

1.7 Exercises

Concept Check

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

1. When a number is written next to a variable, the number is called the _____ of the variable.
2. A/An _____ is a statement that two expressions are equal.
3. Equations with the same solution set are said to be _____.
4. A/An _____ of an equation is a number that gives a true statement when substituted for the variable.
5. Three basic principles used to solve equations are the _____ principle, the _____ principle, and the _____ principle.
6. The _____ principle can be used to solve the equation $5x = 35$.

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. Evaluating expressions and solving equations are basically two different concepts.
8. Variables may appear only on the left side of an equation.
9. The solution to the equation $n + 3 = 10$ is 13.
10. In solving an equation, we want the variable on one side of the equation by itself with a coefficient of 1.

Practice

For each equation, determine whether the given number is a solution to the equation. See Example 1.

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|-------------------------------------|------------------------------------|
| 1. $x + 7 = 12$ given that $x = 5$ | 4. $4 = y - 7$ given that $y = 12$ |
| 2. $x + 12 = 14$ given that $x = 2$ | 5. $3x = 15$ given that $x = 5$ |
| 3. $15 = y - 3$ given that $y = 10$ | 6. $12x = 72$ given that $x = 8$ |

Solve each equation. Show each step and keep the equal signs aligned vertically. See Examples 2, 3, 5, and 6.

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|-------------------|-------------------|
| 7. $x + 12 = 16$ | 12. $y + 18 = 18$ |
| 8. $x + 35 = 65$ | 13. $22 = n + 12$ |
| 9. $27 = x + 14$ | 14. $44 = n + 15$ |
| 10. $32 = x + 10$ | 15. $8x = 32$ |
| 11. $y + 9 = 9$ | 16. $9x = 72$ |

17. $13y = 52$

18. $15y = 75$

19. $84 = 21n$

20. $99 = 11n$

21. $x + 14 = 20$

22. $31 = y + 4$

Simplify and then solve each equation. See Examples 4 and 7.

23. $x + 14 - 1 = 17 + 3$

24. $x + 20 + 3 = 6 + 40$

25. $3 + y + 10 = 11 + 6$

26. $5 + y - 2 = 4 + 9$

27. $14 - 6 = y + 9 - 7$

28. $11 - 1 = y + 4 + 5$

29. $15 + 9 - 5 = y + 10$

30. $6 + 1 + 3 = y + 4$

31. $5 + x = 13 + 8 - 2$

32. $10 + x = 5 + 3 + 9$

33. $7x = 25 + 10$

34. $6x = 14 + 16$

35. $3x = 17 + 19$

36. $2x = 72 - 28$

37. $21 + 30 = 17y$

38. $16 + 32 = 16y$

39. $31 + 15 - 10 = 4x$

40. $17 + 20 - 3 = 17x$

41. $3x = 43 - 40 + 6$

42. $2n = 26 + 3 - 1$

43. $23 - 23 = 5x$

44. $6 - 6 = 3x$

45. $5 + 5 - 5 - 5 = 4x$

46. $6 - 6 + 6 - 6 = 3y$

47. $5 + 5 + 5 = 3x$

48. $6 + 6 + 6 = 3x$

49. $4y = 7 + 7 + 7 + 7$

50. $5n = 2 + 2 + 2 + 2 + 2$

Applications

Solve.

51. Karl purchased 3 pairs of pants for a total of \$84. This situation can be modeled by the equation $3x = \$84$, where x is the cost of each pair of pants. The pants are on sale for \$24 per pair. Did the pants ring up correctly as the sale price? Explain how you know.
52. Constance is taking inventory at a print shop. The print shop had 48 reams of multipurpose paper in stock and received a shipment of r reams of paper. After the shipment, the print shop had 173 reams of multipurpose paper. This situation can be modeled by the equation $48 + r = 173$. The shipment was supposed to contain 125 reams of multipurpose paper. Was the shipment correct? Explain how you know.
53. Apples are on sale for \$2 per pound and Caleb purchases \$18 worth of apples. This situation can be modeled by the equation $2x = \$18$, where x is the number of pounds of apples purchased. Solve this equation for x to determine how many pounds of apples Caleb purchased.
54. A nurse must give a patient 800 milliliters of intravenous (IV) solution over 4 hours. This can be represented by the equation $4x = 800$, where x represents the amount of solution the patient receives per hour. Solve the equation for x to determine how many milliliters of IV solution the patient will receive per hour.

55. At a restaurant, a customer received a bill for \$56. He paid \$65, which included the tip. This situation can be modeled by $\$56 + t = \65 , where t is the value of the tip. Solve this equation for t to determine the value of the tip.
56. Wynona is making invitations. She needs a total of 50 invitations and she has already made 22 invitations. This situation can be modeled by the equation $22 + y = 50$, where y is the number of invitations Wynona still needs to make. Solve the equation for y to determine how many more invitations need to be made.
57. A machine in a machine shop can put the thread on x screws in one hour. After 8 hours, the machine put the thread on 1920 screws. This situation can be modeled by the equation $8x = 1920$. Solve the equation for x to determine how many screws the machine can thread in one hour.
58. John is making a garden in his backyard. He buys enough topsoil to cover 360 square feet. John wants the garden to go along the side of his garage, which is 24 feet in length. To determine how wide the garden needs to be, John uses the equation $24w = 360$, where w is the width of the garden in feet. Solve the equation for w to determine the width of the garden.
59. Clara is buying a car that costs \$15,750, and there will also be a \$125 fee to transfer her title and registration. She has \$4200 to use as a down payment on the car. Clara will need to take out a loan to pay for the rest of the cost. This situation can be modeled by $4200 + y = 15,750 + 125$, where y is the amount of the loan. Solve the equation for y to determine the value of the loan Clara needs to take out.
60. At the end of her shopping trip, Lily had x dollars. In the course of the day, she had spent \$42 on shoes, \$26 on books, and \$39 on a pair of pants. She started her day with \$150. This situation can be modeled by the equation $x + \$42 + \$26 + \$39 = \150 . Solve the equation for x to determine the amount of money Lily had at the end of her shopping trip.

Writing & Thinking

61. In your own words, describe what it means for a value to be a solution to a given equation.
62. Why is it important to write out and organize the steps for solving an equation instead of using guess and check?
63. Consider an equation of the form $x + b = c$, where x is a variable and b and c are constants.
- Use the subtraction principle to solve for the variable x .
 - Keeping in mind that b and c are constants, how many solutions will the original equation, $x + b = c$, have? (**Hint:** Try plugging in different values for b and c to see how many answers you can find each time.)
64. Consider an equation of the form $ax = c$, where x is a variable and a and c are constants.
- Use the division principle to solve for the variable x .
 - Using your answer to part a., are there any values that the constant a cannot be equal to?
 - Keeping in mind that a and c are constants, and assuming that a does not equal the value(s) you found in part b., how many solutions does the original equation, $ax = c$, have? (**Hint:** Try plugging in different values for a and c to see how many answers you can find each time.)