

EXERCISE SET 2.1



Fill in the blanks with the appropriate word, phrase, or symbol(s) from the following list.

conditional terms \emptyset contradiction like terms degree identity unlike terms least common denominator isolate \mathbb{R}

- The parts that are added in an algebraic expression are called the _____ of the expression.
- Terms that have identical variable parts are called _____.
- The goal in solving equations is to _____ the variable on one side of the equation.
- We can eliminate fractions from an equation by multiplying both sides of the equation by the _____.
- An equation that is always true is known as a(n) _____.
- An equation that is true for only specific values of the variable is known as a(n) _____ equation.
- An equation that is never true is known as a(n) _____.
- The _____ of a term is the sum of the exponents on the variables in the term.
- The symbol _____ is used to indicate the solution set of a contradiction.
- The symbol _____ is used to indicate the solution set of an identity.

Practice the Skills

Name each indicated property.

- If $x = 13$, then $13 = x$.
- If $b = c$ and $c = 9$, then $b = 9$.
- $a + c = a + c$
- If $x = 8$, then $x - 8 = 8 - 8$.
- If $5x = 4$, then $\frac{1}{5}(5x) = \frac{1}{5}(4)$.
- If $\frac{t}{4} + \frac{1}{3} = \frac{5}{6}$, then $12\left(\frac{t}{4} + \frac{1}{3}\right) = 12\left(\frac{5}{6}\right)$.
- If $x + 3 = 7$, then $x = 4$.
- If $m + 2 = 3$, then $3 = m + 2$.
- If $x + 1 = a$ and $a = 2y$, then $x + 1 = 2y$.
- If $r = 4$, then $r + 3 = 4 + 3$.
- If $2x = 4$, then $3(2x) = 3(4)$.
- If $a + 2 = 4$, then $a + 2 - 2 = 4 - 2$.
- If $x - 3 = x + y$ and $x + y = z$, then $x - 3 = z$.
- If $5x = 35$ then $x = 7$.

Give the degree of each term.

- | | | | |
|----------------|-----------------------|----------------|--------------|
| 25. $5y$ | 26. $-2z$ | 27. $5c^3$ | 28. $-6y^2$ |
| 29. $3ab$ | 30. $\frac{1}{2}x^4y$ | 31. 6 | 32. -3 |
| 33. $-5r$ | 34. $18p^2q^3$ | 35. $5a^2b^4c$ | 36. m^4n^6 |
| 37. $3x^5y^6z$ | 38. $-2x^4y^7z^8$ | | |

Simplify each expression. If an expression cannot be simplified, so state.

- | | | |
|--------------------------------------------------------|-----------------------------------------------------|-----------------------------------------|
| 39. $7r + 3b - 11x + 12y$ | 40. $3x^2 + 4x + 5$ | 41. $-2x^2 - 5x + 7x - 3$ |
| 42. $2a^2 - 4ab + 5ab - 10b^2$ | 43. $10.6c^2 - 2.3c + 5.9c - 1.9c^2$ | 44. $7y + 3x - 7 + 5x - 2y$ |
| 45. $w^3 + w^2 - w + 1$ | 46. $b + b^2 - 4b + b^2 + 3b$ | 47. $8pq - 9pq + p + q$ |
| 48. $7x^3y^2 + 11y^3x^2$ | 49. $12\left(\frac{1}{6} + \frac{d}{4}\right) + 5d$ | 50. $4.3 - 3.2x - 2(x - 2)$ |
| 51. $3\left(x + \frac{1}{2}\right) - \frac{1}{3}x + 5$ | | 52. $6n + 0.6(n - 3) - 5(n + 0.7)$ |
| 53. $4 - [6(3x + 2) - x] + 4$ | | 54. $3(a + c) - 4(a + c) - 3$ |
| 55. $9x - [3x - (5x - 4y)] - 2y$ | | 56. $-2[3x - (2y - 1) - 5x] + y$ |
| 57. $5b - [7[2(3b - 2) - (4b + 9)] - 2]$ | | 58. $2[[3a - (2b - 5a)] - 3(2a - b)]$ |
| 59. $-[[2rs - 3(r + 2s)] - 2(2r^2 - s)]$ | | 60. $p^2q + 4pq - [-(pq + 4p^2q) + pq]$ |

Solve each equation.

- | | | |
|-----------------------------|-------------------------------|----------------------------|
| 61. $5a - 1 = 14$ | 62. $7x - 6 - 5x = -8$ | 63. $4x - 5 = 2(x + 5)$ |
| 64. $5s - 3 = 2s + 6$ | 65. $4x - 8 = -4(2x - 3) + 4$ | 66. $8w + 7 = -3w - 15$ |
| 67. $-6(z - 1) = -5(z + 2)$ | 68. $7(x - 1) = 3(x + 2)$ | 69. $-3(t - 5) = 2(t - 5)$ |

70. $4(2x - 4) = -2(x + 3)$
 73. $2 - (x + 5) = 4x - 8$
 76. $8x + 2(x - 4) = 8x + 12$
 79. $6 - (n + 3) = 3n + 5 - 2n$
 82. $-2(3w + 6) - (4w - 3) = 21$
 85. $5(a + 3) - a = -(4a - 6) + 1$
 88. $3[6 - (h + 2)] - 6 = 4(-h + 7)$
 90. $-z - 6z + 3 = 4 - [6 - z - (3 - 2z)]$
 92. $3\{[(x - 2) + 4x] - (x - 3)\} = 4 - (x - 12)$
 94. $-3(6 - 4x) = 4 - \{5x - [6x - (4x - (3x + 2))]\}$
71. $3x + 4(2 - x) = 4x + 5$
 74. $4x - 2(3x - 7) = 2x - 6$
 77. $-3(y - 1) + 2y = 4(y - 3)$
 80. $8 - 3(2a - 4) = 5 + 3a - 4a$
 83. $-4(3 - 4x) - 2(x - 1) = 12x$
 86. $3(2x - 4) + 3(x + 1) = 9$
 89. $2[3x - (4x - 6)] = 5(x - 6)$
 91. $4[2 - [3(c + 1) - 2(c + 1)]] = -2c$
 93. $-[4(d + 3) - 5[3d - 2(2d + 7)]] - 8 = -10d - 6$
72. $6(3 - q) = -4(q + 1)$
 75. $p - (p + 4) = 4(p - 1) + 2p$
 78. $5r - 13 - 6r = 3(r + 5) - 16$
 81. $4(2x - 2) - 3(x + 7) = -4$
 84. $-4(2z - 6) = -3(z - 4) + z$
 87. $5(x - 2) - 14x = x - 5$

Solve each equation. Leave your answer as a fraction if it is not an integer value.

95. $\frac{d}{5} = -7$
 98. $\frac{1}{2}(6r - 10) = 7$
 101. $\frac{1}{2}(x - 2) = \frac{1}{3}(x + 2)$
 104. $x - 2 = \frac{3}{4}(x + 4)$
 107. $\frac{1}{4}(x + 3) = \frac{1}{3}(x - 2) + 1$
96. $\frac{7m + 9}{6} = 5$
 99. $\frac{3}{4}t + \frac{7}{8}t = 39$
 102. $\frac{1}{2}x + 2 = \frac{1}{8}x - 1$
 105. $\frac{1}{2} = \frac{4}{5}x - \frac{1}{4}$
 108. $\frac{5}{6}m - \frac{5}{12} = \frac{7}{8}m + \frac{2}{3}$
97. $\frac{4x - 2}{3} = -6$
 100. $\frac{1}{4}(x - 2) = \frac{1}{3}(2x + 6)$
 103. $4 - \frac{3}{4}a = 7$
 106. $\frac{1}{3}x + \frac{5}{6} = 2x$

Solve each equation. Round answers to the nearest hundredth.

109. $0.4n + 4.7 = 5.1n$
 111. $4.7x - 3.6(x - 1) = 4.9$
 113. $5(z + 3.41) = -7.89(2z - 4) - 5.67$
 115. $0.6(500 - 2.4x) = 3.6(2x - 4000)$
 117. $1000(7.34q + 14.78) = 100(3.91 - 4.21q)$
110. $0.2(x - 30) = 1.6x$
 112. $6.1p - 4.5(3 - 2p) = 15.7$
 114. $0.05(2000 + 2x) = 0.04(2500 - 6x)$
 116. $0.42x - x = 5.1(x + 3)$
 118. $0.6(14x - 8000) = -0.4(20x + 12,000) + 20.6x$

Find the solution set for each exercise. Then indicate whether the equation is conditional, an identity, or a contradiction.

119. $3(y + 3) - 4(2y - 7) = -5y + 2$
 121. $7 + 3(x - 2) + 8x = 6(x + 1) + 2x - 9$
 123. $4 - \left(\frac{2}{3}x + 2\right) = 2\left(-\frac{1}{3}x + 1\right)$
 125. $6(x - 1) = -3(2 - x) + 3x$
 127. $0.8z - 0.3(z + 10) = 0.5(z + 1)$
120. $7x + 5 - 5(x - 3) = 5(x + 4) - 3x$
 122. $-5(c + 3) + 4(c - 2) = 2(c + 2)$
 124. $7 - \left(\frac{1}{2}x + 4\right) = 3\left(-\frac{1}{6}x + 2\right)$
 126. $0.6(z + 5) - 0.5(z + 2) = 0.1(z - 23)$
 128. $4(2 - 3x) = -[6x - (8 - 6x)]$

Problem Solving

129. **Population Density** The population density of the United States has been steadily increasing since 2000. The population density of the United States can be estimated using the equation

$$P = 0.82t + 78.5$$

where P is the population density, measured in people per square mile, and t is the number of years since 2000. Use $t = 1$ for 2001, $t = 2$ for 2002, and so on. If the population density continues to increase at its current rate,

- a) determine the population density of the United States in 2008.
 b) during what year will the population density of the United States reach 100 people per square mile?

130. **Sleeping Babies** Dr. Richard Ferber, a pediatric sleep expert, has developed a method* to help children, 6 months of age or older, sleep through the night. Often called "Ferberizing," it calls for parents to wait for increasing lengths of time before entering the child's room at night to comfort the crying child. The suggested waiting time depends on

*Before trying this method, parents should first consult with their pediatrician.

how many nights the parents have been using the method and may be found using the equation

$$W = 5n + 5.$$

where W is the waiting time in minutes and n is the number of the night. For example, on the first night, $n = 1$, on the second night, $n = 2$, and so on.

- How long should parents wait on the first night?
- How long should parents wait on the fourth night?
- On what night should parents wait 30 minutes?
- On what night should parents wait 40 minutes?



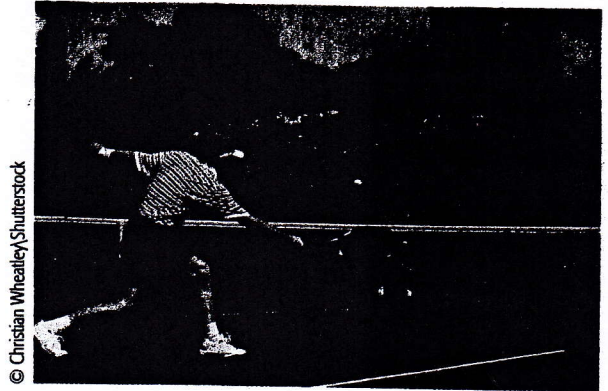
- 131. Rising Health Care Costs** Health care spending in the United States is projected to grow approximately according to the equation $C = 0.2x + 2.8$, where C represents the total amount spent on health care in trillions of dollars and x represents the years since 2008. Use $x = 1$ for 2009, $x = 2$ for 2010, and so on.

Source: National Coalition on Health Care

- How much was spent on health care in the United States in 2009?
- If this trend continues, during what year will health care spending reach \$4 trillion?

- 132. Aging Population** The percentage of the American population that is older than age 65 is projected to grow according to the equation $P = 1.5x + 38.7$. In this equation P represents the percentage of the American population older than 65 and x represents the years since 2008. Use $x = 1$ for 2009, $x = 2$ for 2010, and so on.

Source: National Academy of Sciences



- What is the percentage of Americans older than age 65 in 2009?
- During what year is the percentage of Americans older than age 65 projected to reach 50%?

Solve each equation for the given symbol. Assume that the symbol you are solving for represents the variable and that all other symbols represent nonzero real numbers. See Example 11.

- Solve $*\Delta - \square = \odot$ for Δ .
- Solve $\Delta(\odot + \square) = \otimes$ for Δ .
- Solve $\odot\square + \Delta = \otimes$ for \odot .
- Solve $\Delta(\odot + \square) = \otimes$ for \square .

Concept/Writing Exercises

- Consider the equation $2x = 5$. Give three equivalent equations. Explain why the equations are equivalent.
- Consider the equation $x = 4$. Give three equivalent equations. Explain why the equations are equivalent.
- Make up an equation that is a contradiction. Explain how you created the contradiction.
- Make up an equation that is an identity. Explain how you created the equation.
- Create an equation with two terms to the left of the equals sign and three terms to the right of the equals sign that is equivalent to the equation $\frac{1}{2}p + 3 = 6$.
- Create an equation with three terms to the left of the equals sign and two terms to the right of the equals sign that is equivalent to the equation $3m + 1 = m + 5$.
- Consider the equation $2(a + 5) + n = 4a - 8$. What real number must n be for the solution of the equation to be -2 ? Explain how you determined your answer.
- Consider the equation $-3(x + 2) + 5x + 12 = n$. What real number must n be for the solution of the equation to be 6? Explain how you determined your answer.

Cumulative Review Exercises

- [1.3] **145.**
 - Explain how to find the absolute value of a number.
 - Write the definition of absolute value.
- [1.4] *Evaluate.*
- -3^2
 - $(-3)^2$
 - $\sqrt[3]{-125}$
 - $\left(-\frac{2}{7}\right)^2$