69. $\frac{3 \text{ dollars}}{\cancel{\text{unit}}} \cdot (5 \cancel{\text{units}}) = 15 \text{ dollars}$

71. $\frac{3 \text{ dollars}}{\cancel{\text{pound}}} \cdot (5 \cancel{\text{pounds}}) = 15 \text{ dollars}$

73. $\frac{5 \text{ feet}}{\cancel{\text{second}}} \cdot \frac{60 \cancel{\text{seconds}}}{\cancel{\text{minute}}} \cdot (20 \cancel{\text{minutes}}) = 6000 \text{ feet}$

75. A conditional equation has a solution set that is not the entire set of real numbers, but the solution set for any identity is all real numbers.

77. An expression doesn't contain an equal sign. Simplifying an expression is writing the expression in an equivalent form. Simplifying can involve combining like terms or removing symbols of grouping.

This expression can be simplified: $5x + 2(x + 6)$

$$5x + 2(x + 6) = 5x + 2x + 12 = 7x + 12$$

An equation contains an equal sign, and it can be solved by finding all the values of the variable for which the equation is true.

This equation can be solved: $5x = 2(x + 6)$

$$\begin{aligned} 5x &= 2x + 12 \\ 3x &= 12 \\ x &= 4 \end{aligned}$$

79. To transform an equation into an equivalent equation,

(a) Simplify either side by removing symbols of grouping, combining like terms, or reducing fractions on one or both sides.

(b) Add (or subtract) the same quantity to (from) both sides of the equation.

(c) Multiply (or divide) both sides of the equation by the same nonzero quantity.

(d) Interchange the sides of the equation.

Review Exercises for Chapter 2

1. Terms: $4, -\frac{1}{2}x^3$
Coefficient: $-\frac{1}{2}$

3. Terms: $y^2, -10yz, \frac{2}{3}z^2$
Coefficients: $1, -10, \frac{2}{3}$

5. $5z \cdot 5z \cdot 5z = (5z)^3$ or 5^3z^3

7. $a(b - c) \cdot a(b - c) = [a(b - c)]^2$ or $a^2(b - c)^2$

9. (a) When $x = 0$, the value of $x^2 - 2x + 5$ is $0^2 - 2 \cdot 0 + 5 = 0 - 0 + 5 = 5$.

(b) When $x = 2$, the value of $x^2 - 2x + 5$ is $2^2 - 2 \cdot 2 + 5 = 4 - 4 + 5 = 5$.

11. When $x = 2$ and $y = -1$, the value of $x^2 - x(y + 1) = 2^2 - 2(-1 + 1) = 4 - 2(0) = 4 - 0 = 4$

When $x = 1$ and $y = 2$, the value of $x^2 - x(y + 1) = 1^2 - 1[2 + 1] = 1 - 1(3) = 1 - 3 = -2$

13. $x^2 \cdot x \cdot x = x^{2+1+4} = x^7$

15. $(x^3)^2 = x^{3 \cdot 2} = x^6$

17. $t^4(-2t^2) = -2t^{4+2} = -2t^6$

19. $(xy)(-5x^2y^3) = -5x^{1+2}y^{1+3}$
$= -5x^3y^4$

21. $(-2y^2)^3(8y) = (-2)^3(y^2)^3(8y)$
$= -8y^{2 \cdot 3}(8y)$
$= -8 \cdot 8 \cdot y^6 \cdot y$
$= -64y^{6+1}$
$= -64y^7$

23. Multiplicative Inverse Property

25. Commutative Property of Multiplication

27. Associative Property of Addition

29. $4(x + 3y) = 4x + 4 \cdot 3y$
$= 4x + 12y$

31. $-5(2u - 3v) = (-5)(2u) - (-5)(3v) = -10u + 15v$

33. $x(8x + 5y) = x(8x) + x(5y) = 8x^2 + 5xy$

35. $-(-a + 3b) = a - 3b$

Note: The sign of *each* term is changed.

The expression $-(-a + 3b)$ can be written as $(-1)(-a + 3b) = (-1)(-a) + (-1)(3b) = a - 3b$.

37. $3a - 5a = (3 - 5)a = -2a$

39. $3p - 4q + q + 8p = 3p + 8p - 4q + q$
$= (3 + 8)p + (-4 + 1)q$
$= 11p + (-3)q$
$= 11p - 3q$

41. $\frac{1}{4}s - 6t + \frac{7}{2}s + t = \frac{1}{4}s + \frac{7}{2}s - 6t + t$
$= \left(\frac{1}{4} + \frac{14}{4}\right)s + (-6 + 1)t$
$= \frac{15}{4}s - 5t$

43. $x^2 + 3xy - xy + 4 = x^2 + (3 - 1)xy + 4$
$= x^2 + 2xy + 4$

45. $5x - 5y + 3xy - 2x + 2y = 5x - 2x + 3xy - 5y + 2y$
$= (5 - 2)x + 3xy + (-5 + 2)y$
$= 3x + 3xy - 3y$

47. $5\left(1 + \frac{r}{n}\right)^2 - 2\left(1 + \frac{r}{n}\right)^2 = (5 - 2)\left(1 + \frac{r}{n}\right)^2$
$= 3\left(1 + \frac{r}{n}\right)^2$

49. $5(u - 4) + 10 = 5u - 5 \cdot 4 + 10$
$= 5u - 20 + 10$

51. $3s - (r - 2s) = 3s - r + 2s$
$= 3s + 2s - r$
$= 5s - r$

53. $-3(1 - 10z) + 2(1 - 10z) = (-3 + 2)(1 - 10z)$
$= -1(1 - 10z)$
$= -1 + 10z$

Note: The parentheses could be removed first.

$-3(1 - 10z) + 2(1 - 10z) = -3 \cdot 1 - (-3)(10z) + 2 \cdot 1 - 2(10z)$
$= -3 + 30z + 2 - 20z = -3 + 2 + 30z - 20z$
$= -1 + (30 - 20)z = -1 + 10z$

55. $\frac{1}{3}(42 - 18z) - 2(8 - 4z) = 14 - 6z - 16 + 8z$
$= -6z + 8z + 14 - 16$
$= (-6 + 8)z + 14 - 16$
$= 2z - 2$

57. $10 - [8(5 - x) + 2] = 10 - [40 - 8x + 2]$
$= 10 - 40 + 8x - 2$
$= 8x + 10 - 40 - 2$
$= 8x - 32$

59. $2[x + 2(y - x)] = 2[x + 2y - 2x]$
$= 2x + 4y - 4x$
$= (2 - 4)x + 4y$
$= -2x + 4y$

61. $\frac{2}{3}x + 5$

63. $2x - 10$

65. $50 + 7x$

67. $\dfrac{x + 10}{8}$

69. $x^2 + 64$

71. The sum of a number and three *or* a number increased by three.

73. A number is decreased by two and the result is divided by three *or* two is subtracted from a number and the result is divided by three.

75. (a) $x = 3$
$5(3) + 6 \stackrel{?}{=} 36$
$15 + 6 \stackrel{?}{=} 16$
$21 \neq 36$
3 is *not* a solution.

(b) $x = 6$
$5(6) + 6 \stackrel{?}{=} 36$
$30 + 6 \stackrel{?}{=} 36$
$36 = 36$
6 *is* a solution.

77. (a) $x = -1$
$3(-1) - 12 \stackrel{?}{=} -1$
$-3 - 12 \stackrel{?}{=} -1$
$-15 \neq -1$
-1 is *not* a solution.

(b) $x = 6$
$3(6) - 12 \stackrel{?}{=} 6$
$18 - 12 \stackrel{?}{=} 6$
$6 = 6$
6 *is* a solution.

79. (a) $x = \frac{2}{7}$
$4\left(2 - \frac{2}{7}\right) \stackrel{?}{=} 3\left(2 + \frac{2}{7}\right)$
$4\left(\frac{14}{7} - \frac{2}{7}\right) \stackrel{?}{=} 3\left(\frac{14}{7} + \frac{2}{7}\right)$
$4\left(\frac{12}{7}\right) \stackrel{?}{=} 3\left(\frac{16}{7}\right)$
$\frac{48}{7} = \frac{48}{7}$
$\frac{2}{7}$ *is* a solution.

(b) $x = -\frac{2}{3}$
$4\left(2 - \left(-\frac{2}{3}\right)\right) \stackrel{?}{=} 3\left(2 + \left(-\frac{2}{3}\right)\right)$
$4\left(\frac{6}{3} + \frac{2}{3}\right) \stackrel{?}{=} 3\left(\frac{6}{3} - \frac{2}{3}\right)$
$4\left(\frac{8}{3}\right) \stackrel{?}{=} 3\left(\frac{4}{3}\right)$
$\frac{32}{3} \neq 4$
$-\frac{2}{3}$ is *not* a solution.

81. (a) $x = -1$
$\dfrac{4}{-1} - \dfrac{2}{-1} \stackrel{?}{=} 5$
$-4 - (-2) \stackrel{?}{=} 5$
$-4 + 2 \stackrel{?}{=} 5$
$-2 \neq 5$
-1 is *not* a solution.

(b) $x = \dfrac{2}{5}$
$\dfrac{4}{2/5} - \dfrac{2}{2/5} \stackrel{?}{=} 5$
$4\left(\dfrac{5}{2}\right) - 2\left(\dfrac{5}{2}\right) \stackrel{?}{=} 5$
$10 - 5 \stackrel{?}{=} 5$
$5 = 5$
$\dfrac{2}{5}$ *is* a solution.

83. (a) $x = 3$
$3(3 - 7) \stackrel{?}{=} -12$
$3(-4) \stackrel{?}{=} -12$
$-12 = -12$
3 *is* a solution.

(b) $x = 4$
$4(4 - 7) \stackrel{?}{=} -12$
$4(-3) \stackrel{?}{=} -12$
$-12 = -12$
4 *is* a solution.

85. $P\left(\frac{9}{10}\right)\left(\frac{9}{10}\right)\left(\frac{9}{10}\right)\left(\frac{9}{10}\right)\left(\frac{9}{10}\right) = P\left(\frac{9}{10}\right)^5$

87. The amount of tax is a product.

Verbal model: [Percent of income tax] · [Taxable income]

Labels: Percent of income tax = 0.28 (in decimal form)

Taxable income = I (dollars)

Algebraic expression: $0.28I$ (dollars)

89. The area is a difference of products.

Verbal model: [Length of larger rectangle] · [Width of larger rectangle] − [Length of smaller rectangle] · [Width of smaller rectangle]

Labels: Length of larger rectangle = $6x$

Width of larger rectangle = $2x$

Length of smaller rectangle = $3x$

Width of smaller rectangle = x

Algebraic expression: $6x \cdot 2x - 3x \cdot x$ or $12x^2 - 3x^2$ or $9x^2$ (square units)

91. *Verbal model:* [Time] · [Average speed]

Labels: Time = 10

Average speed = s

Algebraic expression: $10s$

93. *Verbal model:* [Monthly rent] · [Number of months]

Labels: Monthly rent = \$625

Number of months = n

Algebraic expression: $625n$

95. (a)

n	0	1	2	3	4	5
$n^2 + 3n + 2$	2	6	12	20	30	42
Differences:	4	6	8	10	12	
Differences:	2	2	2	2		

When $n = 0$, the value of $n^2 + 3n + 2$ is $0^2 + 3 \cdot 0 + 2 = 0 + 0 + 2 = 2$.

When $n = 1$, the value of $n^2 + 3n + 2$ is $1^2 + 3 \cdot 1 + 2 = 1 + 3 + 2 = 6$.

When $n = 2$, the value of $n^2 + 3n + 2$ is $2^2 + 3 \cdot 2 + 2 = 4 + 6 + 2 = 12$.

When $n = 3$, the value of $n^2 + 3n + 2$ is $3^2 + 3 \cdot 3 + 2 = 9 + 9 + 2 = 20$.

When $n = 4$, the value of $n^2 + 3n + 2$ is $4^2 + 3 \cdot 4 + 2 = 16 + 12 + 2 = 30$.

When $n = 5$, the value of $n^2 + 3n + 2$ is $5^2 + 3 \cdot 5 + 2 = 25 + 15 + 2 = 42$.

(b) In third row, the differences are consecutive even integers. In the fourth row, each difference is two.

97. *Verbal model:* Unknown num- + Reciprocal of number = $\frac{37}{6}$

Labels: Unknown number $= x$

Reciprocal $= \frac{1}{x}$

Equation: $x + \frac{1}{x} = \frac{37}{6}$

99. *Verbal model:* Area of triangle − Area of triangle = Area of shaded region

Labels: Area of rectangle $= x(6)$ or $6x$ (square inches)

Area of triangle $\frac{1}{2}(x)(6)$ or $3x$ (square inches)

Shaded area $= 24$ (square inches)

Equation: $6x - \frac{1}{2}(x)(6) = 24$ or $6x - 3x = 24$

This equation could also be simplified to $3x = 24$.

Note: The area of a rectangle is the product of its length and width ($A = lw$). The area of a triangle is one-half the product of its base and height $\left(A = \frac{1}{2}bh\right)$.

Chapter Test for Chapter 2

1. Terms $2x^2, -7xy, 3y^3$

Coefficients: $2, -7, 3$

2. $x \cdot (x + y) \cdot x \cdot (x + y) \cdot x = x^3(x + y)^2$

3. Associative Property of Multiplication

4. Commutative Property of Addition

5. Additive Inverse Property

6. Multiplicative Identity Property

7. $3(x + 8) = 3x + 24$

8. $-y(3 - 2y) = -3y + 2y^2$

9. $(c^2)^4 = c^{2 \cdot 4}$
$= c^8$

10. $-5uv(2u^3) = -5 \cdot 2 \cdot u \cdot u^3 \cdot v$
$= -10u^{1+3}v$
$= -10u^4v$

11. $3b - 2a + a - 10b = (-2 + 1)a + (3 - 10)b$
$= -a - 7b$

12. $15(u - v) - 7(u - v) = (15 - 7)(u - v)$
$= 8(u - v)$
$= 8u - 8v$

13. $3z - (4 - z) = 3z - 4 + z$
$= 3z + z - 4$
$= 4z - 4$

Note: This problem can also be worked as follows.

$15(u - v) - 7(u - v) = 15u - 15v - 7u + 7v$
$= (15 - 7)u + (-15 + 7)u$
$= 8u - 8v$