

**Example 6 Application: Calculating Net Change**

Robert weighed 230 lb when he started to diet. The first month he lost 7 lb, the second month he gained 2 lb, and the third month he lost 5 lb. What was his weight after 3 months of dieting? What was his net change in weight?

**Solution**

His weight after 3 months can be calculated as follows.

$$\begin{aligned} 230 + (-7) + (+2) + (-5) \\ = 223 + (+2) + (-5) \\ = 225 + (-5) \\ = 220\text{lb} \end{aligned}$$

His net change in weight was

$$230 - 220 = 10\text{ lb.}$$

Thus, Robert's weight after 3 months of dieting was 220 lb which was a net change of 10 lb.

**Now work margin exercise 6.****Margin Exercise Answers**

1. a. -14 b. +9.2 2. a. -11 b. 0 c. 3.8 d.  $-\frac{3}{4}$  e.  $\frac{13}{10}$  3.  $-19^\circ\text{F}$  4. -11,000 ft 5. 19 sales  
6. 221 lb; 15 lb

6. Shawn weighed 236 lb when he started to diet. The first month he lost 8 lb, the second month he gained 3 lb, and the third month he lost 10 lb. What was his weight after 3 months of dieting? What was his net change in weight?

## 8.3 Exercises

### Concept Check

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

- The \_\_\_\_\_ is the opposite of a real number.
- On a horizontal number line, to move in the positive direction is to move to the \_\_\_\_\_.
- On a horizontal number line, to move in the negative direction is to move to the \_\_\_\_\_.
- To subtract  $b$  from  $a$ , add the \_\_\_\_\_ of  $b$  to  $a$ .
- To find the change in value between two numbers, take the end value and \_\_\_\_\_ the beginning value.
- The algebraic sum of several numbers is their \_\_\_\_\_.

**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.)

- The sum of a number and its additive inverse is the number itself.
- The additive inverse of negative seven is seven.

9. We can think of addition of numbers as accumulating numbers.  
 10. The expression “ $15 - 7$ ” can be thought of as “fifteen plus negative seven.”

## Practice

Find the additive inverse (opposite) of each real number. See Example 1.

- |         |                   |
|---------|-------------------|
| 1. 11   | 7. 0              |
| 2. 17   | 8. $\frac{9}{16}$ |
| 3. -6   | 9. $-\frac{5}{7}$ |
| 4. -2   | 10. -257          |
| 5. 4.7  |                   |
| 6. -3.4 |                   |

Subtract. Reduce fractions to lowest terms. See Example 2.

- |                    |                                   |
|--------------------|-----------------------------------|
| 11. $8 - 3$        | 24. $5.3 - (-1.7)$                |
| 12. $5 - 7$        | 25. $-1.4 - 2.6$                  |
| 13. $-4 - 6$       | 26. $-8.5 - 7.1$                  |
| 14. $-18 - 17$     | 27. $1.6 - (-8.4)$                |
| 15. $3 - (-4)$     | 28. $1.5 - 2.3$                   |
| 16. $5 - (-7)$     | 29. $\frac{2}{5} - \frac{3}{4}$   |
| 17. $-8 - (-11)$   | 30. $\frac{7}{15} - \frac{2}{15}$ |
| 18. $-14 - 2$      | 31. $\frac{5}{16} - \frac{9}{16}$ |
| 19. $0 - (-12)$    | 32. $\frac{5}{6} - \frac{7}{10}$  |
| 20. $-8 - 7$       | 33. $\frac{9}{20} - \frac{3}{8}$  |
| 21. $16 - (-8)$    | 34. $\frac{3}{14} - \frac{5}{6}$  |
| 22. $15 - 23$      |                                   |
| 23. $2.8 - (-3.1)$ |                                   |

Perform the indicated operation to find the net change in value. See Examples 5 and 6.

- |                       |                         |
|-----------------------|-------------------------|
| 35. $-6 + (-4) - 5$   | 40. $-8 - 5 - (-3)$     |
| 36. $-2 - 2 + 11$     | 41. $-7 - (-2) + 6$     |
| 37. $6 + (-3) + (-4)$ | 42. $-3 - (-3) + (-6)$  |
| 38. $-3 + (-7) + 2$   | 43. $9.7 - 1.6 - (8.1)$ |
| 39. $-5 - 2 - (-4)$   | 44. $-11.3 + 5.3 - 7.9$ |

Simplify the expression on each side of the blank and then fill in the blank with the proper symbol:  $<$ ,  $>$ , or  $=$ .

45.  $-6 + (-2)$  \_\_\_\_\_  $3 + (-8)$

50.  $0 - 6$  \_\_\_\_\_  $0 - (-6)$

46.  $-4 - (-3)$  \_\_\_\_\_  $-4 + (-3)$

51.  $-8 - (-8)$  \_\_\_\_\_  $-14 - 13$

47.  $5.1 - 8.2$  \_\_\_\_\_  $8.2 - 5.1$


52.  $-\frac{7}{4} - \left(-\frac{3}{8}\right)$  \_\_\_\_\_  $\frac{1}{2} - \frac{7}{3}$

48.  $7 - (-3)$  \_\_\_\_\_  $-3 - 7$

53.  $-151 - 86$  \_\_\_\_\_  $-107 - 141$

49.  $\frac{11}{2} + \left(-\frac{3}{4}\right)$  \_\_\_\_\_  $\frac{11}{2} - \frac{3}{4}$

54.  $2.5 - 6.2$  \_\_\_\_\_  $-1.1 - 2.3$

 Use your calculator to simplify the expression on each side of the blank and then fill in the blank with the proper symbol:  $<$ ,  $>$ , or  $=$ .

55.  $648 - (-396)$  \_\_\_\_\_  $124 - 163$

56.  $-19,824 - 23,417$  \_\_\_\_\_  $12,793 - (-14,387)$

57.  $-43,931 - (-28,677)$  \_\_\_\_\_  $-(13,665 + 21,425)$

58.  $-(24,295 + 13,107)$  \_\_\_\_\_  $-48,261 - (-16,276)$

Solve.

59. Find the difference between  $-5$  and  $-6$ . (**Hint:** Subtract the numbers in the order given.)

63. Subtract 13 from  $-13$ .

60. Find the difference between 30 and  $-12$ . (**Hint:** Subtract the numbers in the order given.)

64. Subtract 20 from  $-20$ .

65. Find the sum of  $-12$  and 6. Then subtract  $-17$ .

61. Subtract  $-3$  from  $-10$ .

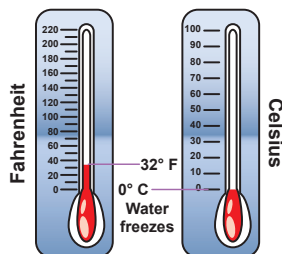
66. Find the sum of 11 and  $-13$ . Then subtract 25.

62. Subtract  $-2$  from 6.

## Applications

Solve.

67. At 2 p.m., the temperature was  $76^\circ\text{F}$ .  
At 8 p.m., the temperature was  $58^\circ\text{F}$ .  
What was the change in temperature?



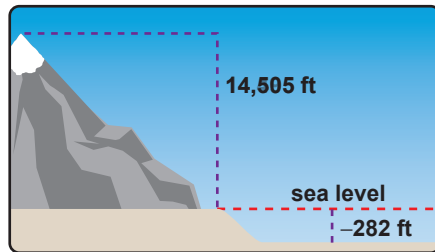
68. According to NASA, the temperature on the Earth's moon during the day is  $260^\circ\text{F}$  and during the night it is  $-280^\circ\text{F}$ . What is the daily temperature change on the moon? <sup>1</sup>

69. On July 1, a certain stock opened at  $\$53$  per share. One month later, on August 1, the stock opened at  $\$60$  per share. Find the change in price of the stock.

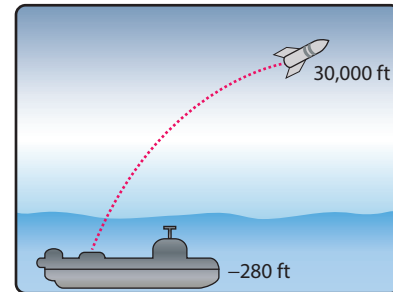
<sup>1</sup> Source: [NASA.gov](http://NASA.gov)

70. Mr. Meade is having a hard time selling his old car. He just slashed the price from \$3500 to \$2750. By how much did he change the price?

71. If you travel from the top of Mt. Whitney, elevation 14,505 ft, to the floor of Death Valley, elevation 282 ft below sea level, what is the change in elevation?

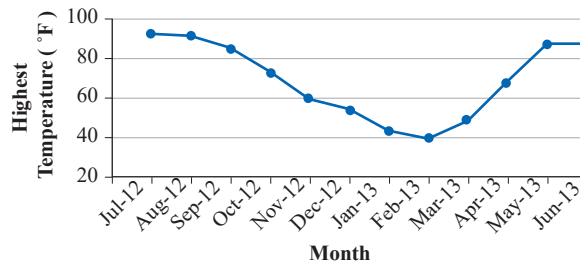


72. A submarine submerged 280 ft below the surface of the sea and fired a rocket that reached an altitude of 30,000 ft. What was the change in altitude of the rocket?



73. The highest temperatures recorded per month from July 2012 through June 2013 in Marquette, MI, are shown. Use the graph to answer the questions. <sup>2</sup>

**Highest Recorded Temperatures,  
July 2012-June 2013, Marquette, MI**



- Was the change in temperature negative or positive from October 2012 to November 2012?
  - Was the change in temperature negative or positive from April 2013 to May 2013?
  - Between which two months did the smallest change in high temperature occur?
  - Between which two months did the largest change take place?
74. James decided to take a road trip from Wilmington, NC, to Los Angeles, CA. The total distance of the trip is 2590 miles. He stops for a break after he has traveled 438 miles. How many more miles must James travel before he reaches Los Angeles?
75. The Kingston Construction Co. made a bid of \$7,043,272 to build a stretch of freeway, but the Beach City Construction Co. made a lower bid of \$6,792,868. How much lower was the Beach City bid?
76. A couple sold their house for \$175,000. They paid the realtor \$9100, and other expenses of the sale came to \$800. If they owed the bank \$126,000 for the mortgage, what were their net proceeds from the sale?
77. If you had \$980 in your checking account and you wrote a check for \$358 and made a deposit of \$225, what would be the balance in the account?

<sup>2</sup> Source: [weather.gov](http://weather.gov)

78. In pricing a four-door car, Pat found she would have to pay a base price of \$30,500 plus \$2135 in taxes and \$1006 for license fees. For a two-door sedan car of the same make, she would pay a base price of \$25,000 plus \$1750 in taxes and \$825 for license fees. Including all expenses, how much cheaper was the two door model?
79. The cost of repairing Sylvia's dishwasher would be \$350 for parts (including tax) plus \$105 for labor. To buy a new dishwasher, she would pay \$670 plus \$40 in sales tax, and a friend of hers would pay her \$90 for her old dishwasher. How much more would Sylvia have to pay to buy a new dishwasher than to have her old one repaired?
80. During a football game, the home team gained 28 yards, gained 9 yards, lost 2 yards, gained 5 yards, gained 1 yard, gained 10 yards, lost 5 yards on a penalty, and lost 11 yards. What was the team's net yardage on this possession of the football?
81. Beginning at a temperature of 10 °C, the temperature in a scientific experiment was measured hourly for four hours. It dropped 5 °C, dropped 8 °C, dropped 6 °C, then rose 3 °C. What was the final temperature recorded?
82. Harry went on a diet for 5 weeks. During those 5 weeks, Harry lost 5 pounds, gained 3 pounds, lost 2 pounds, lost 4 pounds, and gained 1 pound. What was his total loss (or gain) for the 5 weeks? If he weighed 210 pounds when he started the diet plan, what did he weigh at the end of the 5-week period?
83. In a 5-day week the NASDAQ posted a gain of 38 points, a loss of 65 points, a loss of 32 points, a gain of 10 points, and a gain of 15 points. If the NASDAQ started the week at 2350 points, what was the market at the end of the week?
84. Many personal securities accounts have a cash fund to receive dividends. The investor is free to withdrawal money from that account, as well as make deposits. Unlike regular checking accounts, there is no overdraft penalty when the balance is less than zero dollars; instead, a nominal interest rate is charged until the balance becomes positive. In addition, this type of account will accrue interest on positive balances. At the beginning of an account period the balance is \$3520, and five transactions are made before the next statement is posted as follows: \$300 deposit, \$2500 withdrawal, \$1800 withdrawal, \$253 deposit, and \$450 withdrawal. What is the balance at the close of this accounting period?
85. A family has a rain cistern to collect rainwater runoff from the roof to water their lawn and garden. When it rains, the garden does not need to be watered, and the cistern just collects additional water for future use. When it doesn't rain, the stored water is needed to water the plants. At the beginning of a five-week period, the cistern has 873 gallons of water, and the net intake/outflow was noted at the end of each week. First it rose by 461 gallons, then it dropped by 349 gallons, then it dropped by 217 gallons, followed by a 275 gallon increase, and a 177 gallon increase. How many gallons does the cistern contain after this five week period?
86. John goes to a casino in Las Vegas and plays six games. His wins and losses for each respective game was \$15 gained, \$50 lost, \$20 lost, \$80 gained, \$100 lost, and \$40 lost. What was John's net gain or loss?

87. The population of San Bernardino County, California, in 2003 was 197,126. The population shift for the next five years is shown on the chart below.<sup>3</sup>

Year	Population Shift
2004	+2696
2005	-554
2006	+162
2007	-955
2008	+105

- a. What was the change in population in that five year period?
- b. What is the population in 2008?
88. The manager of a music store is required to keep track of the inventory for each instrument that the store rents out. The store had twenty-five trumpets in stock at the beginning of the school year before twelve trumpets were rented out. Five trumpets were returned by the end of the first semester. Seven additional trumpets were rented at the beginning of the second semester. Eight trumpets were returned at the end of the second semester.
- a. How many trumpets did the store have in stock at the end of the second semester?
- b. What was the change in the trumpet inventory between the beginning of the school year and the end of the second semester?
89. A chemist is determining the water content of different foods in his lab by completely dehydrating food samples (that is, he is removing all of the water). He started an experiment with a fresh white potato that had a mass of 115 g. The mass of the potato after being dehydrated was 24.15 g. This situation can be described by the equation  $115 - w = 24.15$ , where  $w$  is the amount of water mass the potato lost in grams. Determine the water mass of the fresh potato by substituting each of the following values into the equation to find the solution: 90.15 g, -90.15 g, 90.85 g, -90.85 g
90. Grace keeps track of her grade average in Introduction to Anthropology throughout the semester. After the first exam, she had a 93.5%. A project decreased her average grade by 1.5%. The next exam decreased her grade by 4.7%. A term paper increased her grade by 2.3%. The final increased her grade by 3.1%.
- a. What was Grace's grade average at the end of the semester?
- b. What was the change in Grace's grade average during the semester?
91. Beginning with a temperature of 8 °F above zero, the temperature was measured hourly for 4 hours. It rose 3 °F, dropped 7 °F, dropped 2 °F, and rose 1 °F. What was the final temperature recorded?
92. 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 period?
93. 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 4200 points, what was the market at the end of the week?

3 Source: [www.idcide.com/citydata/ca/san-bernardino.htm](http://www.idcide.com/citydata/ca/san-bernardino.htm)

94. 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? This was a good game for him, but not his best.

## Writing & Thinking

95. Explain, in your own words, how to find the difference between a positive and a negative number.
96. What is the additive inverse of 0? Why?
97. Under what conditions can the difference between two negative numbers be a positive number?
98. Explain how a subtraction problem is changed to an addition problem. Give an example.