DIAGNOSING READINESS

page 2

1. $\frac{12}{15} = \frac{12 \div 3}{15 \div 3} = \frac{4}{5}$ **2.** $\frac{20}{28} = \frac{20 \div 4}{28 \div 4} = \frac{5}{7}$

3. $\frac{33}{77} = \frac{33 \div 11}{77 \div 11} = \frac{3}{7}$ **4.** $\frac{8}{56} = \frac{8 \div 8}{56 \div 8} = \frac{1}{7}$

5. $\frac{48}{52} = \frac{48 \div 4}{52 \div 4} = \frac{12}{13}$ **6.** $\frac{1}{8} + \frac{1}{6} = \frac{3}{24} + \frac{4}{24} = \frac{7}{24}$

7. $\frac{27}{33} - \frac{6}{22} = \frac{27}{33} - \frac{9}{33} = \frac{18}{33} = \frac{6}{11}$ **8.** $\frac{3}{4} + \frac{7}{10} =$
$\frac{15}{20} + \frac{14}{20} = \frac{29}{20} = 1\frac{9}{20}$ **9.** $\frac{12}{13} - \frac{1}{3} = \frac{36}{39} - \frac{13}{39} = \frac{23}{39}$

10. $5\frac{7}{10} + 6\frac{7}{8} = 11 + \frac{28}{40} + \frac{35}{40} = 11\frac{63}{40} = 12\frac{23}{40}$

11. $7\frac{5}{6} - 3\frac{1}{4} = 4 + \left(\frac{20}{24} - \frac{6}{24}\right) = 4\frac{14}{24} = 4\frac{7}{12}$

12. $3\frac{5}{12} - 1\frac{7}{12} = 2 + \left(\frac{5-7}{12}\right) = 2 + \left(\frac{-2}{12}\right) = 1\frac{10}{12} = 1\frac{5}{6}$

13. $4\frac{5}{7} + 8\frac{3}{4} = 12 + \frac{20}{28} + \frac{21}{28} = 12\frac{41}{28} = 13\frac{13}{28}$

14. 9^5 **15.** $8 \cdot 7^6$ **16.** $2^2 \cdot 3^6$

17. Voting population for Texas in 1988 was about 12,400,000 and for Florida was about 9,750,000. 12,400,000 − 9,750,000 = 2,650,000

18. The graph shows Texas having a greater vertical change from 1992 to 1996. increase ≈ 13,500,000 − 12,500,500 = 1,000,000 voters

1-1 Using Variables *pages 4–8*

Check Skills You'll Need p. 4 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. ÷ **2.** − **3.** + **4.** × **5.** − **6.** + **7.** × **8.** ÷ **9.** 21 **10.** 5 **11.** 4 **12.** 50

Check Understanding 1a. $\frac{4.2}{c}$ **1b.** $t - 15$ **2.** Let n be the number. **2a.** $n - 9$ **2b.** $2n + 31$ **2c.** $\frac{1}{2}n\left(\frac{1}{3}n\right)$ **3a.** $c = 15n$ **3b.** Each CD costs $10.99. **4.** Answers may vary. Sample: e = money earned, s = money saved, $s = \frac{1}{2}e$

Exercises 1. $p + 4$ **2.** $y - 12$ **3.** $12 - m$ **4.** $15c$ **5.** $\frac{n}{8}$ **6.** $\frac{17}{k}$ **7.** $x - 23$ **8.** $v + 3$ **9–16.** Choice of variable for the number may vary. Let n = number. **9.** $2n + 2$ **10.** $n - 11$ **11.** $9 - n$ **12.** $\frac{n}{82}$ **13.** $5n$ **14.** $13 + 2n$ **15.** $\frac{n}{6}$ **16.** $\frac{11}{n}$ **17–24.** Choices of variable may vary. Samples are given. **17.** c = total cost, n = number of cans, $c = 0.70n$ **18.** p = perimeter, s = length of a side, $p = 4s$ **19.** ℓ = total length in feet, n = number of tents, $\ell = 60n$ **20.** ℓ = number of slices left, e = number of slices eaten, $\ell = 8 - e$ **21.** w = number of workers, r = number of radios, $r = 13n$ **22.** n = number of tapes, c = cost, $c = 8.5n$ **23.** n = number of sales, t = total earnings, $t = 0.4n$ **24.** n = number of hours, p = pay, $p = 8n$ **25.** $9 + k - 17$ **26.** $5n + 6.7$ **27.** $37t + 9.85$ **28.** $\frac{3h}{4.5}$ **29.** $15 + \frac{60}{w}$ **30.** $7 - 3v$ **31.** $5m - \frac{t}{7}$ **32.** $\frac{p}{14} + \frac{q}{3}$ **33.** $8 - 9r$ **34–38.** Answers may vary. Samples are given. **34.** 5 more than q **35.** the difference of 3 and t **36.** one

more than the product of 9 and n **37.** the quotient of y and 5 **38.** the product of 7 times h and b **39–40.** Names of variables may vary. Samples: **39.** n = number of days, c = change in height (m), $c = 0.165n$ **40.** t = time in months, ℓ = length in inches, $\ell = 4.1t$ **41a. i.** Yes; 6 = 3 · 2. **ii.** Yes; 6 = 3 + 3. **41b.** Answers may vary. Sample: i; it makes sense that an equation relating lawns mowed and hours worked would have the form hours worked = lawns mowed · n, where n is the number of hours on average it takes to mow a lawn. **42–44.** Choices of variables may vary. Samples: **42a.** a = the amount in dollars and n = the number of quarters, $a = 0.25q$ **42b.** $a = 0.25(13) = 3.25$; $3.25 **43a.** d = drop height (ft), f = height of first bounce (ft), $f = \frac{1}{2}d$ **43b.** $f = \frac{1}{2}20 = 10$; 10 ft **44.** s = height of second bounce (ft), $s = \frac{1}{4}d$

45–47. Answers may vary. Samples are given. **45.** You walk at a rate of 5 mph. How far do you walk in 2 hours? Let d = distance in miles and t = time in hours. **46.** Anabel is three years older than her brother, Barry. How old will Anabel be when Barry is 12? Let a = Anabel's age and b = Barry's age in years. **47.** The Merkurs have budgeted $40 for a baby sitter. What hourly rate can they afford to pay if they need the sitter for 5 hours? Let h = the number of hours and c = the cost per hour. **48.** D **49.** H **50.** A **51.** G **52.** D **53.** F **54.** 0.9 **55.** 1.04 **56.** 1.35 **57.** 1.46 **58.** 0.63 **59.** 0.09 **60.** 0.14 **61.** 0.93 **62.** 1 **63.** 0.23 **64.** 3 **65.** 0.11 **66.** any four of 23, 29, 31, 37, 41, 43, and 47.

1-2 Exponents and Order of Operations *pages 9–16*

Check Skills You'll Need p. 9 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. 16 **2.** 49 **3.** 25 **4.** 81 **5.** 8 **6.** 3 **7.** 11 **8.** 1 **9.** 32 **10.** 10

Investigation 1. $P = 2(\ell + w) = 2(8 + 3) = 2 \cdot 11 = 22$; 22 in. **2.** multiply **3.** add **4.** Answers may vary. Sample: $p = 2(\ell + w)$; easier to use with mental math

Check Understanding 1a. $6 - 10 \div 5 = 6 - 2 = 4$ **1b.** $3 \cdot 6 - 4^2 \div 2 = 18 - 16 \div 2 = 18 - 8 = 10$ **1c.** $4 \cdot 7 + 4 \div 2^2 = 28 + 4 \div 4 = 28 + 1 = 29$ **1d.** $5^3 + 90 \div 10 = 125 + 9 = 134$ **2a.** $4(2) - 2(5) \div 2 = 8 - 10 \div 2 = 8 - 5 = 3$ **2b.** $5 + 6(2) \div 4 = 5 + 12 \div 4 = 5 + 3 = 8$ **2c.** $2^4 - 5 \cdot 2 = 16 - 10 = 6$ **2d.** $40 - 5^2 + 2 \cdot 5 \cdot 3 = 40 - 25 + 30 = 45$ **3.** $C = p + rp$; $C = 24.95 + (0.05)24.95$; $C = 24.95 + 1.25 = 26.20$ **4a.** $(5 + 3) \div 2 + (5^2 - 3) = 8 \div 2 + 22 = 4 + 22 = 26$ **4b.** $8 \div (9 - 7) + (13 \div 2) = 8 \div 2 + 6.5 = 4 + 6.5 = 10.5$ **5a.** $9(14^2) = 9 \cdot 196 = 1764$ **5b.** $9^2 \cdot 14 =$

$81 \cdot 14 = 1134$ **5c.** $(9 \cdot 14)^2 = 126^2 = 15{,}876$
6a. $5[4 + 3(2^2 + 1)] = 5(4 + 3 \cdot 5) = 5 \cdot 19 = 95$
6b. $12 + 3[18 - 5(16 - 13)] = 12 + 3(18 - 15) =$
$12 + 9 = 21$ **6c.** $5 + [(2 + 1)^3 - 3] = 5 + (27 - 3) = 29$

7. $A = h\left(\dfrac{b_1 + b_2}{2}\right); \; A = 130\left(\dfrac{100 + 200}{2}\right) = 130\left(\dfrac{300}{2}\right) =$
$19{,}500; \; 19{,}500 \text{ ft}^2$

Exercises 1. $5 + 6 \cdot 9 = 5 + 54 = 59$ **2.** $40 - 2 \cdot 3^2 =$
$40 - 18 = 22$ **3.** $8 + 12 \div 6 - 3 = 8 + 2 - 3 = 7$
4. $8 \cdot 4 + 9^2 = 32 + 81 = 113$ **5.** $5 \cdot 3^2 - 13 =$
$45 - 13 = 32$ **6.** $21 + 49 \div 7 + 1 = 21 + 7 + 1 = 29$
7. $5 + 12 + 2 \cdot 2 = 17 + 4 = 21$ **8.** $2 \cdot 12 \div 2 + 3 \cdot 5 =$
$12 + 15 = 27$ **9.** $12^2 - 4 \cdot 5 = 144 - 20 = 124$
10. $2 \cdot 5 + 5 = 10 + 5 = 15$ **11.** $5 \cdot 12 \cdot 2 + 5 \cdot 12 =$
$120 + 60 = 180$ **12.** $5 \cdot 5 + 12 \cdot 12 = 25 + 144 = 169$
13. $C = p + r \cdot p = 34.99 + 0.06(34.99) = 34.99 + 2.10 =$
$37.09; \$37.09$ **14.** $329 + 0.055(329) = 329 + 18.10 =$
$347.10; \$347.10$ **15.** $2(5 + 9) - 6 = 2 \cdot 14 - 6 =$
$28 - 6 = 22$ **16.** $(17 - 7) \div 5 + 1 = 10 \div 5 + 1 =$
$2 + 1 = 3$ **17.** $(2 + 9) \cdot (8 - 4) = 11 \cdot 4 = 44$
18. $(7^2 - 3^2) \div 8 = (49 - 9) \div 8 = 40 \div 8 = 5$
19. $17 - 5^2 \div (2^4 + 3^2) = 17 - 25 \div 25 = 16$
20. $(10^2 - 4 \cdot 8) \div (8 + 9) = (100 - 32) \div 17 =$
$68 \div 17 = 4$ **21.** $11 \cdot 8^2 = 11 \cdot 64 = 704$ **22.** $(11 \cdot 8)^2 =$
$88^2 = 7744$ **23.** $11^2 + 8^2 = 121 + 64 = 185$
24. $(11 + 8)^2 = 19^2 = 361$ **25.** $11^2 - 8^2 = 121 - 64 = 57$
26. $(11 - 8)^2 = 3^2 = 9$ **27.** $2(11^2)8 = 2(121)8 = 1936$
28. $(2 \cdot 11)^2 8 = 22^2 \cdot 8 = 3872$ **29.** $6[13 - 2(4 + 1)] =$
$6(13 - 10) = 18$ **30.** $[3(7 + 4) - 2]6 = (3 \cdot 11 - 2)6 =$
$31 \cdot 6 = 186$ **31.** $20 - [4(3 + 2)] = 20 - 4 \cdot 5 =$
$20 - 20 = 0$ **32.** $1^{11} + 3\left[\left(\dfrac{22}{11} + 8\right) \div 5\right] =$
$1 + 3(10 \div 5) = 1 + 3 \cdot 2 = 7$ **33.** $27[5^2 \div (4^2 + 3^2) + 2] =$
$27(25 \div 25 + 2) = 27(1 + 2) = 27 \cdot 3 = 81$
34. $9 + [4 - (10 - 9)^2]^3 = 9 + (4 - 1)^3 = 9 + 27 = 36$
35. $V = \dfrac{Bh}{3} = \dfrac{4 \cdot 6}{3} = 8; 8 \text{ cm}^3$ **36.** $V = \dfrac{Bh}{3} = \dfrac{21 \cdot 13}{3} =$
$91; 91 \text{ in.}^3$ **37.** $V = \dfrac{Bh}{3} = \dfrac{7 \cdot 9}{3} = 21; 21 \text{ ft}^3$ **38.** $V = \dfrac{Bh}{3} =$
$\dfrac{8.4 \cdot 10}{3} = 28; 28 \text{ cm}^3$ **39.** $V = \dfrac{Bh}{3} = \dfrac{500 \cdot 90}{3} = 15{,}000;$
$15{,}000 \text{ ft}^3$ **40.** $V = \dfrac{Bh}{3} = \dfrac{118 \cdot 66}{3} = 2596; 2596 \text{ cm}^3$
41. $(2 + 3)^2 - 10 = 5^2 - 10 = 25 - 10 = 15$
42. $2^3 + 3^2 - 10 = 8 + 9 - 10 = 7$ **43.** $(2^3 + 3)^2 - 10 =$
$(8 + 3)^2 - 10 = 11^2 - 10 = 121 - 10 = 111$
44. $(2^3 + 3^2) - 16 = 8 + 9 - 16 = 1$ **45.** $3 + 6 \cdot 8 =$
$3 + 48 = 51$ **46.** $(5.2 - 1) \cdot 12 = 4.2 \cdot 12 = 50.4$
47. $3 \cdot 9^2 - 1 = 3 \cdot 81 - 1 = 243 - 1 = 242$
48. $5 + (24 \div 3) \cdot 7^1 = 5 + 8 \cdot 7 = 5 + 56 = 61$
49. $(9.8 \cdot 2) + 6.5 \cdot 8 = 19.6 + 52 = 71.6$ **50.** $4\frac{1}{3} + 6 \cdot 9 =$
$4\frac{1}{3} + 54 = 58\frac{1}{3}$ **51.** $\dfrac{8^2 - 4}{72} = \dfrac{64 - 4}{72} = \dfrac{60}{72} = \dfrac{5}{6}$
52. $28 \div [(19 - 7) \div 3] = 28 \div (12 \div 3) = 28 \div 4 = 7$
53. $1 + 2(3 + 4) \div (5 \cdot 6) = 1 + 2 \cdot 7 \div 30 = 1 + 14 \div 30 =$
$1\frac{14}{30} = 1\frac{7}{15}$ **54.** $4^3 \div 8 - 1 + 5 \div 8 = 64 \div 8 - 1 + \frac{5}{8} =$
$8 - 1 + \frac{5}{8} = 7\frac{5}{8}$ **55a.** left side $= (a + b)^2 = (0 + 1)^2 =$
$1;$ right side $= a^2 + b^2 = 0^2 + 1^2 = 1$ **55b.** left side $=$
$(1 + 1)^2 = 4;$ right side $= 1^2 + 1^2 = 2$ **55c.** Answers may
vary. Sample: For $a = 2$ and $b = 3$, left side $= 25$, right

side $= 13$. **55d.** No; as seen in part (b), $(a + b)^2 =$
$a^2 + b^2$ is not true for all values of a and b.
56. $3 \cdot 7 - 4 = 21 - 4 = 17$ **57.** $3(7 - 4) = 3 \cdot 3 = 9$
58. $3 \cdot 7^2 - 4 = 3 \cdot 49 - 4 = 147 - 4 = 143$
59. $3(7^2 - 4) = 3(49 - 4) = 3 \cdot 45 = 135$
60. $(3 \cdot 7^2) - 4 = (3 \cdot 49) - 4 = 147 - 4 = 143$
61. $3(7 - 4)^2 = 3 \cdot 3^2 = 3 \cdot 9 = 27$ **62.** $3 \div 4 + 2 \cdot 7 =$
$\frac{3}{4} + 14 = 14\frac{3}{4}$ **63.** $4 \cdot 7^2 + 7 \cdot 4^2 = 4 \cdot 49 + 7 \cdot 16 =$
$196 + 112 = 308$ **64a.** $A = (17.5 - 4)(14 - 4) =$
$13.5 \cdot 10 = 135; 135 \text{ in.}^2$ **64b.** The frame is 2 in. wide, so it
adds 2 in. on each side. **65.** $w \approx 0.34\left(\dfrac{0.94}{2}\right) \approx 0.16; \$0.16$
66. $V = \dfrac{4\pi(4.6)^3}{3} \approx 407.72; 407.72 \text{ cm}^3$
67a. $V = \dfrac{4\pi(5)^3}{3} \approx 523.60$ **67b.** $\dfrac{4\pi(5 - 0.5)^3}{3} \approx 381.70;$
381.70 cm^3 **67c.** $\dfrac{381.70}{523.60} \approx 0.729;$ about 73%
68. $(5 \cdot 3^2 - 4) - 3 = (5 \cdot 9 - 4) - 3 = 45 - 4 - 3 = 38$
69. $[(5.2 + 3.5) + 4]10 = (8.7 + 4)10 = 12.7 \cdot 10 = 127$
70. $\dfrac{7 + 4 \cdot 5}{3} = \dfrac{7 + 20}{3} = \dfrac{27}{3} = 9$
71. $[12 \div (5 + 1)]5 = (12 \div 6)5 = 2 \cdot 5 = 10$
72. $2 + (34 - 3^2) \div 3 = 2 + (34 - 9) \div 3 =$
$2 + 25 \div 3 = 2 + 8\frac{1}{3} = 10\frac{1}{3}$ **73a.** $V = \pi r^2 h =$
$\pi(1.3)^2 4.5 \approx 23.89; 23.89 \text{ in.}^3$ **73b.** $\dfrac{23.89}{12} \approx 1.991; 2.0 \text{ in.}^3$
73c. $SA = 2\pi r(r + h) = 2\pi(1.3)(1.3 + 4.5) =$
$2\pi(1.3)(5.8) \approx 47.38; 47.38 \text{ in.}^2$ **74.** Yes; the rules for
simplifying are designed to produce exactly one result.
75. $(10 + 6) \div 2 - 3 = 16 \div 2 - 3 = 8 - 3 = 5$
76. $14 - (2 + 5) - 3 = 14 - 7 - 3 = 4$
77. $(3^2 + 9) \div 9 = (9 + 9) \div 9 = 18 \div 9 = 2$
78. $(6 - 4) \div 2 = 2 \div 2 = 1$ **79a.** $12 + 10 = 22;$
$15 + 7 = 22$ **79b.** No; part (a) shows that the value is
unaffected for the given numbers. **80a.** $9 + 7 = 16;$
$12 - 10 = 2$ **80b.** Yes; part (a) shows that the
placement of parentheses can affect the value of the
expression when both addition and subtraction are
involved. **81.** Answers may vary. Samples:
$2(4 - 1) - 5 = 1; 5 + 2 - (1 + 4) = 2; (2^4 - 1) \div 5 = 3;$
$1 + 2 + 5 - 4 = 4; 2 \cdot 5 - (1 + 4) = 5;$
$(5^2 - 1) \div 4 = 6; 5 + 4 - 1 \cdot 2 = 7; 2^5 \div (4 \cdot 1) = 8;$
$2^5 \div 4 + 1 = 9; 4^2 - (1 + 5) = 10; (4^2 - 5) \div 1 = 11;$
$1 + 2 + 4 + 5 = 12; 2^{(4-1)} + 5 = 13; 2 \cdot 5 + 1 \cdot 4 = 14;$
$5(4 - 1^2) = 15; 2(1 + 5) + 4 = 16; 5 + 4(2 + 1) = 17;$
$4(5 - 1) + 2 = 18; 4 \cdot 5 - 1^2 = 19; 4^2 + 5 - 1 = 20$
82a. $A = 8\left(\dfrac{4 + 5.5}{2}\right) = 4 \cdot 9.5 = 38; 38 \text{ ft}^2$
82b. yes; $2h\left(\dfrac{b_1 + b_2}{2}\right) = 2\left[h\left(\dfrac{b_1 + b_2}{2}\right)\right]$
no; $h\left(\dfrac{2b_1 + b_2}{2}\right) \neq 2h\left(\dfrac{b_1 + b_2}{2}\right)$ since $b_2 \neq 0$
yes; $h\left(\dfrac{2b_1 + 2b_2}{2}\right) = h\left(\dfrac{2(b_1 + b_2)}{2}\right) = 2\left[h\left(\dfrac{b_1 + b_2}{2}\right)\right]$
83. $5^3 - 15 \div 2 + 2 = 125 - 7.5 + 2 = 119.5;$ the answer
is D. **84.** $8(5 - 3)^3 + 9 = 8 \cdot 8 + 9 = 73;$ the answer is F.
85. $2(3.3)(4.5) + 2 = 31.7;$ the answer is B.
86. $(9 - 6.5)^2 = 6.25;$ the answer is H. **87.** $25 +$
$0.04 \cdot 25 = 25 + 1 = 26;$ the answer is B. **88.** $d =$
$16 \cdot 3^2 = 16 \cdot 9 = 144;$ the answer is F. **89.** $c + 2$ **90.** $36m$

91. $t - 21$ 92. $\frac{y}{5}$ 93. 50% 94. 34% 95. 95% 96. 145%
97. 6% 98. 43 99. 18.9 100. 1.25 101. 60.3
102–106. Answers may vary. Samples are given.
102. 8, 24, 56 103. 55, 100, 250 104. 44, 66, 121
105. 60, 150, 240 106. 26, 39, 52

READING MATH page 16

a. $4 \cdot 2 - 2 \cdot 5 \div 2 = 8 - 10 \div 2 = 8 - 5 = 3$
b. $5 + 6 \cdot 2 \div 4 = 5 + 12 \div 4 = 5 + 3 = 8$
c. $2^4 - 5 \cdot 2 = 16 - 10 = 6$ d. $40 - 5^2 + 2 \cdot 5 \cdot 3 = 40 - 25 + 30 = 45$

1-3 Exploring Real Numbers pages 17-23

Check Skills You'll Need p. 17 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.
1. $\frac{1}{2}$ 2. $\frac{1}{20}$ 3. $\frac{13}{4}$ 4. $\frac{13}{40}$ 5. 0.4 6. 0.375 7. $0.\overline{6}$ 8. $3.\overline{5}$
Check Understanding 1a. integers, rational numbers **1b.** rational numbers **1c.** natural numbers, whole numbers, integers, rational numbers **2.** rational numbers **3a.** true **3b.** False; answers may vary. Sample: $\frac{3}{1} = 3$ is a whole number. **4.** $\frac{1}{12}, -\frac{2}{3}, -\frac{5}{8}$ equal $\frac{2}{24}, -\frac{16}{24}, -\frac{15}{24}$; order is $-\frac{2}{3}, -\frac{5}{8}, \frac{1}{12}$. **5a.** 5 **5b.** 4 **5c.** 3.7 **5d.** $\frac{5}{7}$
Exercises 1. integers, rational numbers **2.** rational numbers **3.** rational numbers **4.** natural numbers, whole numbers, integers, rational numbers **5.** rational numbers **6.** integers, rational numbers **7.** whole numbers, integers, rational numbers **8.** rational numbers **9.** rational numbers **10.** irrational numbers
11–13. Answers may vary. Samples: **11.** -17 **12.** 53 **13.** 0.3 **14.** rational numbers **15.** whole numbers **16.** integers **17.** whole numbers **18.** rational numbers
19. true **20.** False; answers may vary. Sample: $-\frac{2}{3}$
21. False; answers may vary. Sample: 6 **22.** true
23. False; answers may vary. Sample: $-6 < |6|$
24. $\frac{2}{3} = \frac{4}{6} > \frac{1}{6}$ **25.** $-\frac{2}{3} = -\frac{4}{6} < -\frac{1}{6}$ **26.** $\frac{15}{8} > \frac{14}{8} = 1\frac{6}{8}$
27. $\frac{3}{5} = \frac{6}{10} = 0.6$ **28.** 2.001, 2.01, 2.1
29. $-9\frac{2}{3}, -9\frac{7}{12}, -9\frac{3}{4} = -9\frac{8}{12}, -9\frac{7}{12}, -9\frac{9}{12}$; order is $-9\frac{3}{4}, -9\frac{2}{3}, -9\frac{7}{12}$. **30.** $-\frac{5}{6}, -\frac{1}{2}, \frac{2}{3} = -\frac{5}{6}, -\frac{3}{6}, \frac{4}{6}$; order is $-\frac{5}{6}, -\frac{1}{2}, \frac{2}{3}$. **31.** $-1.01, -1.001, -1.0009$ **32.** $\frac{7}{11} = 0.\overline{63}$; order is $0.63, 0.636, \frac{7}{11}$. **33.** $\frac{22}{25} = 0.88; \frac{8}{9} = 0.\overline{8}$; order is $\frac{22}{25}, 0.8888, \frac{8}{9}$. **34.** 4 **35.** 9 **36.** $\frac{9}{14}$ **37.** 0.5 **38.** $\frac{3}{5}$
39. 0 **40.** 1295 **41.** $\frac{4}{5}$ **42–46.** Answers may vary. Samples are given. **42.** $\frac{1}{5}$ **43.** $\frac{5}{1}$ **44.** $\frac{213}{10}$ **45.** $\frac{1034}{1000}$ **46.** $\frac{-4}{1}$
47. natural numbers, whole numbers, integers, rational numbers **48.** natural numbers, whole numbers, integers, rational numbers **49.** rational numbers **50.** rational numbers **51.** = **52.** > **53.** < **54.** > **55.** = **56.** >
57. $4 + |3 - 1| = 4 + 2 = 6$ **58.** $|41 - 38| + 6 = 3 + 6 = 9$ **59.** $|a - a| + a = 0 + a = a$

60. $|24| + |-4| = 24 + 4 = 28$ **61.** $|12| \cdot |-4| = 12 \cdot 4 = 48$ **62.** $|-6 + 4| + |3| = 2 + 3 = 5$
63a. irrational **b.** No; π has no final digit. **64.** If P and T are opposites, they are the same distance from zero. Since S is 4 units from P and T, the coordinate of S is 0.
65. Negative; 0 is the point between R and S since the coordinates of Q and T are opposites, so if R is to the left of 0, then R is negative. **66.** Q; 0 is the point to the right of S because the coordinates of R and T are opposites. Therefore, the point Q is the farthest from 0, so it has the greatest absolute value. **67.** Answers may vary. Sample: 25, $|25| + |-25| = 50$ **68.** Sometimes; the difference can be a fraction. **69.** Sometimes; the product can be smaller. **70.** Sometimes; the opposite can be greater. **71.** always, by definition **72.** Yes; all can be expressed as ratios of themselves to 1. **73.** $-|5 + 1| = -6$ **74.** $2 \cdot 6 + \left|\frac{5}{1}\right| = 12 + 5 = 17$ **75.** $\frac{|6 - 1|}{5} = \frac{5}{5} = 1$ **76.** $|1 + 2| + |-7| = 3 + 7 = 10$
77a. aluminum $\frac{38.5}{14} = 2.75$; $2.75 \frac{g}{cm^3}$; gold $\frac{38.6}{2} = 19.3$; $19.3 \frac{g}{cm^3}$; silver $\frac{42}{4} = 10.5$; $10.5 \frac{g}{cm^3}$; diamond $\frac{1.75}{0.5} = 3.5$; $3.5 \frac{g}{cm^3}$ **77b.** aluminum, diamond, silver, gold
78. Answers may vary. Samples are given. **78a.** -2.2 **78b.** -2.81 **78c.** $-2\frac{1}{8}$ **78d.** Yes; find the average of the two given numbers. **79.** $-\left|-\frac{3}{4}\right| = -\frac{3}{4} = -0.75$; the answer is A. **80.** Since $-\frac{3}{4} = -0.75$, the order is -1, $-\frac{3}{4}, -0.7$; the answer is G. **81.** $|a| > 0$ and $-|a| < 0$ for all nonzero values of a; the answer is D. **82.** $-\frac{2}{3} = 0.\overline{6}$ is not an integer; the answer is G. **83.** The height difference of the bars is least in the year 1990; the answer is C. **84.** $-\frac{9}{3} = -3$; the answer is I. **85.** Area is often measured to the nearest tenth of a square unit; the answer is C. **86.** $3 + 5 \cdot 6 = 3 + 30 = 33$ **87.** $(3 + 5)6 = 8 \cdot 6 = 48$ **88.** $3 + 52 \cdot 6 = 3 + 312 = 315$
89. $(33 + 9) \div 6 = 42 \div 6 = 7$ **90.** $\frac{12 - 4 \cdot 3}{7 + 13 \cdot 15} = \frac{12 - 12}{7 + 195} = 0$ **91.** $8 - 3 \div 6 = 8 - \frac{1}{2} = 7\frac{1}{2}$
92. $5 \cdot 2 + 15 = 10 + 15 = 25$ **93.** $\frac{15 + 1}{2^2} = \frac{16}{4} = 4$
94. $15^2 - 15 \cdot 2 = 225 - 30 = 195$ **95–98.** Choices of variables may vary. **95.** n = number of tickets, $6.25n$ **96.** i = cost of item, $i + 3.98$ **97.** n = number of hours; d = distance traveled, $d = 7n$ **98.** c = total cost; n = number of books; $c = 3.5n$

1-4 Adding Real Numbers pages 24-31

Check Skills You'll Need p. 24 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.
1. 6 2. 17 3. 14 4. 59 5. 1.3 6. 5.2 7. 10.9 8. 17.1 9. $\frac{4}{5}$
10. $1\frac{2}{9}$ 11. $1\frac{1}{4}$ 12. $\frac{5}{8}$

Check Understanding

1a. $-6 + 4 = -2$
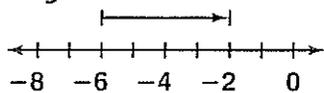
1b. $4 + (-6) = -2$
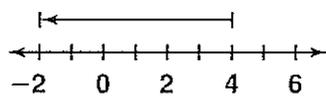
1c. $-3 + (-8) = -11$
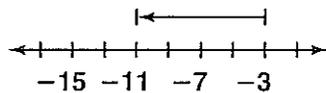
1d. $9 + (-3) = 6$
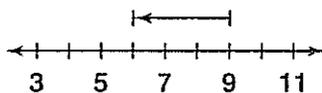
2a. -11 **2b.** -17.4 **2c.** $-1\frac{1}{4}$ **2d.** $\frac{1}{18}$ **3.** $-15 + 18 = 3$, rise of 3°F **4a.** -11.4 **4b.** -9.1 **4c.** 15.6 **4d.** 14.59

5. Choices of variable may vary. Sample: $c = $ change in temperature; $-14 + c$; temperature $= -25$°F

6a. $\begin{bmatrix} 5 \\ 3.2 \\ -4.9 \end{bmatrix} + \begin{bmatrix} -9 \\ -1.7 \\ -11.1 \end{bmatrix} = \begin{bmatrix} 5 - 9 \\ 3.2 - 1.7 \\ -4.9 - 11.1 \end{bmatrix} = \begin{bmatrix} -4 \\ 1.5 \\ -16 \end{bmatrix}$

6b. $\begin{bmatrix} -4 & \frac{7}{8} \\ \frac{3}{8} & 0 \end{bmatrix} + \begin{bmatrix} -5 & -\frac{3}{4} \\ \frac{1}{2} & -1 \end{bmatrix} = \begin{bmatrix} -4 - 5 & \frac{7}{8} - \frac{3}{4} \\ \frac{3}{8} + \frac{1}{2} & 0 - 1 \end{bmatrix} =$

$\begin{bmatrix} -9 & \frac{1}{8} \\ 1\frac{1}{4} & -1 \end{bmatrix}$

Exercises 1. $6 + (-3); 3$ **2.** $-1 + (-2); -3$ **3.** $-5 + 7; 2$
4. $3 + (-4); -1$ **5.** 15 **6.** -11 **7.** -19 **8.** 12.14 **9.** -4
10. 5 **11.** -8 **12.** -42 **13.** 2.2 **14.** -0.65 **15.** -7.49

16. 1.33 **17.** $\frac{4}{5} + \frac{2}{15} = \frac{12}{15} + \frac{2}{15} = \frac{14}{15}$ **18.** $-\frac{5}{9} + \left(-\frac{1}{3}\right) =$

$-\frac{5}{9} - \frac{3}{9} = -\frac{8}{9}$ **19.** $2\frac{1}{4} + 3\frac{15}{16} = 5 + \frac{4}{16} + \frac{15}{16} = 5\frac{19}{16} = 6\frac{3}{16}$

20. $-4\frac{3}{8} + \left(-1\frac{3}{4}\right) = -5 - \frac{3}{8} - \frac{6}{8} = -5\frac{9}{8} = -6\frac{1}{8}$

21. $-\frac{2}{3} + \frac{4}{6} = -\frac{4}{6} + \frac{4}{6} = 0$ **22.** $\frac{1}{9} + \left(-\frac{5}{6}\right) =$

$\frac{2}{18} - \frac{15}{18} = -\frac{13}{18}$ **23.** $-5\frac{7}{12} + 10\frac{3}{4} = 5 - \frac{7}{12} + \frac{9}{12} =$

$5\frac{2}{12} = 5\frac{1}{6}$ **24.** $\frac{9}{7} + \left(-2\frac{3}{14}\right) = \frac{18}{14} - 2\frac{3}{14} = -2 + \frac{15}{14} =$

$-1 + \frac{1}{14} = -\frac{13}{14}$ **25.** $-47 + 12 = -35; 35$ ft

26. $8 + (-5) = 3; 3$ yd **27.** $-6 + 13 = 7; 7$°F **28.** 8.7
29. -1.7 **30.** 1.7 **31.** -8.7 **32.** 12.6 **33.** -5.6 **34.** 5.6
35. -12.6 **36–37.** Choices of variable may vary. **36.** $c = $ change in temperature, $-8 + c$ **36a.** $-8 + 7 = -1; -1$°F
36b. $-8 - 3 = -11; -11$°F **36c.** $-8 + 19 = 11; 11$°F
37. $c = $ change in amount of money, $74 + c$ **37a.** $74 + 18 = 92; \$92$ **37b.** $74 - 29 = 45; \$45$ **37c.** $74 - 47 = 27;$

$\$27$ **38.** $\begin{bmatrix} 7 & -8 \\ -12 & 6.2 \end{bmatrix} + \begin{bmatrix} -8 & 9.4 \\ -9 & 17 \end{bmatrix} =$

$\begin{bmatrix} 7 - 8 & -8 + 9.4 \\ -12 - 9 & 6.2 + 17 \end{bmatrix} = \begin{bmatrix} -1 & 1.4 \\ -21 & 23.2 \end{bmatrix}$

39. $\begin{bmatrix} -7.1 \\ 3.2 \\ -4.9 \end{bmatrix} + \begin{bmatrix} -11 \\ 8.4 \\ 24 \end{bmatrix} = \begin{bmatrix} -7.2 - 11 \\ 3.2 + 8.4 \\ -4.9 + 24 \end{bmatrix} = \begin{bmatrix} -18.2 \\ 11.6 \\ 19.1 \end{bmatrix}$

40. $\begin{bmatrix} \frac{1}{2} \\ 8 \\ -9 \end{bmatrix} + \begin{bmatrix} -\frac{1}{2} \\ 17 \\ -3 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} - \frac{1}{2} \\ 8 + 17 \\ -9 - 3 \end{bmatrix} = \begin{bmatrix} 0 \\ 25 \\ -12 \end{bmatrix}$

41. $\begin{bmatrix} 1.3 & 26 \\ \frac{1}{8} & -2 \end{bmatrix} + \begin{bmatrix} 0.5 & -4 \\ -\frac{5}{8} & 9 \end{bmatrix} = \begin{bmatrix} 1.3 + 0.5 & 26 - 4 \\ \frac{1}{8} - \frac{5}{8} & -2 + 9 \end{bmatrix} =$

$\begin{bmatrix} 1.8 & 22 \\ -\frac{1}{2} & 7 \end{bmatrix}$

42. $2.4 + (-8.7) + 3.6 = 2.4 - 8.7 + 3.6 = -2.7$
43. $-13.2 + 7 + (-6.8) = -13.2 + 7 - 6.8 = -13$
44. $0.9 + 6.4 + (-0.7) = 0.9 + 6.4 - 0.7 = 6.6$
45. $\frac{1}{6} + 12 + \left(-\frac{3}{8}\right) = \frac{4}{24} + 12 - \frac{9}{24} = 12 - \frac{5}{24} =$

$11\frac{19}{24}$ **46.** $|-4| + (-4) + 4 = 4 - 4 + 4 = 4$

47. $1\frac{4}{7} + \left(-8\frac{1}{5}\right) + 3 = 1\frac{20}{35} - 8\frac{7}{35} + 3 = -4 + \frac{20 - 7}{35} =$

$-4 + \frac{13}{35} = -3\frac{22}{35}$ **48.** $-17 + (-1.7) + 0.17 =$

$-17 - 1.7 + 0.17 = -18.53$ **49.** $2.47 + (-9.8) + (-13.5) =$

$2.47 - 9.8 - 13.5 = -20.83$ **50.** $-8.02 + |-5.9| + 0.4 =$

$-8.02 + 5.9 + 0.4 = -1.72$ **51.** $-\frac{1}{3} + \frac{1}{4} + \left(-\frac{1}{5}\right) =$

$-\frac{20}{60} + \frac{15}{60} - \frac{12}{60} = -\frac{17}{60}$ **52.** $-\frac{5}{12} + 1\frac{5}{8} + \left(-6\frac{3}{10}\right) =$

$-5 - \frac{50}{120} + \frac{75}{120} - \frac{36}{120} = -5\frac{11}{120}$ **53.** $|-0.1| + |-0.7| =$

$0.1 + 0.7 = 0.8$ **54.** $|-2| + \left(-\frac{2}{3}\right) + 3 = 2 - \frac{2}{3} + 3 = 4\frac{1}{3}$
55. $-4.3 + 1.2 + (-5.7) = -4.3 + 1.2 - 5.7 = -8.8$

56. 13.8 million people **57.** 6.3 million people

58. Weaving; add the numbers in each column.

59a. $\frac{100}{442} = \frac{50}{221}$ **59b.** $\frac{50}{221} \approx 0.2262; 0.23$ **59c.** about 23%
60. $-(-2) + 2 + (-4) = 2 + 2 - 4 = 0$ **61.** $-|-2| =$
-2 **62.** $-2 + 3 = 1$ **63.** $-2 + (-3) = -2 - 3 = -5$
64. $-2 + 3 \cdot 3 = -2 + 9 = 7$ **65.** $-4 + 3 \cdot 3 =$
$-4 + 9 = 5$ **66.** $-4 + (-2) + 5 = -4 - 2 + 5 = -1$
67. $-[-4 + (-2) + 5] = -(-4 - 2 + 5) = -(-1) = 1$
68. The sum of -227 and 319; the sum of -227 and 319 is positive, while the sum of 227 and -319 is negative.
69. Answers may vary. Samples: Although 20 and -20 are opposite *numbers*, there is no such thing as opposite *temperatures*; 20°F and -20°F are objective data, whereas "very hot" and "very cold" are subjective conditions; 20°F and -20°F are balanced about 0°F, but 0°F is quite cold. **70.** $-3.5 + 3.2 = -0.3$
71. $-9 + (-3.5) + (-1.2) = -9 - 3.5 - 1.2 = -13.7$
72. $-3.5 + |-2.9| = -3.5 + 2.9 = -0.6$
73. $8.5 + (-3.5) + 3.7 = 8.5 - 3.5 + 3.7 = 8.7$
74. $|-3.5| + (-3.4) = 3.5 - 3.4 = 0.1$
75. $-5.6 + (-3.5) + 7.2 = -5.6 - 3.5 + 7.2 = -1.9$
76. $12(+1) + 10(-1) = 12 - 10 = 2$ **77.** Answers may
vary. Sample: $\begin{bmatrix} 2 & 0 & 1 \\ -1 & 3 & 0.5 \end{bmatrix}$ **78.** The matrices are not the
same size, so they can't be added. **79.** No; time and temperature are different kinds of quantity and can't be added.

80a. $\begin{bmatrix} 8 & 3 & 5 & 1 \\ 10 & 2 & 2 & 1 \\ 4 & 1 & 0 & 1 \end{bmatrix}; \begin{bmatrix} 5 & 2 & 1 & 1 \\ 8 & 2 & 0 & 1 \\ 2 & 1 & 0 & 1 \end{bmatrix}$ **80b.** $\begin{bmatrix} 13 & 5 & 6 & 2 \\ 18 & 4 & 2 & 2 \\ 6 & 2 & 0 & 2 \end{bmatrix}$

80c. $2 + 2 = 4$; 4 employees
80d. $4 + 1 + 1 + 2 + 1 + 1 = 10$; 10 employees
80e. Sum the columns of the matrix in 80b above. Multiply each result by the wage, and add:
$37(\$6.25) + 11(\$6.50) + 8(\$7.00) + 6(\$7.50) = \$403.75$; $\$403.75$ per hour. **80f.** Total wages are $\$403.75(8) = \$3230$ for an 8-hour shift. **81.** $-34 + 17 + 49 - 25 = 7$; $\$7$ **82a.** $-n = -(-4) = 4$ **82b.** $-n = -(4) = -4$
82c. negative values of n; positive values of n
83. $\frac{5}{6} \div \frac{2}{3} = \left(\frac{5}{6}\right)\left(\frac{3}{2}\right) = \frac{5}{4} = 1\frac{1}{4}; \left(3\frac{1}{3}\right)\left(\frac{3}{4}\right) = \left(\frac{10}{3}\right)\left(\frac{3}{4}\right) = \frac{5}{2} =$

$2\frac{1}{2}; -4 + 2\frac{1}{2} = -1\frac{1}{2}; \frac{1}{2} + \left(\frac{2}{5}\right)\left(\frac{5}{4}\right) = \frac{1}{2} + \frac{1}{2} = 1; \begin{bmatrix} 1\frac{1}{4} & -1\frac{1}{2} \\ 2\frac{1}{2} & 1 \end{bmatrix}$

84. $\begin{bmatrix} 8 + 2 \div 4 & 2^5 & -12 + (-15) \\ -45 + 5(13) & \frac{10 + 16}{4} & 4 - 2^2 \end{bmatrix} =$

$\begin{bmatrix} 8 + \frac{1}{2} & 32 & -12 - 15 \\ -45 + 65 & \frac{26}{4} & 4 - 4 \end{bmatrix} = \begin{bmatrix} 8\frac{1}{2} & 32 & -27 \\ 20 & 6\frac{1}{2} & 0 \end{bmatrix}$

85. $\frac{w}{5} + \left(-\frac{w}{10}\right) = \frac{2w}{10} - \frac{w}{10} = \frac{w}{10}$

86. $-\frac{c}{4} + \left(-\frac{c}{4}\right) = -\frac{c}{4} - \frac{c}{4} = -\frac{2c}{4} = -\frac{c}{2}$

87. $3\left(\frac{a}{7}\right) + 7\left(\frac{a}{3}\right) = \frac{9a}{21} + \frac{49a}{21} = \frac{58a}{21}$

88. $-1\left(\frac{b}{9}\right) + \left(-\frac{b}{9}\right) = \frac{-b - b}{9} = -\frac{2b}{9}$

89. $\frac{-x}{4} + \frac{x}{3} = -\frac{3x}{12} + \frac{4x}{12} = \frac{x}{12}$

90. $\frac{x}{4} + \left(-\frac{x}{3}\right) = \frac{3x}{12} - \frac{4x}{12} = -\frac{x}{12}$

91. $\frac{2t}{3} + \frac{-3t}{6} = \frac{4t}{6} - \frac{3t}{6} = \frac{t}{6}$

92. $\frac{-m}{2} + \left(\frac{-m + 1}{4}\right) = \frac{-2m - m + 1}{4} = \frac{-3m + 1}{4}$

93. $\frac{m}{6} + \left(-\frac{m}{18}\right) = \frac{3m}{18} - \frac{m}{18} = \frac{2m}{18} = \frac{m}{9}$ **94.** Positive; $-m$ is positive, and the sum of two positives is positive. **95.** Negative; $-n$ is negative, and the sum of two negatives is negative. **96.** Positive; $-m$ is positive, and the sum of two positives is positive. **97.** Zero; the sum of a negative and a positive is the difference of the absolute values. $|n| - |m| = |n| - |n| = 0$ **98.** Zero; $n + (-m) = n + (-n) = 0$ **99.** $10 + |-3| + (-3) = 10 + 3 - 3 = 10$; the answer is B.
100. $[3 \cdot 5 + (-1)] + (-20) = 15 - 1 - 20 = -6$; the answer is F. **101.** A. -4 B. -4 C. -4 D. $+4$; the answer is D. **102.** $18 - (-12) = 18 + 12 = 30$; the answer is F.
103. $-(-(-27)) = -(27) = -27$ A. -27
B. $-12.8 - 14.2 = -27$ C. -25 D. -27; the answer is C.
104. $95 - 34 + 32 - 16 = 77$; the answer is H.
105. $<$ **106.** $=$ **107.** $<$ **108.** $>$

109. $\left|-\frac{3}{10}\right| = \left|-\frac{27}{90}\right| = \frac{27}{90}; \left|\frac{2}{9}\right| = \left|\frac{20}{90}\right| = \frac{20}{90}$; the answer is $>$. **110.** $=$ **111.** $(5 - 2)^2 = 3^2 = 9$ **112.** $-4 + 3.1(2) = -4 + 6.2 = 2.2$ **113.** $9[5 + (-3)] = 9 \cdot 2 = 18$
114. $4^2 + 3^2 - 2^2 = 16 + 9 - 4 = 21$

CHECKPOINT QUIZ 1   *page 31*

1. $b + 4; -2 + 4 = 2$ **2.** $\frac{c}{2}; \frac{2.5}{2} = 1.25$ **3.** $4.3a; 4.3 \cdot 3 =$

12. 9 **4.** $b + c + 2a; -2 + 2.5 + 2 \cdot 3 = 6.5$ **5.** $b + 17$;
$-2 + 17 = 15$ **6.** $3c; 3(2.5) = 7.5$ **7.** $24 - a; 24 - 3 = 21$
8. $b + 2a; -2 + 2 \cdot 3 = 4$ **9.** No; the statement is not true for nonpositive numbers. **10.** whole numbers

1-5 Subtracting Real Numbers
pages 32–36

Check Skills You'll Need p. 32 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.
**1.** -6 **2.** 7 **3.** -3.79 **4.** $\frac{7}{19}$ **5.** 1 **6.** 6 **7.** 5 **8.** $\frac{1}{2}$

Check Understanding
1a. $2 - 6 = -4$
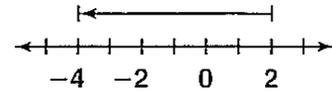
1b. $-1 - 4 = -5$
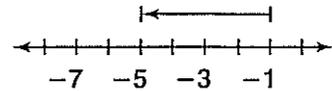
1c. $-3 - 8 = -11$
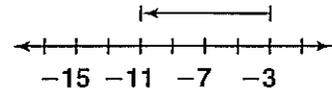
1d. $7 - 2 = 5$
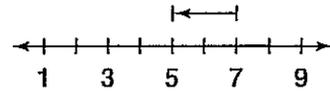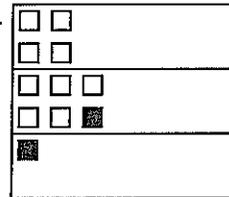
2a. $4 - 5 = -1$
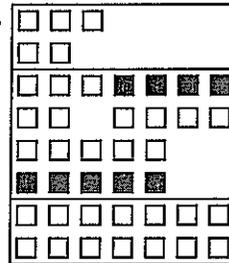
2b. $5 - (-9) = 14$
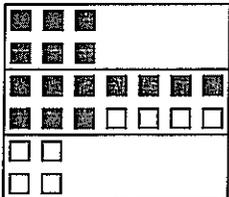
2c. $-6 - (-10) = 4$
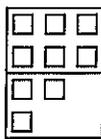
2d. $6 - 3 = 3$

3a. -8 **3b.** $8 - (-4) = 8 + 4 = 12$
3c. $3.7 - (-4.3) = 3.7 + 4.3 = 8.0$
3d. $-\frac{8}{9} - \left(-\frac{5}{6}\right) = -\frac{16}{18} + \frac{15}{18} = -\frac{1}{18}$ **4a.** $|8 - 7| = |1| = 1$ **4b.** $|7 - 8| = |-1| = 1$ **4c.** $|-10 - (-4)| = |-10 + 4| = |-6| = 6$ **4d.** $|-4 - (-10)| =$

$|-4 + 10| = |6| = 6$ **5a.** $-7 - (-2) = -7 + 2 = -5$
5b. $-2 - (-7) = -2 + 7 = 5$ **5c.** $-(-2) - (-7) =$
$2 + 7 = 9$ **5d.** $-(-7) - [-(-2)] = 7 - (2) = 5$
6. ABC: $32.79 - 0.32 = 32.47$, or \$32.47; PQR: $14.23 - (-1.23) = 15.46$, or \$15.46

Exercises 1. -1
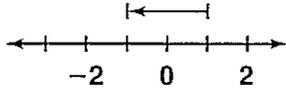
2. -2
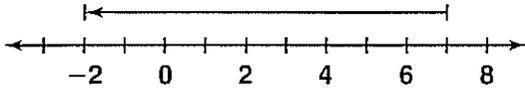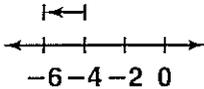
3. -6 **4.** -5
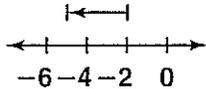
5. 1
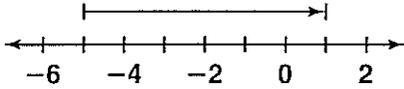
6. -11
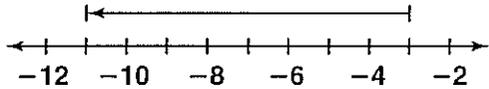
7. 14
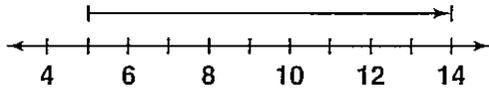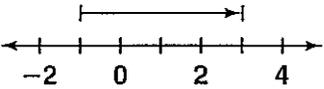
8. 3   **9.** $3 - 7 = -4$
             10. $2 - (-9) =$
             $2 + 9 = 11$ **11.** -10
12. $-5 - (-1) = -5 + 1 = -4$ **13.** $6.2 - 8.3 = -2.1$
14. $-7.4 - 1.8 = -9.2$ **15.** $5.3 - (-8.4) = 5.3 + 8.4 = 13.7$ **16.** $-3.6 - (-7.1) = -3.6 + 7.1 = 3.5$
17. $\frac{1}{3} - \frac{1}{2} = \frac{2}{6} - \frac{3}{6} = -\frac{1}{6}$ **18.** $-\frac{2}{5} - \frac{7}{10} = -\frac{4}{10} - \frac{7}{10} =$
$-\frac{11}{10} = -1\frac{1}{10}$ **19.** $\frac{2}{12} - \left(-\frac{3}{4}\right) = \frac{2}{12} + \frac{9}{12} = \frac{11}{12}$
20. $-\frac{5}{12} - \left(-\frac{1}{10}\right) = -\frac{25}{60} + \frac{6}{60} = -\frac{19}{60}$ **21.** $|5 - 2| =$
$|3| = 3$ **22.** $|-7 - 1| = |-8| = 8$ **23.** $|4 - 10| =$
$|-6| = 6$ **24.** $|-3 - (-5)| = |-3 + 5| = |2| = 2$
25. $|-6 - 7| = |-13| = 13$ **27.** $|3 - 9| = |-6| = 6$
28. $|-11 - (-8)| = |-11 + 8| = |-3| = 3$
29. $-4 - 6 = -10$ **30.** $3 - (-4) = 3 + 4 = 7$
31. $-(-4) - 3 = 4 - 3 = 1$ **32.** $-3 - (-4) =$
$-3 + 4 = 1$ **33.** $6 - 3 = 3$ **34.** $2(3) - 6 = 6 - 6 = 0$
35. $3 + (-4) - 6 = 3 - 4 - 6 = -7$
36. $-6 + (-4) - 3 = -6 - 4 - 3 = -13$
37. $51.72 - 1.08 = 50.64$; \$50.64 **38.** $-2 - 3.5 + (-4) =$
$-2 - 3.5 - 4 = -9.5$ **39.** $-(-4) - 3.5 - 2 =$
$4 - 3.5 - 2 = -1.5$ **40.** $-|-2| = -2$
41. $|-2| + |3.5| = 2 + 3.5 = 5.5$ **42.** $|-2 + 3.5| = |1.5| = 1.5$ **43.** $-|3 + (-2)| = -|3 - 2| = -1$
44. $4(3.5) - (-2) = 14 + 2 = 16$
45. $-4(3.5) - |-2| = -14 - 2 = -16$
46. $|-4 + (-2) - 5| = |-4 - 2 - 5| = |-11| = 11$
47. $|-4 + (-2) + 5| = |-4 - 2 + 5| = |-1| = 1$
48. $|-2 - (-4)| - |-4| = |-2 + 4| - 4 = |2| - 4 = 2 - 4 = -2$ **49.** $|-2| + |3(3.5)| = 2 + |10.5| =$

$2 + 10.5 = 12.5$ **50.** $1000 - 350 = 650$; 650 ft
51. Answers may vary. Sample:
$$\begin{bmatrix} 5 & 12 \\ -3 & 7 \end{bmatrix} - \begin{bmatrix} 4 & 6 \\ 5 & 10 \end{bmatrix} = \begin{bmatrix} 5 - 4 & 12 - 6 \\ -3 - 5 & 7 - 10 \end{bmatrix} = \begin{bmatrix} 1 & 6 \\ -8 & -3 \end{bmatrix}$$
52–53. Examples may vary. Samples: **52.** false;
$-1 - (-7) = 6; -1 + (-7) = -8$ **53.** false; $2 - (-1) = 3; 3 \not< 2$ or -1 **54.** $a - (-a) = a + a = 2a$; true

55a. 1992: $\begin{bmatrix} 5.5 & 8.2 & 4.9 \\ 1.4 & 3.2 & 3.9 \\ 4.2 & 3.8 & 1.3 \\ 1.6 & 5.2 & 5.1 \end{bmatrix}$ 1997: $\begin{bmatrix} 6.8 & 7.9 & 4.9 \\ 1.0 & 1.8 & 1.7 \\ 5.6 & 4.1 & 1.3 \\ 1.8 & 4.9 & 2.9 \end{bmatrix}$

55b. $\begin{bmatrix} 6.8 & 7.9 & 4.9 \\ 1.0 & 1.8 & 1.7 \\ 5.6 & 4.1 & 1.3 \\ 1.8 & 4.9 & 2.9 \end{bmatrix} - \begin{bmatrix} 5.5 & 8.2 & 4.9 \\ 1.4 & 3.2 & 3.9 \\ 4.2 & 3.8 & 1.3 \\ 1.6 & 5.2 & 5.1 \end{bmatrix} =$

$\begin{bmatrix} 6.8 - 5.5 & 7.9 - 8.2 & 4.9 - 4.9 \\ 1.0 - 1.4 & 1.8 - 3.2 & 1.7 - 3.9 \\ 5.6 - 4.2 & 4.1 - 3.8 & 1.3 - 1.3 \\ 1.8 - 1.6 & 4.9 - 5.2 & 2.9 - 5.1 \end{bmatrix} = \begin{bmatrix} 1.3 & -0.3 & 0 \\ -0.4 & -1.4 & -2.2 \\ 1.4 & 0.3 & 0 \\ 0.2 & -0.3 & -2.2 \end{bmatrix}$

55c. Answers may vary.
  Sample: Invest in soccer; it is
  the only sport that has not lost any participants.
56. $\begin{bmatrix} -3 & 4 \\ 0 & -1 \end{bmatrix} - \begin{bmatrix} -5 & 6 \\ 9 & -4 \end{bmatrix} =$
$\begin{bmatrix} -3 - (-5) & 4 - 6 \\ 0 - 9 & -1 - (-4) \end{bmatrix} = \begin{bmatrix} 2 & -2 \\ -9 & 3 \end{bmatrix}$
57. $\begin{bmatrix} \frac{3}{8} & \frac{1}{5} & 4 \end{bmatrix} - \begin{bmatrix} \frac{5}{8} & \frac{2}{10} & 7 \end{bmatrix} =$
$\begin{bmatrix} \left(\frac{3}{8} - \frac{5}{8}\right) & \left(\frac{1}{5} - \frac{1}{5}\right) & 4 - 7 \end{bmatrix} = \begin{bmatrix} -\frac{1}{4} & 0 & -3 \end{bmatrix}$
58. $\begin{bmatrix} \frac{1}{4} \\ -3 \end{bmatrix} - \begin{bmatrix} \frac{2}{3} \\ -2 \end{bmatrix} = \begin{bmatrix} \frac{3}{12} - \frac{8}{12} \\ -3 - (-2) \end{bmatrix} = \begin{bmatrix} -\frac{5}{12} \\ -1 \end{bmatrix}$
59a. Yes; answers may vary. Sample: n and $-n$ always
have the same absolute value. **59b.** No; answers may
vary. Sample: $|1| + |-1| = 2; |1 + (-1)| = 0$
60. $1 - \frac{1}{2} - \frac{1}{3} - \frac{1}{4} - \frac{1}{5} - \frac{1}{6} =$
$1 - \frac{30}{60} - \frac{20}{60} - \frac{15}{60} - \frac{12}{60} - \frac{10}{60} = 1 - \frac{87}{60} = -\frac{27}{60} = -\frac{9}{20}$
61. $1 - \left(\frac{1}{2} - \left(\frac{1}{3} - \left(\frac{1}{4} - \left(\frac{1}{5} - \frac{1}{6}\right)\right)\right)\right) =$
$1 - \left(\frac{1}{2} - \left(\frac{1}{3} - \left(\frac{1}{4} - \left(\frac{6}{30} - \frac{5}{30}\right)\right)\right)\right) =$
$1 - \left(\frac{1}{2} - \left(\frac{1}{3} - \left(\frac{1}{4} - \frac{1}{30}\right)\right)\right) =$
$1 - \left(\frac{1}{2} - \left(\frac{1}{3} - \left(\frac{15}{60} - \frac{2}{60}\right)\right)\right) =$
$1 - \left(\frac{1}{2} - \left(\frac{1}{3} - \frac{13}{60}\right)\right) = 1 - \left(\frac{1}{2} - \left(\frac{20}{60} - \frac{13}{60}\right)\right) =$
$1 - \left(\frac{1}{2} - \frac{7}{60}\right) = 1 - \left(\frac{30}{60} - \frac{7}{60}\right) = 1 - \frac{23}{60} = \frac{37}{60}$
62. $5x - 7x + 6 - 2x - 5 + 8 = -4x + 9$
63. $-8t - 5m + 3m - 7t - (-3t) + m = -12t - m$
64. $\frac{7r - 8}{4} - \left(\frac{-r + 3}{16}\right) = \frac{28r - 32}{16} + \left(\frac{r - 3}{16}\right) = \frac{29r - 35}{16}$
65. $\frac{-5w - 2 + w - 1}{3} - \frac{w - 3w + 4w - 1 + w}{9} =$
$\frac{-4w - 3}{3} - \frac{3w - 1}{9} = \frac{-12w - 9}{9} - \frac{3w - 1}{9} = \frac{-15w - 8}{9}$

66. $|x + y| = |-8 + (-10)| = |-8 - 10| = |-18| = 18$;
$|x - y| = |-8 - (-10)| = |-8 + 10| = |2| = 2$;
$|x| - |y| = |-8| - |-10| = 8 - 10 = -2$;
$x - y = -8 - (-10) = -8 + 10 = 2$; in increasing order: $|x| - |y|$, $|x - y|$ and $x - y$, $|x + y|$
67. $-|-3 - 4| + |-4| = -7 + 4 = -3$; the answer is C.
68. F. -19 G. 5 H. 5 I. 5; the answer is F.
69. Pattern: subtract 3 from previous term; $2 - 3 = -1$; the answer is C. **70.** 1995: 10; 2000: 12.50; 2005: 15.00; the answer is H. **71.** $8 - 5 - 9 = -6$; the answer is D.

72. 4 **73.** -9 **74.** -0.7 **75.** -4.1 **76.** $\begin{bmatrix} 4 & 0 \\ 0 & 16 \end{bmatrix}$
77. $\begin{bmatrix} 1.2 \\ -2.5 \\ 5.2 \end{bmatrix}$ **78.** $\begin{bmatrix} -3\frac{1}{2} & -\frac{2}{3} \\ 6\frac{1}{3} & -4\frac{1}{3} \end{bmatrix}$

79–81. Choices of variables may vary. **79.** t = total cost; p = pounds of pears; $t = 1.19p$ **80.** p = bouquet's price; m = money left; $m = 20 - p$ **81.** c = check (dollars); s = your share; $s = \frac{c}{6}$

1-6 Multiplying and Dividing Real Numbers pages 37–46

Check Skills You'll Need p. 37 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.
1. -8 **2.** -25 **3.** -24 **4.** -72 **5.** $8, 10, 12$ **6.** $0, -2, -4$
7. $3, 0, -3$ **8.** $0, 6, 12$

Investigation 1a. $6, 4, 2, 0, -2, -4, -6$
1b. $-6, -4, -2, 0, 2, 4, 6$ **2.** negative **3.** positive

Check Understanding 1a. -24 **1b.** 50 **1c.** 39.2 **1d.** $-\frac{1}{2}$
2a. $-[(-8)(-7)] = -56$ **2b.** $(-2)(-3)[(-8)(-7)] = 2 \cdot 3(8 \cdot 7) = 336$ **2c.** $-8[-(-7)] = -56$
3a. $-5.5\left(\frac{4500}{1000}\right) = -5.5(4.5) = -24.75; -24.75°F$
3b. $40 - 24.75 = 15.2; 15.2°F$ **4a.** $-4^3 = -4 \cdot 4 \cdot 4 = -64$ **4b.** $(-2)^4 = (-2)(-2)(-2)(-2) = 16$
4c. $(-0.3)^2 = (-0.3)(-0.3) = 0.09$ **4d.** $-\left(\frac{3}{4}\right)^2 = -\left(\frac{3}{4}\right)\left(\frac{3}{4}\right) = -\frac{9}{16}$ **5a.** -6 **5b.** 4 **5c.** -1 **5d.** 13
6a. $3 \cdot 8 \div 2(-3) + (-5) \div 10 = 24 \div (-6) - \frac{5}{10} = -4 - \frac{1}{2} = -4\frac{1}{2}$ **6b.** $\frac{2(-3) + 8}{2(-5)} = \frac{-6 + 8}{-10} = \frac{2}{-10} = -\frac{1}{5}$
6c. $3(-3)^2 - 4(-5) \div 8 = 27 + 20 \div 8 = 27 + 2\frac{1}{2} = 29\frac{1}{2}$ **7.** $\frac{8}{-\frac{4}{5}} = 8 \div \left(-\frac{4}{5}\right) = 8\left(-\frac{5}{4}\right) = -\frac{40}{4} = -10$

Exercises 1. -15 **2.** -15 **3.** 15 **4.** 15 **5.** -34.4 **6.** $-2\frac{1}{2}$
7. -120 **8.** -105 **9.** -80 **10.** 80 **11.** -78 **12.** 81
13. $(-4)3 = -12$ **14.** $-(-4)3 = 12$ **15.** $3(-4) - 3 = -12 - 3 = -15$ **16.** $-5(-1) = 5$ **17.** $2(-4) = -8$
18. $7(-1) - 2 \cdot 3 = -7 - 6 = -13$
19. $8(-1) \cdot (-2 \cdot 3) = -8(-6) = 48$ **20.** $\frac{-4}{-1} - 3 = 4 - 3 = 1$ **21.** $(-4)(3)(-1) = 12$ **22.** $(-4)[3 + (-1)] = -4(3 - 1) = -4(2) = -8$ **23.** $4(3)^3(-4) = 4(27)(-4) = -432$ **24.** $(-4)(-1) + (-3) = 4 - 3 = 1$
25. $(-12)4 - 4(4) = -48 - 16 = -64$

26. $\frac{-12}{4} + 7(-12) = -3 - 84 = -87$ **27.** $\frac{2(-12) - 4}{-7} = \frac{-24 - 4}{-7} = \frac{-28}{-7} = 4$ **28.** $-(-12) + 3 \cdot 4 = 12 + 12 = 24$
29. $3 \cdot 4 - 2(-12) = 12 + 24 = 36$ **30.** $6 \cdot 4 + (-12) = 24 - 12 = 12$ **31a.** $-39 + \frac{3}{2}(10) = -39 + 15 = -24$; $-24°F$ **31b.** $-39 + \frac{3}{2}(-24) = -39 - 36 = -75; -75°F$
31c. $-39 + \frac{3}{2}(-8) = -39 - 12 = -51; -51°F$
31d. $-39 + \frac{3}{2}(5) = -39 + 7.5 = -31.5; -31.5°F$
32. $(-1)^5 = -1$ **33.** $-(-2)^3 = -(-8) = 8$ **34.** $-5^2 = -(5^2) = -25$ **35.** $(-9)^2 = 81$ **36.** $-9^2 = -(9^2) = -81$
37. $3(-4)^3 = 3(-64) = -192$ **38.** -5 **39.** $-5^2(-3)^3 = -25(-27) = 675$ **40.** -2 **41.** -4 **42.** $5\frac{1}{2}$ **43.** 6 **44.** -11
45. $12\frac{4}{5}$ **46.** -2 **47.** -8 **48.** $[3 + 3(-2)] \div 3 = (3 - 6) \div 3 = -3 \div 3 = -1$ **49.** $4(3.5) \div -2 = 14 \div -2 = -7$
50. $4(-2)^3 - \frac{2(3.50)}{-2} = 4(-8) - \frac{7}{-2} = -32 + 3\frac{1}{2} = -28\frac{1}{2}$
51. $[3(-2) + 2(3)] \div [2(-2) + 3(3)] = (-6 + 6) \div (-4 + 9) = 0$ **52.** $(2 \cdot 3.5 + 7) \div 3 = (7 + 7) \div 3 = 14 \div 3 = 4\frac{2}{3}$
53. $8 + 6(-2) \div (4 \cdot 3) - \frac{3(3.5)}{3} = 8 - 12 \div 12 - 3.5 = 8 - 1 - 3.5 = 3.5$ **54.** $\frac{\frac{2}{5}}{\frac{3}{10}} = \frac{2}{5} \cdot \frac{10}{3} = \frac{4}{3} = 1\frac{1}{3}$
55. $\frac{-3\left(\frac{5}{6}\right)}{\frac{1}{6}} = -3\left(\frac{5}{6}\right)\left(\frac{6}{1}\right) = -15$ **56.** $\frac{-\frac{1}{8}}{-3\left(\frac{3}{4}\right)} = \frac{-\frac{1}{8}}{-3}\left(\frac{4}{3}\right) = \frac{1}{18}$
57. $\frac{3\left(\frac{1}{5}\right)}{5\left(-\frac{1}{2}\right)} = \frac{\frac{3}{5}}{-\frac{5}{2}} = \frac{3}{5} \div \left(-\frac{5}{2}\right) = \left(\frac{3}{5}\right)\left(-\frac{2}{5}\right) = -\frac{6}{25}$ **58.** -2
59. 18 **60.** $-\frac{1}{2}$ **61.** $-\frac{8}{15}$ **62.** -125 **63.** 0.75 **64.** -27
65. 22.32 **66.** $|4 + 8(-6)| = |4 - 48| = |-44| = 44$
67. $|-6(-9)| \div (-2) = |54| \div (-2) = 54 \div -2 = -27$
68. $(-6)(-2)(-5) = -60$ **69.** $(-2)(5)(-3) = 30$
70a. i. 2 **ii.** -6 **iii.** 24 **iv.** -120 **70b.** positive
70c. negative **70d.** No; answers may vary. Sample: The sign of the product is not affected by the number of positive factors, only by the number of negative factors.
71a. when a and b are both negative or positive
71b. when a is negative and b positive, or when a is positive and b is negative
72. $-\frac{3}{4} - 2\left(\frac{1}{3}\right) = -\frac{9}{12} - \frac{8}{12} = -1\frac{5}{12}$ **73.** $\frac{1}{3} \div \left(-\frac{2}{5}\right) = -\left(\frac{1}{3}\right)\left(\frac{5}{2}\right) = -\frac{5}{6}$ **74.** $\frac{-\frac{3}{4}}{-\frac{2}{5}} = \left(\frac{3}{4}\right)\left(\frac{5}{2}\right) = \frac{15}{8} = 1\frac{7}{8}$
75. $-2\left(-\frac{3}{4}\right)\left(\frac{1}{3}\right)\left(-\frac{2}{5}\right) = -2\left(\frac{1}{10}\right) = -\frac{1}{5}$
76. $\frac{3}{4}\left(1\frac{1}{3}\right) - 7 = \frac{3}{4}\left(\frac{4}{3}\right) - 7 = 1 - 7 = -6$
77. $\frac{3.6}{2(-0.4)} = -\frac{18}{4} = -4\frac{1}{2}$ **78.** $\frac{-\frac{4}{5}}{8} = -\frac{1}{2 \cdot 5} = -\frac{1}{10}$
79. $\frac{3(-2)}{-5} + (-1) = \frac{6}{5} - 1 = \frac{1}{5}$
80–84. Answers may vary. Samples are given.
80. $ac + b = (-3)(-5) + 2 = 17$
81. $b - a + c = 2 - (-3) + (-5) = 2 + 3 - 5 = 0$
82. $ab - c = (-3)2 - (-5) = -6 + 5 = -1$

83. $-ab + c = -(-3)2 + (-5) = 6 - 5 = 1$

84. $-bc + a = -2(-5) + (-3) = 10 - 3 = 7$

85. $3 \cdot 2 + \left(6\frac{1}{4}\right)4 = 6 + 25 = 31; 31¢$

86. Yes; whatever the signs of a and b, $|ab|$, $|a|$, and $|b|$ are positive, and $|ab| = |a| \cdot |b|$. **87a.** $4, -8, 16, -32, 9, -27, 81, -243$ **87b.** Positive; the expression will involve an even number of negative factors.
87c. Negative; the expression will involve an odd number of negative factors.
88. 0.1 is the multiplicative inverse of 10 because $0.1(10) = 1$. (-10 is the opposite of 10.) **89.** The opposite of a nonzero number n is $-n$ while the multiplicative inverse is $\frac{1}{n}$.

90. $-2\begin{bmatrix} 11 & -5 \\ -9 & 6 \\ -4 & 3 \end{bmatrix} = \begin{bmatrix} -2 \cdot 11 & -2 \cdot (-5) \\ -2 \cdot (-9) & -2 \cdot 6 \\ -2 \cdot (-4) & -2 \cdot 3 \end{bmatrix} = \begin{bmatrix} -22 & 10 \\ 18 & -12 \\ 8 & -6 \end{bmatrix}$

91. $\frac{3}{5}\begin{bmatrix} -25 & 35 \\ \frac{10}{9} & -15 \end{bmatrix} = \begin{bmatrix} \frac{3}{5}(-25) & \frac{3}{5}(35) \\ \frac{3}{5}\left(\frac{10}{9}\right) & \frac{3}{5}(-15) \end{bmatrix} = \begin{bmatrix} -15 & 21 \\ \frac{2}{3} & -9 \end{bmatrix}$

92. $-0.1\begin{bmatrix} -47 & 13 & -7.9 \\ 0.2 & -64 & 0 \end{bmatrix} =$
$\begin{bmatrix} -0.1(-47) & -0.1(13) & -0.1(-7.9) \\ -0.1(0.2) & -0.1(-64) & -0.1(0) \end{bmatrix} = \begin{bmatrix} 4.7 & -1.3 & 0.79 \\ -0.02 & 6.4 & 0 \end{bmatrix}$

93. $-4\begin{bmatrix} 3 & \frac{2}{3} \end{bmatrix} = \begin{bmatrix} -4(3) & -4\left(\frac{2}{3}\right) \end{bmatrix} = \begin{bmatrix} -12 & -2\frac{2}{3} \end{bmatrix}$

94. $2\begin{bmatrix} -4 & -5.3 & 2 \\ 3.1 & 0 & 6 \end{bmatrix} = \begin{bmatrix} 2(-4) & 2(-5.3) & 2(2) \\ 2(3.1) & 2(0) & 2(6) \end{bmatrix} = \begin{bmatrix} -8 & -10.6 & 4 \\ 6.2 & 0 & 12 \end{bmatrix}$

95. $\frac{1}{4}\begin{bmatrix} -1 & \frac{1}{4} \\ \frac{8}{9} & 0 \end{bmatrix} = \begin{bmatrix} \frac{1}{4}(-1) & \frac{1}{4}\left(\frac{3}{4}\right) \\ \frac{1}{4}\left(\frac{8}{9}\right) & \frac{1}{4}(0) \end{bmatrix} = \begin{bmatrix} -\frac{1}{4} & \frac{3}{16} \\ \frac{2}{9} & 0 \end{bmatrix}$

96a. $155 - 16(1)^2 = 155 - 16 = 139; 139$ ft

96b. Less; at the bottom, $h = 0$ so
$155 - 16t^2 = 0$
$16t^2 = 155$
$t^2 = \frac{155}{16} = 9.7$
$t = \sqrt{9.7} = 3.1; 3.1$ s
You could also answer the question by calculating h for $t = 3, 4,$ and 5 s.

97a. $a = 5000 = 25t$ **97b.** $25(12.5) = 312.5; 312.5$ ft
97c. $5000 - 312.5 = 4687.5; 4687.5$ ft **98.** $\frac{5}{9}[-10 - 32] = \frac{5}{9}(-42) = -23.\overline{3} \approx -23; -23°$C **99.** $\left(-\frac{1}{2}\right)^3 = \frac{(-1)^3}{2^3} = \frac{-1}{8} = -\frac{1}{8}$ **100.** $\left(-\frac{1}{2}\right)^4 = \frac{(-1)^4}{2^4} = \frac{1}{16}$ **101.** $\left(-\frac{1}{2}\right)^5 = \frac{(-1)^5}{2^5} = \frac{-1}{32} = -\frac{1}{32}$ **102.** $\left(-\frac{1}{2}\right)^6 = \frac{(-1)^6}{2^6} = \frac{1}{64}$ **103.** $-\left(-\frac{1}{2}\right)^6 =$

$\frac{-(-1)^6}{2^6} = -\frac{1}{64}$ **104.** If $(-n)^3 = -n^3$ is positive, then n^3 must be negative. Choices are $-1, -2$, etc. By trial and error, the first solution encountered is -8.

105. $\frac{\frac{5}{4}}{9} = 5 \div \frac{4}{9} = 5 \cdot \frac{9}{4} = \frac{45}{4} = 11\frac{1}{4}$ **106.** $\frac{\frac{3}{8}}{\frac{-2}{3}} =$
$\frac{3}{8} \div \frac{-2}{3} = \frac{3}{8} \cdot \frac{3}{-2} = -\frac{9}{16}$ **107.** $\frac{\frac{-5}{6}}{8} = \frac{-5}{6} \div 8 = -\frac{5}{48}$
108. $\frac{\frac{-2}{5}}{\frac{-4}{5}} = \frac{-2}{5} \div \frac{-4}{5} = \frac{-2}{5} \cdot \frac{5}{-4} = \frac{2}{4} = \frac{1}{2}$

109. $(-3)(-3)(2)(2)(-1) = (9)(4)(-1) = -36$; the answer is A. **110.** $-(-2)(-3) + 6(-3) = -6 + (-18) = -24$; the answer is F. **111.** $(2.5)(710) = 1775$; the answer is C. **112.** $(-11)^4 \neq -44$; the answer is H.

113. $\frac{-3 + 4 + (-2) + (-5) + (-3) + 1 + 1}{7} = \frac{-7}{7} = -1$;
the answer is B. **114.** -2 **115.** -20 **116.** 0.8 **117.** 9.8

118. $1\frac{3}{4} - \left(-\frac{1}{2}\right) = \frac{7}{4} + \frac{2}{4} = \frac{9}{4} = 2\frac{1}{4}$ **119.** $-\frac{7}{8} - \left(-\frac{8}{9}\right) =$
$\frac{-63}{72} + \frac{64}{72} = \frac{1}{72}$ **120.** 4.95 **121.** 56 **122.** 4.59 **123.** $\frac{3}{4}$
124. $4^2 + 7 = 16 + 7 = 23$ **125.** $(4 + 7)^2 = (11)^2 = 121$
126. $4(7)^2 = 4(49) = 196$ **127.** $32.95 + 0.06(32.95) = 32.95 + 1.977 \approx 34.93; \$34.93$

1. $\begin{bmatrix} 4 + (-5) & -2 + 12 \\ 8 + 0 & 6 + 3 \end{bmatrix} = \begin{bmatrix} -1 & 10 \\ 8 & 9 \end{bmatrix}$

2. $\begin{bmatrix} -5 + 3 & 12 + 15 \\ 0 + 9 & 3 + (-10) \end{bmatrix} = \begin{bmatrix} -2 & 27 \\ 9 & -7 \end{bmatrix}$

3. $\begin{bmatrix} 3 - 4 & 15 - (-2) \\ 9 - 8 & -10 - 6 \end{bmatrix} = \begin{bmatrix} -1 & 17 \\ 1 & -16 \end{bmatrix}$

4. $\begin{bmatrix} 4 + 3 & -2 + 15 \\ 8 + 9 & 6 + (-10) \end{bmatrix} = \begin{bmatrix} 7 & 13 \\ 17 & -4 \end{bmatrix}$

5. $\begin{bmatrix} -5 - 3 & 12 - 15 \\ 0 - 9 & 3 - (-10) \end{bmatrix} = \begin{bmatrix} -8 & -3 \\ -9 & 13 \end{bmatrix}$

6. $\begin{bmatrix} 3(-5) & 3(12) \\ 3(0) & 3(3) \end{bmatrix} = \begin{bmatrix} -15 & 36 \\ 0 & 9 \end{bmatrix}$

7. $\begin{bmatrix} -4(3) & -4(15) \\ -4(9) & -4(-10) \end{bmatrix} = \begin{bmatrix} -12 & -60 \\ -36 & 40 \end{bmatrix}$

8. $\begin{bmatrix} 2 \cdot 4 + (-5) & 2(-2) + 12 \\ 2 \cdot 8 + 0 & 2 \cdot 6 + 3 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 16 & 15 \end{bmatrix}$

9. $\begin{bmatrix} -2(-5) + 3 + 4 & -2(12) + 15 + (-2) \\ -2(0) + 9 + 8 & -2(3) + (-10) + 6 \end{bmatrix} =$
$\begin{bmatrix} 17 & -11 \\ 17 & -10 \end{bmatrix}$

10. $\begin{bmatrix} 4 + 2(-1) & 7 + 2(0) & 3 + 2(6) \\ 8 + 2(2) & 2 + 2(-3) & 1 + 2(4) \\ -7 + 2(1) & 5 + 2(15) & -2 + 2(8) \end{bmatrix} =$
$\begin{bmatrix} 2 & 7 & 15 \\ 12 & -4 & 9 \\ -5 & 35 & 14 \end{bmatrix}$

11. $\begin{bmatrix} 2 + (-1) - 4 & 0 + 0 - 7 & 0 + 6 - 3 \\ 0 + 2 - 8 & -3 + (-3) - 2 & 6 + 4 - 1 \\ 4 + 1 - (-7) & 6 + 15 - 5 & 9 + 8 - (-2) \end{bmatrix} =$

$\begin{bmatrix} -3 & -7 & 3 \\ -6 & -8 & 9 \\ 12 & 16 & 19 \end{bmatrix}$

12.

$\begin{bmatrix} 2(4) - 5 - 2 & 14 + 5(0) - 0 & 6 + 30 - 2(0) \\ 2(8) + 10 - 0 & 4 - 15 - (-3) & 2(1) + 5(4) - 6 \\ -14 + 5(1) - 4 & 10 + 75 - 6 & 2(-2) + 5(8) - 9 \end{bmatrix} =$

$\begin{bmatrix} 1 & 14 & 36 \\ 26 & -8 & 16 \\ -13 & 79 & 27 \end{bmatrix}$

13.

$\begin{bmatrix} -4(4) + 5(2) & -4(7) + 5(0) & -4(3) + 5(0) \\ -4(8) + 5(0) & -4(2) + 5(-3) & -4(1) + 5(6) \\ -4(-7) + 5(4) & -4(5) + 5(6) & -4(-2) + 5(9) \end{bmatrix} =$

$\begin{bmatrix} -6 & -28 & -12 \\ -32 & -23 & 26 \\ 48 & 10 & 53 \end{bmatrix}$

14.

$\begin{bmatrix} -4(4) - 5(2) & -4(7) - 5(0) & -4(3) - 5(0) \\ -4(8) - 5(0) & -4(2) - 5(-3) & -4(1) - 5(6) \\ -4(-7) - 5(4) & -4(5) - 5(6) & -4(-2) - 5(9) \end{bmatrix} =$

$\begin{bmatrix} -26 & -28 & -12 \\ -32 & 7 & -34 \\ 8 & -50 & -37 \end{bmatrix}$

**15.**

$\begin{bmatrix} 4 + (-1) - 2(2) & 7 + 0 - 2(0) & 3 + 6 - 2(0) \\ 8 + 2 - 2(0) & 2 + (-3) - 2(-3) & 1 + 4 - 2(6) \\ -7 + 1 - 2(4) & 5 + 15 - 2(6) & -2 + 8 - 2(9) \end{bmatrix}$

$= \begin{bmatrix} -1 & 7 & 9 \\ 10 & 5 & -7 \\ -14 & 8 & -12 \end{bmatrix}$

Investigation 1. $x - 3$ **2.** $2x + 1$ **3.** $4x - 2$
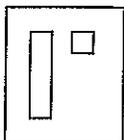
4.   **5.**
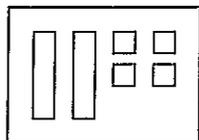
6.
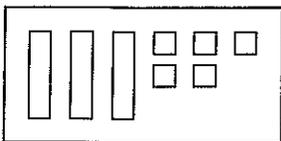
7. $2(x - 4) = 2x - 8$
8. $2(2x + 3) = 4x + 6$
9. $3(x - 3) = 3x - 9$
10. $3x + 3$ **11.** $2x + 8$
12. $6x - 3$ **13.** $10x - 15$;

there are 5 groups of 3 red tiles each, representing 15.

Check Skills You'll Need p. 47 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM.*

1. $3(4 + 7) = 3 \cdot 11 = 33$ **2.** $-2(5 + 6) = -2 \cdot 11 = -22$ **3.** $-1(-9 + 8) = -1(-1) = 1$ **4.** $-0.5(8 - 6) = -0.5(2) = -1$ **5.** $\frac{1}{2}t(10 - 4) = \frac{1}{2}t(6) = 3t$
6. $m(-3 - 1) = m(-4) = -4m$

Check Understanding 1a. $13(103) = 13(100 + 3) = 13(100) + 13(3) = 1300 + 39 = 1339$ **1b.** $21(101) = 21(100 + 1) = 21(100) + 21(1) = 2100 + 21 = 2121$
1c. $24(98) = 24(100 - 2) = 24(100) - 24(2) = 2400 - 48 = 2352$ **1d.** $15(99) = 15(100 - 1) = 15(100) - 15(1) = 1500 - 15 = 1485$ **2.** $6(2.95) = 6(3.00 - 0.05) = 6(3.00) - 6(0.05) = 18.00 - 0.30 = 17.70$; the cost is $17.70. **3a.** $6(m + 5) = 6(m) + 6(5) = 6m + 30$ **3b.** $2(3 - 7t) = 2(3) - 2(7t) = 6 - 14t$
3c. $(0.4 + 1.1c)(3) = 0.4(3) + 1.1c(3) = 1.2 + 3.3c$
4a. $-(2x + 1) = -1(2x) + (-1)1 = -2x - 1$
4b. $-(7 - 5b) = -1(7) - (-1)5b = -7 + 5b$
4c. $(3 - 8a)(-1) = 3(-1) - 8a(-1) = -3 + 8a$
5a. $7y + 6y = (7 + 6)y = 13y$ **5b.** $3t - t = (3 - 1)t = 2t$
5c. $-9w^3 - 3w^3 = (-9 - 3)w^3 = -12w^3$ **5d.** $8d + d = (8 + 1)d = 9d$

Exercises 1. $12(201) = 12(200 + 1) = 12(200) + 12(1) = 2400 + 12 = 2412$ **2.** $51(13) = (50 + 1)(13) = 50 \cdot 13 + 1 \cdot 13 = 650 + 13 = 663$
3. $11(499) = 11(500 - 1) = 11(500) - 11(1) = 5500 - 11 = 5489$ **4.** $8(306) = 8(300 + 6) = 8 \cdot 300 + 8 \cdot 6 = 2400 + 48 = 2448$ **5.** $7(98) = 7(100 - 2) = 7(100) - 7(2) = 700 - 14 = 686$ **6.** $3(999) = 3(1000 - 1) = 3 \cdot 1000 - 3 \cdot 1 = 3000 - 3 = 2997$
7. $41(502) = 41(500 + 2) = 41 \cdot 500 + 41 \cdot 2 = 20,500 + 82 = 20,582$ **8.** $24(1020) = 24(1000 + 20) = 24(1000) + 24(20) = 24,000 + 480 = 24,480$
9. $4(\$.99) = 4(1 - .01) = 4 - .04 = 3.96$; $3.96
10. $6(1.97) = 6(2.00 - 0.03) = 6(2.00) - 6(0.03) = 12.00 - 0.18 = 11.82$; the price is $11.82. **11.** $5(5.91) = 5(6.00 - 0.09) = 5(6.00) - 5(0.09) = 30.00 - 0.45 = 29.55$; the price is $29.55. **12.** $7(29.93) = 7(30.00 - 0.07) = 7(30.00) - 7(0.07) = 210.00 - 0.49 = 209.51$; the price is $209.51. **13.** $3(32.99) = 3(33.00 - 0.01) = 3(33.00) - 3(0.01) = 99.00 - 0.03 = 98.97$; the amount spent is $98.97. **14.** $4(0.69) = 4(0.70 - 0.01) = 4(0.70) - 4(0.01) = 2.80 - .04 = 2.76$; the amount spent is $2.76. **15.** $7(t - 4) = 7(t) - 7(4) = 7t - 28$ **16.** $-2(n - 6) = -2(n) - (-2)6 = -2n + 12$
17. $3(m + 4) = 3(m) + 3(4) = 3m + 12$ **18.** $(5b - 4)\frac{1}{5} = \frac{5b}{5} - \frac{4}{5} = b - \frac{4}{5}$ **19.** $-2(x + 3) = -2(x) + (-2)3 = -2x - 6$ **20.** $\frac{2}{3}(6y + 9) = \frac{12y}{3} + \frac{18}{3} = 4y + 6$
21. $0.25(6q + 32) = 0.25(6q) + 0.25(32) = 1.5q + 8$
22. $(3n - 7)(6) = 3n(6) - 7(6) = 18n - 42$
23. $(8 - 3r)\frac{5}{16} = \frac{40}{16} - \frac{15r}{16} = \frac{5}{2} - \frac{15}{16}r$

24. $-4.5(b - 3) = -4.5(b) - (-4.5)3 =$
$-4.5b + 13.5$ **25.** $\frac{2}{5}(5w + 10) = \frac{10w}{5} + \frac{20}{5} = 2w + 4$
26. $(9 - 4n)(-4) = 9(-4) - 4n(-4) = -36 + 16n$
27. $-(x + 3) = (-1)x + (-1)3 = -x - 3$
28. $-(x - 3) = (-1)x - (-1)3 = -x + 3$
29. $-(3 + x) = (-1)3 + (-1)x = -3 - x$
30. $-(3 - x) = (-1)3 - (-1)x = -3 + x$
31. $-(6k + 5) = (-1)6k + (-1)5 = -6k - 5$
32. $-(7x - 2) = (-1)7x - (-1)2 = -7x + 2$
33. $-(2 - 7x) = (-1)2 - (-1)7x = -2 + 7x$
34. $(4 - z)(-1) = 4(-1) - z(-1) = -4 + z$
35. $4t - 7t = (4 - 7)t = -3t$ **36.** $12k^2 + 8k^2 =$
$(12 + 8)k^2 = 20k^2$ **37.** $9x - 2x = (9 - 2)x = 7x$
38. $w + 23w = (1 + 23)w = 24w$ **39.** $-18v^2 + 23v^2 =$
$(-18 + 23)v^2 = 5v^2$ **40.** $7m - m = (7 - 1)m = 6m$
41. $13q - 30q = (13 - 30)q = -17q$ **42.** $x - 46x =$
$(1 - 46)x = -45x$ **43.** $3(m - 7)$ **44.** $-4(4 + w)$
45. $2(b + 9)$ **46.** $-11(n - 8)$ **47.** $2(3c + 9)$
48. $(3 + r)(r - 7)$ **49.** $9(4998) = 9(5000 - 2) =$
$45,000 - 18 = 44,982$ **50.** $8(299) = 8(300 - 1) =$
$2400 - 8 = 2392$ **51.** $7(2.003) = 7(2.000 + 0.003) =$
$14.000 + 0.021 = 14.021$ **52.** $12(7.001) =$
$12(7.000 + 0.001) = 84.000 + 0.012 = 84.012$
53. $6(1.97) = 6(2.00 - 0.03) = 12.00 - 0.18 = 11.82$
54. $4(3.998) = 4(4.000 - 0.002) = 16.000 - 0.008 =$
15.992 **55.** $7(4.3 + x) = 7(4.3) + 7(x) = 30.1 + 7x$
56. $\frac{10}{14}d(8 - 10h) = \frac{5}{7}d(8) - \frac{5}{7}d(10h) = \frac{40}{7}d - \frac{50}{7}dh$
57. $2(6.4 - 0.5n) = 2(6.4) - 2(0.5n) = 12.8 - n$
58. $144\left(\frac{15}{16}b + \frac{8}{9}\right) = 9(15)b + 16(8) = 135b + 128$
59. $3(6.2 + 5m) = 3(6.2) + 3(5m) = 18.6 + 15m$
60. $\frac{7}{8}\left(\frac{10}{14}d - 48\right) = \frac{7}{8}\left(\frac{10}{14}d\right) - \frac{7}{8}(48) = \frac{5}{8}d - 42$
61. $-(8.4 + 300g + 512h) = (-1)(8.4) + (-1)(300g) -$
$(-1)(512h) = -8.4 - 300g + 512h$
62. $-(12k + 5m - 62) =$
$(-1)(12k) + (-1)(5m) - (-1)(62) = -12k - 5m + 62$
63. $\frac{2}{5}(15p - 35q + 75w) = \frac{30}{5}p - \frac{70}{5}q + \frac{150}{5}w =$
$6p - 14q + 30w$ **64.** $9(4x + 1.2y - 8.1) =$
$9(4x) + 9(1.2y) - 9(8.1) = 36x + 10.8y - 72.9$
65. $2\frac{1}{4}\left(5\frac{1}{2} - k\right)$ **66.** $6\frac{7}{100}\left(8 + \frac{4}{3}p\right)$ **67.** $\frac{11}{20}\left(b - \frac{13}{30}\right)$
68. $\frac{17}{z - 34}$ **69.** $4\frac{1}{3}\left(x - \frac{11}{12}\right)$

70. $4(x + 4) + 4 \cdot 3 + 2(2x + 5) =$
$4x + 16 + 12 + 4x + 10 = 8x + 38$ **71.** No; $2a \cdot 2b =$
$4ab$. **72.** The student did not multiply the second
number in the parentheses, 10, by 4 to get the correct
answer, $12x + 40$. **73.** Answers may vary: Sample:
$2(x + 5) = 2x + 10$ **74.** $4.78d$ **75.** $-21p - 76p^2 -$
$9 + p = -76p^2 + (1 - 21)p - 9 = -76p^2 - 20p - 9$
76. $3.3t^2 + 8.7t - 9.4t^2 + 5t =$
$(3.3 - 9.4)t^2 + (8.7 + 5)t = -6.1t^2 + 13.7t$
77. $1.5m - 4.2m - 12.5v + 4.2m =$
$(1.5 - 4.2 + 4.2)m - 12.5v = 1.5m - 12.5v$

78. $\frac{6}{7}n + n^3 - \left(-\frac{5}{6}n\right) = \frac{36}{42}n + n^3 + \frac{35}{42}n = \frac{71}{42}n + n^3$
79. $-1\frac{1}{15}k + \frac{3}{20}h + \frac{7}{40}k = -\frac{128}{120}k + \frac{3}{20}h + \frac{21}{120}k =$
$-\frac{107}{120}k + \frac{3}{20}h$ **80.** $8m^2 - 5mz + 4mz - m^2 + 4 =$
$(8 - 1)m^2 + (-5 + 4)mz + 4 = 7m^2 - mz + 4$
81. $9 - 4t + 6y - 3t + 10 =$
$6y - (4 + 3)t + (10 + 9) = 6y - 7t + 19$
82. $1.4b - 3b^2 + 4c - 2b^2 + c =$
$(-3 - 2)b^2 + (4 + 1)c + 1.4b = -5b^2 + 5c + 1.4b$
83. $8xyz + 4xy - 12yzx + 2xy =$
$(8 - 12)xyz + (4 + 2)xy = -4xyz + 6xy$ **84.** terms:
$-7t, 6v, 7, -19y$; coefficients: $-7, 6, -19$; constant: 7
85a. $(84 + 10) 50\,\text{ft}^2$ **b.** $84(50) + 10(50) = 4200 +$
$500 = 4700; 4700\,\text{ft}^2$ **86.** 10 pennies, 7 nickels, 4 quarters,
1 dime **87.** $t = 4(1.02) + 3(0.99) + 3(0.52) =$
$4(1.00 + 0.02) + 3(1.00 - 0.01) + 3(0.50 + 0.02) =$
$4.00 + 0.08 + 3.00 - 0.03 + 1.50 + 0.06 = 8.50 + 0.11 =$
$8.61; \$8.61$ **88.** $9(5 + t) - 6(t + 3) = 45 + 9t - 6t - 18 =$
$27 + 3t$ **89.** $4(r + 8) - 5(2r - 1) = 4r + 32 - 10r + 5 =$
$-6r + 37$ **90.** $-(m + 3) - 2(m + 3) =$
$-m - 3 - 2m - 6 = -3m - 9$ **91.** $a[2 + b(2 + c)] =$
$a(2 + 2b + bc) = 2a + 2ab + abc$ **92.** $7b[8 + 6(b - 1)] =$
$7b(8 + 6b - 6) = 14b + 42b^2$ **93.** $-[-5(y + 2z) - 3z] =$
$-(-5y - 10z - 3z) = 5y + 13z$ **94.** $\frac{3x - 10}{3}$
95a. $(a + b) \div c = (-10 + 6) \div -2 = -4 \div -2 = 2;$
$a \div c + b \div c = -10 \div -2 + 6 \div -2 = 5 - 3 = 2$
95b. $(a + b) \div c = (-9 - 3) \div 6 = -12 \div 6 = -2;$
$a \div c + b \div c = -9 \div 6 + (-3) \div 6 = -\frac{3}{2} - \frac{1}{2} = -2$
95c. Yes; the two expressions are equal for the values of
$a, b,$ and c in parts (a) and (b). In general, the
expressions can be shown to be equal by division by
reciprocals (p. 41) and the distributive law.
96a. $a \div (b + c) = -60 \div (3 - 5) = -60 \div -2 = 30;$
$a \div b + a \div c = -60 \div 3 - 60 \div -5 = -20 + 12 = -8$
96b. $a \div (b + c) = -24 \div (-4 + 2) = -24 \div -2 = 12;$
$a \div b + a \div c = -24 \div -4 + (-24) \div 2 = 6 - 12 = -6$
96c. No; parts (a) and (b) show the expressions are not
equal. **97.** $14x - 21x = (14 - 21)x = -7x$; the answer
is C. **98.** $-6(k - 5) = -6(k) - (-6)(5) = -6k + 30$; the
answer is G. **99.** $51 > 43 > 9$, and $24 > 11 > 3$, so the
bicycle category has the most competitors in each race;
the answer is A. **100.** $\frac{16}{24} = 0.\overline{6} \approx 67\%$; the answer is F.
101. $\frac{41 + 37 + 6}{51 + 43 + 9} = \frac{84}{103} \approx 82\%$; the answer is D.
102. 11 hr 45 min $= 11.75$ hr; $\frac{130}{11.75} \approx 11.1$; the answer is
H. **103.** $7q + 8pq - 4qp - 9q = (7 - 9)q + (8 - 4)pq$
$= -2q + 4pq$; the answer is C. **104.** $30(1.89) = 30(1.9 -$
$0.01) = 30(1.9) - 30(0.01) = 57 - 0.3 = 56.7$; the answer
is I. **105.** $8(-7) + 4(-3) = -56 - 12 = -68$
106. $8 + (-4) \cdot 3 = 8 - 12 = -4$ **107.** $(-3)^2 + (-5) =$
$9 - 5 = 4$ **108.** $(9^2 - 60) \div 3 = (81 - 60) \div 3 =$
$21 \div 3 = 7$ **109.** $\frac{-7 + 5}{-7 - 5} = \frac{-2}{-12} = \frac{1}{6}$
110. $\frac{7 - 2}{-12 + 8} = \frac{5}{-4} = -\frac{5}{4}$ **111.** $\frac{1 + (-4)}{21 - 6} = \frac{-3}{15} = -\frac{1}{5}$

112. $\frac{8-5}{16-17} = \frac{3}{-1} = -3$ **113.** $-3^4 \div 9 - 4 \cdot 2 =$
$-81 \div 9 - 8 = -9 - 8 = -17$ **114.** -2.386 **115.** 12.127
116. 45.3 **117.** 45.7 **118.** 2.57 **119.** 0.92 **120.** -9.6
121. -7.7 **122.** 23

1-8 · Properties of Real Numbers
pages 54–58

Check Skills You'll Need p. 54 For complete
solutions see *Daily Skills Check and Lesson Quiz
Transparencies* or *Presentation Pro CD-ROM.*
1. 19 **2.** -30 **3.** 26 **4.** 140 **5.** -1 **6.** 3 **7.** $1 + x$
8. $5t - 8$ **9.** $-7m$

Check Understanding 1a. Ident. Prop. of Mult.; m is
mult. by the mult. identity, 1. **1b.** Assoc. Prop. of Add.;
the grouping of the terms changes. **1c.** Assoc. Prop. of
Mult.; the grouping of the factors changes. **1d.** Ident.
Prop. of Add.; the ident. for add., 0, is added. **1e.** Comm.
Prop. of Mult.; the order of the factors changes. **1f.**
Comm. Prop. of Add.; the order of the terms changes.
2. $2.50 + 2.15 + 0.65 + 3.50 =$
$(2.50 + 3.50) + (2.15 + 0.65) = 6.00 + 2.80 = 8.80$; the
cost is $8.80. **3a.** $5a + 6 + a =$
$(6 + 5a) + a$ (Commutative Property of Addition)
$= 6 + (5a + a)$ (Associative Property of Addition)
$= 6 + (5 + 1)a$ (Distributive Property)
$= 6 + 6a$ (addition)
3b. $2(3t - 1) + 2 = (6t - 2) + 2$ (Distributive Property)
$= [6t + (-2)] + 2$ (definition of subtraction)
$= 6t + [(-2) + 2]$ (Assoc. Prop. of Add.)
$= 6t + 0$ (Inverse Property of Addition)
$= 6t$ (Identity Property of Addition)

Exercises 1. Ident. Prop. of Add.; 0, the identity for
addition, is added. **2.** Comm. Prop. of Add.; the order of
the terms changes. **3.** Ident. Prop. of Mult.; 1, the
identity for multiplication, is multiplied. **4.** Assoc. Prop.
of Add.; the grouping of the terms changes.
5. Inv. Prop. of Add.; a number and its inverse are added.
6. Comm. Prop. of Mult.; the order of the factors
changes. **7.** Dist. Prop.; a number outside parentheses is
distributed to the two terms inside the parentheses.
8. Assoc. Prop. of Mult.; the grouping of the factors
changes. **9.** Inv. Prop. of Mult.; a number and its mult.
inverse are multiplied. **10.** $47 + 39 + 3 + 11 =$
$(47 + 3) + (39 + 11) = 50 + 50 = 100$
11. $25 \cdot 74 \cdot 2 \cdot 2 = 74(25 \cdot 2 \cdot 2) = 74(100) = 7400$
12. $4.75 + 2.95 + 1.25 + 6 = (4.75 + 1.25) + 2.95 + 6 =$
$6.00 + 8.95 = 14.95$ **13.** $10 \cdot 6 \cdot 7 \cdot 10 =$
$(6 \cdot 7)(10 \cdot 10) = 42 \cdot 100 = 4200$ **14.** $2(5 - 3.5) - 8 =$
$2 \cdot 1.5 - 8 = 3 - 8 = -5$ **15.** $6\frac{1}{2} + 4\frac{1}{3} + 1\frac{1}{2} + \frac{2}{3} =$
$\left(6\frac{1}{2} + 1\frac{1}{2}\right) + \left(4\frac{1}{3} + \frac{2}{3}\right) = 8 + 5 = 13$
16. $1.50 + 0.79 + 2.50 + 1.21 =$
$(1.50 + 2.50) + (0.79 + 1.21) = 4.00 + 2.00 = 6.00$; the
cost is $6.00. **17a.** definition of subtraction
17b. Distributive Property **17c.** addition
18a. Commutative Property of Multiplication
18b. Associative Property of Multiplication

18c. multiplication **18d.** multiplication
19. $25 \cdot 1.7 \cdot 4$
$= (1.7 \cdot 25) \cdot 4$ (Commutative Prop. of Mult.)
$= 1.7 \cdot (25 \cdot 4)$ (Associative Property of Multiplication)
$= 1.7 \cdot 100$ (multiplication)
$= 1700$ (multiplication)
20. $-5(7y) = (-5 \cdot 7)y$ (Assoc. Prop. of Mult.)$=$
$-35y$ (multiplication) **21.** $8 + 9m + 7$ means
$(8 + 9m) + 7$ (order of addition)
$= (9m + 8) + 7$ (Commutative Property of Addition)
$= 9m + (8 + 7)$ (Associative Property of Addition)
$= 9m + 17$ (addition)
22. $12x - 3 + 6x =$
$[12x + (-3)] + 6x$ (definition of subtraction)
$= (-3 + 12x) + 6x$ (Commutative Property of Addition)
$= -3 + (12x + 6x)$ (Associative Property of Addition)
$= -3 + (12 + 6)x$ (Distributive Property)
$= -3 + 18x$ (addition) **23.** $29c + (-29c)$
$= [29 + (-29)]c$ (Distributive Property)
$= 0$ (Inverse Property of Addition)
24. $43\left(\frac{1}{43}\right) + 1$
$= 1 + 1$ (Inverse Property of Multiplication)
$= 2$ (addition) **25.** $2 + g\left(\frac{1}{g}\right)$
$= 2 + 1$ (Inverse Property of Multiplication)
$= 3$ (addition)
26. $36jkm - 36mjk$
$= 36jkm + (-36mjk)$ (def. of subtraction)
$= 36jkm + (-36jmk) = 36jkm + (-36jkm)$(Comm.
Prop. of Mult.)
$= [36 + (-36)]jkm$ (Distr. Prop.)
$= 0$ (Inverse Property of Addition)
27. $(3^2 - 2^3)(8759) = (9 - 8)(8759)$ (multiplication)
$= 1(8759)$ (subtraction)
$= 8759$ (Identity Property of Multiplication)
28. $(7^6 - 6^5)(8 - 8)$
$= (7^6 - 6^5)[8 + (-8)]$ (def. of subtraction)
$= (7^6 - 6^5)0$ (Inv. Prop. of Add.)
$= 0$ (Multiplication Property of Zero) **29.** $4 + 6(8 - 3m)$
$= 4 + (48 - 18m)$ (Distributive Property)
$= 4 + [48 + (-18m)]$ (definition of subtraction)
$= (4 + 48) + (-18m)$ (Assoc. Prop. of Add.)
$= 52 + (-18m)$ (addition)
$= 52 - 18m$ (definition of subtraction)
30. $5\left(w - \frac{1}{5}\right) - w(9)$
$= \left[5w - 5\left(\frac{1}{5}\right)\right] - w(9)$ (Distributive Property)
$= (5w - 1) - w(9)$ (Inverse Property of Multiplication)
$= (5w - 1) - 9w$ (Comm. Prop. of Mult.)
$= [5w + (-1)] + (-9w)$ (definition of subtraction)
$= (-1 + 5w) + (-9w)$ (Comm. Prop. of Add.)
$= -1 + [5w + (-9w)]$ (Assoc. Prop. of Add.)
$= -1 + (5w - 9w)$ (definition of subtraction)
$= -1 + (5 - 9)w$ (Distributive Property)
$= -1 + (-4)w$ (subtraction)
$= -1 - 4w$ (definition of subtraction)
31. $31.50 + 14.97 + 6.50 = (31.50 + 6.50) + 14.97 =$
$38.00 + 14.97 = 52.97$ **32.** no; $1 \cdot 6 + m = 6 + m$

33. No; 9 and y are not like terms. **34.** No; all 4 terms are different. **35.** yes; $-(5 - 9) = (-1)(5) - (-1)(9) = -5 + 9 = 9 - 5$ **36.** No; the expressions are opposites. **37.** no; $3(5 + z) = 3(5) + 3(z) = 15 + 3z$ **38.** yes; $2[(2 + 1)t - 2] = 2(3t - 2) = 6t - 4$ **39.** yes; $vwx \cdot yz = v \cdot w \cdot xyz = v \cdot w \cdot xzy$ **40.** No; $3 - 5 = -2$, while $5 - 3 = 2$. **41.** No; $(5 - 3) - 1 = 2 - 1 = 1$, while $5 - (3 - 1) = 5 - 2 = 3$. **42.** No; $1 \div 2 = \frac{1}{2}$, while $2 \div 1 = 2$. **43.** No; $16 \div (4 \div 2) = 16 \div 2 = 8$, while $(16 \div 4) \div 2 = 4 \div 2 = 2$. **44a.** Distributive Property **44b.** Commutative Property of Addition **44c.** Associative Property of Addition **44d.** addition **44e.** Distributive Property **44f.** addition **45.** $(b + c)a = a(b + c)$ (Comm. Prop. of Mult.) $= ab + ac$ (Distributive Property) $= ba + ca$ (Commutative Property of Multiplication) **46.** Answers may vary. Sample: The sandwich tastes the same whether the peanut butter or the jelly is on top. This is like the commutative property of addition, because you can add the peanut butter and jelly in either order. **47.** both **48.** both **49.** both **50.** closed for addition, but not for multiplication; $(-2)(-3) = 6$ **51.** closed for multiplication, but not for addition; $1 + 3 = 4$ **52.** yes **53.** $-4 + 17 - 29 + 4 + 29 - 3 = (-4) + 17 + (-29) + 4 + 29 + (-3) = (-3) + 17 = 14$; the answer is A. **54.** $n \div \frac{5}{2} \times \frac{1}{2} = n \times \frac{2}{5} \times \frac{1}{2} = n \times \left(\frac{2}{5} \times \frac{1}{2}\right) = n \times \frac{1}{5} = n \div 5$; the answer is I. **55.** $A = \pi(2r)^2 = \pi(4r^2) = 4\pi r^2$; the answer is D. **56.** $2^3 = 8; (-3)^3 = -27; 4^3 = 64$; the answer is G. **57.** $3(1.90) + 3(6.10) + 12(1.53) = 5.70 + 18.30 + 18.36 = 42.36$; the answer is B. **58.** $-2h - (5 - 3h) = -2h + (-1)(5) + (-1)(-3h) = -2h + (-5) + 3h = h - 5$; the answer is F. **59.** $5(1.2 + k) = 5(1.2) + 5(k) = 6 + k$ **60.** $\frac{1}{3}(33 - b) = \frac{1}{3}(33) - \frac{1}{3}(b) = 11 - \frac{1}{3}b$ **61.** $-2.5(4p + 14) = (-2.5)(4p) + (-2.5)14 = -10p - 35$ **62.** $4(7 - n) = 4(7) - 4(n) = 28 - 4n$ **63.** $-(-7.4m + 0.05) = (-1)(-7.4m) + (-1)(0.05) = 7.4m - 0.05$ **64.** $(3v - 5.2)(-6) = 3v(-6) - 5.2(-6) = -18v + 31.2$ **65.** $7 + [m + (-17)]$ **66.** $8 - (9 - t)$ **67.** $\frac{1}{2}\left(\frac{b}{4}\right)$ **68.** $\frac{1}{3}(x + 5.1)$ **69.** 7 **70.** -18.3 **71.** $-\frac{1}{4}$ **72.** $-4\frac{6}{10} + 3\frac{2}{5} = -4\frac{6}{10} + 3\frac{4}{10} = \frac{-46}{10} + \frac{34}{10} = \frac{-12}{10} = -1\frac{1}{5}$ **73.** -135 **74.** $|-2.4| + |6.8| = 2.4 + 6.8 = 9.2$

### CHECKPOINT QUIZ 2   *page 58*

1. $7 + 4t + 6 + t = 7 + 6 + (4 + 1)t = 13 + 5t$
2. $(5 \cdot 16) \cdot 2 = (80)2 = 160$ **3.** $(5 + 16)2 = (21)2 = 42$ **4.** $(-4)^3 + (-3)(-5) = -64 + 15 = -49$
5. $-3(4 + w) - 6w = -3(4) + (-3)w + (-6w) = -12 + [-3 + (-6)]w = -12 + (-9w) = 12 - 9w$
6. $-(-5 - 4m) = (-1)(-5) + (-1)(-4m) = 5 + 4m$
7. 1.5 **8.** $9 \div (-3) - 4 \div (-8) = -3 + 0.5 = -2.5$

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9. $3x + 6y - 8x - y = [3 + (-8)]x + [6 + (-1)]y = -5x + 5y$ **10a.** $9t + 3(t + 4)$
$= 9t + (3t + 12)$ (Distributive Property; multiplication)
$= (9t + 3t) + 12$ (Associative Property of Addition)
$= (9 + 3)t + 12$ (Distributive Property)
$= 12t + 12$ (addition) **10b.** -24

1-9 Graphing Data on the Coordinate Plane   pages 59–65

Check Skills You'll Need p. 59 For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. 4   6   8

2. -8 -6 -4 -2

3. 1   2   3   4   **4.** -2 0   2
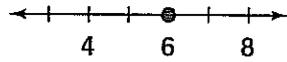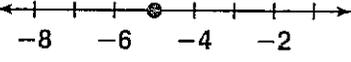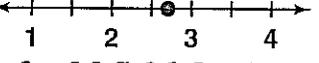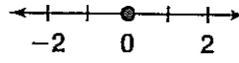
5. 1 **6.** -2.5 **7.** 3.5 **8.** -4

Check Understanding **1a.** $(3, -3)$ **1b.** $(-1, 1)$ **1c.** $(4, 1)$ **1d.** $(0, 2)$

2a–d.   **3a.** x-axis **3b.** IV **3c.** III **3d.** I

4.

5a. 4-year-old car with an asking price of $14,900
5b. $5000
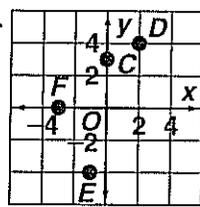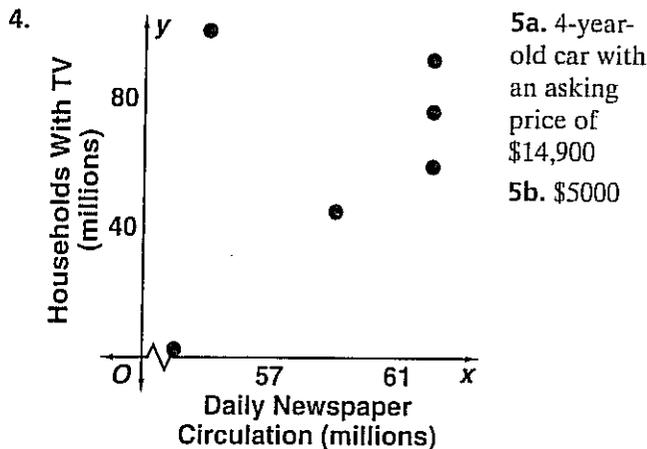
Exercises 1. $(4, 5)$ **2.** $(2, -2)$ **3.** $(-5, 0)$ **4.** $(5, 4)$
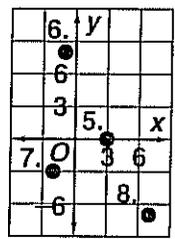
5–8.   **9.** II **10.** x-axis **11.** IV **12.** y-axis **13.** I **14.** II **15.** No; the point is on the y-axis, not in Quadrant III.

16.

Gallons Bought vs. Dollars Spent
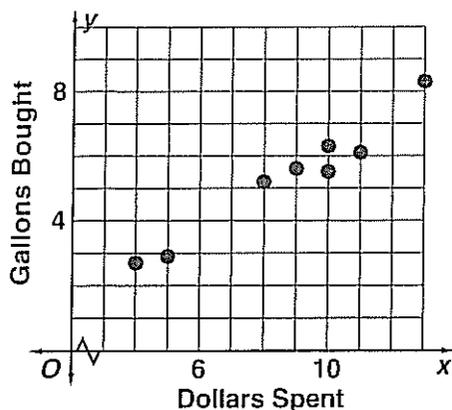
17. negative correlation
18. positive correlation
19. no correlation
20. $(-3, 4)$
**21.** $(5, 0)$
22. $(6, -6)$

23. $(-3, -2), (1, 3), (2, -4)$ **24a.** Answers may vary. Sample: $(-1, 1), (-2, 2), (10, -10)$ **24b.** Answers may vary. Sample: $(1, 1), (-2, 2), (-10, -10)$

25.
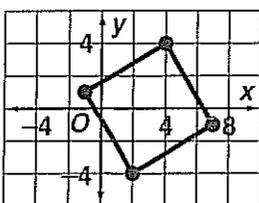
square

26.
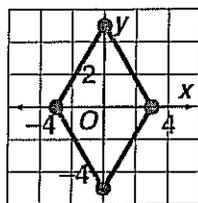
rhombus

27.
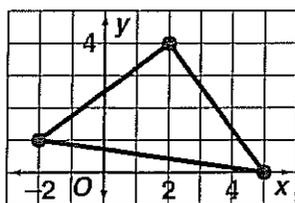
isosceles triangle

28.
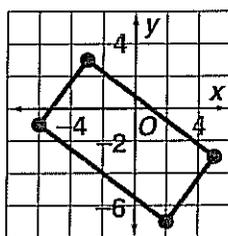
rectangle

29. Negative correlation; the more classes you take, the more work you have; the less free time you have.
30. Positive correlation; the greater the number of cars, the higher the pollution levels are for a city. **31.** No correlation; a baby's length at birth is not related to the calendar month of its birth. **32.** Positive correlation; the more you exercise, the more calories you burn.
33. Answers may vary. Samples: positive correlation— the number of hours a person earning an hourly wage works and the size of the paycheck. Negative correlation—the number of people working on a project and the time it takes to complete the project. No correlation—a person's height and the length of his or her hair **34a.** Voters would be less likely to go to the polls the more it rains or snows. **34b.** Answers may vary. Sample: In general, weather has the same effect on all candidates, but some candidates may worry about exceptions to this rule. **35a.** negative correlation **35b.** Answers may vary. Sample: No; a correlation does not necessarily indicate a direct cause-and-effect relationship. There may be other influences.

36a, b.

Fat and Calories
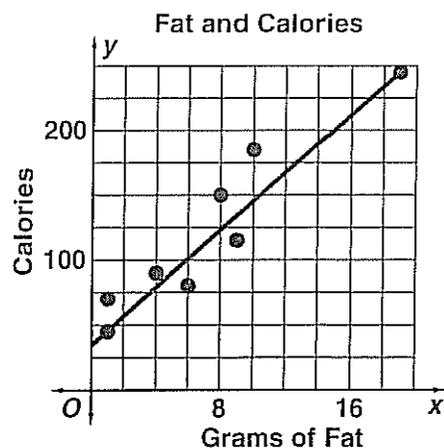
36b. positive correlation **36c.** The general trend is that the number of calories increases with the amount of fat. This does not occur in every individual case.
36d. Answers may vary. Sample: 190 ± 25 calories
37. 20 units; 21 square units **38.** 7.5 square units
39. The smallest such circle centered about $(2, 3)$ has radius $\sqrt{5}$ and passes through the points $(0, 4), (1, 5), (3, 5), (4, 4), (4, 2), (3, 1), (1, 1),$ and $(0, 2)$. There are many such circles that are larger. Some pass through more than eight points having integral coordinates.
40a. the distance a car traveled on the Indiana toll road and the toll charged **40b.** The points have the same x-coordinate; they lie on the same vertical line.
40c. The points have the same y-coordinate; they lie on the same horizontal line. **40d.** Yes, there is a positive correlation. In general, as distance increases, the toll increases, but there is considerable scatter.
41. Both coordinates are negative in quadrant III; the answer is C. **42.** Points on the y-axis have x-coordinate 0; the answer is G. **43.** Points in Quadrant II have a negative x-coordinate and positive y-coordinate; the answer is D. **44.** The student plots the points and accurately sketches the rectangle to find the missing vertex at $(5, 6)$; the answer is G. **45.** As the number of students increases, so should the number of teachers; the answer is A. **46.** A car that often requires fill-ups most likely has a small fuel capacity, whereas a car with a large tank would stop fewer times to fill up; the answer is H. **47.** $x - 4(2x + 1) - 3$
$= x + (-4)(2x + 1) + (-3)$ (definition of subtraction)
$= x + (-8x) + (-4) + (-3)$ (Distributive Property)
$= [1 + (-8)]x + (-4) + (-3)$ (Distributive Property)
$= (-7)x + (-4) + (-3)$ (addition)
$= (-7)x + [-4 + (-3)]$ (Assoc. Prop. of Add.)
$= (-7)x + (-7)$ (addition)
$= -7x - 7$ (definition of subtraction)

48. $5(8t) + 4(9 - t) - 37$
$= 40t + (36 - 4t) - 37$ (Distributive Property)
$= 40t + 36 + (-4t) + (-37)$ (def. of subtr.)
$= 40t + (-4t) + 36 + (-37)$ (Comm. Prop. of Add.)
$= 40t + (-4t) + [36 + (-37)]$ (Assoc. Prop. of Add.)
$= [40 + (-4)]t + [36 + (-37)]$ (Distributive Property)
$= 36t + (-1)$ (addition)
$= 36t - 1$ (definition of subtraction)

49. $8b + 7a - 4b - 9a$ signifies
$8b + 7a + (-4b) + (-9a)$ (definition of subtraction)
$= 8b + (-4b) + 7a + (-9a)$ (Comm. Prop. of Add.)
$= [8b + (-4b)] + [7a + (-9a)]$ (Assoc. Prop. of Add.)
$= [8 + (-4)b)] + [7 + (-9)]a$ (Distributive Property)
$= (4b + 7a) + (-9a)$ (addition)
$= 4b + (-2)a$ (addition)
$= 4b - 2$ (definition of subtraction)

50. $3m^2 - (10m + 3m^2)$
$= 3m^2 - (3m^2 + 10m)$ (Comm. Prop. of Addition)
$= 3m^2 + (-1)(3m^2) + (-1)(10m)$ (Distributive Property)
$= 3m^2 + (-3m^2) + (-10m)$ (Mult. Prop. of -1)
$= 0 + (-10m)$ (Inverse Property of Addition)
$= -10m$ (Identity Property of Addition)

51. $\begin{bmatrix} 3 & -5 \\ 4 & -1 \end{bmatrix} + \begin{bmatrix} 6 & -8 \\ 15 & 0 \end{bmatrix} = \begin{bmatrix} 3+6 & -5+(-8) \\ 4+15 & -1+0 \end{bmatrix} =$
$\begin{bmatrix} 9 & -13 \\ 19 & -1 \end{bmatrix}$ **52.** $[12 \quad -27 \quad 0 \quad -3] -$
$[-4.5 \quad 2 \quad -1 \quad 6.5] =$
$[12 - (-4.5) \quad 27 - 2 \quad 0 - (-1) \quad -3 - 6.5] =$
$[16.5 \quad -29 \quad 1 \quad -9.5]$

53. $\begin{bmatrix} -2.9 & 5 & 17 \\ 0 & -4.7 & 3.9 \\ 1 & -8 & 15 \end{bmatrix} - \begin{bmatrix} -6 & 5.7 & -4 \\ 4.9 & 0 & 6 \\ 2 & -1 & 7 \end{bmatrix} =$

$\begin{bmatrix} -2.9 - (-6) & 5 - 5.7 & 17 - (-4) \\ 0 - 4.9 & -4.7 - 0 & 39 - 6 \\ 1 - 2 & -8 - (-1) & 15 - 7 \end{bmatrix} =$

$\begin{bmatrix} 3.1 & -0.7 & 21 \\ -4.9 & -4.7 & -2.1 \\ -1 & -7 & 8 \end{bmatrix}$ **54.** $\begin{bmatrix} \frac{1}{2} & -\frac{3}{5} \\ 6 & -9 \\ 4 & 16 \end{bmatrix} + \begin{bmatrix} -12 & \frac{1}{10} \\ \frac{9}{2} & -8 \\ 1 & 14 \end{bmatrix} =$

$\begin{bmatrix} \frac{1}{2} - \frac{24}{2} & \frac{-6}{10} + \frac{1}{10} \\ \frac{12}{2} + \frac{9}{2} & -9 + (-8) \\ 4 + 1 & 16 + 14 \end{bmatrix} = \begin{bmatrix} \frac{-23}{2} & \frac{-5}{10} \\ \frac{21}{2} & -17 \\ 5 & 30 \end{bmatrix} =$

$\begin{bmatrix} -11\frac{1}{2} & -\frac{1}{2} \\ 10\frac{1}{2} & -17 \\ 5 & 30 \end{bmatrix}$

55. True; both sets $= \{1, 2, 3, \ldots\}$. **56.** False; 0 and 1 are counterexamples. **57.** True; if a is an integer, then a can be written as $\frac{a}{1}$, so it is a rational number.

TEST-TAKING STRATEGIES

1. 14% of $0.4 = (0.14)(0.4) = 0.056$; the answer is A.

2. $2200 \text{ ft}\left(\frac{1 \text{ mi}}{5280 \text{ ft}}\right) \approx 0.42 \text{ mi}$; the answer is I.

3. $\frac{(1+2)^2}{1+3} = \frac{9}{4}$; the answer is D. **4.** $(0.2)^3 = 0.008$; the answer is I.

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1. term **2.** evaluate **3.** algebraic expression **4.** rational **5.** absolute value **6.** matrix **7.** reciprocal **8.** rational number **9.** x-coordinate **10.** scatter plot **11.** negative correlation **12.** power **13.** Let $n =$ the number; $5 + 3n$. **14.** Let $n =$ the number; $30 - n$. **15.** Let $n =$ the number; $\frac{7}{n}$. **16.** Let $n =$ the number; $n(12)$.

17. $2 \cdot 3^2 - (4 \cdot 2 + 1) = 18 - 9 = 9$

18. $9(3 + 2 \cdot 2) + 1 = 63 + 1 = 64$ **19.** $\frac{2 \cdot 3 + 2}{2} = \frac{8}{2} = 4$ **20.** $4 \cdot 3 - 2^2 = 12 - 4 = 8$ **21.** real numbers, rational numbers **22.** real numbers, irrational numbers **23.** real numbers, rational numbers **24.** real numbers, rational numbers, natural numbers, whole numbers, integers **25.** real numbers, rational numbers, natural numbers, whole numbers, integers **26.** -17 **27.** -5 **28.** 9.9 **29.** 24.9 **30.** -12 **31.** $-3^2 + (-3)^2 = -9 + 9 = 0$

32. 10 **33.** -40 **34.** $\frac{5}{6}\left(-\frac{2}{3}\right) = \frac{5(-2)}{6(3)} = \frac{-10}{18} = -\frac{5}{9}$

35. $\frac{4 - (-2)}{3} = \frac{4 + 2}{3} = \frac{6}{3} = 2$ **36.** $\left(\frac{5}{6}\right) \div \left(-\frac{2}{3}\right) =$ $\frac{5}{6}\left(-\frac{3}{2}\right) = -\frac{5}{4}$ **37.** $\frac{5}{6} + \left(-\frac{2}{3}\right)^2 = \frac{5}{6} + \frac{4}{9} = \frac{15}{18} + \frac{8}{18} = \frac{23}{18}$

38. $9m - 5m + 3 = (9 - 5)m + 3 = 4m + 3$

39. $2b + 8 - b + 2 = 2b - b + 8 + 2 =$ $(2 - 1)b + (8 + 2) = 1b + 10 = b + 10$

40. $-5(w + 4) = (-5)(w) - (-5)(4) = -5w + 20$

41. $9(4 - 3j) = 9(4) - 9(3j) = 36 - 27j$

42. $-(3 - 10y) = (-1)(3) - (-1)(10y) = -3 + 10y$

43. $-2\left(r - \frac{1}{2}\right) = (-2)r - (-2)\left(\frac{1}{2}\right) = -2r + 1$

44. $(7b + 1)(5) = (7b)(5) + (1)(5) = 35b + 5$

45. $7 - 16v - 9v = 7 + [(-16) + (-9)]v =$ $7 + (-25)v = 7 - 25v$ **46.** $\frac{3}{5}(15t - 2) =$ $\frac{3}{5}(15t) - \frac{3}{5}(2) = \frac{45}{5}t - \frac{6}{5} = 9t - \frac{6}{5}$ **47.** $(6 - 3m)(-3) =$ $6(-3) - 3m(-3) = -18 + 9m$

48. $-(4 - x) = (-1)(4) - (-1)(x) = -4 - (-x) =$ $-4 + x$ **49.** $0.5(20g + 3) = 0.5(20g) + 0.5(3) =$ $10g + 1.5$ **50.** Associative Property of Addition **51.** Identity Property of Addition **52.** Commutative Property of Multiplication **53.** Distributive Property

54. $19 + 56\left(\frac{1}{56}\right)$
$= 19 + 1$ (Inverse Property of Multiplication)
$= 20$ (addition)

55. $-12p + 45 - 7p$
$= (-12p + 45) - 7p$ (order of addition)
$= [45 + (-12p)] - 7p$ (Comm. Prop. of Add.)
$= [45 + (-12p)] + (-7p)$ (definition of subtraction)
$= 45 + [-12p + (-7p)]$ (Assoc. Prop. of Add.)
$= 45 + [-12 + (-7)]p$ (Distributive Property)
$= 45 + (-19)p$ (addition)
$= 45 - 19p$ (definition of subtraction)

56. $24abc - 24bac$
$= 24abc - 24abc$ (Comm. Prop. of Mult.)
$= 24abc + (-24abc)$ (definition of subtraction)
$= 0$ (Inverse Property of Addition)