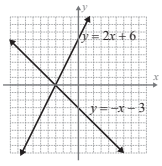
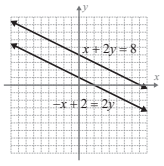
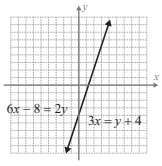
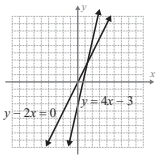
Margin Exercise Answers

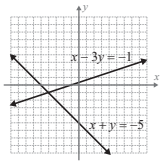
1. $6 - 12 = -6$ True statement; $18 + 8 = 26$ True statement **2.** $2 = -6 + 8$ True statement; $2 = 9 - 8$ False statement **3.** 

$(-3, 0)$ **4.** 

No solution

5. 

$(x, 3x - 4)$ **6.** 

$\left(\frac{3}{2}, 3\right)$ **7.** 

$(-4, -1)$

11.1 Exercises

Concept Check

Fill-in-the-Blank. Complete each sentence using information found in this section.

1. A system of equations is also called a set of _____ equations.

2. When solving a system of two linear equations, the goal is to find ordered pairs that satisfy _____ equations.

3. To solve a system of linear equations by graphing, you should graph both equations on the _____ set of axes.

4. A dependent system has _____ solution(s).

5. A consistent system has exactly ___ solution(s).

6. An inconsistent system has ___ solution(s).

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. To check a solution, substitute it into one of the equations. If the solution satisfies one equation it will satisfy all of the equations.

8. A system of equations with graphs that are parallel lines has exactly one solution.

9. A system of equations with graphs that intersect at one point has exactly one solution.

10. A system of equations with graphs that are the same line has infinitely many solutions.

Practice

Determine which of the given points, if any, lie on both of the lines in the systems of equations by substituting each point into both equations. See Examples 1 and 2.

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

a. $(1, -2)$

b. $(4, -2)$

c. $(2, -4)$

d. $(-1, 2)$

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

a. $(2, 1)$

b. $(2, -2)$

c. $(-1, 2)$

d. $(4, 0)$

3. $\begin{cases} 2x + 4y - 6 = 0 \\ 3x + 6y - 9 = 0 \end{cases}$

a. $(1, 1)$

b. $(2, 0)$

c. $\left(0, \frac{3}{2}\right)$

d. $(-1, 3)$

4. $\begin{cases} 5x - 2y - 5 = 0 \\ 5x = -3y \end{cases}$

a. $(1, 0)$

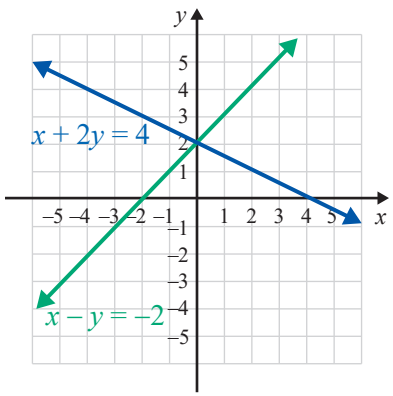
b. $\left(\frac{3}{5}, -1\right)$

c. $(0, 0)$

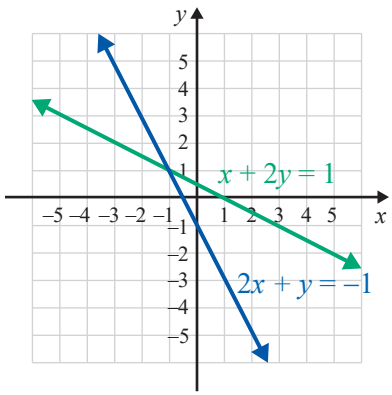
d. $(1, 4)$

The graphs of the lines represented by each system of equations are given. Determine the solution of the system by looking at the graph. Check your solution by substituting into both equations. See Example 3.

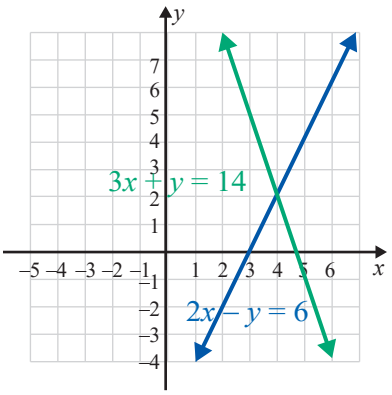
5. $\begin{cases} x + 2y = 4 \\ x - y = -2 \end{cases}$



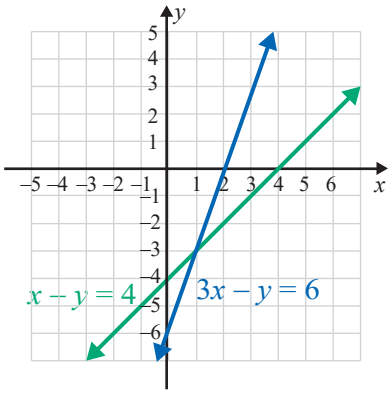
6. $\begin{cases} x + 2y = 1 \\ 2x + y = -1 \end{cases}$



7. $\begin{cases} 2x - y = 6 \\ 3x + y = 14 \end{cases}$



8. $\begin{cases} x - y = 4 \\ 3x - y = 6 \end{cases}$



Show that each system of equations is inconsistent by determining the slope of each line and the *y*-intercept. (That is, show that the lines are parallel and do not intersect.) See Example 4.

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

10. $\begin{cases} 3x - 5y = 1 \\ 6x - 10y = 4 \end{cases}$

11. $\begin{cases} y = \frac{1}{2}x + 3 \\ x - 2y = 1 \end{cases}$

12. $\begin{cases} 3x - y = 8 \\ x - \frac{1}{3}y = 2 \end{cases}$

Solve each system of equations by graphing. Then, state whether the system is consistent or inconsistent and whether the equations are dependent or independent. See Examples 3 through 6.

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

14. $\begin{cases} y = 2x + 5 \\ 4x - 2y = 7 \end{cases}$

15. $\begin{cases} 2x - y = 4 \\ 3x + y = 6 \end{cases}$

16. $\begin{cases} 2x + 3y = 6 \\ 4x + 6y = 12 \end{cases}$

17. $\begin{cases} x + y - 5 = 0 \\ x = 5 - y \end{cases}$

18. $\begin{cases} y = 4x - 3 \\ x = 2y - 8 \end{cases}$

19. $\begin{cases} 3x - y = 6 \\ y = 3x \end{cases}$

20. $\begin{cases} y = 2x \\ 2x + y = 4 \end{cases}$

Solve each system of equations by graphing. See Examples 3 through 6.

21. $\begin{cases} x - y = 5 \\ x = -3 \end{cases}$

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

23. $\begin{cases} x + 2y = 8 \\ 3x - 2y = 0 \end{cases}$

24. $\begin{cases} x + y = 8 \\ 5y = 2x + 5 \end{cases}$

25. $\begin{cases} 5x - 4y = 5 \\ 8y = 10x - 10 \end{cases}$

26. $\begin{cases} 2x + y = 0 \\ 4x + 2y = -8 \end{cases}$

27. $\begin{cases} 4x + 3y + 7 = 0 \\ 5x - 2y + 3 = 0 \end{cases}$

28. $\begin{cases} 4x - 2y = 10 \\ -6x + 3y = -15 \end{cases}$

29. $\begin{cases} x = 5 \\ y = -1 \end{cases}$

30. $\begin{cases} y = 7 \\ x = 8 \end{cases}$

31. $\begin{cases} \frac{1}{2}x + 2y = 7 \\ 2x = 4 - 8y \end{cases}$

32. $\begin{cases} 4x + y = 6 \\ 2x + \frac{1}{2}y = 3 \end{cases}$

33. $\begin{cases} 7x - 2y = 1 \\ y = 3 \end{cases}$

34. $\begin{cases} x = 1.5 \\ x - 3y = 9 \end{cases}$

35. $\begin{cases} y = \frac{1}{2}x + 2 \\ x - 2y + 4 = 0 \end{cases}$

36. $\begin{cases} 2x - 5y = 6 \\ y = \frac{2}{5}x + 1 \end{cases}$

37. $\begin{cases} 2x + 3y = 5 \\ 3x - 2y = 1 \end{cases}$

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

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

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

41. $\begin{cases} \frac{1}{2}x + \frac{1}{3}y = \frac{1}{6} \\ \frac{1}{4}x + \frac{1}{4}y = 0 \end{cases}$

42. $\begin{cases} \frac{1}{4}x - y = \frac{13}{4} \\ \frac{1}{3}x + \frac{1}{6}y = -\frac{1}{6} \end{cases}$

Use a graphing calculator's intersect function to solve each system of equations. If necessary, round values to the nearest ten-thousandth. (Remember to solve each equation for y and then enter them as Y1 and Y2 in the Y= menu.) See Example 7.

43. $\begin{cases} x + 2y = 9 \\ x - 2y = -7 \end{cases}$

44. $\begin{cases} x - 3y = 0 \\ 2x + y = 7 \end{cases}$

45. $\begin{cases} y = 2 \\ 2x - 3y = -3 \end{cases}$

46. $\begin{cases} 2x - 3y = 0 \\ 3x + 3y = \frac{5}{2} \end{cases}$

47. $\begin{cases} y = -3 \\ 2x + y = 0 \end{cases}$

48. $\begin{cases} 2x - 3y = 1.25 \\ x + 2y = 5 \end{cases}$

49. $\begin{cases} x + y = 3.5 \\ -2x + 5y = 7.7 \end{cases}$

50. $\begin{cases} 4x + y = -0.5 \\ x + 2y = -8 \end{cases}$

Applications

Each of the following applications has been modeled using a system of equations. Solve the system graphically.

51. The sum of two numbers is 25 and their difference is 15. What are the two numbers? Let x be one number and y be the other number.

The corresponding modeling system is $\begin{cases} x + y = 25 \\ x - y = 15 \end{cases}$

52. The perimeter of a rectangle is 50 m and the length is 5 m longer than the width. Find the dimensions of the rectangle.
Let x be the length and y be the width.
The corresponding modeling system is $\begin{cases} 2x+2y=50 \\ x-y=5 \end{cases}$

53. OSHA recommends that swimming pool owners clean their pool decks with a solvent composed of a 12% chlorine solution and a 3% chlorine solution. Fifteen gallons of the solvent consists of 6% chlorine. How much of each of the mixing solutions were used?
Let x be the number of gallons of the 12% solution
and y be the number of gallons of the 3% solution.
The corresponding modeling system is $\begin{cases} x+y=15 \\ 0.12x+0.03y=0.06(15) \end{cases}$

54. A student bought a calculator and a textbook for a course in algebra. He told his friend that the total cost was \$170 (without tax) and that the calculator cost \$20 more than twice the cost of the textbook. What was the cost of each item?
Let x be the cost of the calculator and y be the cost of the textbook.
The corresponding modeling system is $\begin{cases} x+y=170 \\ x=2y+20 \end{cases}$

55. Felix is trying to decide between two job offers. Company A is offering \$15 per hour with a \$500 signing bonus and Company B is offering \$18 per hour with a \$100 signing bonus. Graph the system of linear equations to estimate how many hours he must work to make Company B the best financial choice. Round up to the nearest hour.
The corresponding modeling system is $\begin{cases} y=15x+500 \\ y=18x+100 \end{cases}$

56. Silas is comparing two credit card offers. Credit Card A has no annual fee and offers 1.5% cash back on purchases. Credit Card B has a \$95 annual fee and offers 6% back on purchases. Let x be the amount spent and y be the amount of cash back, minus annual fees.
The corresponding modeling system is $\begin{cases} y=0.015x \\ y=0.06x-95 \end{cases}$
Find the ordered pair that represents the amount Silas needs to spend to earn the same amount of cash back minus his annual fees, and the amount of cash back he earns after spending that amount.

57. Mackenzie plans to join a gym and wants to decide between the two gyms that are close to her home, Fit4Life and Workout Nation. At Fit4Life, she would pay a \$20 per month membership fee and \$10 per class. At Workout Nation, she would pay a \$45 per month membership fee and \$5 per class. Mackenzie wants to determine how many classes she would have to take per month for both gyms to have the same cost.

a. Write two equations to represent the situation. Use the variable y to represent the total cost per month and the variable x to represent the number of classes.

b. Graph the two equations on the same coordinate plane.

c. Find the point of intersection.

d. What does the point of intersection mean? Write a complete sentence.

e. If Mackenzie plans to take 10 classes per month, which gym would be the better deal?

58. You are planning a vacation and would like to spend your money wisely. You decide to fly to your destination and then rent a car when you get there. Discount Car Rentals charges $10 per day for the economy class car and $0.10 per mile. Cars For Hire charges $15 per day and $0.05 per mile. You need to determine which car rental service offers the best deal.

a. Write two equations to represent the situation. Use the variable y to represent the total cost per day and the variable x to represent the number of miles driven per day.

b. Graph the two equations on the same coordinate plane.

c. Find the point of intersection.

d. What does the point of intersection mean? Write a complete sentence.

e. You expect to drive at most 75 miles per day. Which car rental company should you rent the car from?

Writing & Thinking

59. Explain, in your own words, why the answer to a consistent system of linear equations can be written as an ordered pair.