

D Real Number Solutions to Equations

Now both addition and subtraction can be used to help determine whether or not a particular integer is a solution to an equation. (This skill will prove useful in evaluating formulas and solving equations.)

Example 7 Checking Solutions in Equations

Determine whether the given integer is a solution to the given equation by substituting for the variable and then subtracting.

a. $x - (-6) = -10$;
 $x = -14$

b. $7 - y = -1$;
 $y = 8$

c. $a - 12 = -2$;
 $a = -10$

Solution

a. $x - (-6) = -10$
 $(-14) - (-6) \stackrel{?}{=} -10$
 $-14 + 6 \stackrel{?}{=} -10$
 $-8 \neq -10$

-14 is **not** a solution.

b. $7 - y = -1$
 $7 - (8) \stackrel{?}{=} -1$
 $-1 = -1$
8 is a solution.

c. $a - 12 = -2$
 $(-10) - 12 \stackrel{?}{=} -2$
 $-22 \neq -2$
 -10 is not a solution.

7. For each equation, determine whether $x = 3$ is a solution.

a. $x - (-2) = 5$

b. $-16 - x = -13$

c. $x - 6 = -3$

Now work margin exercise 7.

Margin Exercise Answers

1. a. 0 b. -11 c. 5 d. -6 e. 11 2. a. -1 b. 7 c. -18 d. -12 e. -6 3. a. -5 b. 10 c. 1
4. -38°F 5. 20,500 ft 6. The water rose 4 cm. 7. a. Yes b. No c. Yes

2.3 Exercises

Concept Check

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

- The difference between two numbers can be found by using the operation of _____.
- The expression $14 - (-5)$ can be simplified to $14 +$ _____.
- To subtract, add the _____ of the number being subtracted.
- To find the change in value between two numbers, take the end value and _____ the beginning value.
- A statement that two expressions are equal is called a/an _____.
- The _____ in a measure is the sum of several positive and negative numbers.

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. Moving to the right on the number line is equivalent to moving in a positive direction.
8. Like addition, subtraction is both commutative and associative.
9. The expression “ $15 - 7$ ” can be thought of as “fifteen plus negative seven.”
10. If an integer is a solution to an equation, it satisfies the equation.

Practice

Subtract. See Examples 1 and 2.

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|----------------|------------------|------------------|
| 1. a. $6 - 14$ | 3. a. $-10 - 19$ | 5. a. $12 - 20$ |
| b. $-6 - 14$ | b. $10 - 19$ | b. $-12 - 20$ |
| 2. a. $17 - 5$ | 4. a. $-25 - 3$ | 6. a. $-15 - 18$ |
| b. $-17 - 5$ | b. $25 - 3$ | b. $15 - 18$ |

Perform the indicated operations. See Examples 1 through 3.

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|--------------------|------------------------|-----------------------------|
| 7. $9 - 3$ | 18. $-17 - 30$ | 30. $-16 + 15 - 1$ |
| 8. $10 - 7$ | 19. $0 - (-4)$ | 31. $25 - 13 - 12$ |
| 9. $13 - 20$ | 20. $0 - 4$ | 32. $18 - 11 - 7$ |
| 10. $17 - 22$ | 21. $0 - 9$ | 33. $-7 - (-10) + 3$ |
| 11. $-8 - 11$ | 22. $0 - (-9)$ | 34. $-10 - (-5) + 5$ |
| 12. $-5 - 11$ | 23. $-2 - 3 + 11$ | 35. $-18 - 17 - 9 + (-1)$ |
| 13. $-5 - (-10)$ | 24. $-5 - 4 + 6$ | 36. $-21 - 5 - 8 + (-2)$ |
| 14. $-8 - (-4)$ | 25. $-6 - 5 - 4$ | 37. $-8 - 7 - 3 + 10$ |
| 15. $-7 + (-13)$ | 26. $-6 - 7 - 8$ | 38. $-6 - (-8) + 10 - 3$ |
| 16. $(-2) + (-15)$ | 27. $-3 - (-3) + (-2)$ | 39. $26 - 13 - 17 + 5 - 20$ |
| 17. $-14 - 20$ | 28. $-7 + (-7) + (-8)$ | 40. $35 - 22 - 8 + 7 - 30$ |
| 18. $-14 - 20$ | 29. $-1 + 12 - 10$ | |

Perform the indicated operations on each side of the blank and then fill in the blank with the proper symbol: $<$, $>$, $=$.

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|---|---|--|
| 41. $-7 + (-2) \underline{\hspace{1cm}} -4 - 6$ | 44. $0 - 12 \underline{\hspace{1cm}} 0 - (-12)$ | 47. $-6 - 6 \underline{\hspace{1cm}} 0 - 12$ |
| 42. $-6 + (-3) \underline{\hspace{1cm}} -2 - 2$ | 45. $9 - (-3) \underline{\hspace{1cm}} 9 - 3$ | 48. $-10 - 10 \underline{\hspace{1cm}} 0 - 20$ |
| 43. $0 - 8 \underline{\hspace{1cm}} 0 - (-8)$ | 46. $4 - (-1) \underline{\hspace{1cm}} 4 - 1$ | |

Determine whether the given integer is a solution to the equation by substituting for the variable and performing the indicated operation. See Example 7.

49. $x - 7 = -9$; $x = -2$

54. $x + 21 = 21$; $x = 0$

50. $x - 4 = -10$; $x = -6$

55. $3 - y = 6$; $y = 3$

51. $a + 5 = -10$; $a = -15$

56. $5 - y = 10$; $y = 5$

52. $a - 3 = -12$; $a = -9$

57. $22 + x = -1$; $x = -23$

53. $x + 13 = 13$; $x = 0$

58. $30 + x = -2$; $x = -32$

 Subtract using a calculator.

59. a. $14,655 - 15,287$

b. $14,655 - (-15,287)$

60. a. $22,456 - 35,000$

b. $22,456 - (-35,000)$

61. a. $-203,450 - 16,500 + 45,600$

b. $-203,450 - (-16,500) + (-45,600)$

62. a. $500,000 - 1,043,500 - 250,000 + 175,500$

b. $500,000 - (-1,043,500) - (-250,000) + (-175,500)$

63. a. $345,300 - 42,670 - 356,020 - 250,000 + 321,000$

b. $345,300 - (-42,670) - (356,020) - (-250,000) + (-321,000)$

Applications

Solve.

64. Beginning with a temperature of 8° above zero, the temperature was measured hourly for 4 hours. It rose 3° , dropped 7° , and rose 1° . What was the final temperature recorded?

65. In a 5-day week, the NASDAQ stock market posted a gain of 145 points, a loss of 100 points, a loss of 82 points, a gain of 50 points, and a gain of 25 points. If the NASDAQ started the week at 6300 points, what was the value of the market at the end of the week?

66. In 10 running plays in a football game, the halfback gained 2 yards, gained 12 yards, lost 5 yards, lost 3 yards, gained 22 yards, gained 3 yards, gained 7 yards, lost 2 yards, gained 4 yards, and gained 45 yards. What was his net yardage for the game?

67. George and his wife went on a diet plan for 5 weeks. During these 5 weeks, George lost 5 pounds, gained 2 pounds, lost 4 pounds, lost 6 pounds, and gained 3 pounds. What was his total loss or gain for these 5 weeks? If he weighed 225 pounds when he started the diet, what did he weigh at the end of the 5-week plan?

68. In a 5-day week, the Dow Jones stock market mean showed a gain of 32 points, a gain of 10 points, a loss of 2 points, and a loss of 25 points. What was the net change in the stock market for the week? If the Dow started the week at 22,110 points, what was the mean at the end of the week?
69. A checking account was overdrawn and showed a balance of $-\$75$. After the account owner deposited money, the account showed a balance of $\$140$. How much money did the account owner deposit?
70. Before a delivery, a bakery had 47 eggs in its inventory. After the delivery, the bakery had 335 eggs in its inventory. How many eggs were delivered?
71. A diver dives off a diving board that is 10 meters above the ground into a pool. The diver reaches a depth of 3.5 meters below the surface of the pool. How far did the diver dive?
72. In her long jump competition, Josie miscalculates her final leap and starts her long jump from 5 inches behind the starting line. Her jump distance, measured from the starting line, is 178 inches. How far did Josie actually jump?

Writing & Thinking

73. Under what conditions can the difference between two negative numbers be a positive number?
74. Explain how a subtraction problem is changed to an addition problem. Give an example.
75. Give two examples to illustrate why subtraction is not commutative.
76. Give two examples to illustrate why subtraction is not associative.