 2(15) = 57 → 3T = 27 → T = 9

Interpret the answer:

T = $9.00 per top
J = $15.00 per pair of jeans

Cathy and Brenda paid $9.00 for each top and $15.00 for each pair of jeans.

▤ Try-It!™ on Your TI–83 Plus and TI–73

Note: The ▤ **Try-It!** exercises cover different functionality available to solve a system of equations. The TI-83 Plus exercise uses the intersect feature that the TI-73 does not have. The TI-73 exercise uses the Solver to solve an independent system. The TI-83 Plus also has a Solver feature. Using the Solver feature on the TI-83 Plus is given as a challenge investigation for the students. (Hints are given below.) The linear system to be solved is the same for both graphing calculators. The problem set, **Using Your Graphing Calculator to Find Solutions**, given after the ▤ **Try-It!,** is identical and is repeated after each ▤ **Try-It!** for your copying convenience.

On the TI-83 Plus, students will:

- Graph two lines of a system of equations.

- Use ⌈TRACE⌉ to locate the intersection of the lines.

- Use the ⌈2nd⌉ ⌈CALC⌉ **intersect** feature to find the solution to a system of equations.

Check the solution on the home screen using ⌈STO▸⌉.

On the TI-73, students will:

- Graph two lines of a system of equations.

- If the lines intersect, use the ⌈MATH⌉ **Solver** feature to find the X value of the solution to the system.

- Find the Y value by using the ⌈STO▸⌉ on the home screen.

Reminders for the 🖩 Try-It!™ Exercises

TI-83 Plus and TI-73:

- Only the variables X and Y are used for graphs and tables. If an equation uses letters other than X and Y, you have to change the variables in the problem to X and Y in order to use some features on the calculators.

- Some value is always stored in each variable. You must store the value you want in order to understand how the calculator interprets a variable expression. The calculator does not perform symbolic manipulations.

- The intersect feature on the TI-83 Plus and the Solver feature on both the TI-83 Plus and the TI-73 are best used to find the solution to a system with one solution. Students should use their knowledge about the equations of lines to determine if lines are parallel or the same line before working the problem.

- In the Solver, **bound = {⁻1E99, 1E99}** represents the real number line for the calculator. You can make the set smaller to find solutions in a particular interval. See the TI-83 Plus or TI-73 guidebook for more details.

TI-83 Plus:

- When the intersect feature is used, an error is displayed if the lines are parallel. If the lines are the same line, the calculator will show *only* one answer.

- In the challenge problem, students are asked to investigate using the Solver feature on the TI-83 Plus to find the solution. Find this feature in MATH **0:Solver**. See the TI-83 Plus guidebook for details about the Solver feature. You have to enter the equation in the Solver as $0 = ⁻4x + 2 - (2x - 2.5)$. You have to input a guess for the X solution. Then, use ALPHA [SOLVE] to find the calculator's numerical solution.

Extra Practice: Using Your Calculator to Find Solutions

Note: These problems are identical for both the TI-83 Plus and the TI-73.

1a.   (3, 0.125)

1b.   (2/3, 4)

2a.   Answers will vary. Students use their choice of calculator feature to solve for Cathy's pay rate.

2b.   Answers will vary. Students use their choice of calculator feature to solve for Cathy and Brenda's shopping trip.