

Chapter 2

Introduction to Integers and Algebraic Expressions

Exercise Set 2.1

2. $-20,000,000$
4. $-2438; -8000$
6. $-58.5; 56.5$
8. $20; -150; 300$
10. $7 > 0$
12. $-7 < 0$
14. $6 > -6$
16. $-1 > -7$
18. $-5 < -3$
20. $-5 > -11$
22. $-6 < -5$
24. 11
26. 4
28. 36
30. 54
32. 79
34. $-(-6) = 6$
36. $-(6) = -6$
38. $-(-1) = 1$
40. $-(-67) = 67$
42. $-(0) = 0$
44. $-(16) = -16$
46. $-(-(-8)) = -8$
48. $-(-3) = 3$
50. $-(-(-19)) = -19$
52. $-(-0) = 0$
54. $-(-73) = 73$
56. $-(-(-37)) = -37$
58. $-|-729| = -729$
60. $-|-1| = -1$

62. $-| -(-3) | = -|3| = -3$

64. $5^3 = 5 \cdot 5 \cdot 5 = 125$

66. $300 \cdot x = 1200$
 $\frac{300 \cdot x}{300} = \frac{1200}{300}$
 $x = 4$

68. $9^2 - 3[2 + (10 - 8)] = 9^2 - 3[2 + 2]$
 $= 9^2 - 3 \cdot 4$
 $= 81 - 3 \cdot 4$
 $= 81 - 12$
 $= 69$

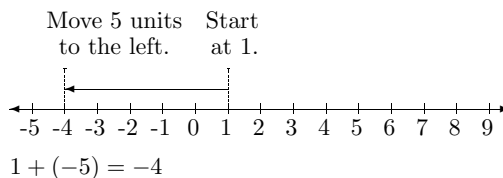
70. $|4| = 4$ and $|-7| = 7$, so $|4| < |-7|$.

72. The numbers whose distance from 0 is 7 are -7 and 7 . These are the solutions of $|x| = 7$.

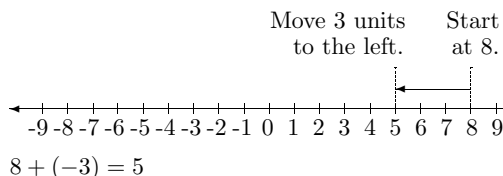
74. $-(-x) = x$
 $-(-(-x)) = -(x) = -x$
 $-(-(-(-x))) = -(-x) = x$

Exercise Set 2.2

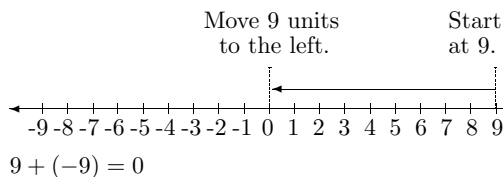
2. $1 + (-5)$



4. $8 + (-3)$

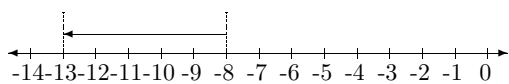


6. $9 + (-9)$



8. $-8 + (-5)$

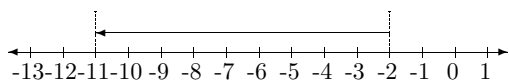
Move 5 units to the left. Start at -8 .



$-8 + (-5) = -13$

10. $-2 + (-9)$

Move 9 units to the left. Start at -2 .



$-2 + (-9) = -11$

12. -10

14. -24

16. -11

18. 27

20. 1

22. -7

24. 0

26. 0

28. -2

30. 11

32. 0

34. 20

36. -34

38. -7

40. -10

42. -20

44. 6

46. 0

48. -50

50. 0

52. $23 + (-5) + 4 = 18 + 4 = 22$

54. $40 + (-8) + 5 = 32 + 5 = 37$

56. $-25 + 25 + (-9) = 0 + (-9) = -9$

58. $63 + (-18) + 12 = 45 + 12 = 57$

60. $-35 + (-63) + 35 = -35 + 35 + (-63) = 0 + (-63) = -63$

62. $75 + (-14) + (-17) + (-5) = 75 + (-36) = 39$

64. $27 + (-54) + (-32) + 65 + 46 =$

$27 + 65 + 46 + (-54) + (-32) = 138 + (-86) = 52$

66. $35 + (-51) + 29 + 51 + (-35) = 35 + (-35) + (-51) + 51 + 29 = 0 + 0 + 29 = 29$

68.
$$\begin{array}{r} 2914 \\ -3046 \\ \hline -2973 \\ \hline 73 \end{array}$$

70.
$$\begin{array}{r} 2 \\ 56 \\ \times 42 \\ \hline 112 \\ 2240 \\ \hline 2352 \end{array}$$

72. Since the digit to the right of the tens place is 5 or higher, we round 9 tens to 10 tens. This requires us to change 4 hundreds to 5 hundreds and 9 tens to 0 tens. Then we change the digit to the right of tens to zero. The result is 3500.

74. $|-32| + (-|15|) = 32 + (-15) = 17$

76. Use a calculator.

$497 + (-3028) = -2531$

78. If $-x$ is negative, it is the reflection of a positive number x across 0 on the number line. Thus, $-x$ is negative for all positive numbers x .

80. If $n = m$ and n is negative, then m is also negative and $-n$ and $-m$ are both positive. Thus, $-n + (-m)$, the sum of two positive numbers, is positive.

82. If n is positive and m is greater than n , then m is also positive. Thus $n + m$, the sum of two positive numbers, is positive.

Exercise Set 2.3

2. -5

4. -8

6. 2

8. 0

10. -5

12. 19

14. 3

16. 0

18. 0

20. 8

22. -11

24. 16

26. -16
28. -6
30. -1
32. 11
34. -23
36. -2
38. -25
40. 1
42. -9
44. 11
46. -45
48. -81
50. -52
52. 121
54. 0
56. -10
58. $-5 - (-8) + 3 - (-7) = -5 + 8 + 3 + 7 = 13$
60. $-43 - (-19) - (-21) + 25 = -43 + 19 + 21 + 25$
 $= -43 + 65$
 $= 22$
62. $39 + (-88) - 29 - (-83)$
 $= 39 + (-88) + (-29) + 83$
 $= 39 + 83 + (-88) + (-29)$
 $= 122 + (-117)$
 $= 5$
64. $84 + (-99) + 44 - (-18) - 43$
 $= 84 + (-99) + 44 + 18 + (-43)$
 $= 84 + 44 + 18 + (-99) + (-43)$
 $= 146 + (-142)$
 $= 4$
66. $14 - (-50) + 20 - (-32) = 14 + 50 + 20 + 32$
 $= 116$
68. $81 - (-20) - 14 - (-50) + 53$
 $= 81 + 20 + (-14) + 50 + 53$
 $= 81 + 20 + 50 + 53 + (-14)$
 $= 204 + (-14)$
 $= 190$
70. We subtract the first page number from the final page number.
 $37 - 29 = 8$
 James wrote 8 pages.
72. $\$129 - \$477 = -\$348$
 Laura now owes \$348 on her credit card.
74. Let S = the final value of the stock.
 $S = \$61 + \$5 - \$7 + \$4 = \$63$
76. We add the elevation at the base to the height of the mountain.
 $-19,684 + 33,480 = 13,796$.
 The peak is 13,796 ft above sea level.
78. Let D = the difference between the temperatures.
 $D = 840^\circ\text{F} - (-290^\circ\text{F}) = 1130^\circ\text{F}$
80. The integer 3 corresponds to 3 over par, and the integer -2 corresponds to 2 under par. We subtract the original average score from the improved score.
 $-2 - 3 = -5$
 Cedric's average score decreased 5 strokes.
82. Let B = the new balance.
 $B = \$470 - \$45 + \$160 - \$500 = \$85$
 Lyle owes \$85.
84. We subtract the lower elevation from the higher elevation:
 $-8648 - (-11,033) = 2385$
 The difference in elevation is 2385 m.
86. We first subtract the cost of the tolls from the original balance.
 $13 - 20 = -7$
 Then we subtract the cost of the fines and fees from the new balance.
 $-7 - 80 = -87$
 The Murrays would be \$87 in debt.
88.
$$\begin{array}{r} 72 \\ \times 68 \\ \hline 576 \\ 4320 \\ \hline 4896 \end{array}$$
90.
$$\begin{array}{r} 143 \\ \times 29 \\ \hline 1287 \\ 2860 \\ \hline 4147 \end{array}$$
92. $24 \cdot 12 \text{ oz} = 288 \text{ oz}$
94. $45 \div (2^2 + 11) = 45 \div (4 + 11)$
 $= 45 \div 15$
 $= 3$
96. $(13 - 2)(13 + 2) = 11 \cdot 15 = 165$
98. Use a calculator.
 $23,011 - (-60,432) = 83,443$
100. False; $0 - 3 \neq 3$.
102. True
104. False; $3 - 3 = 0$, but $3 \neq -3$.
106. x is the number we add to -48 to get -15 . If we think of starting at -48 on the number line and moving to -15 , we move 33 units to the right, so $x = 33$.

108. a) We add the values of the cards:

$$-1 + (-1) + 1 + 1 + 1 + (-1) + (-1) + 0 + (-1) + (-1) + 1 = -2$$

b) Since the final count on the sequence of cards is negative, the player has a winning edge.

Exercise Set 2.4

2. -21
4. -24
6. -24
8. -72
10. 16
12. 72
14. 24
16. 72
18. -120
20. 0
22. -123
24. 43
26. -200
28. 0
30. $(-7) \cdot (-4) \cdot (-1) = 28 \cdot (-1) = -28$
32. $9(-2)(-6)7 = 9 \cdot 12 \cdot 7 = 108 \cdot 7 = 756$
34. $(-2)(-5)(-3)(-5) = 10 \cdot 15 = 150$
36. $-6(-5)(-9) = 30(-9) = -270$
38. $19(-7)(-8) \cdot 0 \cdot 6 = 0$
40. $(-5)6(-4)5 = -30(-20) = 600$
42. $(-8)^2 = (-8)(-8) = 64$
44. $(-2)^4 = (-2)(-2)(-2)(-2) = 4 \cdot 4 = 16$
46. $(-1)^5 = (-1)(-1)(-1)(-1)(-1) = 1 \cdot 1 \cdot (-1) = 1 \cdot (-1) = -1$
48. $(-2)^6 = (-2)(-2)(-2)(-2)(-2)(-2) = 4 \cdot 4 \cdot 4 = 16 \cdot 4 = 64$
50. $-10^4 = -1 \cdot 10^4 = -1 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = -1 \cdot 100 \cdot 100 = -1 \cdot 10,000 = -10,000$
52. $(-1)^{13} = (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot (-1) = 1 \cdot 1 \cdot 1 \cdot (-1) = 1 \cdot (-1) = -1$
54. $-2^6 = -1 \cdot 2^6 = -1 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = -1 \cdot 4 \cdot 4 \cdot 4 = -4 \cdot 16 = -64$
56. $-2^5 = -1 \cdot 2^5 = -1 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = -2 \cdot 4 \cdot 4 = -8 \cdot 4 = -32$
58. $(-6)^8$ is read “negative six to the eighth power.”

60. -5^4 is read “the opposite of five to the fourth power.”

62. 60,000,000

$$\begin{array}{r} 64. \quad \frac{2}{3} 4 \\ \times 75 \\ \hline 170 \\ 2380 \\ \hline 2550 \end{array}$$

$$\begin{aligned} 66. \quad & 2 \cdot 5^2 - 3 \cdot 2^3 \div (3 + 3^2) \\ & = 2 \cdot 5^2 - 3 \cdot 2^3 \div (3 + 9) \\ & = 2 \cdot 5^2 - 3 \cdot 2^3 \div 12 \\ & = 2 \cdot 25 - 3 \cdot 8 \div 12 \\ & = 50 - 24 \div 12 \\ & = 50 - 2 \\ & = 48 \end{aligned}$$

68. $2880 \div 12 = 240$ cartons

70. $50 \div 16 = 3$ R 2, so 4 trips will be required.

$$\begin{aligned} 72. \quad & (-2)^3 \cdot [(-1)^{29}]^{46} \\ & = (-2)^3 \cdot [-1]^{46} \\ & = -8 \cdot 1 \\ & = -8 \end{aligned}$$

$$\begin{aligned} 74. \quad & -5^2(-1)^{29} \\ & = -1 \cdot 5^2(-1)^{29} \\ & = -1 \cdot 5^2 \cdot (-1) \\ & = -1 \cdot 25 \cdot (-1) \\ & = -25 \cdot (-1) \\ & = 25 \end{aligned}$$

$$\begin{aligned} 76. \quad & |-12(-3)^2 - 5^3 - 6^2 - (-5)^2| \\ & = |-12 \cdot 9 - 125 - 36 - 25| \\ & = |-108 - 125 - 36 - 25| \\ & = |-294| \\ & = 294 \end{aligned}$$

78. Use a calculator.

$$-53^2 = -2809$$

80. Use a calculator.

$$(-23)^4 = 279,841$$

82. Use a calculator.

$$(-49 + 34)^3 = -3375$$

84. Use a calculator.

$$(-17)^4(129 - 133)^5 = -85,525,504$$

86. The integer -95 corresponds to the elevation of 95 m below the surface. At a rate of 7 meters per minute, in 9 min the diver rises $7 \cdot 9$ m. We have:

$$\begin{aligned} -95 + 7 \cdot 9 & = -95 + 63 \\ & = -32 \end{aligned}$$

The diver’s new elevation is 32 m below the surface, or -32 m.

88. (a) If $-mn$ is positive, then mn is negative so m and n must have different signs.
 (b) If $-mn$ is zero, then at least one of m and n must be zero.
 (c) If $-mn$ is negative, then mn is positive so m and n must have the same sign.

Exercise Set 2.5

2. -6
 4. -2
 6. 11
 8. 8
 10. -2
 12. -50
 14. -16
 16. 21
 18. 0
 20. 29
 22. -31
 24. Undefined
 26. -17
 28. -23
 30. $8 - (2 \cdot 3 - 9) = 8 - (6 - 9)$
 $= 8 - (-3)$
 $= 11$
 32. $(8 - 2)(3 - 9) = 6(-6)$
 $= -36$
 34. $10 \cdot 20 - 15 \cdot 24 = 200 - 360$
 $= -160$
 36. $2^4 + 2^2 - 10 = 16 + 4 - 10$
 $= 20 - 10$
 $= 10$
 38. $4^3 + 10 \cdot 20 + 8^2 - 23 = 64 + 10 \cdot 20 + 64 - 23$
 $= 64 + 200 + 64 - 23$
 $= 264 + 64 - 23$
 $= 328 - 23$
 $= 305$
 40. $5^3 + 4 \cdot 9 - (8 + 9 \cdot 3)$
 $= 5^3 + 4 \cdot 9 - (8 + 27)$
 $= 5^3 + 4 \cdot 9 - 35$
 $= 125 + 4 \cdot 9 - 35$
 $= 125 + 36 - 35$
 $= 161 - 35$
 $= 126$
 42. $-6 + (-3)^2 + 6 \div (-2) = -6 + 9 + 6 \div (-2)$
 $= -6 + 9 - 3$
 $= 3 - 3$
 $= 0$
 44. $9 - (-2)^3 - 50 \div 2 = 9 - (-8) - 50 \div 2$
 $= 9 - (-8) - 25$
 $= 9 + 8 - 25$
 $= 17 - 25$
 $= -8$
 46. $\frac{100 - 6^2}{(-5)^2 - 3^2} = \frac{100 - 36}{25 - 9}$
 $= \frac{64}{16}$
 $= 4$
 48. $10(-5) \div 1(-1) = -50 \div 1(-1)$
 $= -50(-1)$
 $= 50$
 50. $14 \div 2(-6) + 7 = 7(-6) + 7$
 $= -42 + 7$
 $= -35$
 52. $9 \cdot 0 \div 5 \cdot 4 = 0 \div 5 \cdot 4$
 $= 0 \cdot 4$
 $= 0$
 54. $-5^2 + 7 = -25 + 7 = -18$
 56. $-9^2 - 11 = -81 - 11 = -92$
 58. $(2 - 5)^2 \div (-9) = (-3)^2 \div (-9)$
 $= 9 \div (-9)$
 $= -1$
 60. $3 - 3^2 = 3 - 9$
 $= -6$
 62. $20 + 4^3 \div (-8) = 20 + 64 \div (-8)$
 $= 20 - 8$
 $= 12$
 64. $-7(3^4) + 18 = -7(81) + 18$
 $= -567 + 18$
 $= -549$
 66. $8[(6 - 13) - 11] = 8[-7 - 11]$
 $= 8[-18]$
 $= -144$
 68. $256 + (-32) \div (-4) = 256 + 8$
 $= 264$
 70. $-1 - 5[3 - (7 - 4^2)] = -1 - 5[3 - (7 - 16)]$
 $= -1 - 5[3 - (-9)]$
 $= -1 - 5[3 + 9]$
 $= -1 - 5 \cdot 12$
 $= -1 - 60$
 $= -61$
 72. $-10[(2 - 8)^2 - 6] = -10[(-6)^2 - 6]$
 $= -10[36 - 6]$
 $= -10 \cdot 30$
 $= -300$

$$\begin{aligned}
 74. \quad |8 - 7 - 9| \cdot 2 + 1 &= |1 - 9| \cdot 2 + 1 \\
 &= |-8| \cdot 2 + 1 \\
 &= 8 \cdot 2 + 1 \\
 &= 16 + 1 \\
 &= 17
 \end{aligned}$$

$$\begin{aligned}
 76. \quad 9 - |5 - 7|^3 &= 9 - |-2|^3 \\
 &= 9 - 2^3 \\
 &= 9 - 8 \\
 &= 1
 \end{aligned}$$

$$\begin{aligned}
 78. \quad \frac{6 \div 2 \cdot 4^2 - 7^2 + 1}{(7 - 4)^3 - 2 \cdot 5 - 4} &= \frac{6 \div 2 \cdot 16 - 49 + 1}{3^3 - 2 \cdot 5 - 4} \\
 &= \frac{3 \cdot 16 - 49 + 1}{27 - 2 \cdot 5 - 4} \\
 &= \frac{48 - 49 + 1}{27 - 10 - 4} \\
 &= \frac{-1 + 1}{17 - 4} \\
 &= \frac{0}{13} \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 80. \quad \frac{5 \cdot 6^2 \div (2^2 \cdot 5) - 7^2}{3^2 - 4^2 - (-2)^3 - 2} &= \frac{5 \cdot 6^2 \div (4 \cdot 5) - 7^2}{9 - 16 - (-8) - 2} \\
 &= \frac{5 \cdot 6^2 \div 20 - 7^2}{9 - 16 + 8 - 2} \\
 &= \frac{5 \cdot 36 \div 20 - 49}{-7 + 8 - 2} \\
 &= \frac{180 \div 20 - 49}{1 - 2} \\
 &= \frac{9 - 49}{-1} \\
 &= \frac{-40}{-1} \\
 &= 40
 \end{aligned}$$

$$\begin{aligned}
 82. \quad \frac{(3 - 5)^2 - (7 - 13)}{(2 - 5)3 + 2 \cdot 4} &= \frac{(-2)^2 - (-6)}{-3 \cdot 3 + 2 \cdot 4} \\
 &= \frac{4 - (-6)}{-3 \cdot 3 + 2 \cdot 4} \\
 &= \frac{4 - (-6)}{-9 + 8} \\
 &= \frac{10}{-1} \\
 &= -10
 \end{aligned}$$

$$\begin{aligned}
 84. \quad \frac{-16 \cdot 28 \div 2^2}{5 \cdot 25 - 5^3} &= \frac{-16 \cdot 28 \div 4}{5 \cdot 25 - 125} \\
 &= \frac{-448 \div 4}{125 - 125} \\
 &= \frac{-112}{0}
 \end{aligned}$$

Since division by 0 is undefined, this expression is undefined.

$$86. \quad 4 \cdot 62 = 248 \text{ rooms}$$

$$88. \quad 378 \div 14 = 27 \text{ gallons}$$

$$90. \quad 7 \cdot 8 = 56 \text{ g per bag}; 12 \cdot 56 = 672 \text{ g}$$

92. $24 \div 5 = 4 \text{ R } 4$, so each person will receive 4 lozenges and 4 lozenges will remain.

$$\begin{aligned}
 94. \quad \frac{7^3 \cdot 9 - 6^2 \cdot 8 + 4^3 \cdot 6}{5^2 - 25} &= \frac{343 \cdot 9 - 36 \cdot 8 + 64 \cdot 6}{25 - 25} \\
 &= \frac{3087 - 288 + 384}{0}
 \end{aligned}$$

This expression is undefined.

$$\begin{aligned}
 96. \quad \frac{(7 - 8)^{37}}{7^2 - 8^2} \cdot (98 - 7^2 \cdot 2) &= \frac{(-1)^{37}}{49 - 64} \cdot (98 - 49 \cdot 2) \\
 &= \frac{-1}{-15} \cdot (98 - 98) \\
 &= \frac{-1}{-15} \cdot 0 \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 98. \quad \frac{195 + (-15)^3}{195 - 7 \cdot 5^2} &= \frac{195 - 3375}{195 - 7 \cdot 25} \\
 &= \frac{195 - 3375}{195 - 175} \\
 &= \frac{-3180}{20} \\
 &= -159
 \end{aligned}$$

100. Use a calculator.

$$9^3 - 36^3/12^2 + 9^2 = 486$$

$$102. \quad \left(\left[1 \right] \left[6 \right] \left[x^2 \right] \left[- \right] \left[2 \right] \left[4 \right] \left[\times \right] \left[2 \right] \left[3 \right] \right) \left[\div \right] \left(\left[3 \right] \left[\times \right] \left[4 \right] \right) \left[+ \right] \left[5 \right] \left[x^2 \right] \right) \left[= \right]$$

104. Entering the given keystrokes and then pressing $\boxed{=}$, we get 2.

106. $-n$ is negative and $-m$ is positive, so $\frac{-n}{-m}$ is the quotient of a negative and a positive number and, thus, is negative.

108. n and $-m$ are both positive, so $\frac{n}{-m}$ is the quotient of two positive numbers and, thus, is positive. Then $-\left(\frac{n}{-m}\right)$ is the opposite of a positive number and, thus, is negative.

Chapter 2 Mid-Chapter Review

- The statement is false. The integer 0 is neither positive nor negative.
- If $a > b$, then a lies to the right of b on the number line. Thus, the given statement is false.
- The absolute value of a number is its distance from zero on the number line. Since distance is always nonnegative, the absolute value of a number is always nonnegative. The given statement is true.
- $-x = -(-4) = 4$
 $-(-x) = -(-(-4)) = -(4) = -4$

5. $5 - 13 = 5 + (-13) = -8$
6. $-6 - (-7) = -6 + 7 = 1$
7. The integer 450 corresponds to a \$450 deposit; the integer -79 corresponds to writing a check for \$79.
8. $-(9) = -9$
9. Since -6 is to the left of 6, we have $-6 < 6$.
10. Since -5 is to the left of -3, we have $-5 < -3$.
11. Since -10 is to the left of 0, we have $-10 < 0$.
12. Since -20 is to the right of -30, we have $-20 > -30$.
13. The distance of 38 from 0 is 38, so $|38| = 38$.
14. The distance of -18 from 0 is 18, so $|-18| = 18$.
15. The distance of 0 from 0 is 0, so $|0| = 0$.
16. The distance of -12 from 0 is 12, so $|-12| = 12$.
17. The additive inverse of -56 is 56 because $-56 + 56 = 0$.
18. The additive inverse of 3 is -3 because $3 + (-3) = 0$.
19. The additive inverse of 0 is 0 because $0 + 0 = 0$.
20. The additive inverse of -49 is 49 because $-49 + 49 = 0$.
21. If $x = -19$, then $-x = -(-19) = 19$.
22. If $x = 23$, then $-(-x) = -(-23) = 23$.
23. $7 + (-9)$ The absolute values are 7 and 9. The difference is $9 - 7$, or 2. The negative number has the larger absolute value, so the answer is negative. $7 + (-9) = -2$
24. $-6 + (-10)$ Two negative numbers
Add the absolute values, 6 and 10, getting 16. Make the answer negative.
 $-6 + (-10) = -16$
25. $36 + (-36)$ A positive and a negative number
The numbers have the same absolute value. The sum is 0.
 $36 + (-36) = 0$
26. $-8 + (-9)$ Two negative numbers
Add the absolute values, 8 and 9, getting 17. Make the answer negative. $-8 + (-9) = -17$
27. $-9 + 10$ The absolute values are 9 and 10. The difference is $10 - 9$, or 1. The positive number has the larger absolute value, so the answer is positive.
 $-9 + 10 = 1$
28. $19 + (-17)$ The absolute values are 19 and 17. The difference is $19 - 17$, or 2. The positive number has the larger absolute value, so the answer is positive.
 $19 + (-17) = 2$
29. $2 - 28 = 2 + (-28) = -26$
30. $-8 - (-4) = -8 + 4 = -4$
31. $-3 - 10 = -3 + (-10) = -13$
32. $5 - (-11) = 5 + 11 = 16$
33. $0 - (-6) = 0 + 6 = 6$
34. $12 - 24 = 12 + (-24) = -12$
35. $-12 \cdot 3 = -36$
36. $6(-9) = -54$
37. $(-13)(-2) = 26$
38. $(-2)(-41) = 82$
39. $(-9)^2 = (-9)(-9) = 81$
40. $-9^2 = -1 \cdot 9^2 = -1 \cdot 9 \cdot 9 = -81$
41. $-75 \div (-3) = 25$
42. $-20 \div 4 = -5$
43. $17 - (-25) + 15 - (-18) = 17 + 25 + 15 + 18 = 75$
44. $-9 + (-3) + 16 - (-10) = -9 + (-3) + 16 + 10 = 14$
45. $(-7)(-2)(-1)(-3) = 14 \cdot 3 = 42$
46. $3 - 6 \cdot 5 - 11 = 3 - 30 - 11$
 $= -27 - 11$
 $= -38$
47. $-5^2 + 6[1 - (3 - 4)] = -5^2 + 6[1 - (-1)]$
 $= -5^2 + 6[1 + 1]$
 $= -5^2 + 6 \cdot 2$
 $= -25 + 6 \cdot 2$
 $= -25 + 12$
 $= -13$
48. $\frac{6^2 - 3(5 - 9)}{7^2 - (-5)^2} = \frac{36 - 3(5 - 9)}{49 - 25}$
 $= \frac{36 - 3(-4)}{24}$
 $= \frac{36 + 12}{24}$
 $= \frac{48}{24}$
 $= 2$
49. Let T = the difference in the temperatures, in degrees Celsius.
- | | | | | |
|-------------------------------|-----|-----------------------|-------|----------------------|
| Difference in
temperatures | is | Higher
temperature | minus | Lower
temperature |
| \downarrow | $=$ | \downarrow | $-$ | \downarrow |
| T | | 25 | | (-8) |
- We carry out the subtraction.
- $$T = 25 - (-8) = 25 + 8 = 33$$
- The difference in the two temperature is 33°C .

50. Let
- S
- = the final value of the stock.

$$\begin{array}{ccccccc} \text{Final} & = & \text{Beginning} & + & \text{First} & + & \text{Second} & + & \text{Third} \\ \text{value} & & \text{price} & & \text{change} & & \text{change} & & \text{change} \\ \downarrow & & \downarrow & & \downarrow & & \downarrow & & \downarrow \\ S & = & 56 & + & (-6) & + & 2 & + & (-8) \end{array}$$

We carry out the addition.

$$S = 56 + (-6) + 2 + (-8) = 44$$

The final value of the stock was \$44.

51. The student is confusing the absolute values of the numbers with the numbers themselves.
52. No; for example, $(10 - 5) - 2 = 5 - 2 = 3$, but $10 - (5 - 2) = 10 - 3 = 7$.
53. Answers may vary. If we think of the addition on the number line, we start at a negative number and move to the left. This always brings us to a point on the negative portion of the number line.
54. Yes; consider $m - (-n)$ where both m and n are positive. Then $m - (-n) = m + n$. Now $m + n$, the sum of two positive numbers, is positive.

Exercise Set 2.6

2. $99 \cdot 2 = 198¢$
4. $\frac{18}{2} = 9$
6. $\frac{5 \cdot 15}{-25} = \frac{75}{-25} = -3$
8. $\frac{72}{2} = 36$ yr
10. $9 - 2 \cdot 5 = 9 - 10 = -1$
12. $3(2 + 4) = 3(6) = 18$
14. $3 \cdot 2 + 3 \cdot 4 = 6 + 12 = 18$
16. $4 \cdot (-5) - 4 \cdot 1 = -20 - 4 = -24$
18. $4(-5 - 1) = 4 \cdot (-6) = -24$
20. $\frac{49 \cdot 10^2}{10} = \frac{49 \cdot 100}{10} = \frac{4900}{10} = 490$ m
22. $(2 + 10)^2 = 12^2 = 144$
24. $8 \cdot 17 + 8(-17) = 136 + (-136) = 0$
26. $\frac{5(50 - 32)}{9} = \frac{5 \cdot 18}{9} = \frac{90}{9} = 10$
28. $4 - y^2 = 4 - (-1)^2 = 4 - 1 = 3$
30. $a^2 + b^2 = 3^2 + 4^2 = 9 + 16 = 25$
32. $x^2 - x^3 = (-10)^2 - (-10)^3 = 100 - (-1000) = 100 + 1000 = 1100$
34. $-\frac{7}{x}, \frac{-7}{x}$
36. $\frac{-3}{r}, \frac{3}{-r}$
38. $-\frac{u}{5}, \frac{u}{-5}$
40. $-\frac{23}{m}, \frac{23}{-m}$
42. $\frac{-a}{b} = \frac{-40}{2} = -20;$
 $\frac{a}{-b} = \frac{40}{-2} = -20;$
 $-\frac{a}{b} = -\frac{40}{2} = -20$
44. $\frac{-a}{b} = \frac{-56}{7} = -8;$
 $\frac{a}{-b} = \frac{56}{-7} = -8;$
 $-\frac{a}{b} = -\frac{56}{7} = -8$
46. $(-2x)^2 = (-2 \cdot 3)^2 = (-6)^2 = 36;$
 $-2x^2 = -2(3)^2 = -2 \cdot 9 = -18$
48. $2x^2 = 2(5)^2 = 2 \cdot 25 = 50;$
 $2x^2 = 2(-5)^2 = 2 \cdot 25 = 50$
50. $x^6 = 2^6 = 64;$
 $x^6 = (-2)^6 = 64$
52. $x^5 = 3^5 = 243;$
 $x^5 = (-3)^5 = -243$
54. $1^7 = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 = 1;$
 $(-1)^7 = (-1)(-1)(-1)(-1)(-1)(-1)(-1) = -1$
56. $7x + 7y$
58. $6a + 6$
60. $3x - 18$
62. $4(1 - y) = 4 \cdot 1 - 4 \cdot y = 4 - 4y$
64. $54m - 63$
66. $20x + 32 + 12p$
68. $-9y + 63$
70. $2x + 8$
72. $16x - 40y - 64z$
74. $-6a - 12b + 6c$
76. $45x - 5y + 40z$
78. $63a - 28b + 21c - 7d$
80. $-6a - 7b$
82. $-7x + 8y + 9$
84. $-a + b + c$

$$\begin{array}{r} 86. \quad \begin{array}{r} 2 \\ 5 \overline{) 3} \\ 3 1 \\ 5 3 \\ 9 0 1 \end{array} \end{array}$$

$$\begin{array}{r} 88. \quad \begin{array}{r} 9 9 4 \\ 3 \overline{) 2 9 8 2} \\ 2 7 \\ 2 8 \\ 2 7 \\ 1 2 \\ 1 2 \\ 0 \end{array} \end{array}$$

90. Price of wings: $3 \cdot \$12 = \36
 Price of nachos: $3 \cdot \$9 = \27
 Total price: $\$36 + \$27 = \$63$

$$92. \quad \frac{9C}{5} + 32 = \frac{9 \cdot 10}{5} + 32 = \frac{90}{5} + 32 = 18 + 32 = 50$$

$$\frac{9C}{5} + 32 = \frac{9 \cdot 20}{5} + 32 = \frac{180}{5} + 32 = 36 + 32 = 68$$

When the Celsius temperature is doubled, the corresponding Fahrenheit temperature is not doubled.

94. Use a calculator.

$$18^2 - 23(-21) + (-21)^3 = -8454$$

96. Use a calculator.

$$(-8)^3(-6) - (-8)^2(-6)^2 + (-8)(-6)^3 = 2496$$

$$98. \quad \begin{aligned} x^{1492} - x^{1493} &= (-1)^{1492} - (-1)^{1493} \\ &= 1 - (-1) \\ &= 1 + 1 \\ &= 2 \end{aligned}$$

$$100. \quad \begin{aligned} 5a^{3a-4} &= 5 \cdot 2^{3 \cdot 2 - 4} \\ &= 5 \cdot 2^{6-4} \\ &= 5 \cdot 2^2 \\ &= 5 \cdot 4 \\ &= 20 \end{aligned}$$

$$102. \quad 59 \boxed{\times} 17 \boxed{+} 59 \boxed{\times} 8 = 1475$$

104. False; $2^3 = 8$, but $-2^3 = -8$.

106. True

Exercise Set 2.7

2. $4x - 6y + 7z = 4x + (-6y) + 7z$
 The terms are $4x$, $-6y$, and $7z$.

4. $7rs - s - 5 = 7rs + (-s) + (-5)$
 The terms are $7rs$, $-s$, and -5 .

6. $4a^3b + ab^2 - 9b^3 = 4a^3b + ab^2 + (-9b^3)$
 The terms are $4a^3b$, ab^2 , and $-9b^3$.

8. $16a$

10. $-16x$

12. $10y - t$

14. $41x - 4$

16. $-7 + a + 6b$

18. $4x + 5y + 5$

20. $3x + 2y + 2$

22. $12y^3 - 3z$

24. $11a^5 + 5b^4$

26. $2a^2 + 8a^3 + 5$

28. $7xy + 6y^2 - 1$

30. $a^2b - 3ab^2 + 2ab$

32. $-4x^4 - y^4 + 8x^4y^4$

34. $P = 4s$
 $P = 4 \cdot 5 \text{ in.}$
 $P = 20 \text{ in.}$

36. Perimeter = $4 \text{ mm} + 6 \text{ mm} + 7 \text{ mm}$
 $= (4 + 6 + 7) \text{ mm}$
 $= 17 \text{ mm}$

38. Perimeter = $4 \text{ m} + 4 \text{ m} + 4 \text{ m} + 5 \text{ m} + 1 \text{ m}$
 $= (4 + 4 + 4 + 5 + 1) \text{ m}$
 $= 18 \text{ m}$

40. $P = 2l + 2w = 2 \cdot 78 \text{ ft} + 2 \cdot 36 \text{ ft}$
 $= 156 \text{ ft} + 72 \text{ ft} = 228 \text{ ft}$

42. $P = 2l + 2w = 2 \cdot 27 \text{ ft} + 2 \cdot 18 \text{ ft}$
 $= 54 \text{ ft} + 36 \text{ ft} = 90 \text{ ft}$

44. $P = 2 \cdot (l + w) = 2 \cdot (3 \text{ ft} + 4 \text{ ft}) = 14 \text{ ft}$

46. $P = 4s = 4 \cdot 2 \text{ m} = 8 \text{ m}$

48. $P = 4s = 4 \cdot 12 \text{ yd} = 48 \text{ yd}$

50. $P = 2l + 2w = 2 \cdot 40 \text{ ft} + 2 \cdot 35 \text{ ft} = 150 \text{ ft}$

52. $700 - 490 = 210$

54. $(9 - 7)^4 - 3^2 = 2^4 - 3^2$
 $= 16 - 9$
 $= 7$

56. $27 \div 3(2 + 1) = 27 \div 3 \cdot 3$
 $= 9 \cdot 3$
 $= 27$

58. $30 - 4^2 \div 8 \cdot 2 = 30 - 16 \div 8 \cdot 2$
 $= 30 - 2 \cdot 2$
 $= 30 - 4$
 $= 26$

60. $19 = x + 6$
 $19 - 6 = x$
 $13 = x$

62. $50 = 2t$

$$\frac{50}{2} = t$$

$$25 = t$$

64. $3(a - 7) + 7(a + 4) = 3a - 21 + 7a + 28 = 10a + 7$

66. $7(2 - 5x) + 3(x - 8) = 14 - 35x + 3x - 24 = -10 - 32x$

68. $3(4 - 2x) + 5(9x - 3y + 1) = 12 - 6x + 45x - 15y + 5 = 17 + 39x - 15y$

70. Find the amount of lace required:

$$6 \cdot 4 \cdot 5 \text{ ft} + 6 \cdot 4 \cdot 7 \text{ ft} = 288 \text{ ft}$$

Find the number of yards in 288 ft:

$$288 \div 3 = 96$$

Finally, find the cost of 96 yd of trim:

$$96 \cdot \$2 = \$192$$

72. Length of box: $3 \cdot 72 \text{ mm} = 216 \text{ mm}$

Width of box: $2 \cdot 72 \text{ mm} = 144 \text{ mm}$

$$P = 2 \cdot (l + w) = 2 \cdot (216 \text{ mm} + 144 \text{ mm}) = 720 \text{ mm}$$

Exercise Set 2.8

2. $6 + 4x - 5 = 4x + 1$, so $4x + 1$ and $6 + 4x - 5$ are equivalent expressions.4. $5(-2) = -10$, so $t = -2$ and $5t = -10$ are equivalent equations.6. $r - 10 + r + 3 = 2r - 7$, so $2r - 7$ and $r - 10 + r + 3$ are equivalent expressions.8. $t = 9 + 6 = 15$ and $15 + 4 = 19$, so $t + 4 = 19$ and $t = 9 + 6$ are equivalent equations.

10. $2x = -14$ $x - 2 = -9$

$$x = -7$$
 $x = -7$

 $2x = -14$ and $x - 2 = -9$ are equivalent equations.12. $4(x - 7) = 4x - 28$ and $3x - 28 + x = 4x - 28$, so $4(x - 7)$ and $3x - 28 + x$ are equivalent expressions.

14. $x - 5 = -7$

$$x - 5 + 5 = -7 + 5$$

$$x = -2$$

16. $x - 7 = 5$

$$x - 7 + 7 = 5 + 7$$

$$x = 12$$

18. $x + 9 = -3$

$$x + 9 - 9 = -3 - 9$$

$$x = -12$$

20. $38 = a + 12$

$$38 - 12 = a + 12 - 12$$

$$26 = a$$

22. $-9 = x + 3$

$$-9 - 3 = x + 3 - 3$$

$$-12 = x$$

24. $17 = n - 6$

$$17 + 6 = n - 6 + 6$$

$$23 = n$$

26. $3 = 17 + x$

$$3 - 17 = 17 - 17 + x$$

$$-14 = x$$

28. $-7 + t = -7$

$$-7 + t + 7 = -7 + 7$$

$$t = 0$$

30. $-8t = 40$

$$\frac{-8t}{-8} = \frac{40}{-8}$$

$$t = -5$$

32. $3x = 24$

$$\frac{3x}{3} = \frac{24}{3}$$

$$x = 8$$

34. $64 = -2t$

$$\frac{64}{-2} = \frac{-2t}{-2}$$

$$-32 = t$$

36. $-5n = -65$

$$\frac{-5n}{-5} = \frac{-65}{-5}$$

$$n = 13$$

38. $-x = 83$

$$-1 \cdot x = 83$$

$$\frac{-1 \cdot x}{-1} = \frac{83}{-1}$$

$$x = -83$$

40. $-2x = 0$

$$\frac{-2x}{-2} = \frac{0}{-2}$$

$$x = 0$$

42. $-x = -475$

$$-1 \cdot x = -475$$

$$\frac{-1 \cdot x}{-1} = \frac{-475}{-1}$$

$$x = 475$$

44. $n(-7) = 42$

$$\frac{n(-7)}{-7} = \frac{42}{-7}$$

$$n = -6$$

46. $3t = -45$

$$\frac{3t}{3} = \frac{-45}{3}$$

$$t = -15$$

48. $x + 9 = -15$

$$x + 9 - 9 = -15 - 9$$

$$x = -24$$

50. $-13 = x - 4$

$$-13 + 4 = x - 4 + 4$$

$$-9 = x$$

52. $-42 = -x$

$$-1(-42) = -1(-x)$$

$$42 = x$$

54. $7 + t = -18$

$$7 + t - 7 = -18 - 7$$

$$t = -25$$

56. $-34 = x - 10$

$$-34 + 10 = x - 10 + 10$$

$$-24 = x$$

58. $-48 = t(-12)$

$$\frac{-48}{-12} = \frac{t(-12)}{-12}$$

$$4 = t$$

60. $-135 = -9t$

$$\frac{-135}{-9} = \frac{-9t}{-9}$$

$$15 = t$$

62. $7x - 3 = 25$

$$7x - 3 + 3 = 25 + 3$$

$$7x = 28$$

$$\frac{7x}{7} = \frac{28}{7}$$

$$x = 4$$

64. $3t + 5 = 26$

$$3t + 5 - 5 = 26 - 5$$

$$3t = 21$$

$$\frac{3t}{3} = \frac{21}{3}$$

$$t = 7$$

66. $8a + 3 = -37$

$$8a + 3 - 3 = -37 - 3$$

$$8a = -40$$

$$\frac{8a}{8} = \frac{-40}{8}$$

$$a = -5$$

68. $3x - 5 = -35$

$$3x - 5 + 5 = -35 + 5$$

$$3x = -30$$

$$\frac{3x}{3} = \frac{-30}{3}$$

$$x = -10$$

70. $-4t + 3 = -17$

$$-4t + 3 - 3 = -17 - 3$$

$$-4t = -20$$

$$\frac{-4t}{-4} = \frac{-20}{-4}$$

$$t = 5$$

72. $-7x - 4 = -46$

$$-7x - 4 + 4 = -46 + 4$$

$$-7x = -42$$

$$\frac{-7x}{-7} = \frac{-42}{-7}$$

$$x = 6$$

74. $-x - 6 = 8$

$$-x - 6 + 6 = 8 + 6$$

$$-x = 14$$

$$-1(-x) = -1 \cdot 14$$

$$x = -14$$

76. $9 = 4x - 7$

$$9 + 7 = 4x - 7 + 7$$

$$16 = 4x$$

$$\frac{16}{4} = \frac{4x}{4}$$

$$4 = x$$

78. $33 = 5 - 4x$

$$33 - 5 = 5 - 4x - 5$$

$$28 = -4x$$

$$\frac{28}{-4} = \frac{-4x}{-4}$$

$$-7 = x$$

80. $12 = 7 - x$

$$12 - 7 = 7 - x - 7$$

$$5 = -x$$

$$-1 \cdot 5 = -1(-x)$$

$$-5 = x$$

82. Terms are similar if they have the same variable factor(s).84. Equations are equivalent if they have the same solutions.86. A variable is a letter that can stand for various numbers.88. We substitute for a variable when we replace it with a number.

$$\begin{aligned}
 90. \quad & 9 + x - 5 = 23 \\
 & x + 4 = 23 \\
 & x + 4 - 4 = 23 - 4 \\
 & x = 19
 \end{aligned}$$

$$\begin{aligned}
 92. \quad & 3 - 6x + 5 = 2(4) \\
 & 8 - 6x = 8 \\
 & 8 - 6x - 8 = 8 - 8 \\
 & -6x = 0 \\
 & \frac{-6x}{-6} = \frac{0}{-6} \\
 & x = 0
 \end{aligned}$$

$$\begin{aligned}
 94. \quad & 10 \div 5 \cdot 2 + 3 = 5t - 4t \\
 & 2 \cdot 2 + 3 = t \\
 & 4 + 3 = t \\
 & 7 = t
 \end{aligned}$$

$$\begin{aligned}
 96. \quad & (-9)^2 = 2^3t + (3 \cdot 6 + 1)t \\
 & (-9)^2 = 2^3t + (18 + 1)t \\
 & (-9)^2 = 2^3t + 19t \\
 & 81 = 8t + 19t \\
 & 81 = 27t \\
 & \frac{81}{27} = \frac{27t}{27} \\
 & 3 = t
 \end{aligned}$$

$$\begin{aligned}
 98. \quad & (-42)^3 = 14^2t \\
 & -74,088 = 196t \\
 & \frac{-74,088}{196} = \frac{196t}{196} \\
 & -378 = t
 \end{aligned}$$

$$\begin{aligned}
 100. \quad & 23^2 = x + 22^2 \\
 & 529 = x + 484 \\
 & 529 - 484 = x + 484 - 484 \\
 & 45 = x
 \end{aligned}$$

$$\begin{aligned}
 102. \quad & 248 = 24 - 32x \\
 & 248 - 24 = 24 - 32x - 24 \\
 & 224 = -32x \\
 & \frac{224}{-32} = \frac{-32x}{-32} \\
 & -7 = x
 \end{aligned}$$

Chapter 2 Concept Reinforcement

- The statement is true. See page 91 in the text.
- The statement is true. See page 108 in the text.
- The statement is false. For example, let $x = 1$. Then $2(x + 3) = 2(1 + 3) = 2 \cdot 4 = 8$ and $2 \cdot x + 3 = 2 \cdot 1 + 3 = 5$. We see that $2(x + 3) \neq 2 \cdot x + 3$ for an allowable replacement for x , so the expressions are not equivalent.

Chapter 2 Important Concepts

- The number is negative, so we make it positive.
 $|-17| = 17$
 - The number is positive, so the absolute value is the same as the number.
 $|300| = 300$
- $37 + (-16)$ A positive number and a negative number
The difference of the absolute values is $37 - 16$, or 21.
The positive number has the larger absolute value, so the answer is positive.
 $37 + (-16) = 21$
- $6 - (-8) = 6 + 8 = 14$
- $6(-15) = -90$
- $99 \div (-9) = -11$
- $4 - 8^2 \div (10 - 6) = 4 - 8^2 \div 4$
 $= 4 - 64 \div 4$
 $= 4 - 16$
 $= -12$
- $5(6x - 8y - z) = 5 \cdot 6x - 5 \cdot 8y - 5 \cdot z = 30x - 40y - 5z$
- $8a - b + 9a - 6b = 8a + (-1 \cdot b) + 9a + (-6b)$
 $= 8a + 9a + (-1 \cdot b) + (-6b)$
 $= (8 + 9)a + (-1 - 6)b$
 $= 17a - 7b$
- $-19 = 5x + 11$
 $-19 - 11 = 5x + 11 - 11$
 $-30 = 5x$
 $\frac{-30}{5} = \frac{5x}{5}$
 $-6 = x$
The solution is -6 .

Chapter 2 Review Exercises

- The integer -45 corresponds to a debt of \$45; the integer 72 corresponds to having \$72 in a savings account.
- Since 0 is to the right of -5 , we have $0 > -5$.
- Since -7 is to the left of 6, we have $-7 < 6$.
- Since -4 is to the right of -19 , we have $-4 > -19$.
- The distance from -39 to 0 is 39, so $|-39| = 39$.
- The distance from 23 to 0 is 23, so $|23| = 23$.
- The distance from 0 to 0 is 0, so $|0| = 0$.
- When $x = -72$, $-x = -(-72) = 72$.

9. When $x = 59$, $-(-x) = -(-59) = 59$.
10. $-14 + 5$ The absolute values are 14 and 5. The difference is 9. The negative number has the larger absolute value, so the answer is negative. $-14 + 5 = -9$
11. $-5 + (-6)$
Add the absolute values: $5 + 6 = 11$
Make the answer negative: $-5 + (-6) = -11$
12. $14 + (-8)$ The absolute values are 14 and 8. The difference is 6. The positive number has the larger absolute value, so the answer is positive. $14 + (-8) = 6$
13. $0 + (-24) = -24$
When 0 is added to any number, that number remains unchanged.
14. $17 - 29 = 17 + (-29) = -12$
15. $9 - (-14) = 9 + 14 = 23$
16. $-8 - (-7) = -8 + 7 = -1$
17. $-3 - (-3) = -3 + 3 = 0$
18. $-3 + 7 + (-8)$
 $= -3 + (-8) + 7$ Using a commutative law
 $= -11 + 7$
 $= -4$
19. $8 - (-9) - 7 + 2$
 $= 8 + 9 + (-7) + 2$
 $= 19 + (-7)$ Adding the positive numbers
 $= 12$
20. $-23 \cdot (-4) = 92$
21. $7(-12) = -84$
22. $2(-4)(-5)(-1)$
 $= -8 \cdot 5$ Multiplying the first two numbers
and the last two numbers
 $= -40$
23. $15 \div (-5) = -3$ Check: $-3(-5) = 15$
24. $\frac{-55}{11} = -5$ Check: $-5 \cdot 11 = -55$
25. $\frac{0}{7} = 0$ Check: $0 \cdot 7 = 0$
26. $625 \div (-25) \div 5 = -25 \div 5 = -5$
27. $-16 \div 4 - 30 \div (-5) = -4 - (-6)$
 $= -4 + 6$
 $= 2$
28. $9[(7 - 14) - 13] = 9[-7 - 13] = 9[-20] = -180$
29. $(-3)|4 - 3^2| - 5$
 $= (-3)|4 - 9| - 5$
 $= (-3)|-5| - 5$
 $= -3 \cdot 5 - 5$
 $= -15 - 5$
 $= -20$
30. $[-12(-3) - 2^3] - (-9)(-10)$
 $= [-12(-3) - 8] - (-9)(-10)$
 $= [36 - 8] - (-9)(-10)$
 $= 28 - (-9)(-10)$
 $= 28 - 90$
 $= -62$
31. $3a + b = 3 \cdot 4 + (-5) = 12 + (-5) = 7$
32. $\frac{-x}{y} = \frac{-30}{5} = -6$
 $\frac{x}{-y} = \frac{30}{-5} = -6$
 $-\frac{x}{y} = -\frac{30}{5} = -6$
33. $4(5x + 9) = 4 \cdot 5x + 4 \cdot 9 = 20x + 36$
34. $3(2a - 4b + 5) = 3 \cdot 2a - 3 \cdot 4b + 3 \cdot 5 = 6a - 12b + 15$
35. $-10(2x + y) = -10 \cdot 2x + (-10) \cdot y = -20x - 10y$
36. $5a + 12a = (5 + 12)a = 17a$
37. $-7x + 13x = (-7 + 13)x = 6x$
38. $9m + 14 - 12m - 8$
 $= 9m - 12m + 14 - 8$
 $= (9 - 12)m + (14 - 8)$
 $= -3m + 6$
39. $P = 2l + 2w = 2 \cdot 10 \text{ in.} + 2 \cdot 8 \text{ in.}$
 $= 20 \text{ in.} + 16 \text{ in.} = 36 \text{ in.}$
40. $P = 4s = 4 \cdot 25 \text{ cm} = 100 \text{ cm}$
41. $x - 9 = -17$
 $x - 9 + 9 = -17 + 9$
 $x = -8$
The solution is -8 .
42. $-4t = 36$
 $\frac{-4t}{-4} = \frac{36}{-4}$
 $t = -9$
The solution is -9 .
43. $13 = -x$
 $-1 \cdot 13 = -1 \cdot (-x)$
 $-13 = x$
The solution is -13 .

$$\begin{aligned}
 44. \quad & 56 = 6x - 10 \\
 & 56 + 10 = 6x - 10 + 10 \\
 & 66 = 6x \\
 & \frac{66}{6} = \frac{6x}{6} \\
 & 11 = x
 \end{aligned}$$

The solution is 11.

$$\begin{aligned}
 45. \quad & -x + 3 = -12 \\
 & -x + 3 - 3 = -12 - 3 \\
 & -x = -15 \\
 & \frac{-x}{-1} = \frac{-15}{-1} \\
 & x = 15
 \end{aligned}$$

The solution is 15.

$$\begin{aligned}
 46. \quad & 18 = 4 - 2x \\
 & 18 - 4 = 4 - 2x - 4 \\
 & 14 = -2x \\
 & \frac{14}{-2} = \frac{-2x}{-2} \\
 & -7 = x
 \end{aligned}$$

The solution is -7 .

47. Let t = the total gain or loss. We represent the gains as positive numbers and the loss as a negative number. We add the gains and the loss to find t .

$$t = 5 + (-12) + 15 = -7 + 15 = 8$$

There is a total gain of 8 yd.

48. Let a = Kaleb's total assets after he borrows \$300.

$$\begin{array}{ccccccc}
 \text{Total} & \text{is} & \text{Initial} & \text{minus} & \text{Amount} & & \\
 \text{assets} & & \text{assets} & & \text{of loan} & & \\
 \underbrace{} & & \underbrace{} & & \underbrace{} & & \\
 \downarrow & & \downarrow & & \downarrow & & \\
 a & = & 170 & - & 300 & &
 \end{array}$$

We carry out the subtraction.

$$a = 170 - 300 = -130$$

Kaleb's total assets were $-\$130$.

$$49. \quad -| -(-10) | = -|10| = -10$$

Answer A is correct.

$$50. \quad -3 \cdot 4 - 12 \div 4 = -12 - 3 = -15$$

Answer B is correct.

51. **Familiarize.** Let x = the larger number. Then $800 - x$ = the smaller number.

Translate.

$$\begin{array}{ccccccc}
 \text{Larger number} & \text{minus} & \text{Smaller number} & \text{is} & 6. & & \\
 \underbrace{} & & \underbrace{} & & & & \\
 \downarrow & & \downarrow & & \downarrow & & \\
 x & - & (800 - x) & = & 6 & &
 \end{array}$$

Solve.

$$\begin{aligned}
 x - (800 - x) &= 6 \\
 x - 800 + x &= 6 \\
 2x - 800 &= 6 \\
 2x - 800 + 800 &= 6 + 800 \\
 2x &= 806 \\
 \frac{2x}{2} &= \frac{806}{2} \\
 x &= 403
 \end{aligned}$$

If $x = 403$, then $800 - x = 800 - 403 = 397$.

Check. $403 + 397 = 800$ and $403 - 397 = 6$, so the answer checks.

State. The numbers are 403 and 397.

$$52. \quad \text{a) } -7 + (-6) + (-5) + (-4) + (-3) + (-2) + (-1) + 0 + 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8$$

b) Since one of the factors is 0, the product is 0.

$$\begin{aligned}
 53. \quad & 87 \div 3 \cdot 29^3 - (-6)^6 + 1957 \\
 &= 87 \div 3 \cdot 24,389 - 46,656 + 1957 \\
 &= 29 \cdot 24,389 - 46,656 + 1957 \\
 &= 707,281 - 46,656 + 1957 \\
 &= 660,625 + 1957 \\
 &= 662,582
 \end{aligned}$$

$$\begin{aligned}
 54. \quad & 1969 + (-8)^5 - 17 \cdot 15^3 \\
 &= 1969 + (-32,768) - 17 \cdot 3375 \\
 &= 1969 + (-32,768) - 57,375 \\
 &= -30,799 - 57,375 \\
 &= -88,174
 \end{aligned}$$

$$\begin{aligned}
 55. \quad & \frac{113 - 17^3}{15 + 8^3 - 507} = \frac{113 - 4913}{15 + 512 - 507} \\
 &= \frac{-4800}{527 - 507} \\
 &= \frac{-4800}{20} \\
 &= -240
 \end{aligned}$$

56. $8 + x^3$ will be negative for all values of x for which x^3 is less than -8 . Thus, $8 + x^3$ will be negative for $x < -2$.

57. $|x| > x$ for all negative values of x , or for $x < 0$.

Chapter 2 Discussion and Writing Exercises

- We know that the product of an even number of negative numbers is positive, and the product of an odd number of negative numbers is negative. Since $(-7)^8$ is equivalent to the product of eight negative numbers, it will be a positive number. Similarly, since $(-7)^{11}$ is equivalent to the product of eleven negative numbers, it will be a negative number.
- No; when x is a negative number or 0, $-x$ is nonnegative. For example, when x is -3 , $-x = -(-3) = 3$ and when x is 0, $-x = -(0) = 0$.

3. Jake is expecting the multiplication to be performed before the division.
4. The expression $-x^2$ represents a negative number, except for $x = 0$. For all other values of x , x^2 is positive, and thus the opposite of x^2 is negative.

Chapter 2 Test

1. The integer -542 corresponds to selling 542 fewer shirts than expected; the integer 307 corresponds to selling 307 more shirts than expected.
2. Since -14 is to the right of -21 , we have $-14 > -21$.
3. The distance from -739 to 0 is 739, so $|-739| = 739$.
4. When $x = -19$, $-(-x) = -(-(-19)) = -(19) = -19$.
5. $6 + (-17)$ The absolute values are 6 and 17. The difference is 11. The negative number has the larger absolute value, so the answer is negative. $6 + (-17) = -11$
6. $-9 + (-12)$
Add the absolute values: $9 + 12 = 21$
Make the answer negative: $-9 + (-12) = -21$
7. $-8 + 17$ The absolute values are 8 and 17. The difference is 9. The positive number has the larger absolute value, so the answer is positive. $-8 + 17 = 9$
8. $0 - 12 = 0 + (-12) = -12$
When 0 is added to any number, that number remains unchanged.
9. $7 - 22 = 7 + (-22) = -15$
10. $-5 - 19 = -5 + (-19) = -24$
11. $-8 - (-27) = -8 + 27 = 19$
12. $31 - (-3) - 5 + 9$
 $= 31 + 3 + (-5) + 9$
 $= 43 + (-5)$ Adding the positive numbers
 $= 38$
13. $(-4)^3 = -4(-4)(-4) = 16(-4) = -64$
14. $27(-10) = -270$
15. $-9 \cdot 0 = 0$
16. $-72 \div (-9) = 8$ Check: $8(-9) = -72$
17. $\frac{-56}{7} = -8$ Check: $-8 \cdot 7 = -56$
18. $8 \div 2 \cdot 2 - 3^2 = 8 \div 2 \cdot 2 - 9$
 $= 4 \cdot 2 - 9$
 $= 8 - 9$
 $= -1$
19. $29 - (3 - 5)^2 = 29 - (-2)^2$
 $= 29 - 4$
 $= 25$
20. We subtract the lower temperature from the higher temperature.
 $-67 - (-81) = -67 + 81 = 14$
The average high temperature is 14°F higher than the average low temperature.
21. $\frac{a - b}{6} = \frac{-8 - 10}{6} = \frac{-18}{6} = -3$
22. $7(2x + 3y - 1) = 7 \cdot 2x + 7 \cdot 3y - 7 \cdot 1 = 14x + 21y - 7$
23. $9x - 14 - 5x - 3 = 9x - 5x - 14 - 3$
 $= (9 - 5)x + (-14 - 3)$
 $= 4x - 17$
24. $P = 4s = 4 \cdot 5 \text{ ft} = 20 \text{ ft}$
25. $-7x = -35$
 $\frac{-7x}{-7} = \frac{-35}{-7}$
 $x = 5$
The solution is 5.
26. $a + 9 = -3$
 $a + 9 - 9 = -3 - 9$
 $a = -12$
The solution is -12 .
27. $95 = -x$
 $95 = -1 \cdot x$
 $\frac{95}{-1} = \frac{-1 \cdot x}{-1}$
 $-95 = x$
The solution is -95 .
28. $3t - 7 = 5$
 $3t - 7 + 7 = 5 + 7$
 $3t = 12$
 $\frac{3t}{3} = \frac{12}{3}$
 $t = 4$
The solution is 4.
29. $-2(n - 6m) = -2 \cdot n - (-2) \cdot 6m = -2n - (-12m) = -2n + 12m$
Answer C is correct.
30. The amount of trim needed is given by the perimeter of the room, less the 3 ft width of the door, plus the lengths of the three sides of the door that will get trim.
Perimeter of room: $P = 2(l + w)$
 $= 2(14 \text{ ft} + 12 \text{ ft})$
 $= 2(26 \text{ ft})$
 $= 52 \text{ ft}$

Subtract the width of the door: $52 \text{ ft} - 3 \text{ ft} = 49 \text{ ft}$

Trim on door: $7 \text{ ft} + 3 \text{ ft} + 7 \text{ ft} = 17 \text{ ft}$

Total length of trim: $49 \text{ ft} + 17 \text{ ft} = 66 \text{ ft}$

- 31.** $9 - 5[x + 2(3 - 4x)] + 14$
 $= 9 - 5[x + 6 - 8x] + 14$
 $= 9 - 5(-7x + 6) + 14$
 $= 9 + 35x - 30 + 14$
 $= 35x - 7$
- 32.** $15x + 3(2x - 7) - 9(4 + 5x)$
 $= 15x + 6x - 21 - 36 - 45x$
 $= -24x - 57$
- 33.** $49 \cdot 14^3 \div 7^4 + 1926^2 \div 6^2$
 $= 49 \cdot 2744 \div 2401 + 3,709,476 \div 36$
 $= 134,456 \div 2401 + 3,709,476 \div 36$
 $= 56 + 3,709,476 \div 36$
 $= 56 + 103,041$
 $= 103,097$
- 34.** $3487 - 16 \div 4 \cdot 4 \div 2^8 \cdot 14^4$
 $= 3487 - 16 \div 4 \cdot 4 \div 256 \cdot 38,416$
 $= 3487 - 4 \cdot 4 \div 256 \cdot 38,416$
 $= 3487 - 16 \div 256 \cdot 38,416$
 $= 3487 - 2401$ Dividing and then multiplying
 $= 1086$