

# Chapter 10

## Real Numbers

### Exercise Set 10.1

**RC2.**  $\left| \frac{0}{-8} \right| = |0| = 0$ ; this is point E.

**RC4.**  $\frac{17}{3} = 5\frac{2}{3}$ ; this is point D.

**RC6.**  $3\bar{4}$  is point G.

**RC8.** H lies to the left of B on the number line, so it is true that  $H < B$ .

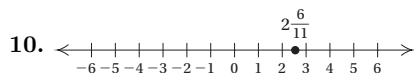
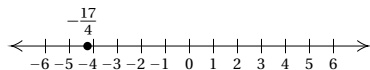
**RC10.** J lies to the left of D on the number line, so it is false that  $J > D$ .

2. 750; -125

4. -58.5; 56.5

6. -35

8.  $-\frac{17}{4} = -4.25$



12. 
$$\begin{array}{r} 0.125 \\ 8 \overline{) 1.000} \\ \underline{8} \phantom{00} \\ 20 \\ \underline{16} \phantom{0} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

$\frac{1}{8} = 0.125$ , so  $-\frac{1}{8} = -0.125$ .

14.  $\frac{5}{3}$  means  $5 \div 3$ , so we divide.

$$\begin{array}{r} 1.66\dots \\ 3 \overline{) 5.00} \\ \underline{3} \phantom{00} \\ 20 \\ \underline{18} \phantom{0} \\ 20 \\ \underline{18} \phantom{0} \\ 2 \end{array}$$

We have  $\frac{5}{3} = 1.\bar{6}$ .

16. 
$$\begin{array}{r} 0.4166\dots \\ 12 \overline{) 5.0000} \\ \underline{48} \phantom{00} \\ 20 \\ \underline{12} \phantom{00} \\ 80 \\ \underline{72} \phantom{0} \\ 80 \\ \underline{72} \phantom{0} \\ 8 \end{array}$$

$\frac{5}{12} = 0.41\bar{6}$ , so  $-\frac{5}{12} = -0.41\bar{6}$ .

18. 
$$\begin{array}{r} 0.25 \\ 4 \overline{) 1.00} \\ \underline{8} \phantom{00} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

$\frac{1}{4} = 0.25$

20. 
$$\begin{array}{r} 0.375 \\ 8 \overline{) 3.000} \\ \underline{24} \phantom{00} \\ 60 \\ \underline{56} \phantom{0} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

$\frac{3}{8} = 0.375$ , so  $-\frac{3}{8} = -0.375$ .

22. 
$$\begin{array}{r} 0.3125 \\ 16 \overline{) 5.0000} \\ \underline{48} \phantom{00} \\ 20 \\ \underline{16} \phantom{00} \\ 40 \\ \underline{32} \phantom{00} \\ 80 \\ \underline{80} \\ 0 \end{array}$$

$9\frac{5}{16} = 9.3125$ , so  $-9\frac{5}{16} = -9.3125$

24.  $3 > 0$

26.  $6 > -6$

28.  $0 > -9$

30.  $-4 < -3$

32.  $-3 > -4$

34.  $-10 > -14$

36.  $-3.3 < -2.2$

38.  $17.2 > -1.67$

40.  $-7\frac{5}{16} < -3\frac{11}{16}$

42.  $-\frac{13}{16} = -0.8125$  and  $-\frac{5}{9} = -0.\bar{5}$ , so  $-\frac{13}{16} < -\frac{5}{9}$ .

44. The distance of  $-7$  from  $0$  is  $7$ , so  $|-7| = 7$ .

46. The distance of  $0$  from  $0$  is  $0$ , so  $|0| = 0$ .

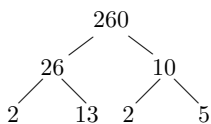
48. The distance of  $-4$  from  $0$  is  $4$ , so  $|-4| = 4$ .

50. The distance of  $-7\frac{4}{5}$  from  $0$  is  $7\frac{4}{5}$ , so  $|-7\frac{4}{5}| = 7\frac{4}{5}$ .

52. The distance of  $-\frac{10}{7}$  from  $0$  is  $\frac{10}{7}$ , so  $|\frac{10}{7}| = \frac{10}{7}$ .

54. The distance of  $14.8$  from  $0$  is  $14.8$ , so  $|14.8| = 14.8$ .

56.



$$260 = 2 \cdot 2 \cdot 5 \cdot 13, \text{ or } 2^2 \cdot 5 \cdot 13$$

58.  $18 = 2 \cdot 3 \cdot 3$

$24 = 2 \cdot 2 \cdot 2 \cdot 3$

The LCM is  $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$ , or  $72$ .

60.  $12 = 2 \cdot 2 \cdot 3$

$36 = 2 \cdot 2 \cdot 3 \cdot 3$

$84 = 2 \cdot 2 \cdot 3 \cdot 7$

The LCM is  $2 \cdot 2 \cdot 3 \cdot 3 \cdot 7$ , or  $252$ .

62.  $|4| = 4$ , and  $|-7| = 7$ . Since  $4$  is to the left of  $7$  we have  $|4| < |-7|$ .

64.  $-\frac{2}{3}, \frac{1}{2}, -\frac{3}{4}, -\frac{5}{6}, \frac{3}{8}, \frac{1}{6}$  can be written in decimal notation as  $-0.\bar{6}, 0.5, -0.75, -0.8\bar{3}, 0.375, 0.1\bar{6}$ , respectively. Listing from least to greatest, we have  $-\frac{5}{6}, -\frac{3}{4}, -\frac{2}{3}, \frac{1}{6}, \frac{3}{8}, \frac{1}{2}$ .

10.  $-10$

12.  $-36$

14.  $0$

16.  $-37$

18.  $0$

20.  $0$

22.  $1$

24.  $-2$

26.  $11$

28.  $0$

30.  $20$

32.  $-1.7$

34.  $-14.4$

36.  $-\frac{2}{3}$

38.  $-\frac{10}{9}$

40.  $-\frac{1}{6}$

42.  $-\frac{5}{8} + \left(-\frac{1}{3}\right) = -\frac{15}{24} + \left(-\frac{8}{24}\right) = -\frac{23}{24}$

44.  $-\frac{5}{9} + \left(-\frac{5}{18}\right) = -\frac{10}{18} + \left(-\frac{5}{18}\right) = -\frac{15}{18} = -\frac{5}{6}$

46.  $-10.3 + (-7.5) + 3.1 = -17.8 + 3.1 = -14.7$

48.  $-\frac{3}{24} + \frac{7}{36} = -\frac{9}{72} + \frac{14}{72} = \frac{5}{72}$

50.  $28 + (-44) + 17 + 31 + (-94) = 76 + (-138) = -62$

52.  $24 + 3.1 + (-44) + (-8.2) + 63 = 90.1 + (-52.2) = 37.9$

54.  $-455 + (-123) + 1026 + (-919) + 213 + 111 + (-874) = -2371 + 1350 = -1021$

56.  $84$

58.  $-27.4$

60.  $26$

62.  $-\frac{1}{526}$

64.  $31$

66.  $-7.8$

68.  $18.3$

70.  $\frac{5}{8}$

72.  $A = \frac{1}{2} \cdot b \cdot h = \frac{1}{2} \cdot 12.3 \text{ ft} \cdot 7.4 \text{ ft} = 45.51 \text{ ft}^2$

74. When  $x$  is negative, the inverse of  $x$ ,  $-x$ , is positive.

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**Exercise Set 10.2**


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**RC2.** To add  $-3 + (-5)$ , start at  $0$ , move left to  $-3$ , and then move  $5$  units left. The sum is  $-8$ .

**RC4.** To add  $-8 + 3$ , start at  $0$ , move left to  $-8$ , and then move  $3$  units right. The sum is  $-5$ .

2.  $-3$

4.  $1$

6.  $0$

8.  $-14$

76. 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.

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**Exercise Set 10.3**


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RC2.  $-18 - (-6) = -18 + 6$ ; the correct choice is (b).

RC4.  $18 - (-6) = 18 + 6$ ; the correct choice is (a).

2. -5
4. -8
6. 2
8. 0
10. -5
12. 19
14. 3
16. 0
18. -11
20. 16
22. -16
24. -6
26. -10
28. -2
30. -45
32. -81
34. -52
36. 121
38. 4.94
40.  $\frac{3}{9} - \frac{9}{9} = \frac{3}{9} + \left(-\frac{9}{9}\right) = -\frac{6}{9} = -\frac{2}{3}$
42.  $\frac{5}{8} - \frac{3}{4} = \frac{5}{8} + \left(-\frac{3}{4}\right) = \frac{5}{8} + \left(-\frac{6}{8}\right) = -\frac{1}{8}$
44.  $-\frac{5}{8} - \frac{3}{4} = -\frac{5}{8} + \left(-\frac{3}{4}\right) = -\frac{5}{8} + \left(-\frac{6}{8}\right) = -\frac{11}{8}$
46.  $-\frac{3}{4} - \left(-\frac{2}{3}\right) = -\frac{3}{4} + \frac{2}{3} = -\frac{9}{12} + \frac{8}{12} = -\frac{1}{12}$
48. 5
50. -8.6
52. -0.13
54.  $5.1 - 3.02 = 2.08$
56. 17.3
58.  $-\frac{3}{8} - \left(-\frac{1}{2}\right) = -\frac{3}{8} + \frac{1}{2} = -\frac{3}{8} + \frac{4}{8} = \frac{1}{8}$
60. 0
62.  $-\frac{4}{18} - \left(-\frac{2}{9}\right) = -\frac{4}{18} + \frac{2}{9} = -\frac{4}{18} + \frac{4}{18} = 0$
64.  $-\frac{1}{7} - \left(-\frac{1}{6}\right) = -\frac{1}{7} + \frac{1}{6} = -\frac{6}{42} + \frac{7}{42} = \frac{1}{42}$
66. -22
68. 22
70. 4
72. 116
74. 190
76. Let  $D$  = the difference in elevations.  
 $D = 29,035 \text{ ft} - (-1348 \text{ ft}) = 30,383 \text{ ft}$
78. Let  $A$  = the amount owed on the account.  
 $A = \$327 - \$200 + \$48 = \$175$
80. Let  $S$  = the final value of the stock.  
 $S = \$61.38 + \$4.75 - \$7.38 + \$5.13 = \$63.88$
82. Let  $B$  = the balance after the check is written.  
 $B = \$825 - \$920 = -\$95$
84. Let  $D$  = the difference in elevations.  
 $D = -131 \text{ ft} - (-512 \text{ ft}) = 381 \text{ ft}$
86.  $40 \div \frac{4}{15} = 40 \cdot \frac{15}{4} = \frac{4 \cdot 10 \cdot 15}{4 \cdot 1} = 150$
88.  $24 \cdot 12 \text{ oz} = 288 \text{ oz}$
90. False;  $5 - 0 = 5$ , but  $0 - 5 = -5$ .
92. True
94. False;  $3 - 3 = 0$ , but  $3 \neq -3$ .
96. True

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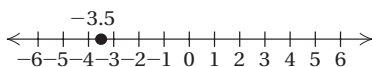
**Chapter 10 Mid-Chapter Review**


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- The statement is true. See page 582 in the text.
- 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.
- $-x = -(-4) = 4$   
 $-(-x) = -(-(-4)) = -(4) = -4$
- $5 - 13 = 5 + (-13) = -8$
- $-6 - (-7) = -6 + 7 = 1$

7. The integer 450 corresponds to a \$450 deposit; the integer  $-79$  corresponds to writing a check for \$79.

8. The number  $-3.5$  is halfway between  $-4$  and  $-3$ .



9. We first find decimal notation for  $\frac{4}{5}$ . Since  $\frac{4}{5}$  means  $4 \div 5$ , we divide.

$$\begin{array}{r} 0.8 \\ 5 \overline{)4.0} \\ \underline{40} \\ 0 \end{array}$$

Thus  $\frac{4}{5} = 0.8$ , so  $-\frac{4}{5} = -0.8$ .

10.  $\frac{7}{3}$  means  $7 \div 3$ , so we divide.

$$\begin{array}{r} 2.333 \dots \\ 3 \overline{)7.000} \\ \underline{6} \\ 10 \\ \underline{9} \\ 10 \\ \underline{9} \\ 1 \end{array}$$

We have  $\frac{7}{3} = 2.\bar{3}$ .

11. We first find decimal notation for  $\frac{5}{16}$ . Since  $\frac{5}{16}$  means  $5 \div 16$ , we divide.

$$\begin{array}{r} 0.3125 \\ 16 \overline{)5.0000} \\ \underline{48} \\ 20 \\ \underline{16} \\ 40 \\ \underline{32} \\ 80 \\ \underline{80} \\ 0 \end{array}$$

Thus  $\frac{5}{16} = 0.3125$ , so  $-\frac{5}{16} = -0.3125$ .

12. First we find decimal notation for  $\frac{3}{4}$ . Since  $\frac{3}{4}$  means  $3 \div 4$ , we divide.

$$\begin{array}{r} 0.75 \\ 4 \overline{)3.00} \\ \underline{28} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

Thus  $\frac{3}{4} = 0.75$ , so  $3\frac{3}{4} = 3 + \frac{3}{4} = 3 + 0.75 = 3.75$  and then  $-3\frac{3}{4} = -3.75$ .

13. Since  $-6$  is to the left of  $6$ , we have  $-6 < 6$ .

14. Since  $-5$  is to the left of  $-3$ , we have  $-5 < -3$ .

15. Since  $-9.9$  is to the right of  $-10.1$ , we have  $-9.9 > -10.1$ .

16. Convert to decimal notation:  $-\frac{3}{5} = -0.6$  and  $-\frac{3}{4} = -0.75$ . Since  $-0.6$  is to the right of  $-0.75$ , we have  $-0.6 > -0.75$ .

17. The distance of  $15.6$  from  $0$  is  $15.6$ , so  $|15.6| = 15.6$ .

18. The distance of  $-18$  from  $0$  is  $18$ , so  $|-18| = 18$ .

19. The distance of  $0$  from  $0$  is  $0$ , so  $|0| = 0$ .

20. The distance of  $-\frac{12}{5}$  from  $0$  is  $\frac{12}{5}$ , so  $|\frac{12}{5}| = \frac{12}{5}$ .

21. The additive inverse of  $-5.6$  is  $5.6$  because  $-5.6 + 5.6 = 0$ .

22. The additive inverse of  $\frac{7}{4}$  is  $-\frac{7}{4}$  because  $\frac{7}{4} + (-\frac{7}{4}) = 0$ .

23. The additive inverse of  $0$  is  $0$  because  $0 + 0 = 0$ .

24. The additive inverse of  $-49$  is  $49$  because  $-49 + 49 = 0$ .

25. If  $x = -19$ , then  $-x = -(-19) = 19$ .

26. If  $x = 2.3$ , then  $-(-x) = -(-2.3) = 2.3$ .

27.  $7 + (-9)$  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.  $7 + (-9) = -2$

28.  $-\frac{3}{8} + \frac{1}{4}$  The absolute values are  $\frac{3}{8}$  and  $\frac{1}{4}$ . The difference is  $\frac{3}{8} - \frac{1}{4}$ , or  $\frac{3}{8} - \frac{2}{8}$ , or  $\frac{1}{8}$ . The negative number has the larger absolute value, so the answer is negative.

$$-\frac{3}{8} + \frac{1}{4} = -\frac{1}{8}$$

29.  $3.6 + (-3.6)$  A positive and a negative number. The numbers have the same absolute value. The sum is  $0$ .  $3.6 + (-3.6) = 0$

30.  $-8 + (-9)$  Two negative numbers. Add the absolute values,  $8$  and  $9$ , getting  $17$ . Make the answer negative.  $-8 + (-9) = -17$

31.  $\frac{2}{3} + (-\frac{9}{8})$  The absolute values are  $\frac{2}{3}$  and  $\frac{9}{8}$ . The difference is  $\frac{9}{8} - \frac{2}{3}$ , or  $\frac{27}{24} - \frac{16}{24}$ , or  $\frac{11}{24}$ . The negative number has the larger absolute value, so the answer is negative.

$$\frac{2}{3} + (-\frac{9}{8}) = -\frac{11}{24}$$

32.  $-4.2 + (-3.9)$  Two negative numbers. Add the absolute values,  $4.2$  and  $3.9$ , getting  $8.1$ . Make the answer negative.  $-4.2 + (-3.9) = -8.1$

33.  $-14 + 5$  The absolute values are  $14$  and  $5$ . The difference is  $14 - 5$ , or  $9$ . The negative number has the larger absolute value, so the answer is negative.  $-14 + 5 = -9$

34.  $19 + (-21)$  The absolute values are 19 and 21. The difference is  $21 - 19$ , or 2. The negative number has the larger absolute value, so the answer is negative.  
 $19 + (-21) = -2$

35.  $-4.1 - 6.3 = -4.1 + (-6.3) = -10.4$

36.  $5 - (-11) = 5 + 11 = 16$

37.  $-\frac{1}{4} - \left(-\frac{3}{5}\right) = -\frac{1}{4} + \frac{3}{5} = -\frac{5}{20} + \frac{12}{20} = \frac{7}{20}$

38.  $12 - 24 = 12 + (-24) = -12$

39.  $-8 - (-4) = -8 + 4 = -4$

40.  $-\frac{1}{2} - \frac{5}{6} = -\frac{1}{2} + \left(-\frac{5}{6}\right) = -\frac{3}{6} + \left(-\frac{5}{6}\right) = -\frac{8}{6} = -\frac{4}{3}$

41.  $12.3 - 14.1 = 12.3 + (-14.1) = -1.8$

42.  $6 - (-7) = 6 + 7 = 13$

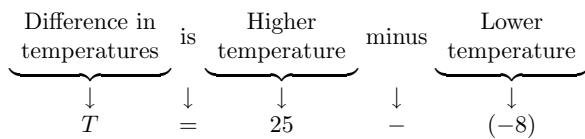
43.  $16 - (-9) - 20 - (-4) = 16 + 9 + (-20) + 4 = 9$

44.  $-4 + (-10) - (-3) - 12 = -4 + (-10) + 3 + (-12) = -23$

45.  $17 - (-25) + 15 - (-18) = 17 + 25 + 15 + 18 = 75$

46.  $-9 + (-3) + 16 - (-10) = -9 + (-3) + 16 + 10 = 14$

47. Let  $T$  = the difference in the temperatures, in degrees Celsius.

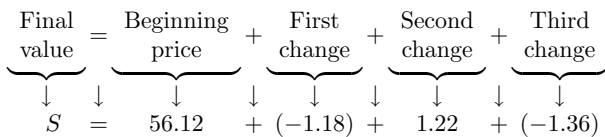


We carry out the subtraction.

$$T = 25 - (-8) = 25 + 8 = 33$$

The difference in the two temperature is  $33^\circ\text{C}$ .

48. Let  $S$  = the final value of the stock.



We carry out the addition.

$$S = 56.12 + (-1.18) + 1.22 + (-1.36) = 54.80$$

The final value of the stock was \$54.80.

49. Answers may vary. Three examples are  $\frac{6}{13}$ ,  $-23.8$ , and  $\frac{43}{5}$ . These are rational numbers because they can be named in the form  $\frac{a}{b}$ , where  $a$  and  $b$  are integers and  $b$  is not 0. They are not integers, however, because they are not whole numbers or the opposites of whole numbers.

50. Answers may vary. Three examples are  $\pi$ ,  $-\sqrt{7}$ , and  $0.31311311131111\dots$ . Rational numbers can be named as described in Exercise 49 above. Real numbers that are not rational are irrational. Decimal notation for rational numbers either terminates or repeats. Decimal notation for irrational numbers neither terminates nor repeats.

51. 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.

52. 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 10.4**

**RC2.** To multiply two negative numbers, we multiply their absolute values. The answer is positive.

**RC4.** The product of an odd number of negative numbers is negative.

2. -15

4. -10

6. -60

8. 20

10. 18

12. 110

14. 195

16. -1677

18. -203.7

20. -6.6

22. 30

24. 12.8

26.  $-\frac{10}{21}$

28.  $\frac{1}{4}$

30. -52.7

32. -6

34. 756

36.  $-\frac{3}{160}$

38. -70

40. 30

42.  $\frac{6}{35}$

44. -5712

46. -52

48. -1

50. 120

52. -518.4

54.  $\frac{4}{7}$

56. 5040

58.  $\frac{11}{90} - \frac{11}{120} = \frac{44}{360} - \frac{33}{360} = \frac{11}{360}$

60.  $6\frac{1}{2} - 2\frac{3}{10} = 6\frac{5}{10} - 2\frac{3}{10} = 4\frac{2}{10} = 4\frac{1}{5}$

62. 206.31

64.  $\frac{3}{108} = \frac{40}{x}$   
 $3 \cdot x = 108 \cdot 40$   
 $x = \frac{108 \cdot 40}{3} = 1440$

**Exercise Set 10.5****RC2.** The multiplicative inverse, or reciprocal, of a number is what we multiply the number by to get 1.**RC4.** The numbers  $-\frac{9}{4}$  and  $-\frac{4}{9}$  are called reciprocals of each other.

2. -6

4. -2

6. 9

8. 8

10. -2

12. -25

14.  $\frac{64}{7}$

16.  $\frac{300}{13}$

18. 0

20. 29

22.  $-\frac{8}{5}$

24.  $-\frac{1}{8}$

26.  $\frac{7}{8} \div \left(-\frac{1}{2}\right) = \frac{7}{8} \cdot \left(-\frac{2}{1}\right) = -\frac{14}{8} = -\frac{7}{4}$

28.  $-\frac{5}{9} \div \left(-\frac{5}{6}\right) = -\frac{5}{9} \cdot \left(-\frac{6}{5}\right) = \frac{30}{45} = \frac{2}{3}$

30.  $-\frac{3}{5} \div \left(-\frac{5}{8}\right) = -\frac{3}{5} \cdot \left(-\frac{8}{5}\right) = \frac{24}{25}$

32.  $-\frac{5}{8} \div \left(-\frac{6}{5}\right) = -\frac{5}{8} \cdot \left(-\frac{5}{6}\right) = \frac{25}{48}$

34. 7

36. -0.085

38. -5.5625

40. Not defined

42. Let  $l$  = the amount of juice left in the container at the end of the week, in ounces.

$l = 64 - 7 \cdot 8 = 64 - 56 = 8 \text{ oz}$

44. Decrease in population:  $4 \cdot 380 = 1520$ 

Population after 4 years:  $12,500 - 1520 = 10,980$

46. Total amount of purchases:  $7 \cdot \$39 = \$273$ 

New balance:  $\$234 - \$273 = -\$39$

48. Amount of increase:  $\$63.87 - \$59.33 = \$4.54$ 

Percent increase:  $\frac{\$4.54}{\$59.33} \approx 0.08 = 8\%$

50. Amount of decrease:  $57.4 - 67.5 = -10.1$ 

Percent decrease:  $\frac{-10.1}{67.5} \approx -0.15 = -15\%$

52.  $8 - (2 \cdot 3 - 9) = 8 - (6 - 9)$   
 $= 8 - (-3)$   
 $= 11$

54.  $(8 - 2)(3 - 9) = 6(-6)$   
 $= -36$

56.  $10 \cdot 20 - 15 \cdot 24 = 200 - 360$   
 $= -160$

58.  $40 - 3^2 - 2^3 = 40 - 9 - 8$   
 $= 31 - 8$   
 $= 23$

60.  $4^3 + 10 \cdot 20 + 8^2 - 23 = 64 + 10 \cdot 20 + 64 - 23$   
 $= 64 + 200 + 64 - 23$   
 $= 264 + 64 - 23$   
 $= 328 - 23$   
 $= 305$

62.  $4 \cdot (6 + 8)/(4 + 3) = 4 \cdot 14/7$   
 $= 56/7$   
 $= 8$

64.  $5^3 - 7^2 = 125 - 49$   
 $= 76$

66.  $10(-5) + 1(-1) = -50 - 1$   
 $= -51$

68.  $14 - 2(-6) + 7 = 14 + 12 + 7$   
 $= 26 + 7$   
 $= 33$

70.  $-32 - 8 \div 4 - (-2) = -32 - 2 - (-2)$   
 $= -34 - (-2)$   
 $= -32$

72.  $-5^2 + 7 = -25 + 7 = -18$

74.  $-9^2 - 11 = -81 - 11 = -92$

76.  $20 + 4^3 \div (-8) = 20 + 64 \div (-8)$   
 $= 20 - 8$   
 $= 12$

$$\begin{aligned}
 78. \quad & -7(3^4) + 18 = -7(81) + 18 \\
 & = -567 + 18 \\
 & = -549 \\
 80. \quad & 8[(6 - 13) - 11] = 8[-7 - 11] \\
 & = 8[-18] \\
 & = -144 \\
 82. \quad & 256 \div (-32) \div (-4) = -8 \div (-4) \\
 & = 2 \\
 84. \quad & (8 - 7) - 9 = 1 - 9 \\
 & = -8 \\
 86. \quad & \frac{5^2 - 4^3 - 3}{9^2 - 2^2 - 1^5} = \frac{25 - 64 - 3}{81 - 4 - 1} \\
 & = \frac{-39 - 3}{77 - 1} \\
 & = \frac{-42}{76} \\
 & = -\frac{21}{38}
 \end{aligned}$$

$$\begin{aligned}
 88. \quad & \frac{(3 - 5)^2 - (7 - 13)}{(12 - 9)^2 + (11 - 14)^2} \\
 & = \frac{(-2)^2 - (-6)}{3^2 + (-3)^2} \\
 & = \frac{4 - (-6)}{9 + 9} \\
 & = \frac{10}{18} \\
 & = \frac{5}{9}
 \end{aligned}$$

$$90. \text{ Mean: } \frac{9 + 17 + 34 + 40 + 40}{5} = \frac{140}{5} = 28$$

Median: The middle number is 34. It is the median.

Mode: 40

$$92. \text{ Solve: } n \cdot 8600 = 344, \text{ or } \frac{N}{100} = \frac{344}{8600}.$$

The answer is 4%.

94. Use a calculator.

$$\begin{aligned}
 \frac{19 - 17^2}{13^2 - 34} &= \frac{19 - 289}{169 - 34} \\
 &= \frac{-270}{135} \\
 &= -2
 \end{aligned}$$

96.  $-n$  and  $m$  are both negative, so  $\frac{-n}{m}$  is the quotient of two negative numbers and, thus, is positive.

98.  $\frac{-n}{m}$  is positive (see Exercise 96), so  $-\left(\frac{-n}{m}\right)$  is the opposite of a positive number and, thus, is negative.

2. The integers are  $\dots, -3, -2, -1, 0, 1, 2, 3, \dots$

3. The absolute value of a number is its distance from zero on the number line.

4. The rational numbers consist of all numbers that can be named in the form  $\frac{a}{b}$ , where  $a$  and  $b$  are integers and  $b$  is not 0.

5. The real numbers consist of the rational numbers and the irrational numbers.

6. Numbers such as  $-3$  and  $3$  are called opposites, or additive inverses.

7. Decimal notation for an irrational number neither terminates nor repeats.

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## Chapter 10 Concept Reinforcement

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1. The set of natural numbers  $= \{1, 2, 3, 4, \dots\}$  = the set of positive integers. The given statement is true.

2. For a number  $n$ ,  $-(-n) = n \neq \frac{1}{n}$ . The given statement is false.

3. The statement is true. See page 601 in the text.

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## Chapter 10 Study Guide

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1. We first find decimal notation for  $\frac{5}{8}$ . Since  $\frac{5}{8}$  means  $5 \div 8$ , we divide.

$$\begin{array}{r}
 0.625 \\
 8 \overline{)5.000} \\
 \underline{48} \phantom{00} \\
 20 \phantom{0} \\
 \underline{16} \phantom{0} \\
 40 \\
 \underline{40} \\
 0
 \end{array}$$

Thus  $\frac{5}{8} = 0.625$ , so  $-\frac{5}{8} = -0.625$ .

2. Since  $-7$  is to the left of  $1$  on the number line, we have  $-7 < 1$ .

3. a) The number is negative, so we make it positive.  
 $|-17| = 17$

b) The number is positive, so the absolute value is the same as the number.  $\left|\frac{4}{9}\right| = \frac{4}{9}$

4.  $-5.6 + (-3.9)$  Two negative numbers. We add the absolute values,  $5.6$  and  $3.9$ , getting  $9.5$ . Make the answer negative.  $-5.6 + (-3.9) = -9.5$

$$5. \quad 6 - (-8) = 6 + 8 = 14$$

$$6. \quad 6(-15) = -90$$

---

## Chapter 10 Vocabulary Reinforcement

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1. Two numbers whose product is 1 are called reciprocals or multiplicative inverses, of each other.

7.  $-\frac{4}{3} \div \left(-\frac{12}{5}\right) = -\frac{4}{3} \cdot \left(-\frac{5}{12}\right) = \frac{4 \cdot 5}{3 \cdot 12} = \frac{4 \cdot 5}{3 \cdot 3 \cdot 4} = \frac{5}{9}$
8.  $4 - 8^2 \div (10 - 6) = 4 - 8^2 \div 4$   
 $= 4 - 64 \div 4$   
 $= 4 - 16$   
 $= -12$

### Chapter 10 Review Exercises

1. The integer 620 corresponds to earning \$620; the integer -125 corresponds to getting a speeding ticket for \$125.
2. The distance of -38 from 0 is 38, so  $|-38| = 38$ .
3. The distance of 7.3 from 0 is 7.3, so  $|7.3| = 7.3$ .
4. The distance of  $\frac{5}{2}$  from 0 is  $\frac{5}{2}$ , so  $\left|\frac{5}{2}\right| = \frac{5}{2}$ .
5. The distance of -0.2 from 0 is 0.2, so  $|-0.2| = 0.2$ . Then  $-|-0.2| = -(0.2) = -0.2$ .
6. First we divide to find decimal notation for  $\frac{7}{4}$ .

$$\begin{array}{r} 1.75 \\ 4 \overline{) 7.00} \\ \underline{4} \phantom{00} \\ 30 \phantom{0} \\ \underline{28} \phantom{0} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

We have  $\frac{7}{4} = 1.75$ , so  $-\frac{7}{4} = -1.75$ .

7. First we divide to find decimal notation for  $\frac{5}{6}$ .

$$\begin{array}{r} 0.8\overline{33} \dots \\ 6 \overline{) 5.000} \\ \underline{48} \phantom{00} \\ 20 \phantom{0} \\ \underline{18} \phantom{0} \\ 20 \\ \underline{18} \phantom{0} \\ 2 \end{array}$$

We have  $\frac{5}{6} = 0.8\overline{3}$ , so  $-\frac{5}{6} = -0.8\overline{3}$ .

8. First we divide to find decimal notation for  $\frac{5}{12}$ .

$$\begin{array}{r} 0.41\overline{66} \dots \\ 12 \overline{) 5.0000} \\ \underline{48} \phantom{000} \\ 20 \phantom{00} \\ \underline{12} \phantom{00} \\ 80 \\ \underline{72} \phantom{00} \\ 80 \\ \underline{72} \phantom{00} \\ 8 \end{array}$$

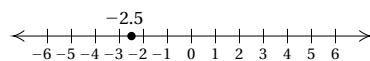
We have  $\frac{5}{12} = 0.41\overline{6}$ , so  $-\frac{5}{12} = -0.41\overline{6}$ .

9. First we divide to find decimal notation for  $\frac{3}{11}$ .

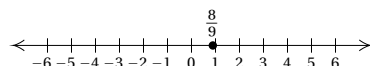
$$\begin{array}{r} 0.27\overline{27} \dots \\ 11 \overline{) 3.0000} \\ \underline{22} \phantom{000} \\ 80 \phantom{0} \\ \underline{77} \phantom{00} \\ 30 \\ \underline{22} \phantom{00} \\ 80 \\ \underline{77} \phantom{00} \\ 3 \end{array}$$

We have  $\frac{3}{11} = 0.2\overline{7}$ , so  $-\frac{3}{11} = -0.2\overline{7}$ .

10. The graph of -2.5 is halfway between -3 and -2.



11. The graph of  $\frac{8}{9}$  is  $\frac{8}{9}$  of the way from 0 to 1.



12. Since -3 is to the left of 10, we have  $-3 < 10$ .
13. Since -1 is to the right of -6, we have  $-1 > -6$ .
14. Since 0.126 is to the right of -12.6, we have  $0.126 > -12.6$ .

15.  $-\frac{2}{3} = -\frac{2}{3} \cdot \frac{10}{10} = -\frac{20}{30}$   
 $-\frac{1}{10} = -\frac{1}{10} \cdot \frac{3}{3} = -\frac{3}{30}$

Since  $-\frac{20}{30}$  is to the left of  $-\frac{3}{30}$ , then  $-\frac{2}{3}$  is to the left of  $-\frac{1}{10}$  and we have  $-\frac{2}{3} < -\frac{1}{10}$ .

16. The opposite of 3.8 is -3.8 because  $3.8 + (-3.8) = 0$ .

17. The opposite of  $-\frac{3}{4}$  is  $\frac{3}{4}$  because  $-\frac{3}{4} + \frac{3}{4} = 0$ .

18. If  $x = -34$ , then  $-x = -(-34) = 34$ .

19. If  $x = 5$ , then  $-(-x) = -(-5) = 5$ .

20. The reciprocal of  $\frac{3}{8}$  is  $\frac{8}{3}$  because  $\frac{3}{8} \cdot \frac{8}{3} = 1$ .

21. The reciprocal of -7 is  $-\frac{1}{7}$  because  $-7 \cdot \left(-\frac{1}{7}\right) = 1$ .

22.  $4 + (-7)$

The absolute values are 4 and 7. The difference is  $7 - 4$ , or 3. The negative number has the larger absolute value, so the answer is negative.  $4 + (-7) = -3$

23.  $-\frac{2}{3} + \frac{1}{12}$

The absolute values are  $\frac{2}{3}$  and  $\frac{1}{12}$ . The difference is

$$\frac{2}{3} - \frac{1}{12} = \frac{2}{3} \cdot \frac{4}{4} - \frac{1}{12} = \frac{8}{12} - \frac{1}{12} = \frac{7}{12}$$

The negative



number has the larger absolute value, so the answer is

negative.  $-\frac{2}{3} + \frac{1}{12} = -\frac{7}{12}$

24.  $6 + (-9) + (-8) + 7$   
 a) Add the negative numbers:  $-9 + (-8) = -17$   
 b) Add the positive numbers:  $6 + 7 = 13$   
 c) Add the results:  $-17 + 13 = -4$
25.  $-3.8 + 5.1 + (-12) + (-4.3) + 10$   
 a) Add the negative numbers:  $-3.8 + (-12) + (-4.3) = -20.1$   
 b) Add the positive numbers:  $5.1 + 10 = 15.1$   
 c) Add the results:  $-20.1 + 15.1 = -5$
26.  $-3 - (-7) = -3 + 7 = 4$
27.  $-\frac{9}{10} - \frac{1}{2} = -\frac{9}{10} - \frac{5}{10} = -\frac{9}{10} + \left(-\frac{5}{10}\right) = -\frac{14}{10} = -\frac{7 \cdot 2}{5 \cdot 2} = -\frac{7}{5} \cdot \frac{2}{2} = -\frac{7}{5}$
28.  $-3.8 - 4.1 = -3.8 + (-4.1) = -7.9$
29.  $-9 \cdot (-6) = 54$
30.  $-2.7(3.4) = -9.18$
31.  $\frac{2}{3} \cdot \left(-\frac{3}{7}\right) = -\left(\frac{2 \cdot 3}{3 \cdot 7}\right) = -\left(\frac{2 \cdot \cancel{3}}{\cancel{3} \cdot 7}\right) = -\frac{2}{7}$
32.  $3 \cdot (-7) \cdot (-2) \cdot (-5) = -21 \cdot 10 = -210$
33.  $35 \div (-5) = -7$  Check:  $-7 \cdot (-5) = 35$
34.  $-5.1 \div 1.7 = -3$  Check:  $-3 \cdot (1.7) = -5.1$
35.  $-\frac{3}{11} \div -\frac{4}{11} = -\frac{3}{11} \cdot \left(-\frac{11}{4}\right) = \frac{3 \cdot 11}{11 \cdot 4} = \frac{3}{4} \cdot \frac{11}{11} = \frac{3}{4}$
36.  $[-12(-3) - 2^3] - (-9)(-10)$   
 $= [-12(-3) - 8] - (-9)(-10)$   
 $= [36 - 8] - (-9)(-10)$   
 $= 28 - (-9)(-10)$   
 $= 28 - 90$   
 $= -62$
37.  $625 \div (-25) \div 5 = -25 \div 5 = -5$
38.  $-16 \div 4 - 30 \div (-5) = -4 - (-6)$   
 $= -4 + 6$   
 $= 2$
39.  $9[(7 - 14) - 13] = 9[-7 - 13] = 9[-20] = -180$
40. Let  $a$  = Chang's total assets after he borrows \$2500.
- |                 |     |                   |       |                   |
|-----------------|-----|-------------------|-------|-------------------|
| Total<br>assets | is  | Initial<br>assets | minus | Amount<br>of loan |
| ↓               | ↓   | ↓                 | ↓     | ↓                 |
| $a$             | $=$ | 2140              | $-$   | 2500              |
- We carry out the subtraction.  
 $a = 2140 - 2500 = -360$   
 Chang's total assets were  $-\$360$ .

41. First we multiply to find the total drop  $d$  in the price:

$$d = 8(-\$1.63) = -\$13.04$$

Now we add this number to the opening price to find the price  $p$  after 8 hr:

$$p = \$17.68 + (-\$13.04) = \$4.64$$

After 8 hr the price of the stock was \$4.64 per share.

42. 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.

43. Let  $p$  = the price of each tee shirt.

Original balance	minus 7 times	price of each shirt	is	New balance
↓	↓	↓	↓	↓
68	$-$	$7 \cdot p$	$=$	$-64.65$

We solve the equation.

$$68 - 7p = -64.65$$

$$68 - 7p - 68 = -64.65 - 68$$

$$-7p = -132.65$$

$$\frac{-7p}{-7} = \frac{-132.65}{-7}$$

$$p = 18.95$$

Each tee shirt cost \$18.95.

44. The reciprocal of  $-\frac{1}{10}$  is  $-\frac{10}{1}$ , or  $-10$ , because

$$-\frac{1}{10} \cdot (-10) = 1.$$

Answer A is correct.

45.  $-3 \cdot 4 - 12 \div 4 = -12 - 3 = -15$

Answer B is correct.

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

**Translate.**

Larger number	minus	Smaller number	is	6.
↓	↓	↓	↓	↓
$x$	$-$	$(800 - x)$	$=$	6

**Solve.**

$$x - (800 - x) = 6$$

$$x - 800 + x = 6$$

$$2x - 800 = 6$$

$$2x - 800 + 800 = 6 + 800$$

$$2x = 806$$

$$\frac{2x}{2} = \frac{806}{2}$$

$$x = 403$$

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.

47. 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.

48. There are five pair of reciprocals:  $-\frac{1}{11}$  and  $-11$ ,  $-\frac{1}{9}$  and  $-9$ ,  $-\frac{1}{7}$  and  $-7$ ,  $-\frac{1}{5}$  and  $-5$ ,  $-\frac{1}{3}$  and  $-3$ . The product of each pair is 1 by the definition of reciprocals. That leaves us with  $1 \cdot (-1)$ , or  $-1$ .

$$\begin{aligned} 49. \quad -\left|\frac{7}{8} - \left(-\frac{1}{2}\right) - \frac{3}{4}\right| &= -\left|\frac{7}{8} + \frac{1}{2} - \frac{3}{4}\right| \\ &= -\left|\frac{7}{8} + \frac{4}{8} - \frac{6}{8}\right| \\ &= -\left|\frac{11}{8} - \frac{6}{8}\right| \\ &= -\left|\frac{5}{8}\right| \\ &= -\frac{5}{8} \end{aligned}$$

$$\begin{aligned} 50. \quad (|2.7 - 3| + 3^2 - |-3|) \div (-3) \\ &= (|2.7 - 3| + 9 - |-3|) \div (-3) \\ &= (|-0.3| + 9 - |-3|) \div (-3) \\ &= (0.3 + 9 - 3) \div (-3) \\ &= (9.3 - 3) \div (-3) \\ &= 6.3 \div (-3) \\ &= -2.1 \end{aligned}$$

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### Chapter 10 Discussion and Writing Exercises

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- 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.
- Yes; the numbers 1 and  $-1$  are their own reciprocals:  $1 \cdot 1 = 1$  and  $-1(-1) = 1$ .
- Jake is expecting the multiplication to be performed before the division.
- At 4 p.m. the temperature in Circle City was  $23^\circ$ . By 11 p.m. the temperature had dropped  $32^\circ$ . What was the temperature at 11 p.m.?

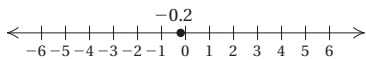
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### Chapter 10 Test

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- Since  $-4$  is to the left of 0 on the number line, we have  $-4 < 0$ .
- Since  $-3$  is to the right of  $-8$  on the number line, we have  $-3 > -8$ .
- Since  $-0.78$  is to the right of  $-0.87$  on the number line, we have  $-0.78 > -0.87$ .
- Since  $-\frac{1}{8}$  is to the left of  $\frac{1}{2}$  on the number line, we have  $-\frac{1}{8} < \frac{1}{2}$ .
- First we find decimal notation for  $\frac{1}{8}$ .
 
$$\begin{array}{r} 0.125 \\ 8 \overline{)1.000} \\ \underline{8} \phantom{00} \\ 20 \phantom{0} \\ \underline{16} \phantom{0} \\ 40 \\ \underline{40} \\ 0 \end{array}$$
 Thus,  $\frac{1}{8} = 0.125$ , so  $-\frac{1}{8} = -0.125$ .
- First we find decimal notation for  $\frac{4}{9}$ .
 
$$\begin{array}{r} 0.44 \\ 9 \overline{)4.00} \\ \underline{36} \phantom{0} \\ 40 \\ \underline{36} \\ 4 \end{array}$$
 Thus,  $\frac{4}{9} = 0.\bar{4}$ , so  $-\frac{4}{9} = -0.\bar{4}$ .
- First we find decimal notation for  $\frac{2}{11}$ .
 
$$\begin{array}{r} 0.1818 \\ 11 \overline{)2.0000} \\ \underline{11} \phantom{000} \\ 90 \phantom{0} \\ \underline{88} \phantom{0} \\ 20 \\ \underline{11} \phantom{0} \\ 90 \\ \underline{88} \\ 2 \end{array}$$
 Thus  $\frac{2}{11} = 0.\bar{18}$ , so  $-\frac{2}{11} = -0.\bar{18}$ .
- The distance of  $-7$  from 0 is 7, so  $|-7| = 7$ .
- The distance of  $\frac{9}{4}$  from 0 is  $\frac{9}{4}$ , so  $\left|\frac{9}{4}\right| = \frac{9}{4}$ .
- The distance of  $-2.7$  from 0 is 2.7, so  $|-2.7| = 2.7$ . Then  $-|-2.7| = -2.7$ .
- The opposite of  $\frac{2}{3}$  is  $-\frac{2}{3}$  because  $\frac{2}{3} + \left(-\frac{2}{3}\right) = 0$ .
- The opposite of  $-1.4$  is 1.4 because  $-1.4 + 1.4 = 0$ .
- If  $x = -8$ , then  $-x = -(-8) = 8$ .

14. The graph of  $-0.2$  is  $\frac{2}{10}$  of the way from 0 to  $-1$ .



15. The reciprocal of  $-2$  is  $-\frac{1}{2}$  because  $-2\left(-\frac{1}{2}\right) = 1$ .

16. The reciprocal of  $\frac{4}{7}$  is  $\frac{7}{4}$  because  $\frac{4}{7} \cdot \frac{7}{4} = 1$ .

17.  $3.1 + (-4.7) = -1.6$

18.  $-8 + 4 + (-7) + 3 = -4 + (-7) + 3$   
 $= -11 + 3$   
 $= -8$

19.  $-\frac{1}{5} + \frac{3}{8} = -\frac{1}{5} \cdot \frac{8}{8} + \frac{3}{8} \cdot \frac{5}{5}$   
 $= -\frac{8}{40} + \frac{15}{40}$   
 $= \frac{7}{40}$

20.  $2 - (-8) = 2 + 8 = 10$

21.  $3.2 - 5.7 = 3.2 + (-5.7) = -2.5$

22.  $\frac{1}{8} - \left(-\frac{3}{4}\right) = \frac{1}{8} + \frac{3}{4}$   
 $= \frac{1}{8} + \frac{3}{4} \cdot \frac{2}{2}$   
 $= \frac{1}{8} + \frac{6}{8}$   
 $= \frac{7}{8}$

23.  $4 \cdot (-12) = -48$

24.  $-\frac{1}{2} \cdot \left(-\frac{3}{8}\right) = \frac{3}{16}$

25.  $-45 \div 5 = -9$  Check:  $-9 \cdot 5 = -45$

26.  $-\frac{3}{5} \div \left(-\frac{4}{5}\right) = -\frac{3}{5} \cdot \left(-\frac{5}{4}\right) = \frac{3 \cdot 5}{5 \cdot 4} = \frac{3 \cdot \cancel{5}}{\cancel{5} \cdot 4} = \frac{3}{4}$

27.  $4.864 \div (-0.5) = -9.728$

28.  $-2(16) - [2(-8) - 5^3] = -2(16) - [2(-8) - 125]$   
 $= -2(16) - [-16 - 125]$   
 $= -2(16) - [-141]$   
 $= -2(16) + 141$   
 $= -32 + 141$   
 $= 109$

29. Let  $D$  = the difference in elevations.

$$\underbrace{\text{Difference in elevation}} \text{ is } \underbrace{\text{Higher elevation}} \text{ minus } \underbrace{\text{Lower elevation}}$$

$$D = 2229 - (-15)$$

We carry out the subtraction.

$$D = 2229 - (-15) = 2229 + 15 = 2244$$

The difference in elevations is 2244 m.

30. Let  $P$  = the number of points by which the market has changed over the five week period.

$$\begin{array}{ccccccc} \text{Total} & & \text{Week 1} & & \text{Week 2} & & \text{Week 3} \\ \text{change} & = & \text{change} & + & \text{change} & + & \text{change} & + \\ \downarrow & & \downarrow & & \downarrow & & \downarrow & & \downarrow \\ P & = & -13 & + & (-16) & + & 36 & + \\ & & & & \underbrace{\text{Week 4}} & + & \underbrace{\text{Week 5}} & \\ & & & & \text{change} & & \text{change} & \\ & & & & \downarrow & & \downarrow & \\ & & & & (-11) & + & 19 & \end{array}$$

We carry out the computation.

$$\begin{aligned} P &= -13 + (-16) + 36 + (-11) + 19 \\ &= -29 + 36 + (-11) + 19 \\ &= 7 + (-11) + 19 \\ &= -4 + 19 \\ &= 15 \end{aligned}$$

The market rose 15 points.

31. First we multiply to find the total decrease  $d$  in the population.

$$d = 6 \cdot 420 = 2520$$

The population decreased by 2520 over the six year period.

Now we subtract to find the new population  $p$ .

$$18,600 - 2520 = 16,080$$

After 6 yr the population was 16,080.

32. First we subtract to find the total drop in temperature  $t$ .

$$t = 16^\circ\text{C} - (-17^\circ\text{C}) = 16^\circ\text{C} + 17^\circ\text{C} = 33^\circ\text{C}$$

Then we divide to find by how many degrees  $d$  the temperature dropped each minute in the 44 minutes from 11:08 A.M. to 11:52 A.M.

$$d = 33 \div 44 = 0.75$$

The temperature changed  $-0.75^\circ\text{C}$  each minute.

33. If  $x = 14$ , then  $-(-x) = -(-14) = 14$ . (The opposite of the opposite of 14 is 14.)

Answer D is correct.

34.  $|-27 - 3(4)| - |-36| + |-12|$   
 $= |-27 - 12| - |-36| + |-12|$   
 $= |-39| - |-36| + |-12|$   
 $= 39 - 36 + 12$   
 $= 3 + 12$   
 $= 15$

35. Let  $d$  = the difference in the depths. We represent the depth of the Marianas Trench as  $-11,033$  m and the depth of the Puerto Rico Trench as  $-8648$  m.

$$\begin{array}{ccccccc} \text{Difference} & & \text{Higher} & & \text{minus} & & \text{Lower} \\ \text{in depths} & \text{is} & \text{depth} & & & & \text{depth} \\ \downarrow & & \downarrow & & \downarrow & & \downarrow \\ d & = & -8648 & - & (-11,033) \end{array}$$

We carry out the subtraction.

$$d = -8648 - (-11,033) = -8648 + 11,033 = 2385$$

The Puerto Rico Trench is 2385 m higher than the Marianas Trench.

36. a) 6, 5, 3, 0,     ,     ,

Observe that  $5 = 6 - \boxed{1}$ ,  $3 = 5 - \boxed{2}$ , and  $0 = 3 - \boxed{3}$ .

To find the next three numbers in the sequence we subtract 4, 5, and 6, in order, from the preceding number. We have

$$\begin{aligned} 0 - 4 &= -4, \\ -4 - 5 &= -9, \\ -9 - 6 &= -15. \end{aligned}$$

- b) 14, 10, 6, 2,     ,     ,

Observe that each number is 4 less than the one that precedes it. Then we find the next three numbers as follows:

$$\begin{aligned} 2 - 4 &= -2, \\ -2 - 4 &= -6, \\ -6 - 4 &= -10. \end{aligned}$$

- c) -4, -6, -9, -13,     ,     ,

Observe that  $-6 = -4 - \boxed{2}$ ,  $-9 = -6 - \boxed{3}$ , and  $-13 = -9 - \boxed{4}$ . To find the next three numbers in the sequence we subtract 5, 6, and 7, in order, from the preceding number. We have

$$\begin{aligned} -13 - 5 &= -18, \\ -18 - 6 &= -24, \\ -24 - 7 &= -31. \end{aligned}$$

- d) 8, -4, 2, -1, 0.5,     ,     ,

Observe that we find each number by dividing the preceding number by  $-2$ . Then we find the next three numbers as follows:

$$\begin{aligned} \frac{0.5}{-2} &= -0.25, \\ \frac{-0.25}{-2} &= 0.125, \\ \frac{0.125}{-2} &= -0.0625 \end{aligned}$$

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### Cumulative Review Chapters 1 - 10

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1.  $26.3\% = 26.3 \times 0.01 = 0.263$

2. First we find decimal notation for  $\frac{5}{11}$ . Since  $\frac{5}{11}$  means  $5 \div 11$ , we divide.

$$\begin{array}{r} 0.4545\dots \\ 11 \overline{)5.0000} \\ \underline{44} \phantom{00} \\ 60 \phantom{0} \\ \underline{55} \phantom{0} \\ 50 \phantom{0} \\ \underline{44} \phantom{0} \\ 60 \phantom{0} \\ \underline{55} \phantom{0} \\ 5 \phantom{0} \end{array}$$

We have  $\frac{5}{11} = 0.\overline{45}$ , so  $-\frac{5}{11} = -0.\overline{45}$ .

3. Move the decimal point 1 place to the right.

$$83.4 \text{ cg} = 834 \text{ mg}$$

4. Move the decimal point 2 places to the left.

$$2.75 \text{ mm}^2 = 0.0275 \text{ cm}^2$$

5. The distance of  $-4.5$  from 0 is 4.5, so  $|-4.5| = 4.5$ .

6.  $\frac{150 \text{ m}}{12 \text{ sec}} = \frac{150 \text{ m}}{12 \text{ sec}} = 12.5 \text{ m/sec}$

7.  $r = \frac{d}{2} = \frac{70 \text{ mi}}{2} = 35 \text{ mi}$

$$C = \pi \cdot d \approx \frac{22}{7} \cdot 70 \text{ mi} = \frac{22 \cdot 70}{7} \text{ mi} = 220 \text{ mi}$$

$$A = \pi \cdot r \cdot r \approx \frac{22}{7} \cdot 35 \text{ mi} \cdot 35 \text{ mi} = \frac{22 \cdot 35 \cdot 35}{7} \text{ mi}^2 = 3850 \text{ mi}^2$$

8.  $\sqrt{225} = 15$  because  $15^2 = 225$ .

9.  $\sqrt{69} \approx 8.307$

10.  $-2 + 10$  The absolute values are 2 and 10. The difference is  $10 - 2$ , or 8. The positive number has the larger absolute value, so the answer is positive.  $-2 + 10 = 8$

11.  $2 - 13 = 2 + (-13) = -11$

12.  $(-2)(5) = -10$

13.  $\frac{-48}{-16} = 3$

14. The type of farmer with the greatest number of symbols is the type that works the greatest number of hours per week. This is the dairy farmer.

15. The cash grain farmer is represented by 4 symbols. Thus, this type of farmers works  $4 \cdot 10$ , or 40 hr, per week.

16. Move the decimal point 3 places to the left.

$$14.85 \times 0.001 = 0.01485$$

17.  $750,000$

$$\times 12,854$$

$$\hline 3000000$$

$$37500000$$

$$600000000$$

$$1500000000$$

$$7500000000$$

$$\hline 9,640,500,000$$

18.  $\frac{5}{22} - \frac{4}{11} = \frac{5}{22} - \frac{4}{11} \cdot \frac{2}{2}$

$$= \frac{5}{22} - \frac{8}{22} = \frac{5-8}{22}$$

$$= \frac{-3}{22}, \text{ or } -\frac{3}{22}$$

19.  $4 \left[ \frac{2}{9} \cdot \frac{2}{2} \right] = 4 \frac{4}{18} = 3 \frac{22}{18}$

$$-2 \frac{7}{18} = -2 \frac{7}{18} = -2 \frac{7}{18}$$

$$1 \frac{15}{18} = 1 \frac{5}{6}$$

20.  $35.1 + (-2.61)$  The absolute values are 35.1 and 2.61. The difference is  $35.1 - 2.61$ , or 32.49. The positive number has the larger absolute value, so the answer is positive.  
 $35.1 + (-2.61) = 32.49$

21. 
$$-\frac{3}{14} \div \frac{6}{7} = -\frac{3}{14} \cdot \frac{7}{6} = -\frac{3 \cdot 7}{14 \cdot 6} = -\frac{3 \cdot 7 \cdot 1}{2 \cdot 7 \cdot 2 \cdot 3} =$$

$$-\frac{1}{2 \cdot 2} \cdot \frac{3 \cdot 7}{3 \cdot 7} = -\frac{1}{4}$$

22.  $36 - (-3) + (-42) = 36 + 3 + (-42) = -3$

23. 
$$\frac{2}{27} \cdot \left(-\frac{9}{16}\right) = -\frac{2 \cdot 9}{27 \cdot 16} = -\frac{2 \cdot 9 \cdot 1}{3 \cdot 9 \cdot 2 \cdot 8} =$$

$$-\frac{1}{3 \cdot 8} \cdot \frac{2 \cdot 9}{2 \cdot 9} = -\frac{1}{24}$$

24. 
$$3(-4.5) + (2^2 - 3 \cdot 4^2) = 3(-4.5) + (4 - 3 \cdot 16)$$

$$= 3(-4.5) + (4 - 48)$$

$$= 3(-4.5) + (-44)$$

$$= -13.5 + (-44)$$

$$= -57.5$$

25. 
$$32 \div [(-2)(-8) - (15 - (-1))]$$

$$= 32 \div [(-2)(-8) - (15 + 1)]$$

$$= 32 \div [(-2)(-8) - 16]$$

$$= 32 \div [16 - 16]$$

$$= 32 \div 0$$

Division by 0 is not defined, so this expression is not defined.

26. Using a percent equation:

$$7 = \underbrace{\text{what percent of } 8?}_p \times 8$$

We divide by 8 on both sides of the equation and convert to percent notation.

$$7 = p \times 8$$

$$\frac{7}{8} = \frac{p \times 8}{8}$$

$$0.875 = p$$

$$87.5\% = p$$

Thus, 7 is 87.5% of 8.

Using a proportion.

$$\frac{7}{8} = \frac{N}{100}$$

$$7 \cdot 100 = 8 \cdot N \quad \text{Equating cross products}$$

$$\frac{7 \cdot 100}{8} = \frac{8 \cdot N}{8}$$

$$87.5 = N$$

Thus 7 is 87.5% of 8.

27. Using a percent equation.

*Translate.*  $4 = 12\frac{1}{2}\% \times b$ , or  $4 = 12.5\% \times b$

*Solve.* We divide by 12.5% on both sides.

$$\frac{4}{12.5\%} = \frac{12.5\% \times b}{12.5\%}$$

$$\frac{4}{0.125} = b \quad 12.5\% = 0.125$$

$$32 = b$$

Thus, 4 is  $12\frac{1}{2}\%$  of 32.

Using a proportion:

$$\frac{4}{b} = \frac{12\frac{1}{2}}{100}, \text{ or } \frac{4}{b} = \frac{12.5}{100}$$

$$4 \cdot 100 = b \cdot 12.5 \quad \text{Equating cross products}$$

$$\frac{4 \cdot 100}{12.5} = \frac{b \cdot 12.5}{12.5}$$

$$32 = b$$

Thus, 4 is  $12\frac{1}{2}\%$  of 32.

28. **Familiarize.** Let  $a$  = the final amount in the checking account.

**Translate.** We write an equation, starting with the original balance and then adding the deposit and the interest and subtracting the amounts of the checks and the service charge.

$$a = 324.98 - 12.76 - 213.25 + 429.72 + 0.97 - 3.00$$

**Solve.** We carry out the computation. We have  $a = 526.66$ .

**Check.** We can repeat the computation. The answer checks.

**State.** The final amount in the checking account is \$526.66.

29.  $r = \frac{d}{2} = \frac{7 \text{ cm}}{2} = 3.5 \text{ cm}$

$$V = \pi \cdot r^2 \cdot h$$

$$\approx 3.14 \times 3.5 \text{ cm} \times 3.5 \text{ cm} \times 8 \text{ cm}$$

$$= 307.72 \text{ cm}^3$$

30. 
$$\frac{42^\circ + 40^\circ + 43^\circ + 52^\circ + 50^\circ + 40^\circ}{6} = \frac{267^\circ}{6} = 44.5^\circ$$

31. **Familiarize.** Let  $s$  = the number of students who made the Dean's list.

**Translate.** We translate to a percent equation.

$$\begin{array}{c} \text{What is 13\% of 600?} \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ s = 13\% \times 600 \end{array}$$

**Solve.** We convert 13% to decimal notation and multiply.  
 $s = 0.13 \times 600 = 78$

**Check.** We see that  $\frac{78}{600} = 0.13 = 13\%$ . The answer checks.

**State.** 78 students made the Dean's list.

32. **Familiarize.** We will use the formula for the area of a rectangle,  $A = l \cdot w$  to find the area of the lot, the house, and the pool. Then we will subtract the areas of the house

and the pool from the area of the lot to find how much area is left after the house and the pool are built.

**Translate.**

$$\text{Area of the lot: } A = 125.5 \text{ m} \cdot 75 \text{ m}$$

$$\text{Area of the house: } A = 60 \text{ m} \cdot 40.5 \text{ m}$$

$$\text{Area of the pool: } A = 10 \text{ m} \cdot 8 \text{ m}$$

**Solve.** First we carry out the computations.

$$\text{Area of the lot: } A = 125.5 \text{ m} \cdot 75 \text{ m} = 9412.5 \text{ m}^2$$

$$\text{Area of the house: } A = 60 \text{ m} \cdot 40.5 \text{ m} = 2430 \text{ m}^2$$

$$\text{Area of the pool: } A = 10 \text{ m} \cdot 8 \text{ m} = 80 \text{ m}^2$$

Now let  $L$  = the area left.

$$L = 9412.5 - 2430 - 80 = 6902.5$$

**Check.** We repeat the calculations. The answer checks.

**State.** The area left after the house and the pool are built is 6902.5 m<sup>2</sup>.

- 33. Familiarize.** Let  $f$  = the number of cups of flour needed to make both recipes.

**Translate.** We write an addition sentence.

$$f = 1\frac{1}{4} + 1\frac{2}{3}$$

**Solve.** We carry out the addition.

$$\begin{array}{r} 1 \frac{1}{4} \cdot \frac{3}{3} = 1 \frac{3}{12} \\ + 1 \frac{2}{3} \cdot \frac{4}{4} = + 1 \frac{8}{12} \\ \hline 2 \frac{11}{12} \end{array}$$

Thus,  $f = 2\frac{11}{12}$ .

**Check.** We repeat the calculation. The answer checks.

**State.** To make both recipes,  $2\frac{11}{12}$  cups of flour are needed.

- 34. Familiarize.** Let  $w$  = the amount the four won in all. Let  $a$  = the average winnings.

**Translate.**

$$w = 74,834 + 58,253 + 57,200 + 49,154$$

$$a = \frac{74,834 + 58,253 + 57,200 + 49,154}{4}, \text{ or } \frac{w}{4}$$

**Solve.**

$$w = 74,834 + 58,253 + 57,200 + 49,154 = 239,441$$

$$a = \frac{w}{4} = \frac{239,441}{4} = 59,860.25$$

**Check.** We repeat the calculations. The answers check.

**State.** In all, the four winners won \$239,441. The average winnings were \$59,860.25.

- 35. Familiarize.** Let  $d$  = the distance walked, in km.

**Translate.**

$$\begin{array}{ccccccc} \text{Distance} & \text{is} & \text{Distance} & \text{times} & \text{Number} \\ \text{walked} & & \text{around} & & \text{of times} \\ \text{ } & & \text{block} & & \text{block is} \\ \text{ } & & \text{ } & & \text{circled} \\ \text{ } & & \text{ } & & \text{ } \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ d & = & 0.7 & \times & 6.5 \end{array}$$

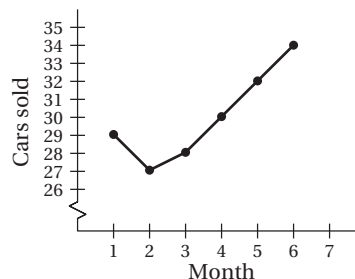
**Solve.** We carry out the multiplication.

$$d = 0.7 \times 6.5 = 4.55$$

**Check.** We repeat the calculation. The answer checks.

**State.** The walker traveled 4.55 km.

- 36.** We draw a horizontal scale, number it by ones from 1 through 6, and title it "Month." We observe that the number of cars sold ranges from 27 through 34. We number the vertical scale by ones from 26 through 35 and title it "Cars Sold." We draw a jagged line from 0 to 26 to indicate that this portion of the vertical scale is not shown. Next we mark the number of cars sold at appropriate levels above each month and draw line segments connecting adjacent points.



**37.**  $10\frac{8}{11} \approx 10\frac{1}{2}$

**38.**  $12\frac{3}{17} \approx 12$

**39.**  $7\frac{3}{10} + 4\frac{5}{6} - \frac{31}{29} \approx 7\frac{1}{2} + 5 - 1 = 11\frac{1}{2}$

**40.** 
$$\begin{aligned} 33\frac{14}{15} + 27\frac{4}{5} + 8\frac{27}{30} \cdot 8\frac{37}{76} \\ \approx 34 + 28 + 9 \cdot 8\frac{1}{2} \\ = 34 + 28 + 9 \cdot \frac{17}{2} \\ = 34 + 28 + \frac{153}{2} \\ = 34 + 28 + 76\frac{1}{2} \\ = 138\frac{1}{2} \end{aligned}$$

**41.**  $28^\circ + 32^\circ + x = 180^\circ$

$$60^\circ + x = 180^\circ$$

$$60^\circ + x - 60^\circ = 180^\circ - 60^\circ$$

$$x = 120^\circ$$