Name Key Class Date

3-3

# Solving Systems Graphically

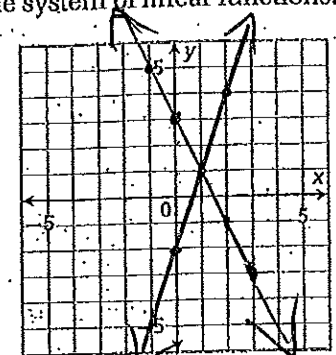
COMMON CORE

CC.8.EE.8a
CC.8.EE.8c

**Essential question:** *How can you solve a system of equations by graphing?*

## 1 EXPLORE Investigating Systems of Equations

**A** Graph the system of linear functions: $\begin{cases} y = 3x - 2 \\ y = -2x + 3 \end{cases}$




**B** Explain how to tell whether the ordered pair $(2, -1)$ is a solution of the equation $y = 3x - 2$ without using the graph.

put (2,-1) into the equation and the result is a false statement. This means it is not a solution $-1 = 3(2) - 2 \rightarrow -1 \neq 4$

**C** Explain how to tell whether the ordered pair $(2, -1)$ is a solution of the equation $y = -2x + 3$ without using the graph.

You Do the same as above $-1 = -2(2) + 3$
$-1 = -4 + 3$
$-1 = -1$ ✓

**D** Explain how to use the graph to tell whether the ordered pair $(2, -1)$ is a solution of either equation.

If the point (2,-1) is on the line, then it is a solution to the equation

**E** Find an ordered pair that is a solution of both equations. Test the coordinates in each equation to verify your hypothesis.

(1,1) $y = 3x - 2$ | $y = -2x + 3$
$1 = 3(1) - 2$ | $1 = -2(1) + 3$
$1 = 3 - 2$ | $1 = -2 + 3$
$1 = 1$ ✓ | $1 = 1$ ✓

The point (1,1) is a solution of both equations.

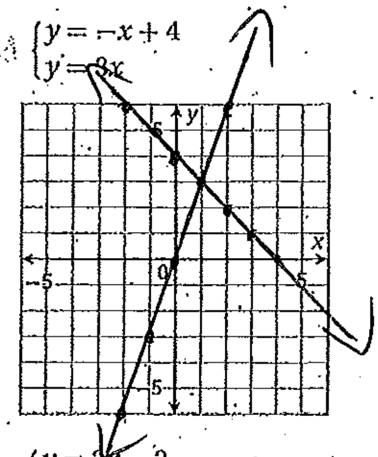
An ordered pair $(x, y)$ is a solution of an equation in two variables if substituting the $x$- and $y$-values into the equation results in a true statement. A **system of equations** is a set of equations that have the same variables. An ordered pair is a solution of a system of equations if it is a solution of every equation in the system.

Since the graph of a function represents all ordered pairs that are solutions of the related equation, if a point lies on the graphs of two functions, the point is a solution of both related equations.

## 2 EXAMPLE Solving Systems Graphically

**Solve each system by graphing.**

A $\begin{cases} y = -x + 4 \\ y = 3x \end{cases}$



Start by graphing each function.

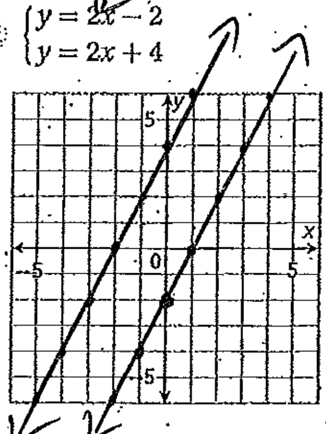
Identify if there are any ordered pairs that are solutions of both equations.

The solution of the system appears to be

(1,3)

To check your answer, you can substitute the values for $x$ and $y$ into each equation and make sure the equations are true statements.

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



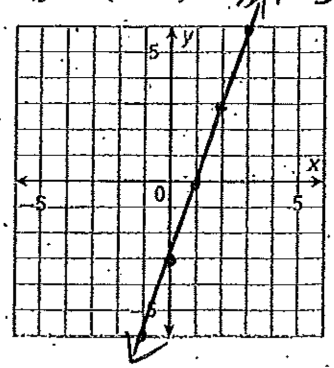
Start by graphing each function.

Identify if there are any ordered pairs that are solutions of both equations.

The graphs are parallel, so there is no ordered pair that is a solution of both equations. The system has

No Solutions

C $\begin{cases} y = 3x - 3 \\ y = 3(x - 1) \end{cases}$ $\rightarrow y = 3x - 3$



Start by graphing each function.

Identify if there are any ordered pairs that are solutions of both equations.

The graphs overlap, so every ordered pair that is a solution of one equation is also a solution of the other equation. The system has

Infinitely Many

## 3 EXAMPLE Solving a Real-World Problem by Graphing

**Kelsha and her friends visit the concession stand at a football game. The stand charges \$2 for a hot dog and \$1 for a drink. The friends buy a total of 8 items for \$11. Tell how many hot dogs and how many drinks they bought.**

A. Let $x$ represent the number of hot dogs they bought and $y$ represent the number of drinks they bought.

Write an equation representing the **number of items they purchased.**

| Number of hot dogs | + | Number of drinks | = | Total items |
|---|---|---|---|---|
| x | + | y | = | 8 |

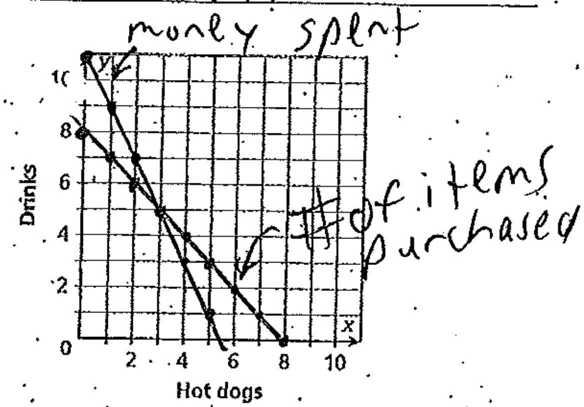
Write an equation representing the **money spent on the items.**

| Cost of 1 hot dog times number of hot dogs | + | Cost of 1 drink times number of drinks | = | Total cost |
|---|---|---|---|---|
| 2x | + | y | = | 11 |

B. Write your equations in slope-intercept form.

$y = -x + 8$ and $y = -2x + 11$

C. Graph the solutions of both equations.




D. Use the graph to identify the solution of the system of equations. Check your answer by substituting the ordered pair into both equations.

(3,5) $x + y = 8$ $2x + y = 11$
$3 + 5 = 8$ $2(3) + 5 = 11$
$8 = 8$ ✓ $6 + 5 = 11$
$11 = 11$ ✓

The point (3,5) is a solution of both equations.

E. Interpret the solution in the original context.

Keisha and her friends bought 3 hot dog(s) and 5 drink(s).

**REFLECT**

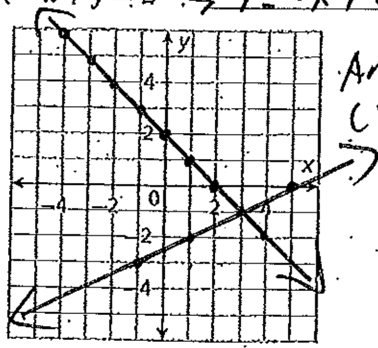
3. **Conjecture** Why do you think the graph is limited to the first quadrant?

We dont deal with negative #s when purchasing items

## PRACTICE

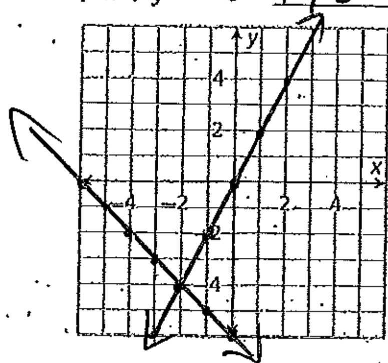
Solve each system by graphing.

1. $\begin{cases} 2x - 4y = 10 \\ x + y = 2 \end{cases}$ $\rightarrow y = \frac{1}{2}x + {}^{-}2.5$ ; $\rightarrow y = -x + 2$




Answer (3, -1)

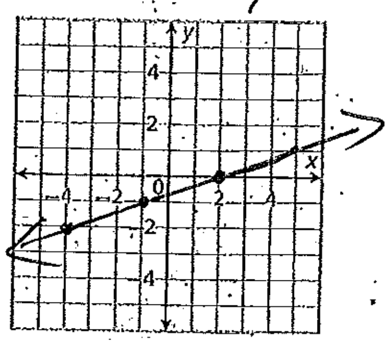
2. $\begin{cases} 2x - y = 0 \\ x + y = -6 \end{cases}$ $\rightarrow y = 2x$ ; $\rightarrow y = -x + {}^{-}6$




Answer (-2, -4)

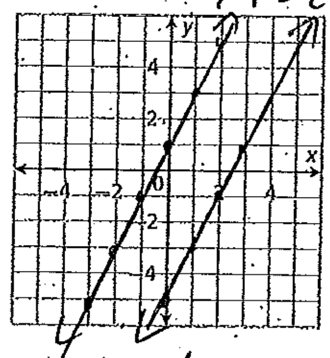
Graph each system and tell how many solutions the system has.

3. $\begin{cases} x - 3y = 2 \\ -3x + 9y = -6 \end{cases}$ $\rightarrow y = \frac{1}{3}x + \frac{3}{3}$ ; $\rightarrow$



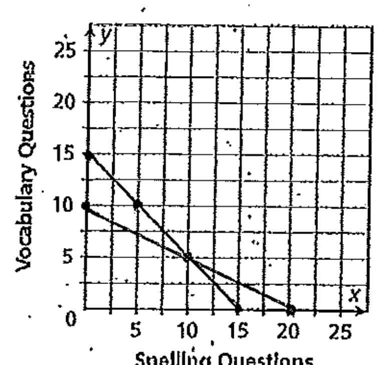

Infinetely solutions

4. $\begin{cases} 2x - y = 5 \\ 2x - y = -1 \end{cases}$ $\rightarrow y = 2x + {}^{-}5$ ; $\rightarrow y = 2x + 1$




No solutions

Mrs. Morales wrote a test with 15 questions covering spelling and vocabulary. Spelling questions ($x$) are worth 5 points and vocabulary questions ($y$) are worth 10 points. The maximum number of points possible on the test is 100.




5. Write an equation in slope-intercept form to represent the number of questions on the test.

$y = -x + 15$

6. Write an equation in slope-intercept form to represent the total points on the test.

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

7. Graph the solutions of both equations.

8. Use your graph to tell how many of each question type are on the test.

10 spelling questions; 5 vocabulary questions

(10, 5)