Completion Example Answers

5. $$\begin{aligned} 6x+10y&=-6 \\ 35x-10y&=-35 \\ \hline 41x&=-41 \\ x&=-1 \end{aligned}$$

Substitute $x=-1$; $$\begin{aligned} 3(-1)+5y&=-3 \\ -3+5y&=-3 \\ 5y&=0 \\ y&=0 \end{aligned}$$

The solution is $(-1, 0)$.

Margin Exercise Answers

1. $(-2,5)$ **2.** $(x,-2x+5)$ or $\left(\frac{-1}{2}y+\frac{5}{2}, y\right)$ **3.** No solution **4.** $(5,0.6)$ **5.** $(2,-3)$
6. $y=\frac{5}{2}x-12$

4.3 Exercises

Concept Check

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

1. When using the method of addition, the objective is to ______ one of the variables so that a new equation is found with just one variable.

2. The first step of the method of addition is to write one equation under the other so that the __________ are aligned vertically.

3. To make it easier to align terms, the equations should be written in ______ form.

4. Multiply the terms of one equation by a constant so that two like terms have _____ coefficients. You may need to multiply both equations by different constants.

5. Next, add the two equations by ______ like terms and solve the resulting equation for the other variable.

6. The addition method is particularly efficient if the ______ for one of the variables are opposites.

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. When using the method of addition, the solution only needs to be checked in one of the original equations.

8. It's possible for a system of equations to have no solutions.

9. Both the addition method and the substitution method gives approximate solutions.

10. The graphing method is helpful in "seeing" the geometric relationship between the lines and finding approximate solutions.

Practice

Use the method of addition to solve each system. See Examples 1 through 5.

1. $\begin{cases} 8x - y = 29 \\ 2x + y = 11 \end{cases}$

2. $\begin{cases} x + 3y = 9 \\ x - 7y = -1 \end{cases}$

3. $\begin{cases} 3x + 2y = 0 \\ 5x - 2y = 8 \end{cases}$

4. $\begin{cases} 12x - 3y = 21 \\ 4x - y = 7 \end{cases}$

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

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

7. $\begin{cases} 3x + 3y = 9 \\ x + y = 3 \end{cases}$

8. $\begin{cases} 9x + 2y = -42 \\ 5x - 6y = -2 \end{cases}$

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

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

11. $\begin{cases} x + y = 12 \\ 0.05x + 0.25y = 1.6 \end{cases}$

12. $\begin{cases} x + 0.1y = 8 \\ 0.1x + 0.01y = 0.64 \end{cases}$

Solve each system of linear equations. See Examples 1 through 5.

13. $\begin{cases} x = 11 + 2y \\ 2x - 3y = 17 \end{cases}$

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

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

16. $\begin{cases} 2x + y = 3 \\ 4x + 2y = 7 \end{cases}$

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

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

19. $\begin{cases} 7x - y = 16 \\ 2y = 2 - 3x \end{cases}$

20. $\begin{cases} 3x + y = -10 \\ 2y - 1 = x \end{cases}$

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

22. $\begin{cases} x + y = 6 \\ 2x + y = 16 \end{cases}$

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

24. $\begin{cases} x + 2y = 0 \\ 2x = 4y \end{cases}$

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

26. $\begin{cases} x - 3y = 4 \\ 3x - 9y = 10 \end{cases}$

27. $\begin{cases} 5x - 2y = 17 \\ 2x - 3y = 9 \end{cases}$

28. $\begin{cases} \frac{1}{2}x + 2y = 9 \\ 2x - 3y = 14 \end{cases}$

29. $\begin{cases} 3x + 2y = 14 \\ 7x + 3y = 26 \end{cases}$

30. $\begin{cases} 4x + 3y = 28 \\ 5x + 2y = 35 \end{cases}$

31. $\begin{cases} 2x+7y=2 \\ 5x+3y=-24 \end{cases}$

32. $\begin{cases} 7x-6y=-1 \\ 5x+2y=37 \end{cases}$

33. $\begin{cases} 10x+4y=7 \\ 5x+2y=15 \end{cases}$

34. $\begin{cases} 6x-5y=-40 \\ 8x-7y=-54 \end{cases}$

35. $\begin{cases} 0.5x-0.3y=7 \\ 0.3x-0.4y=2 \end{cases}$

36. $\begin{cases} 0.6x+0.5y=5.9 \\ 0.8x+0.4y=6 \end{cases}$

37. $\begin{cases} 2.5x+1.8y=7 \\ 3.5x-2.7y=4 \end{cases}$

38. $\begin{cases} 0.75x-0.5y=2 \\ 1.5x-0.75y=7.5 \end{cases}$

39. $\begin{cases} \frac{2}{3}x-\frac{1}{2}y=\frac{2}{3} \\ \frac{8}{3}x-2y=\frac{17}{6} \end{cases}$

40. $\begin{cases} \frac{3}{4}x+\frac{1}{4}y=\frac{3}{8} \\ \frac{3}{2}x+\frac{1}{2}y=\frac{3}{4} \end{cases}$

41. $\begin{cases} \frac{1}{6}x-\frac{1}{12}y=-\frac{13}{6} \\ \frac{1}{5}x+\frac{1}{4}y=2 \end{cases}$

42. $\begin{cases} \frac{5}{3}x-\frac{2}{3}y=-\frac{29}{30} \\ 2x+5y=0 \end{cases}$

Write an equation for the line determined by the two given points by using the formula *y* = *mx* + *b* to set up a system of equations with *m* and *b* as the unknowns. See Example 6.

43. $(2,3),(1,-2)$

44. $(0,6),(-3,-3)$

45. $(1,-3),(5,-3)$

46. $(5,3),(5,-4)$

47. $(1,2),(-3,0)$

48. $(-4,2),(5,-1)$

Applications

Each of the following applications has been modeled using a system of equations. Use the method of substitution or the method of addition to solve each system.

49. For two months, Martin used the same snow removal company to help clear his property. The company has a fixed reservation rate per month, plus an hourly rate for the amount of time that is spent clearing snow. Martin received two bills from the snow removal company. The first bill was $150 for 4 hours of snow removal and the second bill was $200 for 6 hours of snow removal. Find the equation of the line that represents the snow removal company's fixed reservation rate and charge per hour. Round to the nearest cent if necessary.

50. For two months, Milan used the same landscaping maintenance company. The company has a fixed reservation rate per month, plus an hourly rate for the amount of time that is spent on landscaping work. Milan received two bills from the landscaping company. The first bill was $109.50 for 3.5 hours of landscaping work and the second bill was $147.75 for 5.75 hours of landscaping work. Find the equation of the line that represents the landscaping company's fixed reservation rate and charge per hour. Round to the nearest cent if necessary.

51. Georgia had $10,000 to invest, and she put the money into two accounts. One of the accounts will pay 6% interest and the other will pay 10%. How much did she put in each account if the interest from the 10% account exceeded the interest from the 6% account by $40?
Let x be the amount in the 10% account and y be the amount in the 6% account.
The system that models the problem is $\begin{cases} x+y=10{,}000 \\ 0.10x-0.06y=40 \end{cases}$

52. A minor league baseball team has a game attendance of 4500 people. Tickets cost $5 for children and $8 for adults. The total revenue made at this game was $26,100. How many adults and how many children attended the game?
Let x be the number of adults and y be the number of children.
The system that models the problem is $\begin{cases} x+y=4500 \\ 8x+5y=26{,}100 \end{cases}$

53. How many liters each of a 30% acid solution and a 40% acid solution must be used to produce 100 liters of a 36% acid solution?
Let x be the amount of 30% solution and y be the amount of 40% solution.
The system that models the problem is $\begin{cases} x+y=100 \\ 0.30x+0.40y=0.36(100) \end{cases}$

54. Two cars leave Denver at the same time traveling in opposite directions. One travels at an average speed of 55 mph and the other at 65 mph. In how many hours will they be 420 miles apart?
Let x be the time of travel for first car and y be the time of travel for second car.
The system that models the problem is $\begin{cases} x=y \\ 55x+65y=420 \end{cases}$

55. You are deciding between two credit cards with similar rewards programs. The City credit card will give you 3500 points as a sign-up bonus and 1.5 points for every dollar you spend. The International credit card gives you 1000 points as a sign-up bonus and gives you 2 points for every dollar you spend. How much would you have to spend to earn the same amount of rewards on each credit card?

a. Write two equations to represent the situation. Use the variable x to represent the number of dollars spent and the variable y to represent the total number of points earned.

b. Solve the system of equations by addition.

c. What does the solution mean? Write a complete sentence.

d. If you only plan to purchase $4000 in merchandise, which credit card will give you the most points?

56. Barbara's Bombtastic Bakery uses chocolate chips in one type of cookie and in one type of muffin. The cookie recipe calls for 5 cups of chocolate chips and the muffin recipe calls for 2 cups of chocolate chips. The cookie recipe makes 30 large cookies and the muffin recipe makes 18 giant muffins. The bakery currently has 50 cups of chocolate chips and only has room in the display case for a combination of 360 cookies and muffins. The manager wants to determine how many of each item to bake to use all of the chocolate chips.

- **a.** Write two equations to represent the situation. Use the variable x to represent the number of batches of chocolate chip cookies and the variable y to represent the number of batches of muffins.
- **b.** Solve the system of equations by addition.
- **c.** What does the solution mean? Write a complete sentence.
- **d.** If the manager makes the amount of chocolate chip cookies and muffins described in part c., will the bakery be able to fulfill an order for 150 chocolate chip cookies and 160 chocolate chip muffins?

Writing & Thinking

57. Explain, in your own words, why the answer to a system with infinite solutions is written as an ordered pair with variables.