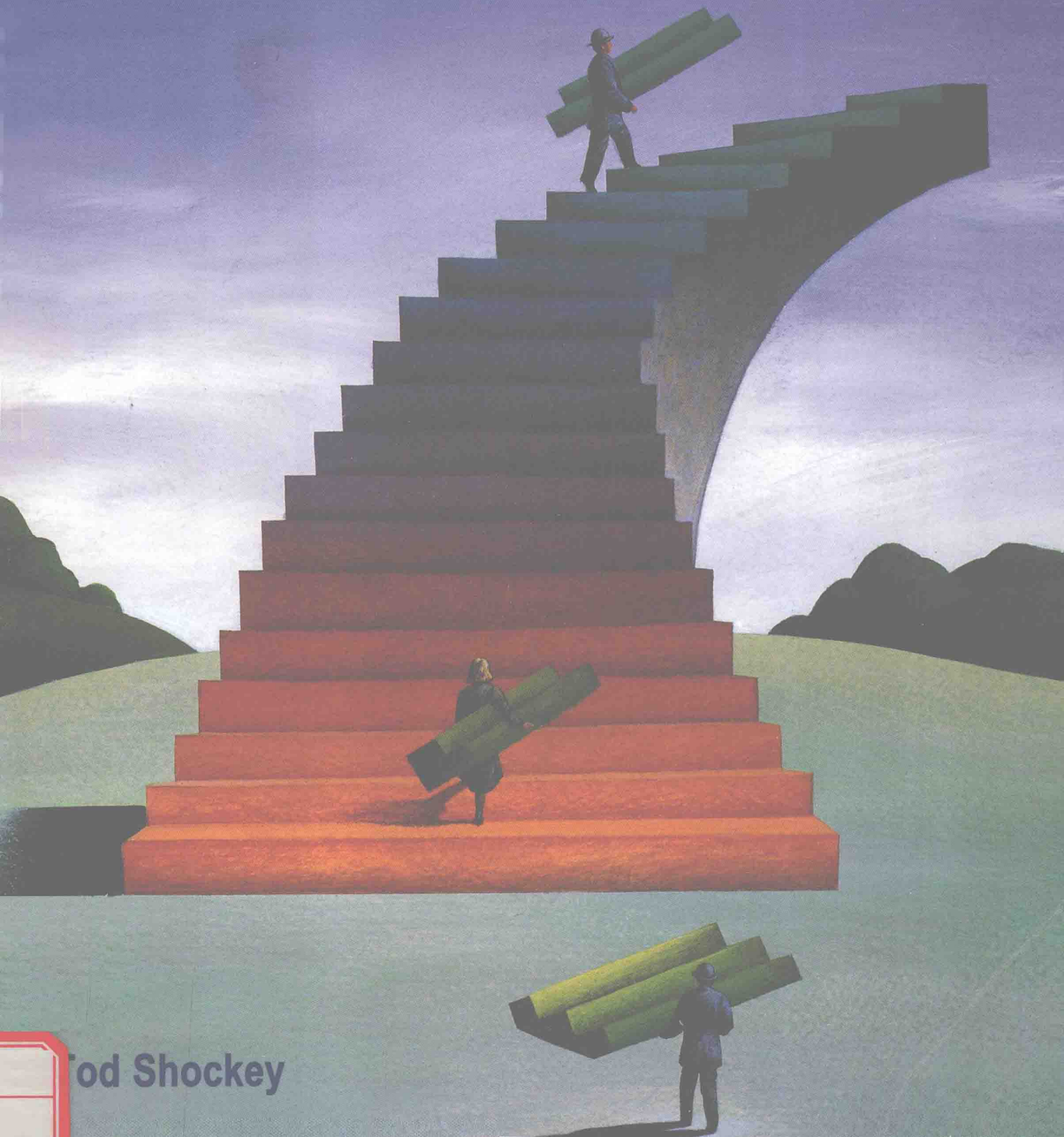
STUDENT SOLUTIONS MANUAL FOR TUSSY AND GUSTAFSON'S

Elementary Algebra

SECOND EDITION



Tod Shockey

Student Solutions Manual for Tussy and Gustafson's

Elementary Algebra

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Cover Printing: *Globus Printing Company*
Printing and Binding: *Globus Printing Company*

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511 Forest Lodge Road
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Printed in the United States of America

5 4 3 2

ISBN 0-534-37458-1

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Section 1.1
Vocabulary

1. The answer to an addition problem is called the **sum**.

3. The answer to a multiplication problem is called the **product**.

5. **Variables** are letters that stand for numbers.

7. Variables and numbers can be combined with the operations of addition, subtraction, multiplication, and division to create algebraic **expressions**.

9. An equation such as $t = 2b$, which expresses a known relationship between two or more variables, is called a **formula**.

11. In illustration 1, the **horizontal** axis of the graph has been scaled in units of **1** second.

Concepts

13. $18 + m = 23$ equation

15. $y - 1$ algebraic expression

17. $30x$ algebraic expression

19. $r = \frac{2}{3}$ equation

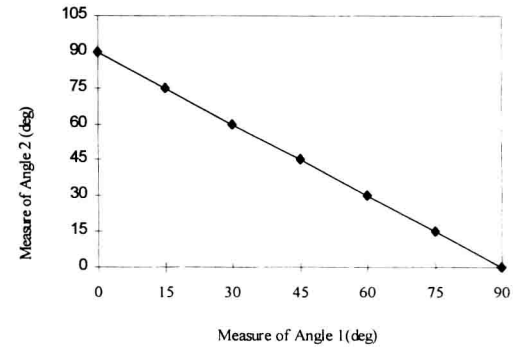
21. a. The expression $5x - 16$ contains multiplication and subtraction.
    b. The variable is x.

23. a. The equation $4 + 1 = 20 - m$ contains addition and subtraction.
    b. The variable is m.

25. a. Angle 1 + Angle 2 = 90°

Angle 1	Angle 2
0°	90°
30°	60°
45°	45°
60°	30°
90°	0°

b.



27. a. The dotted lines help us determine that 15-year-old machinery is worth $35,000.
    b. As the machinery ages its value decreases.

Notation

29. $5 \times 6 = 5 \cdot 6 = 5(6)$

31. $34 \times 75 = 34 \cdot 75 = 34(75)$

33. $4 \cdot x = 4x$

35. $3 \cdot r \cdot t = 3rt$

37. $l \cdot w = lw$

39. $P \cdot r \cdot t = Prt$

41. $32 \div x = \frac{32}{x}$

43. $\frac{90}{30}$

Practice

45. 18(24), the product of 18 and 24

47. $11 - 9$, the difference of 11 and 9

49. $2x$, the product of 2 and x

51. $\frac{66}{11}$, the quotient of 66 and 11

53. The sale price is \$100 minus the discount.
$S = 100 - d$

55. 7 times the age of a dog in years gives the dog's equivalent human age.
$7d = h$

57. $s = 3c$, where s is sand and c is cement.

59. $w = e + 1,200$, where w is truck weight and e is engine weight.

61. $p = r - 600$, where p is profit and r is revenue.

63. $\frac{l}{4} = m$, where l is laps and m is miles.

65. $d = 360 + l$

Lunch Time (min)	School Day (min)
30	$d = 360 + 30 = 390$
40	$d = 360 + 40 = 400$
45	$d = 360 + 45 = 405$

67. $t = 1,500 - d$

Deductions	Take-Home Pay
200	$t = 1,500 - 200 = 1,300$
300	$t = 1,500 - 300 = 1,200$
400	$t = 1,500 - 400 = 1,100$

69. $d = \frac{e}{12}$; the number of dozen eggs is the quotient of the number of eggs and 12.

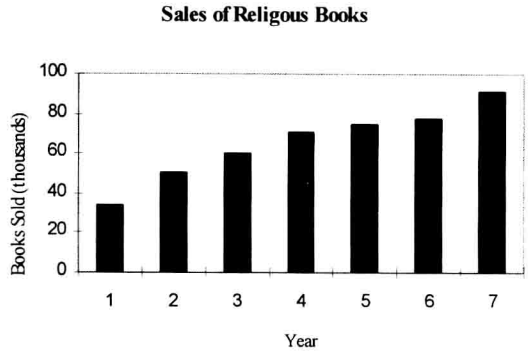
71. $T = b + 35,000$; the total compensation is the sum of the benefit package and 35,000.

Applications

73. CHAIR PRODUCTION
$l = 4c$; 4 legs per chair
$a = 2c$; 2 arms per chair
$S = c$; 1 seat per chair
$b = c$; 1 back per chair
$p = 2c$; 2 arm pads per chair
$s = 20c$; 20 screws per chair

75. SPARE PARTS
$d = x + 500$, the number of left doors to order is the sum of the number of cars produced and 500.

77. RELIGOUS BOOKS
Trend: Sales have steadily increased over the years.



Writing

79. Answers will vary

81. Answers will vary

Section 1.2
Vocabulary

1. The set of **whole** numbers is $\{0, 1, 2, 3, 4, 5, ...\}$.

3. Numbers less than zero are **negative**, and numbers greater than zero are **positive**.

5. A **rational** number can be written as a fraction with an **integer** in the numerator and a nonzero integer in its denominator.

7. The set of **integers** is $\{... -2, -1, 0, 1, 2, ...\}$.

9. An **irrational** number cannot be written as a fraction with an integer for its numerator and denominator.

11. The **absolute value** of a number is the distance on a number line between the number and 0.

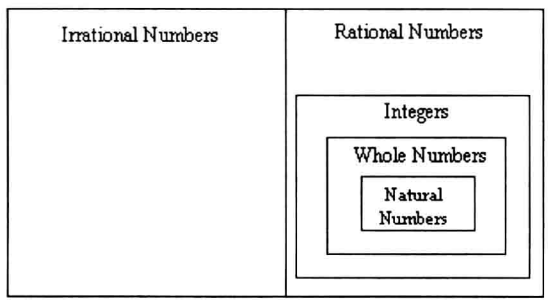
Concepts

13. $6 = \frac{6}{1}; -9 = \frac{-9}{1}; -\frac{7}{8} = -\frac{7}{8}$
$3\frac{1}{2} = \frac{7}{2}; -0.3 = -\frac{3}{10}; 2.83 = \frac{283}{100}$

15. 13 and -3 are 8 away from 5 on the number line.

17. a. $a < b$
b. $b > a$
c. $b > 0$ and $a < 0$

19.



Notation

21. $\sqrt{5}$ is read as "the **square root** of 5."

23. The symbol $\approx$ means **is approximately equal to**.

25. In $\frac{3}{4}$, 3 is the **numerator**, and 4 is the **denominator** of the fraction.

27. 4π means the product of 4 and π or $4 \cdot \pi$.
$4\pi \approx 12.6$

29. $-2 > -3$

31. $|3.4| > \sqrt{10}$

33. $-|-1.1| < -1$

35. $-(-\frac{5}{8}) < (-\frac{3}{8})$

37. $|-\frac{15}{2}| = 7.5$

39. $\frac{99}{100} = 0.99$

41. $0.333... > 0.3$

43. $-(-1) > |-\frac{15}{16}|$

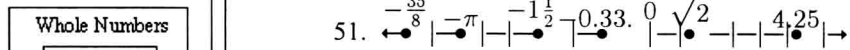
Practice

45.

whole	0
integers	$0, -50$
rational	$-\frac{5}{6}, 35.99, 0, 4\frac{3}{8}, -50, \frac{17}{5}$
irrational	$\sqrt{2}$
real	all

47. a. true
b. false
c. false
d. true

49. a. $-6 < -5$ is the same as $-5 > -6$
b. $16 > -25$ is the same as $-25 < 16$

51. 

53. $\sqrt{5} \approx 2.236$

55. $\sqrt{99} \approx 9.950$

57. $2\sqrt{5} \approx 4.472$

59. $5\pi \approx 15.708$

61. The opposite of 5 is -5.

63. The opposite of $-\frac{7}{8}$ is $\frac{7}{8}$.

65. $-(-10) = 10$

67. $-(-2.3) = 2.3$

Applications

69. BANKING

natural	750, 5000
whole	750, 5000
integers	750, 5000
rational	all
irrational	none
real	all

71. AUTOMOBILE INDUSTRY

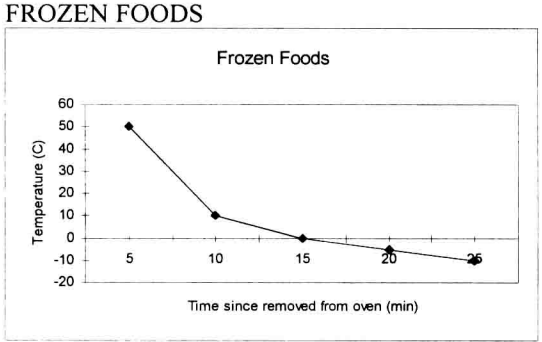
a.

Year	Approx. Net Income
1990	\$0.3
1991	−\$0.8
1992	\$0.9
1993	−\$2.3
1994	\$3.8
1995	\$2.0
1996	\$3.8
1997	\$2.8

b. A negative net income means the company lost money.

73. TIRES
Using $C = \pi d$ to estimate how far a tire with a diameter of 26 inches will roll in one revolution, $C = \pi(26)$.
$C = 81.68140...$, to the nearest tenth the tire will roll 81.7 inches in one revolution.

75. FROZEN FOODS



77. VELOCITY AND SPEED
The speed of the car is 55 mph to the right and the speed of the motorcycle is 30 mph to the left.

79. 500 years are the basic unit for the scale.

81. A.D. can thought of as the positive numbers and B.C. can be thought of as the negative numbers.

Writing

83. Answers will vary.

85. Answers will vary.

87. Answers will vary.

Review

89. $7 - 5 = 2$, the difference of 7 and 5 is 2.

91. $30 \div 15 = 2$, the quotient of 30 and 15 is 2.

93. $T = 15g$, where T is the number of teeth and g is the number of gears.

Gears	Teeth
10	$T = 15(10) = 150$
12	$T = 15(12) = 180$
15	$T = 15(15) = 225$

Section 1.3
Vocabulary

1. In the multiplication statement $6 \cdot 7 = 42$, the numbers being multiplied are called **factors**.

3. 10^2 can be read as **ten squared**, and 10^3 can be read as **ten cubed**.

5. The arithmetic **mean** or **average** of a set of numbers is a value around which the values of the numbers are grouped.

Concepts

7. a. $4 + 5 \cdot 6$ contains addition and multiplication
   b. $4 + 5 \cdot 6 = 9 \cdot 6 = 54$
   $4 + 5 \cdot 6 = 4 + 30 = 34$
   c. $4 + 5 \cdot 6 = 4 + 30 = 34$ is correct since multiplication is done before addition.

9. a. Divide the sum of the scores by the number of scores.
   b. $\frac{75+81+47+53}{4} = \frac{256}{4} = 64$

11. a. $12 + 5^2 \cdot 3$ contains addition, power, and multiplication.
    b. power, multiplication, addition

13. $\frac{36-4(7)}{2(10-8)}$ multiplication first in the numerator, subtraction first in the denominator.

15. a. $80 - 3 + 5 - 2^2$ power
    b. $80 - (3 + 5) - 2^2$ addition
    c. $80 - 3 + (5 - 2)^2$ subtraction

Notation

17. 12^6

19. $50 + 6 \cdot 3^2 = 50 + 6 \cdot 9$
$= 50 + 54$
$= 104$

21. $19 - 2[(1 + 2) \cdot 3] = 19 - 2[3 \cdot 3]$
$= 19 - 2(9)$
$= 19 - 18$
$= 1$

Practice

23. $d = 16t^2$

25. Let s be the side length then the volume is $V = s^3$.

Side Length (in.)	Volume (in^3)
1	$V = (1)^3 = 1$
2	$V = (2)^3 = 8$
3	$V = (3)^3 = 27$
4	$V = (4)^3 = 64$

27. $b \cdot b \cdot b = b^3$

29. $10 \cdot 10 \cdot k \cdot k \cdot k = 10^2k^3$

31. $4 \cdot \pi \cdot r \cdot r = 4\pi r^2$

33. $6 \cdot x \cdot x \cdot y \cdot y \cdot y = 6x^2y^3$

35. $12 - 2 \cdot 3 = 12 - 6 = 6$

37. $15 + (30 - 4) = 15 + 26 = 41$

39. $100 - 8(10) + 60 = 100 - 80 + 60 = 80$

41. $22 - (15 - 3) = 22 - 12 = 10$

43. $2(9) - 2(5) = 18 - 10 = 8$

45. $5^2 + 13^2 = 25 + 169 = 194$

47. $3 \cdot 8^2 = 3 \cdot 64 = 192$

49. $8 \cdot 5 - 4 \div 2 = 40 - 2 = 38$

51. $14 + 3(7 - 5) = 14 + 3(2) = 14 + 6 = 20$

53. $4 + 2[26 - 5(3)]$
$= 4 + 2[26 - 15]$
$= 4 + 2(11)$
$= 4 + 22$
$= 26$

55. $(10 - 3)^2 = 7^2 = 49$

57. $10 - 3^2 = 10 - 9 = 1$

59. $19 - (45 - 41)^2$
$= 19 - 4^2$
$= 19 - 16$
$= 3$

61. $2 + 3 \cdot 2^2 \cdot 4$
$= 2 + 3 \cdot 4 \cdot 4$
$= 2 + 48$
$= 50$

63. $3(4)(5)(6)$
$= 12(5)(6)$
$= 60(6)$
$= 360$

65. $5[9(2) - 2(8)]$
$= 5[18 - 16]$
$= 5(2)$
$= 10$

67. $75 - 3 \cdot 1^2$
$= 75 - 3$
$= 72$

69. $5(150 - 3^3)$
$= 5(150 - 27)$
$= 5(123)$
$= 615$

71. $(4 + 2 \cdot 3)^4$
$= (4 + 6)^4$
$= 10^4$
$= 10,000$

73. $3(2)^5(2)^2$
$= 3(32)(4)$
$= 384$

75. $6(\frac{25}{5}) - \frac{36}{9} + 1$
$= 6(5) - 4 + 1$
$= 30 - 4 + 1$
$= 27$

77. $\frac{5(68-32)}{9}$
$= \frac{5(36)}{9}$
$= \frac{180}{9}$
$= 20$

79. $\frac{(6-5)^4+21}{27-4^2}$
$= \frac{1^4+21}{27-16}$
$= \frac{1+21}{27-16}$
$= \frac{22}{11}$
$= 2$

81. $\frac{13^2-5^2}{3(9-5)}$
$= \frac{169-25}{3(4)}$
$= \frac{144}{12}$
$= 12$

83. $\frac{8^2-10}{2(3)(4)-5(3)}$
$= \frac{64-10}{24-15}$
$= \frac{54}{9}$
$= 6$

85. $56,120$

87. $91,985$

Applications

89. CASH AWARDS
a. Money awarded is the sum of the grand prize, four first place prizes,thirty-five second place prizes, and eighty-five third place prizes.
$M = 2,500 + 4(500) + 35(150) + 85(25)$
$M = 2,500 + 2,000 + 5,250 + 2,125$
$M = \$11,875$
b. Let c be the cash average; 125 is the toal number of prizes awarded.
$c = \frac{2,500+4(500)+35(150)+85(25)}{125}$
$c = \frac{11,875}{125}$
$c = \$95$

91. STAKES RACES
Let s be the average stake award
$s = \frac{2(300,000)+2(200,000)+2(175,000)+2(150,000)}{8}$
$s = \frac{600,000+400,000+350,000+300,000}{8}$
$s = \frac{1,650,000}{8}$
$s = \$206,250$

93. SPREADSHEETS

	A	B	C	D $= \frac{6C-(A+B)}{12}$
1	20	4	8	$\frac{6(8)-(20+4)}{12} = \frac{48-24}{12} = \frac{24}{12} = 2$
2	9	3	16	$\frac{6(16)-(9+3)}{12} = \frac{96-12}{12} = \frac{84}{12} = 7$
3	1	5	11	$\frac{6(11)-(1+5)}{12} = \frac{66-6}{12} = \frac{60}{12} = 5$

95. CABLE TELEVISION
a.

Month 1	Month 2	Month 3	Month 4
$5 = 5^1$	$25 = 5^2$	$125 = 5^3$	$625 = 5^4$

b. Based on this pattern in month 5 we could predict 5^5 or 3,125 new cable subscribers.

Writing

97. Answers may vary.

99. Answers may vary.

Review

101. $|-5| = 5$

103. True

105. -9 and 3 are a distance of 6 away from -3.

Section 1.4
Vocabulary

1. To **evaluate** an algebraic expression, we substitute the values for the variables and then apply the rules for the order of operations.

3. When translated to mathematical symbols words such as decreased and reduced indicate the operation of **subtraction**.

Concepts

5. Answers may vary. Examples: $6 + 20x$; $\frac{6-x}{20}$

7. $3x - 6$ evaluated for $x = 4$, could be misunderstood as $34 - 6$ without parentheses, $3(4) - 6$.

9. a. Let x be the weight of the car;
   $2x - 500 =$ the weight of the van.
   b. If the car weighs 2,000 pounds then the van weighs $2(2,000) - 500 = 4,000 - 500$
   $= 3500$ pounds.

11. a. The evaluated algebraic expression is $8x - x^2$.
    b. The expression was evaluated for x equal to 3, 4, and 5.
    c. For $x = 4$, the expression $8x - x^2$ is $8(4) - (4)^2 = 32 - 16 = 16$

Notation

13. $9a - a^2$evaluated for $a = 5$ is
    $= 9(5) - 5^2$
    $= 9(5) - 25$
    $= 45 - 25$
    $= 20$

Practice

15. The sum of the length l and 15 is $l + 15$.

17. The product of a number and 50 is $50x$.

19. The ratio of the amount won w and lost l is $\frac{w}{l}$.

21. P increased by p is $P + p$.

23. The square of k minus 2,005 is $k^2 - 2,005$.

25. J reduced by 500 is $J - 500$.

27. 1,000 split n equal ways is $\frac{1000}{n}$.

29. 90 more than the current price p, is $p + 90$.

31. The total of 35, h, and 300 is $35 + h + 300$.

33. 680 fewer than the entire population p is $p - 680$.

35. The product of d and 4 decreased by 15 is $4d - 15$.

37. Twice the sum of 200 and t is $2(200 + t)$.

39. The absolute value of the difference of a and 2 is $|a - 2|$.

41. 7 less than a number

43. The product of 7 and a number increased by 4.

45. a. In 5 hours there are $5(60)$ or 300 minutes
    b. In h hours there are $60h$ minutes

47. a. There are $3y$ feet in a y yards
    b. There are $\frac{f}{3}$ yards in f feet

49. The altered skirt length is $x + 2$

51. After the jeans are washed the new length will be $36 - x$

53. a. In an 8-hour day the clerk earns $\$8x$
    b. In a 40-hour week the cleark earns $\$40x$

55. Tickets for a family and two neighbors will cost $\$5(x + 2)$ where $x + 2$ represents the total number of people

57. For $x = 7$, $6x$ is $6(7) = 42$

59. For $t = 8$, $3(t - 6)$ is $3(8 - 6) = 3(2) = 6$

61.

g	$g^2 - 7g + 1$
0	$0^2 - 7(0) + 1 = 1$
7	$7^2 - 7(7) + 1 = 1$
10	$10^2 - 7(10) + 1 = 31$

63.

s	$\frac{5s+36}{s}$
1	$\frac{5(1)+36}{1} = 41$
6	$\frac{5(6)+36}{6} = 11$
12	$\frac{5(12)+36}{12} = 8$

65.

x	$2x - \frac{x}{2}$
100	$2(100) - \frac{100}{2} = 150$
300	$2(300) - \frac{300}{2} = 450$

67.

a	$3a^2 + 1$
4	$3(4)^2 + 1 = 49$
8	$3(8)^2 + 1 = 193$

69. For $a = 5$ and $b = 12$,
$a^2 + b^2 = 5^2 + 12^2 = 169$

71. For $s = 23$ and $t = 21$, $\frac{s+t}{s-t} = \frac{23+21}{23-21} = 22$

73. For $h = 5, b = 7$, and $c = 9$,
$\frac{h(b+c)}{2} = \frac{5(7+9)}{2} = \frac{5(16)}{2} = \frac{80}{2} = 40$

75. A basketball with radius 4.5 inches has a volume of
$\frac{4\pi r^3}{3} = \frac{4\pi(4.5)^3}{3} = 381.7 \text{ in}^3$

Applications

77. TRAINING PROGRAM
Let $n =$ the original number entering the lifeguard program, then $\frac{n-6}{8}$ is the number of lifeguards in each squad.

79. OCCUPANCY RATE
Let $a =$ the number of apartments occupied before the rent was lowered, then $2a - 3$ is the number of apartments now occupied.

81. ROCKETRY

t	$h = 64t - 16t^2$
0	$h = 64(0) - 16(0)^2 = 0$
0.5	$h = 64(0.5) - 16(0.5)^2 = 28$
1	$h = 64(1) - 16(1)^2 = 48$
1.5	$h = 64(1.5) - 16(1.5)^2 = 60$
2	$h = 64(2) - 16(2)^2 = 64$
2.5	$h = 64(2.5) - 16(2.5)^2 = 60$
3	$h = 64(3) - 16(3)^2 = 48$
3.5	$h = 64(3.5) - 16(3.5)^2 = 28$
4	$h = 64(4) - 16(4)^2 = 0$

83. PACKAGING

	B	C	D	E=2*B1*C1+2*B1*D1+2*C1*D1
1	12	6	6	2(12)(6)+2(12)(6)+2(6)(6)=360 in^2
2	18	12	12	2(18)(12)+2(18)(12)+2(12)(12)=1152 in^2
3	18	24	18	2(18)(24)+2(18)(18)+2(24)(18)=2376 in^2

85. ENERGY CONSERVATION
Using $h = 5.5$ feet and $r = 2$ feet, the heater surface is $2\pi rh = 2\pi(2)(5.5) = 69 \text{ ft}^2$

Writing

87. Answers will vary

Review

89. Simplify -0.0

91. $\left|-\frac{2}{3}\right| = \frac{2}{3}$

93. $c \cdot c \cdot c \cdot c = c^4$

95. $\frac{84+93+72}{3} = 83$

Section 1.5
Vocabulary

1. An **equation** is a statement indicating that two expressions are equal.

3. To **check** the solution of an equation, we substitute the value for the variable in the original equation and see whether the result is a **true** statement.

5. Two equations are **equivalent** when they have the same solutions.

7. To solve an equation, we **isolate** the variable on one side of the equals side.

Concepts

9. a. $x - 8 = 24$ subtraction of 8, addition of 8
   b. $x + 8 = 24$ addition of 8, subtraction of 8
   c. $\frac{x}{8} = 24$ division by 8, multiplication by 8
   d. $8x = 24$ multiplication by 8, division by 8

11. a. $x + 6$ forms the left side of the equation
    b. neither
    c. Let $x = 5$ then $x + 6$ becomes $5 + 6 \neq 12$; no
    d. Let $x = 6$ then $x + 6$ becomes $6 + 6 = 12$; yes

13. $x + 15 = 45$
    $x + 15 - 15 = 45 - 15$
    $x = 30$

15. $12 = 0.40 \cdot x$

17. a. 35% translates to 0.35
    b. 3.5% translates to 0.035
    c. 350% translates to 3.5
    d. $\frac{1}{2}$% translates to 0.005

Practice

19. $x = 6$ is a solution since $6 + 12 = 18$

21. $b = 5$ is not a solution since $2(5) + 3 \neq 13$

23. $x = 5$ is not a solution since $0.5(5) \neq 2.9$

25. $x = 6$ is a solution since $33 - \frac{6}{2} = 30$

27. $c = 20$ is not a solution since $|20 - 8| \neq 10$

29. $x = 12$ is not a solution since
    $3(12) - 2 \neq 4(12) - 5$
    $34 \neq 43$

31. $x = 3$ is a solution since
    $(3)^2 - 3 - 6 = 0$

33. $a = 1$ is a solution since
    $\frac{2}{1+1} + 5 = \frac{12}{1+1}$

35. $x = 201$ is a solution since
    $\sqrt{(201 - 5)} + 1 = 15$

37. $x + 7 = 10$
    $x + 7 - 7 = 10 - 7$
    $x = 3$
    check
    $3 + 7 = 10$

39. $a - 5 = 66$
    $a - 5 + 5 = 66 + 5$
    $a = 71$
    check
    $71 - 5 = 66$

41. $0 = n - 9$
    $0 + 9 = n - 9 + 9$
    $9 = n$
    check
    $0 = 9 - 9$

43. $9 + p = 90$
    $9 - 9 + p = 90 - 9$
    $p = 81$
    check
    $9 + 81 = 90$

45. $9 + p = 9$
    $9 - 9 + p = 9 - 9$
    $p = 0$
    check
    $9 + 0 = 9$

47. $203 + f = 442$
    $203 - 203 + f = 442 - 203$
    $f = 239$
    check
    $203 + 239 = 442$

49. $4x = 16$
    $\frac{4x}{4} = \frac{16}{4}$
    $x = 4$
    check
    $4(4) = 16$