Stations for Solving Linear Equations by Graphing

Goal: To provide opportunities for students to develop concepts and skills related to solving linear systems of equations by graphing

Common Core Standards

Expressions and Equations

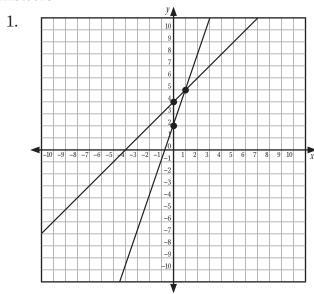
- **8.EE.8.** Analyze and solve pairs of simultaneous linear equations.
 - **a.** Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
 - **b.** Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
 - **c.** Solve real-world and mathematical problems leading to two linear equations in two variables.

Student Activities Overview and Answer Key

Station 1

Students will be given graph paper and a ruler. Students will graph a system of linear equations. They will find the point of intersection of the lines and realize that this is the solution to the linear system. They will double-check the point of intersection by substituting it into the original equations.

Answers



Set 4: Solving 2-by-2 Systems by Graphing

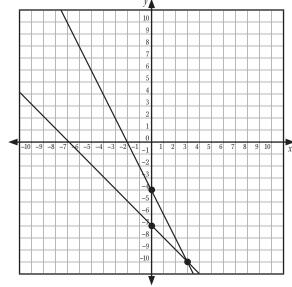
Instruction

2. Yes, (1, 5)

The point of intersection is the solution of the system of linear equations.

Substitute (1, 5) into both equations to verify that it satisfies both equations.





6. (3, -10)

Station 2

Students will be given four index cards with the following systems of linear equations written on them:

$$\begin{cases} 10x - 2y = 10 \\ 5x - y = 5 \end{cases}; \begin{cases} x - y = 3 \\ 2x - y = 5 \end{cases}; \begin{cases} y = 4 \\ -x + y = 10 \end{cases}; \begin{cases} y = 2x + 5 \\ -2x + y = 8 \end{cases}$$

Students will work together to match each system of linear equations with the appropriate graph. They will explain the strategy they used to match the graphs.

Answers

1.
$$\begin{cases} 5x + y = -3 \\ 7x + y = -5 \end{cases}$$

$$2. \quad \begin{cases} y = 4 \\ -x + y = 10 \end{cases}$$

$$\begin{cases} y = 4 \\ -x + y = 10 \end{cases}$$
3.
$$\begin{cases} 10x - 2y = 10 \\ 5x - y = 5 \end{cases}$$

Set 4: Solving 2-by-2 Systems by Graphing

Instruction

$$4. \quad \begin{cases} y = 2x + 5 \\ -2x + y = 8 \end{cases}$$

5. Answers will vary. Possible answer: Finding the point of intersection of the lines. This is the solution to the linear system. Substitute this point into the equations to see which systems of linear equations have this solution.

Station 3

Students will be given linear equations and will find points that satisfy the equations. Then they will look at the equations as a linear system. They will find the solution, or no solution, of the linear system. They will describe the strategy they used to determine the solution of the linear system.

Answers

1.

х	y
- 5	-14
0	-4
5	6
10	16
15	26

2.

х	y
-4	37
0	31
8	19
10	16
12	13

- 3. Yes, (10, 16)
- 4. They had the same ordered pair of (10, 16), which means the lines intersect at that point.

5.

х	y
-2	6
0	10
2	14
4	18

Set 4: Solving 2-by-2 Systems by Graphing

Instruction

6.

х	у
-2	-14
0	-10
2	-6
4	-2

- 7. The table of values may or may not contain the solution.
- 8. You can use the slope of each line and *y*-intercepts, or you can graph the equations and see if they intersect.
- 9. There is no solution. Each equation has the same slope, but different *y*-intercepts.

Station 4

Students will be given a graphing calculator. Students will be shown how to find the solution of a system of linear equations using the graphing calculator. Then they will use the graphing calculator to find the solutions of given systems of linear equations.

Answers

- 1. (-1.67, -9.67)
- 2. (-8, -12)
- 3. (1.29, 3.86)
- 4. (0.73, 3.27)

Materials List/Setup

- **Station 1** graph paper; ruler
- **Station 2** four index cards with the following systems of linear equations written on them:

$$\begin{cases} 10x - 2y = 10 \\ 5x - y = 5 \end{cases}; \begin{cases} 5x + y = -3 \\ 7x + y = -5 \end{cases}; \begin{cases} y = 4 \\ -x + y = 10 \end{cases}; \begin{cases} y = 2x + 5 \\ -2x + y = 8 \end{cases}$$

- **Station 3** none
- **Station 4** graphing calculator

Set 4: Solving 2-by-2 Systems by Graphing

Instruction

Discussion Guide

To support students in reflecting on the activities and to gather some formative information about student learning, use the following prompts to facilitate a class discussion to "debrief" the station activities.

Prompts/Questions

- 1. How do you solve systems of linear equations by graphing?
- 2. How do you know if a system of linear equations has infinite solutions?
- 3. How do you know if a system of linear equations has no solutions?
- 4. How can you use a graphing calculator to graph and solve systems of linear equations?
- 5. Give an example of a graph of a linear system that is used in the real world.

Think, Pair, Share

Have students jot down their own responses to questions, then discuss with a partner (who was not in their station group), and then discuss as a whole class.

Suggested Appropriate Responses

- 1. Graph each line. Their point of intersection is the solution to the linear system.
- 2. Graph each line. If the lines are the same line then they have infinite solutions. Or, if the lines have the same slope and *y*-intercept, then there are infinite solutions.
- 3. Graph each line. If the lines are parallel or have no point of intersection, the system has no solutions.
- 4. Type the equations into Y1 and Y2. Hit "GRAPH", "2nd", "Trace", and select "5: Intersect". Then hit the "ENTER" key three times to find the point of intersection. The point of intersection is the solution to the linear system.
- 5. Answers will vary. Possible answer: comparing service plans from two different cell phone companies

Possible Misunderstandings/Mistakes

- Incorrectly graphing the equations by not finding the correct slope and intercepts
- Not realizing that equations with the same slope and *y*-intercept are the same line. If they are a system of linear equations then the system has infinite solutions.
- Not realizing that parallel lines have no solutions
- Not realizing the point of intersection of the two lines is the solution to the system of linear equations

Set 4: Solving 2-by-2 Systems by Graphing

Station 1

At this station, you will find graph paper and a ruler. You can find the solution to a system of linear equations by graphing each equation in the same coordinate plane.

1. As a group, graph each of the following linear equations on the same graph.

$$y = 3x + 2$$

$$y = x + 4$$

- 2. Do the lines intersect? If so, find the point at which the two lines intersect.
- 3. What does this point of intersection tell you about the two equations?
- 4. How can you double-check your answer to problem 3?
- 5. As a group, graph the system of linear equations on a new graph.

$$\begin{cases} y = -2x - 4 \\ y = -x - 7 \end{cases}$$

6. Using this graph, what is the solution to the linear system?

Set 4: Solving 2-by-2 Systems by Graphing

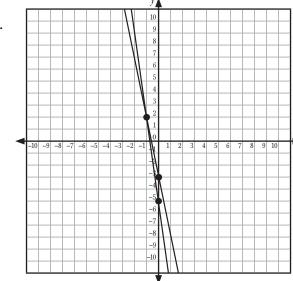
Station 2

At this station, you will find four index cards with the following linear systems of equations written on them:

$$\begin{cases} 10x - 2y = 10 \\ 5x - y = 5 \end{cases}; \begin{cases} 5x + y = -3 \\ 7x + y = -5 \end{cases}; \begin{cases} y = 4 \\ -x + y = 10 \end{cases}; \begin{cases} y = 2x + 5 \\ -2x + y = 8 \end{cases}$$

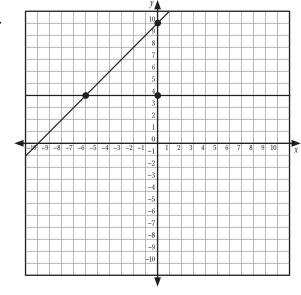
Work together to match each system of linear equations with the appropriate graph below. Write the appropriate system of linear equations under each graph.

1.



Answer: _____

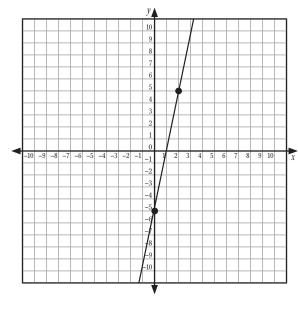
2.



Answer:

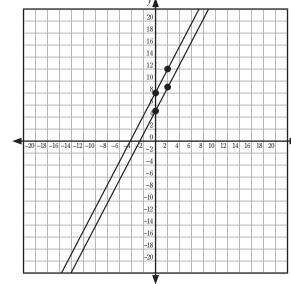
Set 4: Solving 2-by-2 Systems by Graphing

3.



Answer:

4.



Answer:

5. What strategy did you use to match the systems of linear equations with the appropriate graph?

Set 4: Solving 2-by-2 Systems by Graphing

Station 3

Use what you know about linear equations to answer the questions.

1. Complete the table below for the linear equation 2x - y = 4.

x	y
-5	
0	
5	
10	
15	

2. Complete the table below for the linear equation 3x + 2y = 62.

x	y
-4	
0	
8	
10	
12	

3. If $\begin{cases} 2x - y = 4 \\ 3x + 2y = 62 \end{cases}$ were a set of linear equations, would the set have a solution?

If so, what is the solution?

- 4. What strategy did you use in problem 3 to find your answer?
- 5. Complete the table below for the linear equation 2x = y 10.

х	у
-2	
0	
2	
4	

Set 4: Solving 2-by-2 Systems by Graphing

6. Complete the table below for the linear equation 2x = y + 10.

х	у
-2	
0	
2	
4	

- 7. If $\begin{cases} 2x = y 10 \\ 2x = y + 10 \end{cases}$ were a set of linear equations, why would you need more information than just the values in the tables you found for problems 5 and 6 to determine any solutions?
- 8. What information would you need to determine whether or not a system of linear equations has a solution, infinite solutions, or no solutions?
- 9. Does $\begin{cases} 2x = y 10 \\ 2x = y + 10 \end{cases}$ have a solution? Why or why not?

Set 4: Solving 2-by-2 Systems by Graphing

Station 4

At this station, you will find a graphing calculator. You can graph systems of linear equations on your calculator to find their point of intersection. Work together to graph systems of linear equations on your calculator.

Given:
$$\begin{cases} y = 4x - 3 \\ y = x - 8 \end{cases}$$

Follow these steps on your graphing calculator to find the point of intersection for this system of equations:

- 1. Hit the "Y =" key. Type Y1 = 4x 3.
- 2. Type Y2 = x 8.
- 3. Hit the "GRAPH" key.
- 4. Hit "2nd" and then "TRACE". Select "5: Intersect".
- 5. Hit "ENTER" three times. You will be given the *x* and *y*-values of the intersection.
- 1. What is the intersection/solution of $\begin{cases} y = 4x 3 \\ y = x 8 \end{cases}$?

Using the same steps, find the solution to each system of linear equations below on your graphing calculator.

$$2. \quad \begin{cases} y = 3x + 12 \\ y = x - 4 \end{cases}$$

Solution = _____

$$3. \quad \begin{cases} y = -4x + 9 \\ y = 3x \end{cases}$$

Solution = ____

4.
$$\begin{cases} 2x + 2y = 8 \\ y = 10x - 4 \end{cases}$$

Solution = ____