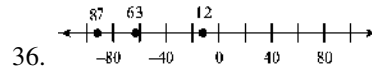
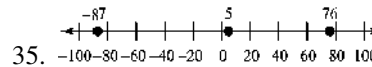
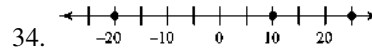
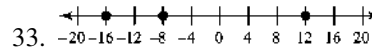
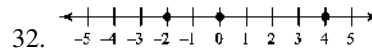
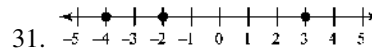


### Section 2.1 Integers and the Number Line

1. positive
2. negative
3. opposite
4. 0
5. a
6. integers
7. origin
8. absolute value
9.  $-3$
10.  $+17$  or  $17$
11. The opposite of  $7$  is  $-7$ .
12. The opposite of  $13$  is  $-13$ .
13. The opposite of  $-43$  is  $43$ .
14. The opposite of  $-21$  is  $21$ .
15. The opposite of  $-237$  is  $237$ .
16. The opposite of  $452$  is  $-452$ .
17. The opposite of  $93,000$  is  $-93,000$ .
18. The opposite of  $-3967$  is  $3967$ .
19.  $-(8) = -8$
20.  $-(11) = -11$
21. By the double negative rule,  $-(-26) = 26$ .
22. By the double negative rule,  $-(-13) = 13$ .
23.  $-(0) = 0$
24.  $-(-0) = 0$
25. By the double negative rule,  $-(-23) = 23$ .
26. By the double negative rule,  $-(-39) = 39$ .
27. By the double negative rule,  $-(-5) = 5$ , so  $-(-(-5)) = -5$ .
28. By the double negative rule,  $-(-9) = 9$ , so  $-(-(-9)) = -9$ .
29. By the double negative rule,  $-(-(-1)) = -(-1) = 1$ .
30. By the double negative rule,  $-(-(-6)) = -(-6) = 6$ .



37.  $4 > -7$ , since  $4$  is to the right of  $-7$  on the number line.

38.  $-2 < 9$ , since  $-2$  is to the left of  $9$  on the number line.

39.  $-8 > -12$ , since  $-8$  is to the right of  $-12$  on the number line.

40.  $-17 < -1$ , since  $-17$  is to the left of  $-1$  on the number line.

41.  $43 < 206$ , since  $43$  is to the left of  $206$  on the number line.

42.  $99 > 34$ , since  $99$  is to the right of  $34$  on the number line.

43.  $-34 < -29$ , since  $-34$  is to the left of  $-29$  on the number line.
44.  $-63 < -36$ , since  $-63$  is to the left of  $-36$  on the number line.
45.  $0 > -293$ , since  $0$  is to the right of  $-293$  on the number line.
46.  $-349 < 0$ , since  $-349$  is to the left of  $0$  on the number line.
47.  $0 < 167$ , since  $0$  is to the left of  $167$  on the number line.
48.  $682 > 0$ , since  $682$  is to the right of  $0$  on the number line.
49. Because  $10$  is  $10$  units from the origin,  $|10| = 10$ .
50. Because  $-8$  is  $8$  units from the origin,  $|-8| = 8$ .
51. Because  $0$  is  $0$  units from the origin,  $|0| = 0$ .
52. Because  $-0$  is  $0$  units from the origin,  $|-0| = 0$ .
53. Because  $-18$  is  $18$  units from the origin,  $|-18| = 18$ .
54. Because  $45$  is  $45$  units from the origin,  $|45| = 45$ .
55. Because  $-87$  is  $87$  units from the origin,  $|-87| = 87$ .
56. Because  $-53$  is  $53$  units from the origin,  $|-53| = 53$ .
57.  $-|2| = -2$
58.  $-|-3| = -3$
59.  $-|-19| = -19$
60.  $-|12| = -12$
61.  $-|0| = 0$
62.  $-|-0| = 0$
63.  $2 > -|2|$ , since  $2$  is to the right of  $-2$  on the number line.
64.  $-|8| = -8$ , since  $-8 = -8$ .
65.  $|-12| > -|12|$ , since  $12$  is to the right of  $-12$  on the number line.
66.  $|-8| > -|-8|$ , since  $8$  is to the right of  $-8$  on the number line.
67.  $-|-29| = -|29|$ , since  $-29 = -29$ .
68.  $-|10| < -|-10|$ , since  $-10$  is to the left of  $10$  on the number line.
69.  $-|25| < 25$ , since  $-25$  is to the left of  $25$  on the number line.
70.  $-|-46| < |-46|$ , since  $-46$  is to the left of  $46$  on the number line.
71. Since Death Valley is below sea level we write the elevation as  $-282$ .
72. Since The Maldives is above sea level we write the elevation as  $7$ .
73. Since Mt. Kilimanjaro is above sea level we write the elevation as  $19,340$ .
74. Since Amsterdam is below sea level we write the elevation as  $-13$ .
75. a) Romania, since  $-685,000$  is negative and furthest to the left on the number line.  
b) Malta and Tonga, since the positive numbers are showing growth.
76. a) Florida, since  $336,000$  is positive and furthest to the right on the number line.  
b) Alaska and Ohio, since the negative numbers are showing a decrease.

77. The solution is  $-1745$  since  $|-1745| > |1050|$ .
78. The solution is  $44$  since  $|44| > |-32|$ .
79. The solution is  $-200$  since  $|-200| > |160|$ .
80. The solution is  $12,900$  since  $|12,900| > |-7,800|$ .
81. a) Pacific,  $-35,837$  has the largest absolute value.  
 b) Arctic,  $-18,456$  has the smallest absolute value.  
 c) Southern  
 d) Indian,  $|-24,460| > |-23,736|$
82. a) January,  $-46$  has the largest absolute value.  
 b) October,  $2$  is the smallest distance from the origin.
83. According to the graph there is a loss of \$4000, represented as  $-4000$
84. According to the graph this occurs when there are 200 videos sold.
85. According to the graph this occurs when there are 400 videos sold.
86. According to the graph the profit is \$0.

### **Section 2.2 Adding Integers**

1. absolute values
2. Negative
3. Positive
4. Negative
5. additive inverses or opposites
6. 0
7. right, left
8.  $\cap, \cup$

9.  $3 + 9 = 12$
10.  $7 + 12 = 19$
11. Because  $|-5| + |-7| = 12$ ,  $-5 + (-7) = -12$
12. Because  $|-8| + |-2| = 10$ ,  $-8 + (-2) = -10$
13.  $13 + 28 = 41$
14.  $33 + 21 = 54$
15. Because  $|-25| + |-17| = 42$ ,  
 $-25 + (-17) = -42$
16. Because  $|-30| + |-24| = 54$ ,  
 $-30 + (-24) = -54$
17. Because  $|-28| > |13|$ , the sum is negative.  $-28 + (13) = -15$
18. Because  $|-31| > |17|$ , the sum is negative.  $-31 + (17) = -14$
19. Because  $|35| > |-12|$ , the sum is positive.  $35 + (-12) = 23$
20. Because  $|50| > |-30|$ , the sum is positive.  $50 + (-30) = 20$
21. Because  $|-39| = |39|$ , the sum is 0.  
 $-39 + (39) = 0$
22. Because  $|47| = |-47|$ , the sum is 0.  
 $47 + (-47) = 0$
23. Because  $|139| > |-100|$ , the sum is positive.  $139 + (-100) = 39$
24. Because  $|150| > |-75|$ , the sum is positive.  $-75 + (150) = 75$
25. Because  $|-62| > |61|$ , the sum is negative.  $-62 + (61) = -1$

26. Because  $|-79| > |77|$ , the sum is negative.  $-79 + 77 = -2$

27. Because  $|-33| + |-33| = 66$ ,  
 $-33 + (-33) = -66$

28. Because  $|-41| + |-41| = 82$ ,  
 $-41 + (-41) = -82$

29. Because  $|-143| > |0|$ , the sum is negative.  $-143 + 0 = -143$

30. Because  $|-78| > |0|$ , the sum is negative.  $0 + (-78) = -78$

31. Commutative

32. Identity

33. Inverse

34. Associative

35. Associative

36. Inverse

37. Identity

38. Commutative

39.  $-5 + 3 + (-2) = -5 + (-2) + 3 =$   
 $-7 + 3 = -4$

40.  $4 + 8 + (-4) = 4 + (-4) + 8 =$   
 $0 + 8 = 8$

41.  $-1 + (-9) + (-7) = -10 + (-7) = -17$

42.  $-4 + (-8) + (12) = -12 + (12) = 0$

43.  $-7 + (-17) + (24) = -24 + (24) = 0$

44.  $-11 + 9 + (-7) = -11 + (-7) + 9 =$   
 $-18 + 9 = -9$

45.  $-18 + 53 + 29 = -18 + 82 = 64$

46.  $34 + (-51) + 38 = 34 + 38 + (-51) =$   
 $72 + (-51) = 21$

47.  $-31 + (-29) + (-47) + 62 =$   
 $-60 + (-47) + 62 = -60 + 15 = -45$

48.  $111 + (-15) + (-152) + 68 =$   
 $111 + 68 + (-15) + (-152) =$   
 $179 + (-167) = 12$

49.  $x + y = (-12) + (-4) = -16$

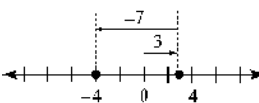
50.  $x + y = (-2) + (19) = 17$

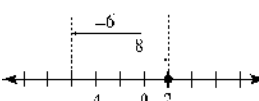
51.  $x + y = (27) + (-14) = 13$

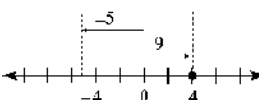
52.  $x + y = 32 + 22 = 54$

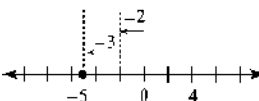
53.  $x + y = 0 + (-93) = -93$

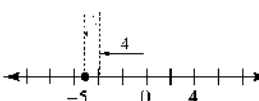
54.  $x + y = (-65) + 1 = -64$

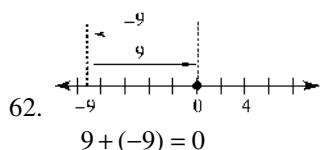
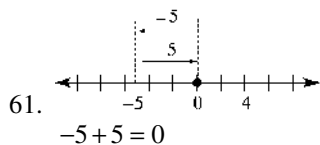
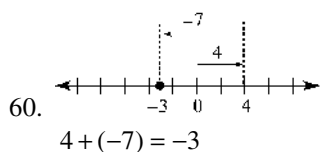
55.   
 $3 + (-7) = -4$

56.   
 $-6 + 8 = 2$

57.   
 $-5 + 9 = 4$

58.   
 $-2 + (-3) = -5$

59.   
 $-4 + (-1) = -5$



63.  $\circ \circ \circ \circ$   
 $3 + 1 = 4$

64.  $\circ \circ \circ \circ \circ \circ \circ \circ$   
 $5 + 4 = 9$

65.  $\circ \circ \circ \circ$   
 $\cup \cup \cup \cup \cup$   
 $4 + (-6) = -2$

66.  $\cup \cup \cup \cup \cup \cup \cup \cup$   
 $-7 + (-3) = -10$

67.  $\cup \cup \cup \cup \cup \cup \cup$   
 $-4 + (-5) = -9$

68.  $\circ \circ$   
 $\cup \cup \cup \cup$   
 $-4 + 2 = -2$

69.  $\circ \circ \circ \circ \circ \circ \circ$   
 $\cup \cup$   
 $-2 + 7 = 5$

70.  $\circ \circ \circ \circ \circ \circ \circ \circ$   
 $\cup \cup$   
 $8 + (-2) = 6$

71.  $-54 + 103 = 49$  degrees F

72.  $44 - 100 = -56$  degrees F

73.  $-1 + (-3) + 13 + 4 = -4 + 4 + 13$   
 $= 13$  yards

74.  $-7 + 4 = -3$  points

75.  $-203 + (-816) = -1019$  feet or  
 1019 feet below ground level

76.  $-97 + 56 = -41$  feet or 41 feet  
 below sea level

77.  $-32 + 7 = -25$  million dollars

78.  $-282 + 627 = 345$  feet

79.  $3534 + (-282) + 445 +$   
 $390 + (-1598) = 2489$  dollars

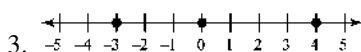
80.  $617 + (-17) + (-120) + 200 + (-40)$   
 $= 640$  dollars

**Sections 2.1 and 2.2 Checking Basic Concepts**

1. a) The opposite of 23 is  $-23$ .
- b) The opposite of  $-16$  is 16.

2. a) By the double negative rule,  
 $-(-52) = 52$ .

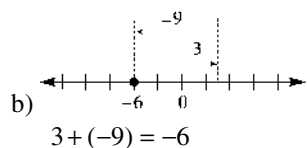
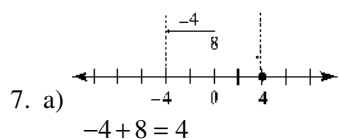
- b) By the double negative rule,  
 $-(-9) = 9$ , so  $-(-(-9)) = -9$





4. a)  $67 > -68$ , since 67 is to the right of  $-68$  on a number line.
- b)  $0 > -10,003$  since 0 is to the right of  $-10,003$  on a number line

5. a)  $|17| = 17$
- b)  $|-31| = 31$

6. a) Because  $|22| > |-14|$ , the sum is positive.  $-14 + 22 = 8$
- b) Because  $|-27| + |-8| = 35$ ,  
 $-27 + (-8) = -35$
- c) Because  $|-25| > |4|$ , the sum is negative.  $-25 + 4 = -21$
- d)  $52 + 31 = 83$



8. a)   
 $-6 + 8 = 2$

b)   
 $3 + (-8) = -5$

9. The solution is  $-420$  since  
 $|-420| > |380|$ .

10.  $3783 + (-1378) = 2405$  feet

13.  $-10 - 5 = -10 + (-5) = -15$

14.  $-20 - 7 = -20 + (-7) = -27$

15.  $-25 - 17 = -25 + (-17) = -42$

16.  $-24 - 24 = -24 + (-24) = -48$

17.  $21 - (-6) = 21 + (6) = 27$

18.  $33 - (-10) = 33 + (10) = 43$

19.  $5 - (-24) = 5 + (24) = 29$

20.  $11 - (-29) = 11 + (29) = 40$

21.  $-14 - (-9) = -14 + (9) = -5$

22.  $-40 - (-12) = -40 + (12) = -28$

23.  $-21 - (-29) = -21 + (29) = 8$

24.  $-17 - (-33) = -17 + (33) = 16$

25.  $34 - 0 = 34$

26.  $-28 - 0 = -28$

27.  $0 - (-52) = 0 + 52 = 52$

28.  $0 - 75 = 0 + (-75) = -75$

29.  $x - y = -8 - (-17) = -8 + (17) = 9$

30.  $x - y = -3 - (20) = -3 + (-20) = -23$

31.  $x - y = 30 - (-15) = 30 + (15) = 45$

32.  $x - y = 19 - (43) = 19 + (-43) = -24$

33.  $x - y = -70 - (-3) = -70 + (3) = -67$

34.  $x - y = -48 - (1) = -48 + (-1) = -49$

35.  $-3 - 3 - (-4) = -3 + (-3) + 4 = -2$

36.  $5 - 9 - (-3) = 5 + (-9) + 3 = -1$

37.  $-1 - (-9) - (-5) = -1 + 9 + 5 = 13$

### Section 2.3 Subtracting Integers

1. opposite

2.  $(-7)$

3. 9

4. step to the right

5. step to the left

6. stop and change direction

7. subtraction symbol

8. True

9.  $8 - 2 = 6$

10.  $12 - 5 = 7$

11.  $13 - 18 = 13 + (-18) = -5$

12.  $22 - 25 = 22 + (-25) = -3$

38.  $-4 - (-8) - 12 = -4 + 8 + (-12) = -8$

39.  $-2 + (-3) - (-9) = -2 + (-3) + 9 = 4$

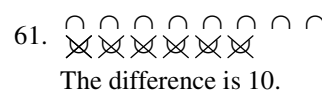
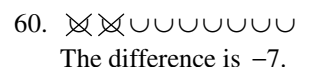
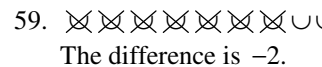
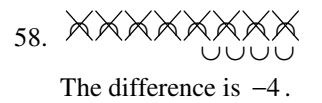
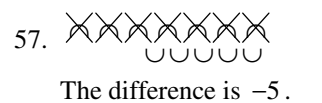
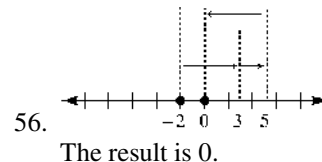
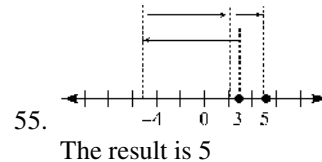
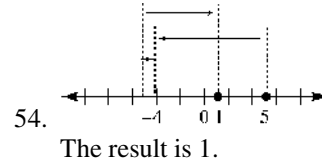
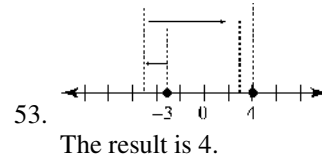
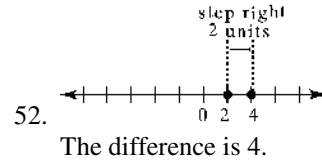
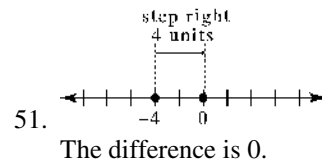
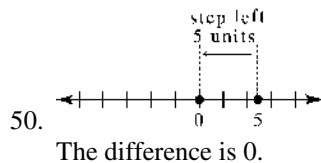
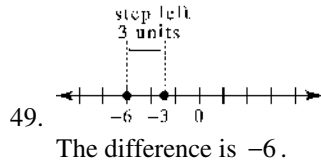
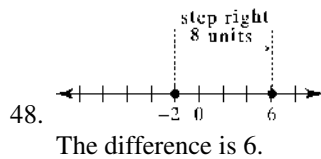
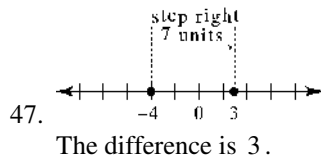
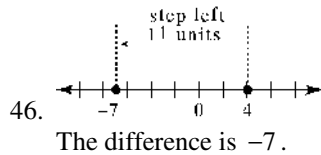
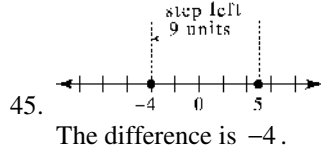
40.  $4 - (-15) + 10 = 4 + 15 + 10 = 29$

41.  $-17 - 7 + (-7) =$   
 $-17 + (-7) + (-7) = -31$

42.  $-14 + 2 - (-8) = -14 + 2 + 8 = -4$

43.  $-31 + (-16) - (-40) + 21 =$   
 $-31 + (-16) + 40 + 21 = 14$

44.  $-111 - (-99) + (-55) + 68 =$   
 $-111 + 99 + (-55) + 68 = 1$



62.  $\begin{array}{cccccccc} \cup & \cup & \cup & \cup & \cup & \cup & \cup & \cup \\ \times & \times & \times & \times & \times & \times & \times & \times \end{array}$

The difference is 8.

63.  $\begin{array}{cccccccc} \cup & \cup & \cup & \cup & \cup & \cup & \cup & \cup \\ \times & \times & \times & \times & \times & \times & \times & \times \end{array}$

The difference is 7.

64.  $\begin{array}{cccc} \cup & & & \\ \times & \times & \times & \times \end{array}$

The difference is 1.

65.  $78 - (-9) = 87$  degrees F

66.  $91 - (-321) = 412$  degrees F

67.  $14,494 - (-282) = 14,776$  feet

68.  $535 - (-8) = 543$  feet

69.  $(-37) - (-52) = 15$  feet

70.  $(-26) - (-73) = 47$  feet

71.  $153,800 - (-35,600) = \$189,400$

72.  $4 - (-5) = 9$  points

73.  $129 - (-47) = \$176$

74.  $217 - (-55) = \$272$

75.  $-6 + 8 - 5 - 7 = -6 + 8 + (-5) + (-7)$   
 $= -10$  degrees F

76.  $(-54) + 17 - 26 =$   
 $-54 + 17 + (-26) = -63$  feet

6. negative

7. False

8. True

9. positive

10. negative

11.  $\sqrt{4}$

12.  $-\sqrt{4}$

13.  $2(-6) = -12$

14.  $-7(4) = -28$

15.  $-5(-8) = 40$

16.  $-8(-7) = 56$

17.  $-1 \cdot 18 = -18$

18.  $-14 \cdot 0 = 0$

19.  $-10 \cdot (-17) = 170$

20.  $-50 \cdot (-2) = 100$

21.  $0 \cdot (-21) = 0$

22.  $1 \cdot (-34) = -34$

23.  $14 \cdot (-3) = -42$

24.  $15 \cdot (-4) = -60$

25.  $-25 \cdot 6 = -150$

26.  $-30 \cdot 4 = -120$

27. There is an odd number of negative factors so the product is negative.  $-2 \cdot 6 \cdot 3 = -36$

28. There is an odd number of negative factors so the product is negative.  $4 \cdot (-3) \cdot 2 = -24$

29. There is an even number of negative factors so the product is positive.  
 $-3 \cdot 5 \cdot (-2) = 30$

### **Section 2.4 Multiplying and Dividing Integers**

1. positive

2. negative

3. identity

4. distributive

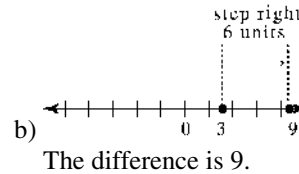
5. positive



30. There is an even number of negative factors so the product is positive.  
 $6 \cdot (-4) \cdot (-2) = 48$
31. There is an odd number of negative factors so the product is negative.  
 $-7(-1)(-3) = -21$
32. There is an odd number of negative factors so the product is negative.  
 $-8(-8)(-1) = -64$
33. There is an odd number of negative factors so the product is negative.  
 $5(-2)(-3)(-3) = -90$
34. There is an even number of negative factors so the product is positive.  
 $5(5)(-1)(-4) = 100$
35. There is a factor of 0 so the product is 0.
36. There is a factor of 0 so the product is 0.
37. There is an odd number of negative factors so the product is negative.  
 $2(-1)(5)(-2)(-4) = -80$
38. There is an odd number of negative factors so the product is negative.  
 $-2(5)(3)(-2)(-1) = -60$
39. There is an even number of negative factors so the product is positive.  
 $2(-1)(5)(-2)(-4)(5)(-1) = 400$
40. There is an odd number of negative factors so the product is negative.  
 $-1(-3)(5)(-2)(-3)(5)(-2) = -900$
41. Associative
42. Associative
43. Zero
44. Identity
45. Commutative
46. Zero
47. Distributive
48. Commutative
49. Identity
50. Distributive
51.  $-2^3 = -1 \cdot 2 \cdot 2 \cdot 2 = -8$
52.  $(-3)^2 = -3 \cdot (-3) = 9$
53.  $(-4)^2 = -4 \cdot (-4) = 16$
54.  $-5^2 = -1 \cdot 5 \cdot 5 = -25$
55.  $-9^2 = -1 \cdot 9 \cdot 9 = -81$
56.  $(-8)^2 = (-8) \cdot (-8) = 64$
57.  $-1^4 = -(1 \cdot 1 \cdot 1 \cdot 1) = -1$
58.  $-3^4 = -1 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = -81$
59.  $(-3)^3 = (-3) \cdot (-3) \cdot (-3) = -27$
60.  $-1^5 = -(1 \cdot 1 \cdot 1 \cdot 1 \cdot 1) = -1$
61.  $-10^6 = -(10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10)$   
 $= -1,000,000$
62.  $(-10)^3 = (-10) \cdot (-10) \cdot (-10) = -1000$
63.  $(-10)^4 = (-10) \cdot (-10) \cdot (-10) \cdot (-10)$   
 $= 10,000$
64.  $-10^5 = -(10 \cdot 10 \cdot 10 \cdot 10 \cdot 10)$   
 $= -100,000$
65.  $18 \div (-6) = -3$
66.  $-48 \div 8 = -6$
67.  $\frac{-40}{-8} = 5$
68.  $\frac{24}{-3} = -8$

69.  $-12 \div (-1) = 12$
70.  $-20 \div 1 = -20$
71.  $\frac{-50}{25} = -2$
72.  $\frac{-72}{-12} = 6$
73.  $-35 \div 0$  is undefined
74.  $0 \div (-3) = 0$
75.  $-24 \div (-24) = 1$
76.  $-10 \div 10 = -1$
77.  $0 \div (-9) = 0$
78.  $-63 \div 0$  is undefined
79.  $\frac{72}{-12} = -6$
80.  $\frac{-64}{16} = -4$
81. Because  $5^2 = 25$  and  $(-5)^2 = 25$ , the integer square roots of 25 are 5 and  $-5$ .
82. Because  $3^2 = 9$  and  $(-3)^2 = 9$ , the integer square roots of 9 are 3 and  $-3$ .
83. Because  $9^2 = 81$  and  $(-9)^2 = 81$ , the integer square roots of 81 are 9 and  $-9$ .
84. Because  $10^2 = 100$  and  $(-10)^2 = 100$ , the integer square roots of 100 are 10 and  $-10$ .
85. A negative number has no integer square roots.
86. A negative number has no integer square roots.
87. Because  $0^2 = 0$  the integer square root of 0 is 0.
88. Because  $1^2 = 1$  and  $(-1)^2 = 1$  the integer square roots of 1 are 1 and  $-1$ .
89. Because  $4^2 = 16$  and 4 is positive,  $\sqrt{16} = 4$ .
90. Because  $7^2 = 49$  and 7 is positive,  $\sqrt{49} = 7$ .
91. Because  $(-6)^2 = 36$  and  $-6$  is negative,  $-\sqrt{36} = -6$ .
92. Because  $(-12)^2 = 144$  and  $-12$  is negative,  $-\sqrt{144} = -12$ .
93. Because  $10^2 = 100$  and 10 is positive,  $\sqrt{100} = 10$ .
94. Because  $(-9)^2 = 81$  and  $-9$  is negative,  $-\sqrt{81} = -9$ .
95. A negative number has no integer square roots.
96. A negative number has no integer square roots.
97. Because  $(-1)^2 = 1$  and  $-1$  is negative,  $-\sqrt{1} = -1$ .
98. Because  $0^2 = 0$  the integer square root of 0 is 0.
99.  $3x = 3(-7) = -21$
100.  $-8y = -8(-2) = 16$
101.  $\frac{x}{6} = \frac{-60}{6} = -10$
102.  $4xy = 4(-3)(5) = -60$
103.  $\frac{a}{b} = \frac{-30}{6} = -5$
104.  $-ab = -(-6)(11) = 66$

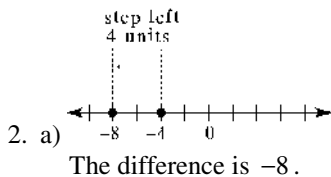
105.  $m \cdot (-n) = (-5)(-5) = 25$
106.  $2 \cdot (-m) \cdot (-n) = 2(-4)(-6) = -48$
107.  $\sqrt{-x} = \sqrt{-(-100)} = \sqrt{100} = 10$
108.  $-\sqrt{y} = -\sqrt{4} = -2$
109.  $-\sqrt{a} = -\sqrt{-64}$ , a negative number has no integer square roots.
110.  $-\sqrt{-a} = -\sqrt{-(81)}$ , a negative number has no integer square roots.
111.  $4(-11) = -44$  degrees C
112.  $3(-19) = -57$  degrees C
113.  $5(-107) = -535$ , 535 feet deep
114.  $4(-5) = -20$  points
115.  $-300 \div 12 = -25$ , 25 fewer prisoners per month
116.  $-1089 \div 3 = -363$ , 363 fewer homeless per year.
117.  $5(-29) = -145$ , charges of \$145
118.  $-129 \div 43 = -3$



3. a)  $\times \times \times \times$   
 $\cup \cup \cup \cup \cup \cup \cup \cup$   
 The result is  $-8$ .
- b)  $\times \times \times \cup \cup \cup \cup \cup$   
 The result is  $-5$ .
4.  $-2 - (-7) + 5 + (-6)$   
 $= -2 + 7 + 5 + (-6) = 4$
5. a)  $-11 \cdot 4 = -44$   
 b)  $-3 \cdot (-13) = 39$   
 c)  $6 \cdot (-8) = -48$   
 d)  $5 \cdot 10 = 50$
6. There is an odd number of negative factors so the product is negative.  
 $2(-1)(4)(-2)(-3) = -48$
7. a)  $24 \div (-6) = -4$   
 b)  $-60 \div 12 = -5$   
 c)  $\frac{-36}{-4} = 9$   
 d)  $\frac{25}{-1} = -25$
8. a) Because  $8^2 = 64$  and 8 is positive,  
 $\sqrt{64} = 8$ .  
 b) Because  $(-4)^2 = 16$  and  $-4$  is negative,  
 $-\sqrt{16} = -4$ .
9.  $108 - (-57) = 165$  dollars
10.  $3(-23) = -69$ , 69 feet deep

**Sections 2.3 and 2.4 Checking Basic Concepts**

1. a)  $-11 - 23 = -11 + (-23) = -34$   
 b)  $-21 - (-7) = -21 + (7) = -14$   
 c)  $3 - (-30) = 3 + (30) = 33$   
 d)  $54 - 39 = 15$



**Section 2.5 Order of Operations; Averages**

- order of operations
- innermost

3. parentheses
4. average
5.  $2 + (-3) \cdot 4 = 2 + (-12) = -10$
6.  $-8 - 4(-5) = -8 + 20 = 12$
7.  $-36 \div 3^2 + 7 = -36 \div 9 + 7 = -4 + 7 = 3$
8.  $48 \div 12 - 11 = 4 - 11 = -7$
9.  $60 + (-35) \div 7 - 28 = 60 - 5 - 28 = 27$
10.  $-55 + 9 \cdot 7 - 18 = -55 + 63 - 18 = -10$
11.  $49 \div 7 + (-2) \cdot 4 = 7 + (-8) = -1$
12.  $-2 \cdot (-50) - 8 \div 2 = 100 - 4 = 96$
13.  $\frac{3-25}{7+4} = \frac{-22}{11} = -2$
14.  $\frac{19+16}{5(-1)} = \frac{35}{-5} = -7$
15.  $\frac{45+9(-10)}{-5} = \frac{45+(-90)}{-5} = \frac{-45}{-5} = 9$
16.  $\left| \frac{19-59}{2 \cdot 5} \right| = \left| \frac{-40}{10} \right| = |-4| = 4$
17.  $36 - 3^2 \div (6-9) = 36 - 9 \div (-3)$   
 $= 36 + 3 = 39$
18.  $-28 \div (2 - 3^2) + 3 = -28 \div (2 - 9) + 3$   
 $= -28 \div (-7) + 3 = 4 + 3 = 7$
19.  $35 - |3 + 4^2 \div (-2)| =$   
 $35 - |3 + 16 \div (-2)| =$   
 $35 - |3 - 8| = 35 - |-5| = 35 - 5 = 30$
20.  $(36 \div 6^2 - 4) \cdot |-3| = (36 \div 36 - 4) \cdot |-3| =$   
 $(1 - 4) \cdot 3 = -3 \cdot 3 = -9$
21.  $\sqrt{41+8} + (-7) = \sqrt{49} + (-7) =$   
 $7 + (-7) = 0$
22.  $-78 - \sqrt{80+1} = -78 - \sqrt{81} =$   
 $-78 - 9 = -87$
23.  $-8^2 + |9 \cdot (-8)| = -64 + |-72| =$   
 $-64 + 72 = 8$
24.  $\sqrt{-5^2 + 61} - 3^2 = \sqrt{-25 + 61} - 9 =$   
 $\sqrt{36} - 9 = 6 - 9 = -3$
25.  $\sqrt{100} \cdot \sqrt{|0-25|} = 10 \cdot \sqrt{|-25|} =$   
 $10 \cdot \sqrt{25} = 10 \cdot 5 = 50$
26.  $|-43| - |20 - 6^2| = 43 - |20 - 36| =$   
 $43 - |-16| = 43 - 16 = 27$
27.  $((2-7)^2 \div 5) - 18 = ((-5)^2 \div 5) - 18$   
 $= (25 \div 5) - 18 = 5 - 18 = -13$
28.  $(20 \cdot (6-7) \div 10)^3 = (20 \cdot (-1) \div 10)^3$   
 $= (-20 \div 10)^3 = (-2)^3 = -8$
29.  $\frac{(13-9) \cdot 6}{|37-41| \cdot 2} = \frac{4 \cdot 6}{|-4| \cdot 2} = \frac{4 \cdot 6}{4 \cdot 2} = \frac{24}{8} = 3$
30.  $\frac{2 \cdot (4+1)^2 + 10}{5 \cdot |4-7|} = \frac{2 \cdot (5)^2 + 10}{5 \cdot |-3|}$   
 $= \frac{2 \cdot 25 + 10}{5 \cdot 3} = \frac{50 + 10}{15} = \frac{60}{15} = 4$
31.  $\frac{(6-3) \cdot 5}{2^3 - \sqrt{81}} = \frac{3 \cdot 5}{8-9} = \frac{15}{-1} = -15$
32.  $\frac{(\sqrt{64} + 2) \cdot 5}{|6^2 - 41|} = \frac{(8+2) \cdot 5}{|36-41|} = \frac{10 \cdot 5}{|-5|} =$   
 $\frac{50}{5} = 10$
33.  $(7-9)^2 - 3\sqrt{2 \cdot 8} = (-2)^2 - 3\sqrt{16}$   
 $= 4 - 3 \cdot 4 = 4 - 12 = -8$
34.  $(4-5)^2 \cdot \sqrt{50-25} = (-1)^2 \cdot \sqrt{25} = 1 \cdot 5 = 5$

$$\begin{aligned}
 35. \quad & -4|2-4\cdot 3|+\left((72\div 9)^2+6\right)= \\
 & -4|2-12|+\left((8)^2+6\right)= \\
 & -4|-10|+(64+6)=-4\cdot 10+70 \\
 & =-40+70=30
 \end{aligned}$$

$$\begin{aligned}
 36. \quad & 50-5^2\cdot 3-32\div 2^3+8= \\
 & 50-25\cdot 3-32\div 8+8= \\
 & 50-75-4+8=-21
 \end{aligned}$$

$$\begin{aligned}
 37. \quad & 29-\left(3\cdot 9-\left(32\div 2^4\right)+3\right)= \\
 & 29-\left(3\cdot 9-\left(32\div 16\right)+3\right)= \\
 & 29-(27-2+3)=29-28=1
 \end{aligned}$$

$$\begin{aligned}
 38. \quad & 0-\sqrt{-40\div 5-(3-3\cdot 2^2)}= \\
 & 0-\sqrt{-40\div 5-(3-3\cdot 4)}= \\
 & 0-\sqrt{-40\div 5-(3-12)}= \\
 & 0-\sqrt{-8-(-9)}=0-\sqrt{1}=0-1=-1
 \end{aligned}$$

$$\begin{aligned}
 39. \quad & \sqrt{25-3-(-1\cdot 6^2\div 12)}+11= \\
 & \sqrt{25-3-(-1\cdot 36\div 12)}+11 \\
 & \sqrt{25-3-(-36\div 12)}+11= \\
 & \sqrt{25-3-(-3)}+11=\sqrt{25}+11= \\
 & 5+11=16
 \end{aligned}$$

$$\begin{aligned}
 40. \quad & -34-3\cdot 7+2+2^2(-3)-16\div 2^3-9 \\
 & =-34-3\cdot 7+2+4(-3)-16\div 8-9 \\
 & =-34-21+2+(-12)+(-2)-9=-76
 \end{aligned}$$

$$\begin{aligned}
 41. \quad & -20+10\cdot(14-12)=-20+10(2)= \\
 & -20+20=0
 \end{aligned}$$

$$42. \quad -4-(3-8)-1=-4-(-5)-1=0$$

$$\begin{aligned}
 43. \quad & -5^2\div(3+2)+5=-25\div 5+5= \\
 & -5+5=0
 \end{aligned}$$

$$\begin{aligned}
 44. \quad & (7-10)\cdot 3^2+27=(-3)\cdot 9+27= \\
 & -27+27=0
 \end{aligned}$$

$$\begin{aligned}
 45. \quad & (32\div 4^2-2)\cdot 9=(32\div 16-2)\cdot 9= \\
 & (2-2)\cdot 9=0\cdot 9=0
 \end{aligned}$$

$$46. \quad (5-5)\cdot(3^2\div 3)=0\cdot(9\div 3)=0\cdot 3=0$$

$$\begin{aligned}
 47. \quad & (16-4^2)\div(4-9)=(16-16)\div(-5) \\
 & 0\div(-5)=0
 \end{aligned}$$

$$\begin{aligned}
 48. \quad & 8-(5+6^2\div 12)=8-(5+36\div 12)= \\
 & 8-(5+3)=8-8=0
 \end{aligned}$$

$$49. \quad 4\cdot y+x=4\cdot 1+(-5)=4-5=-1$$

$$\begin{aligned}
 50. \quad & 3a+9-b=3\cdot 5+9-(-6)= \\
 & 15+9+6=30
 \end{aligned}$$

$$\begin{aligned}
 51. \quad & 24v-6w=24\cdot(-2)-6\cdot(-8)= \\
 & -48+48=0
 \end{aligned}$$

$$52. \quad 3c-5d=3\cdot(-5)-5\cdot(-3)=-15+15=0$$

$$\begin{aligned}
 53. \quad & 2m+(4^2+n)\div 8= \\
 & 2\cdot 7+(16+(-32))\div 8= \\
 & 14+(-16)\div 8=14+(-2)=12
 \end{aligned}$$

$$\begin{aligned}
 54. \quad & w+\left((3-v)^2\div w\right)= \\
 & -3+\left((3-0)^2\div(-3)\right)= \\
 & -3+\left((3)^2\div(-3)\right)= \\
 & -3+(9\div(-3))=-3+(-3)=-6
 \end{aligned}$$

$$\begin{aligned}
 55. \quad & 2m+|2^3+n|\div 8= \\
 & 2\cdot 5+|8+(-16)|\div 8= \\
 & 10+|-8|\div 8=10+8\div 8= \\
 & 10+1=11
 \end{aligned}$$

$$\begin{aligned}
 56. \quad & w+\left((5-2v)^2\div 3w\right)= \\
 & (-1)+\left((5-2\cdot 4)^2\div 3\cdot(-1)\right)= \\
 & -1+\left((5-8)^2\div 3\cdot(-1)\right)= \\
 & -1+\left((-3)^2\div 3\cdot(-1)\right)=-1+(9\div 3(-1))= \\
 & -1+3\cdot(-1)=-1+(-3)=-4
 \end{aligned}$$

$$\begin{aligned}
 57. \quad & \sqrt{p^2-7}-2q^2=\sqrt{(-4)^2-7}-2(2)^2 \\
 & =\sqrt{16-7}-2\cdot 4=\sqrt{9}-8=3-8=-5
 \end{aligned}$$

$$58. \sqrt{r-3} - (14+s) =$$

$$\sqrt{39-3} - (14+(-6)) =$$

$$\sqrt{36} - 8 = 6 - 8 = -2$$

$$59. \frac{2(7+c)}{|d-5| \cdot (-4)} = \frac{2(7+5)}{|4-5| \cdot (-4)} =$$

$$\frac{2(12)}{|-1| \cdot (-4)} = \frac{24}{1 \cdot (-4)} = \frac{24}{-4} = -6$$

$$60. \frac{(6-g)+7}{(\sqrt{2h}-3)^2} = \frac{(6-(-5))+7}{(\sqrt{2 \cdot 2}-3)^2} =$$

$$\frac{(11)+7}{(\sqrt{4}-3)^2} = \frac{18}{(2-3)^2} =$$

$$\frac{18}{(-1)^2} = \frac{18}{1} = 18$$

$$61. xy + (y^2 - x) \div y =$$

$$-12 \cdot (-3) + ((-3)^2 - (-12)) \div (-3) =$$

$$36 + (9 + 12) \div (-3) =$$

$$36 + (21) \div (-3) = 36 + (-7) = 29$$

$$62. a \cdot b - a \div b + b =$$

$$0 \cdot (-1) - 0 \div (-1) + (-1) =$$

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

$$63. C = \frac{5(F-32)}{9} = \frac{5(-4-32)}{9}$$

$$= \frac{5(-36)}{9} = -20^\circ \text{C}$$

$$64. C = \frac{5(F-32)}{9} = \frac{5(-40-32)}{9}$$

$$= \frac{5(-72)}{9} = -40^\circ \text{C}$$

$$65. F = \frac{9C}{5} + 32 = \frac{9 \cdot (-15)}{5} + 32$$

$$= -27 + 32 = 5^\circ \text{F}$$

$$66. F = \frac{9C}{5} + 32 = \frac{9 \cdot (-40)}{5} + 32$$

$$= -72 + 32 = -40^\circ \text{F}$$

$$67. \frac{17+9+(-5)+(-11)+(-15)}{5} = \frac{-5}{5} = -1,$$

there is a loss of \$1,000.

$$68. \frac{17+9+(-5)}{3} = \frac{21}{3} = 7$$

there is a profit of \$7,000.

$$69. \frac{-16+(-22)+1+11+(-2)+(-21)+7}{7} =$$

$$\frac{-42}{7} = -6^\circ \text{F}$$

$$70. \frac{-6+(-2)+15+18+(-5)+4}{6} = \frac{24}{6} = 4^\circ \text{F}$$

### Group Activity Working with Real Data

Use  $F = \left(\frac{6g}{13}\right) \div 12$  to compute F (in feet),

for the given values of g (in quadrillion gallons).

G	26	130	312	468	650
F	1	5	12	18	25

Answers may vary

### Section 2.6 Solving Equations with Integer Solutions

- equation
- solution
- variable
- check
- Yes, since  $2 - (-7) = 2 + 7 = 9$
- Yes, since  $3 + (-12) = -9$
- No,  $4(-3) - 2 = -12 - 2 = -14$
- No,  $5(3) - 12 = 15 - 12 = 3$

9. No,  $\frac{3(-6)-2}{5} = \frac{-18-2}{5} = \frac{-20}{5} = -4$
10. Yes,  $\frac{52}{9+4} = \frac{52}{13} = 4$
11. No,  $\sqrt{1-(-3)} \neq 3(-3)+10$   
 $\sqrt{4} \neq -9+10$   
 $2 \neq 1$
12. Yes,  $|2(1)-8| = 6$   
 $|2-8| = 6$   
 $6 = 6$
13. No,  $6+4 \div 2 \neq 5$   
 $6+2 \neq 5$   
 $8 \neq 5$
14. Yes,  $\sqrt{6(4)+1} = 4+1$   
 $\sqrt{24+1} = 5$   
 $\sqrt{25} = 5$   
 $5 = 5$
15. Yes,  $|(-9)-8| = 8-(-9)$   
 $|-17| = 17$   
 $17 = 17$
16. No,  $(3-(-2))^2 \neq 5(-2)+15$   
 $5^2 \neq -10+15$   
 $25 \neq 5$
17. Yes,  $(-7)^2 + 2(-7) = 35$   
 $49-14 = 35$   
 $35 = 35$
18. Yes,  $10-(-6) \div 2 = -6+19$   
 $10-(-3) = 13$   
 $13 = 13$
19. No,  $3(-2)^2 - (-2) + 5 \neq 15$   
 $3(4) + 2 + 5 \neq 15$   
 $12 + 7 \neq 15$
20. No,  $(-1)^3 + 5(-1) - 2 \neq 4$   
 $-1 + (-5) - 2 \neq 4$   
 $-8 \neq 4$
21. The solution to  $b+3 = -12$  is  $-15$  because  $-15+3 = -12$ .
22. The solution to  $3x = 36$  is  $12$  because  $3(12) = 36$ .
23. The solution to  $11-z = 16$  is  $-5$  because  $11-(-5) = 16$ .
24. The solution to  $m-(-4) = 3$  is  $-1$  because  $-1-(-4) = 3$ .
25. The solution to  $-48 \div d = -6$  is  $8$  because  $-48 \div 8 = -6$ .
26. The solution to  $n \div (-5) = -9$  is  $45$  because  $45 \div (-5) = -9$ .
27. The solution to  $35 = -7x$  is  $-5$  because  $35 = -7(-5)$ .
28. The solution to  $7+y = -8$  is  $-15$  because  $7+(-15) = -8$ .
29. The solution to  $w^3 = -1$  is  $-1$  because  $(-1)^3 = -1$ .
30. The solution to  $8 = m^3$  is  $2$  because  $8 = 2^3$ .
31. The solution to  $\sqrt{b} = 8$  is  $64$  because  $\sqrt{64} = 8$ .
32. The solution to  $-\sqrt{a} = -3$  is  $9$  because  $-\sqrt{9} = -3$ .
33. The solution to  $(-x)^3 = 27$  is  $-3$  because  $(-(-3))^3 = 27$ .
34. The solution to  $(-y)^3 = -1$  is  $1$  because  $(-1)^3 = -1$ .

35. The solution to  $-\sqrt{n} = -10$  is 100  
because  $-\sqrt{100} = -10$ .

36. The solution to  $\sqrt{a} = 12$  is 144 because  
 $\sqrt{144} = 12$ .

37. The solution to  $2x + 1 = 11$  is 5 because  
 $2(5) + 1 = 11$ .

38. The solution to  $3x - 2 = 10$  is 4 because  
 $3(4) - 2 = 10$ .

39. The solution to  $18 - 2x = 4$  is 7 because  
 $18 - 2(7) = 4$ .

40. The solution to  $25 - 3m = 7$  is 6 because  
 $25 - 3(6) = 7$ .

41.  $-2 + 2 = 0, -1 + 2 = -1$   
 $0 + 2 = 2, 1 + 2 = 3$   
 $2 + 2 = 4$   
Therefore,  $x + 2 = 1$  when  $x = -1$

42.  $3 - (-2) = 5, 3 - (-1) = 4$   
 $3 - 0 = 3, 3 - 1 = 2$   
 $3 - 2 = 1$   
Therefore,  $3 - x = 3$  when  $x = 0$ .

43.  $3(-2) + 5 = -1, 3(-1) + 5 = 2$   
 $3(0) + 5 = 5, 3(1) + 5 = 8$   
 $3(2) + 5 = 11$   
Therefore,  $3x + 5 = 8$  when  $x = 1$ .

44.  $7(-2) - 4 = -18, 7(-1) - 4 = -11$   
 $7(0) - 4 = -4, 7(1) - 4 = 3$   
 $7(2) - 4 = 10$   
Therefore,  $7x - 4 = -18$  when  $x = -2$ .

45.  $5 + 6(-2) = -7, 5 + 6(-1) = -1$   
 $5 + 6(0) = 5, 5 + 6(1) = 11$   
 $5 + 6(2) = 17$   
Therefore,  $5 + 6x = 17$  when  $x = 2$ .

46.  $3 - 4(-2) = 11, 3 - 4(-1) = 7$   
 $3 - 4(0) = 3, 3 - 4(1) = -1$   
 $3 - 4(2) = -5$   
Therefore,  $3 - 4x = 7$  when  $x = -1$ .

47.  $\sqrt{3 - (-13)} = \sqrt{16} = 4$   
 $\sqrt{3 - (-6)} = \sqrt{9} = 3$   
 $\sqrt{3 - (-1)} = \sqrt{4} = 2$   
 $\sqrt{3 - 2} = \sqrt{1} = 1$   
 $\sqrt{3 - (3)} = \sqrt{0} = 0$   
Therefore,  $\sqrt{3 - x} = 3$  when  $x = -6$ .

48.  $\sqrt{-7 + 7} = \sqrt{0} = 0$   
 $\sqrt{-6 + 7} = \sqrt{1} = 1$   
 $\sqrt{-3 + 7} = \sqrt{4} = 2$   
 $\sqrt{2 + 7} = \sqrt{9} = 3$   
 $\sqrt{9 + 7} = \sqrt{16} = 4$   
Therefore,  $\sqrt{x + 7} = 2$  when  $x = -3$

49. 

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$x - 2$	$-5$	$-4$	$-3$	$-2$	$-1$	$0$	$1$

  
Therefore,  $x - 2 = -3$  when  $x = -1$ .

50. 

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$6 - x$	$9$	$8$	$7$	$6$	$5$	$4$	$3$

  
Therefore,  $6 - x = 5$  when  $x = 1$ .

51. 

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$-3x + 8$	$17$	$14$	$11$	$8$	$5$	$2$	$-1$

  
Therefore,  $-3x + 8 = 14$  when  $x = -2$

52. 

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$-2x + 5$	$11$	$9$	$7$	$5$	$3$	$1$	$-1$

  
Therefore,  $-2x + 5 = -1$  when  $x = 3$ .

53. 

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$4 - 9x$	$31$	$22$	$13$	$4$	$-5$	$-14$	$-21$

  
Therefore,  $4 - 9x = -14$  when  $x = 2$ .

54. 

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$4 - 3x$	$13$	$10$	$7$	$4$	$1$	$-2$	$-5$

  
Therefore,  $4 - 3x = 7$  when  $x = -1$ .

55. 

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$1 + 3x$	$-8$	$-5$	$-2$	$1$	$4$	$7$	$10$

  
Therefore,  $1 + 3x = 1$  when  $x = 0$ .



$$56. \begin{array}{c|c|c|c|c|c|c} x & -3 & -2 & -1 & 0 & 1 & 2 & 3 \\ \hline 8+2x & 2 & 4 & 6 & 8 & 10 & 12 & 14 \end{array}$$

Therefore,  $8 + 2x = 2$  when  $x = -3$ .

57. Locate 3 at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 7.

58. Locate  $-6$  at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 9.

59. Locate 15 at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 3.

60. Locate  $-10$  at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 6.

61. Locate  $-20$  at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 3.

62. Locate 0 at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 4.

$x$	$168x - 335,778$
2004	894
2005	1062
2006	1230
2007	1398
2008	1566
2009	1734
2010	1902

In 2008, there were 1566 million Internet users.

$x$	$42x - 83,197$
2002	887
2003	929
2004	971
2005	1013
2006	1055
2007	1097
2008	1139

64.

In 2003, there were 929 thousand HIV infections.

$$65. \begin{array}{c|c|c|c|c|c} x & 1 & 2 & 3 & 4 & 5 \\ \hline \frac{120}{G} & 120 & 60 & 40 & 30 & 24 \end{array}$$

The car uses 4 gallons of gasoline.

$$66. \begin{array}{c|c|c|c|c|c} x & 1 & 2 & 3 & 4 & 5 \\ \hline 75-19x & 56 & 37 & 18 & -1 & -20 \end{array}$$

The altitude is 4 miles.

67. Locate 250 at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 2000. In the year 2000 the Medicare costs were \$250 billion.

68. Locate  $-15$  at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 4. The altitude is 4 miles.

### Sections 2.5 and 2.6 Checking Basic Concepts

1. a)  $40 + (-28) \div 4 - 10 =$

$$40 + (-7) - 10 = 23$$

b)  $4 - |5 + 3^2 \div (-9)| =$

$$4 - |5 + 9 \div (-9)| = 4 - |5 + (-1)|$$

$$= 4 - |4| = 4 - 4 = 0$$

c)  $(5 - 9)^2 - 5\sqrt{2 \cdot 18} =$

$$(-4)^2 - 5\sqrt{36} = 16 - 5 \cdot 6 =$$

$$16 - 30 = -14$$

2. a)  $6(-2) - 5(-4) = -12 + 20 = 8$

b)  $(7-1)^2 \div (-3) + 1 =$   
 $(6^2 \div (-3)) + 1 = 36 \div (-3) + 1$   
 $= -12 + 1 = -11$

c)  $\frac{(5 - (-5)) + 14}{(\sqrt{9} - 5)^2} = \frac{10 + 14}{(3 - 5)^2} =$   
 $\frac{24}{(-2)^2} = \frac{24}{4} = 6$

3. No,  $6(-2) - 12 = -24$

4. Yes,  $(1 - (-3))^2 = 1 - 5(-3)$   
 $4^2 = 1 + 15$   
 $16 = 16$

5. a) The solution to  $b + 2 = -3$  is  $-5$  because  $-5 + 2 = -3$ .

b) The solution to  $-24 \div d = -4$  is  $6$  because  $-24 \div 6 = -4$ .

6.  $5 - 2(-2) = 9$ ,  $5 - 2(-1) = 7$   
 $5 - 2(0) = 5$ ,  $5 - 2(1) = 3$   
 $5 - 2(2) = 1$

Therefore,  $5 - 2x = 7$  when  $x = -1$

7.  $F = \frac{9 \cdot (-50)}{5} + 32$   
 $= -90 + 32 = -58^\circ F$

7.  $-7 < 19$  since  $-7$  is to the left of  $19$  on a number line.

8.  $2 > -5$  since  $2$  is to the right of  $-5$  on a number line.

9.  $-11 > -15$  since  $-11$  is to the right of  $-15$  on a number line.

10.  $-32 < -3$  since  $-32$  is to the left of  $-3$  on a number line.

11.  $-|6| = -6$

12.  $-|-1| = -1$

13.  $|-0| = 0$

14.  $|-12| = 12$

15.  $2 > -|2|$ , since  $2$  is to the right of  $-2$  on the number line.

16.  $-|-8| = -8$ , since  $-8$  is equal to  $-8$  on the number line.

17. Sunday, since  $-8$  is the largest absolute value of the negative numbers.

18. Increase, since the temperature difference is positive.

19.  $-14 + 13 = -1$

20.  $-3 + (-12) = -15$

21.  $-21 + (-30) = -51$

22.  $45 + (-23) = 22$

23.  $-14 + 45 + 22 = 31 + 22 = 53$

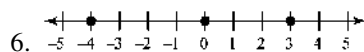
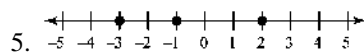
24.  $27 + (-53) + 8 = -26 + 8 = -18$

25.  $-42 + (-21) + (-37) + 54 =$   
 $-100 + 54 = -46$

26.  $105 + (-35) + (-64) + 13 =$   
 $118 + (-99) = 19$

### Chapter 2 Review Exercises

- The opposite of  $19$  is  $-19$ .
- The opposite of  $-52$  is  $52$ .
- By the double negative rule,  $-(-31) = 31$ .
- By the double negative rule,  $-(-2) = 2$ , so  $-(-(-2)) = -2$ .



27.  $x + y = 12 + (-7) = 5$

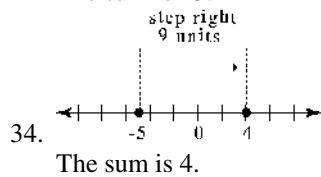
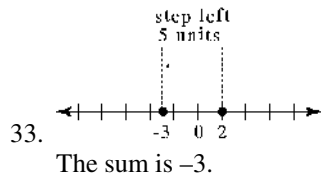
28.  $x + y = -2 + (-3) = -5$

29. Inverse

30. Associative

31. Commutative

32. Identity



35.  $\cup\cup\cup$   
 $\cup\cup\cup\cup\cup\cup\cup$   
 The sum is -4.

36.  $\cup\cup\cup\cup\cup\cup\cup\cup$   
 $\cup\cup\cup\cup\cup\cup$   
 The sum is 2.

37.  $15 - (-4) = 15 + 4 = 19$

38.  $-16 - 16 = -16 + (-16) = -32$

39.  $-23 - 7 = -23 + (-7) = -30$

40.  $11 - 29 = 11 + (-29) = -18$

41.  $-17 - 0 = -17$

42.  $0 - 22 = 0 + (-22) = -22$

43.  $x - y = -5 - (-12) = -5 + 12 = 7$

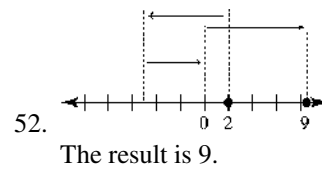
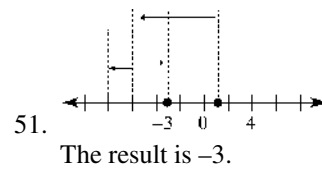
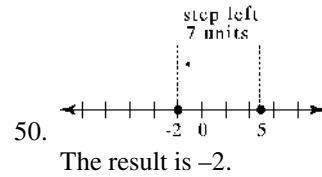
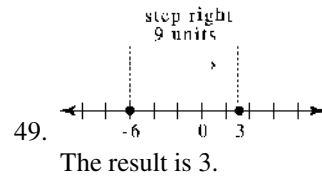
44.  $x - y = -4 - 18 = -4 + (-18) = -22$

45.  $-7 - 13 + (-1) = -7 + (-13) + (-1) = -21$

46.  $8 + (-18) - 2 = 8 + (-18) + (-2) = -12$

47.  $-33 - (-15) + (-40) + 9 =$   
 $-33 + 15 + (-40) + 9 = -49$

48.  $101 - (-99) + (-50) + 10 =$   
 $101 + 99 + (-50) + 10 = 160$



53.  $\cup\cup\cup$   
 The result is -3.

54.  $\cup\cup\cup\cup\cup\cup\cup\cup\cup\cup$   
 $\times\times\times\times\times\times\times\times$   
 The result is 9.

55.  $-42 \div 7 = -6$

56.  $-10 \times (-9) = 90$

57.  $-3 \cdot 8 = -24$

58.  $-14 \div (-14) = 1$

59.  $\frac{-75}{5} = -15$

60.  $\frac{-36}{-12} = 3$

61. There is an odd number of negative factors so the product is negative.

$$3(-1)(3)(-2)(-5) = -90$$

62. There is an even number of negative factors so the product is positive.

$$-2(4)(3)(2)(-1) = 48$$

63. Associative

64. Identity

65. Zero

66. Distributive

$$67. -7^2 = -1 \cdot 7 \cdot 7 = -49$$

$$68. (-7)^2 = (-7) \cdot (-7) = 49$$

69. Because  $(-4)^2 = 16$  and  $-4$  is negative,  $-\sqrt{16} = -4$ .

70. A negative number has no integer square roots.

$$71. \frac{2a}{b} = \frac{2 \cdot (-20)}{5} = \frac{-40}{5} = -8$$

$$72. 3 \cdot (-x) \cdot (-y) = 3 \cdot (-3) \cdot (-(-5)) \\ = 3 \cdot (-3) \cdot 5 = -45$$

$$73. -\sqrt{y} = -\sqrt{25} = -5$$

74.  $\sqrt{a} = \sqrt{-36}$ , a negative number has no integer square roots.

$$75. -2 \cdot (10) - 12 \div 6 = -20 - 2 = -22$$

$$76. 5 - 3^2 \div (4 - 7) = 5 - 9 \div (-3) = \\ 5 - (-3) = 5 + 3 = 8$$

$$77. \sqrt{52+12} + (-7) = \sqrt{64} + (-7) \\ = 8 + (-7) = 1$$

$$78. \sqrt{-5^2 + 50} - 3^2 = \sqrt{-25 + 50} - 9 \\ = \sqrt{25} - 9 = 5 - 9 = -4$$

$$79. \frac{-39 + 6(-4)}{-3} = \frac{-39 - 24}{-3} = \frac{-63}{-3} = 21$$

$$80. -\left| \frac{39 - 49}{2 \cdot (-1)} \right| = -\left| \frac{-10}{-2} \right| = -|5| = -5$$

$$81. -10 + 5 \cdot (8 - 6) \\ -10 + 5(2) = -10 + 10 = 0$$

$$82. 14 - (16 - 3) - 1 = 14 - 13 - 1 = 0$$

$$83. (7 - 11) \cdot 4^2 + 64 = (-4) \cdot 16 + 64 \\ = -64 + 64 = 0$$

$$84. -3^2 \div (5 - 2) + 3 = -9 \div 3 + 3 = -3 + 3 = 0$$

$$85. 12(-1) - 3(-4) = -12 - (-12) = \\ -12 + 12 = 0$$

$$86. 3(2) + |2^3 + (-8)| \div 4 = \\ 6 + |8 + (-8)| \div 4 = \\ 6 + 0 \div 4 = 6 + 0 = 6$$

$$87. -2 + \left( (3 - 9)^2 \div (-2) \right) = \\ -2 + \left( (-6)^2 \div (-2) \right) = \\ -2 + (36 \div (-2)) = \\ -2 + (-18) = -20$$

$$88. \sqrt{13 - (-2)^2} - 2(2)^2 = \\ \sqrt{13 - 4} - 2 \cdot 4 = \\ \sqrt{9} - 8 = 3 - 8 = -5$$

$$89. \text{Yes, } 6(2) - 14 = 12 - 14 = -2$$

$$90. \text{Yes, } |3(-3) - 2| = |-9 - 2| = |-11| = 11$$

$$91. \text{No, } \frac{5(-2) + 1}{3} = \frac{-10 + 1}{3} = \frac{-9}{3} = -3$$

$$92. \text{No, } \sqrt{1 - (-3)} \neq 4(-3) + 5 \\ \sqrt{4} \neq -12 + 5 \\ 2 \neq -7$$

93. The solution to  $b + 9 = -2$  is  $-11$   
because  $-11 + 9 = -2$ .

94. The solution to  $-27 = m^3$  is  $-3$   
because  $-27 = (-3)^3$ .

95. The solution to  $\sqrt{x} = 6$  is  $36$   
because  $\sqrt{36} = 6$ .

96. The solution to  $n \div (-5) = -4$  is  $20$   
because  $20 \div (-5) = -4$ .

97.  $3(-2) - 5 = -11$ ,  $3(-1) - 5 = -8$   
 $3(0) - 5 = -5$ ,  $3(1) - 5 = -2$   
 $3(2) - 5 = 1$   
Therefore,  $3x - 5 = 1$  when  $x = 2$ .

98.  $7 - 2(-2) = 11$ ,  $7 - 2(-1) = 9$   
 $7 - 2(0) = 7$ ,  $7 - 2(1) = 5$   
 $7 - 2(2) = 3$   
Therefore,  $7 - 2x = 9$  when  $x = -1$ .

99. Locate 10 at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 6.

100. Locate  $-10$  at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 5.

101. a) Mormons, since this has the largest positive change.  
b) Lutherans and Jewish, since both of these show a negative change.

102.  $534 + (-72) + (-125) + 300 + (-45)$   
 $= \$592$

103. Locate 15 at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is 2006. In 2006 the music sales were \$15,000

104.  $-60,000 \div 8 = -7,500$ , There is a decrease of \$7500 a year.

105.  $C = \frac{5(-13 - 32)}{9} = \frac{5(-45)}{9} = -25^\circ C$

$x$	$133(x - 2002) + 707$
2003	840
2004	973
2005	1106
2006	1239
2007	1372
2008	1505

In 2006 the result is 1239.

107.  $-2 + 10 + (-3) - 8 = -3^\circ F$

108.  $8 \cdot (-19) = -152$ , The result is \$152.

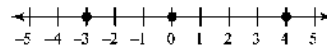
109.  $-16 + 9 = -7$ , The result is  $-\$7$  million.

110.  $\frac{-8 + (-4) + 13 + 16 + (-3) + 4}{6} = \frac{18}{6} = 3^\circ C$

111. The solution is  $-\$64$  since  $|-64| > 32$ .

112. The solution is \$850 since  $|850| > -753$ .

## Chapter 2 Test



- $-5$   $-4$   $-3$   $-2$   $-1$   $0$   $1$   $2$   $3$   $4$   $5$
- $x + y = -3 + 8 = 5$
- $-19 > -25$  since  $-19$  is to the right of  $-25$  on the number line.
- $-|8| = -8$  since  $-8$  is equal to  $-8$  on the number line.
- $16 + (-21) = -5$
- $-38 - 12 = -50$
- $-12 \cdot (-7) = 84$
- $-63 \div 9 = -7$
- $3 - 5 + (-1) - (-4) = 3 + (-5) + (-1) + 4 = 1$

10. There is an odd number of negative factors so the product is negative.

$$2(-1)(-3)(-2)(7) = -84$$

11.  $-11^2 = -1 \cdot 11 \cdot 11 = -121$

12. Because  $(-10)^2 = 100$  and  $-10$  is negative,  $-\sqrt{100} = -10$ .

13.  $-21 + 4 \cdot 7 - 15 = -21 + 28 - 15 = -8$

14.  $9 - 4^2 \div 8 - 14 =$   
 $9 - 16 \div 8 - 14 =$   
 $9 - 2 - 14 = -7$

15.  $\sqrt{-13 + 38} - (-3) =$   
 $\sqrt{25} + 3 = 5 + 3 = 8$

16.  $5 - |6^2 \div (-4)| = 5 - |36 \div (-4)|$   
 $5 - |-9| = 5 - 9 = -4$

17.  $\frac{(13-7) \cdot 5}{|33-48| \cdot 2} = \frac{6 \cdot 5}{|-15| \cdot 2} =$   
 $\frac{30}{15 \cdot 2} = \frac{30}{30} = 1$

18.  $\frac{(-5-3) \cdot 3}{2^3 - \sqrt{4}} = \frac{-8 \cdot 3}{8-2} =$   
 $\frac{-24}{6} = -4$

19. Yes,  $\frac{-42}{10+4} = \frac{-42}{14} = -3$

20. No,  $\sqrt{5(7)+1} \neq -7+1$   
 $\sqrt{36} \neq -6$   
 $6 \neq -6$

21. The solution is  $-6$  since  $72 = -12(-6)$ .

22. The solution is  $9$  since  $-\sqrt{9} = -3$ .

23.  $5 - 4(-2) = 13$ ,  $5 - 4(-1) = 9$   
 $5 - 4(0) = 5$ ,  $5 - 4(1) = 1$   
 $5 - 4(2) = -3$

Therefore,  $5 - 4x = -3$  when  $x = 2$ .

24. Locate  $-10$  at left edge of the graph, move horizontally to the graphed line, from this position move vertically to the value of  $x$ . The solution is  $7$ .

25.  $107,200 - (-25,700) = 132,900$   
 The result is \$132,900.

26. 

$x$	0	1	2	3	4
$70 - 19x$	70	51	32	13	-6

The altitude is 4 miles.

### Chapters 1-2 Cumulative Review

#### Exercises

1. The ten-thousands place is the fifth place from the right. The digit is 8.

2. In expanded form, 32,010 is written as  $30,000 + 2000 + 10$ .

$$289$$

3.  $\frac{+5775}{6064}$

$$19,043$$

4.  $\frac{-7938}{11,105}$

5.  $\frac{279}{\times 23}$

$$837$$

$$\underline{5580}$$

$$6417$$

6.  $45 \overline{)3672} \begin{array}{r} 81 \\ 81r27 \end{array}$

$$\underline{360}$$

$$72$$

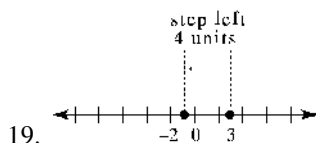
$$\underline{45}$$

$$27$$

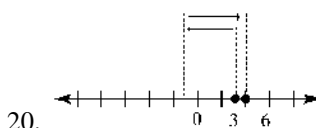
7.  $7 \cdot 7 \cdot 7 = 7^3$

8. The solution is 19 since  $19 - 13 = 6$ .

9. The digit to the right of the millions place is 6, so we round to 33,000,000.
10.  $800 + 500 + 200 = 1500$
11.  $\sqrt{80} \approx 9$  because  $9^2 = 81 \approx 80$ .
12.  $3 \cdot 15 - 60 \div 10 = 45 - 6 = 39$
13.  $4x + x - 5 = 5x - 5$
14.  $-|5| < 5$  since  $-5$  is to the left of 5 on the number line.
15.  $-14 + (-3) = -17$
16.  $-3 - (-8) = -3 + 8 = 5$
17.  $-50 \div 5 = -10$
18.  $-5 \cdot (-20) = 100$
- Therefore,  $7x - 12 = -5$  when  $x = 1$ .
27.  $1296 - 504 - 81 + 700 - 432 = \$979$
28.  $F = \frac{9(-20)}{5} + 32 = -36 + 32 = -4^\circ \text{F}$
29.  $R = \frac{885\sqrt{25}}{25} = \frac{885 \cdot 5}{25} = 177 \text{ bpm}$
30.  $10 + 5 + 6 + 5 + 4 + 10 = 40 \text{ cm}$



The result is  $-1$ .



The result is 4.

21. There is an odd number of negative factors so the product is negative.  
 $4(-2)(5)(-1)(-2) = -80$
22. Zero property
23.  $6 - 4^2 \div (3 - 11) = 6 - 16 \div (-8)$   
 $= 6 - (-2) = 6 + 2 = 8$
24.  $(1 + (2 - 3)^2) \div 2 = (1 + (-1)^2) \div 2$   
 $= (1 + 1) \div 2 = (2 \div 2) = 1$
25. No,  $4 + 8 \div 2 = 4 + 4 = 8$
26.  $7(-2) - 12 = -26$ ,  $7(-1) - 12 = -19$   
 $7(0) - 12 = -12$ ,  $7(1) - 12 = -5$   
 $7(2) - 12 = 2$