9–4 *The Addition-or-Subtraction Method*

Objective: To use addition or subtraction to solve systems of linear equations in two variables.

Vocabulary

Addition-or-subtraction method A method to solve systems of equations. You can use the addition-or-subtraction method whenever two equations have the same or opposite coefficients for one of their terms.

Example 1 (The Addition Method)

Solve: $4x - y = 7$
$2x + y = 5$

Solution

1. Add similar terms of the two equations.

$$4x - y = 7$$
$$\underline{2x + y = 5}$$
$$6x \quad\;\; = 12$$

$\begin{cases} \text{The } y\text{-terms} \\ \text{are eliminated.} \end{cases}$

2. Solve the resulting equation.

$$x = 2$$

3. Substitute 2 for x in either of the original equations to find y.

$$2x + y = 5$$
$$2(2) + y = 5$$
$$y = 1$$

4. Check $x = 2$ and $y = 1$ in *both* original equations.

$$4x - y = 7 \qquad\qquad 2x + y = 5$$
$$4(2) - 1 \overset{?}{=} 7 \qquad 2(2) + 1 \overset{?}{=} 5$$
$$7 = 7 \qquad\qquad\qquad 5 = 5$$

The solution is (2, 1).

Example 2 (The Subtraction Method)

Solve: $5c + 3d = 14$
$5c - d = 22$

Solution

1. Subtract similar terms of the two equations.

$$5c + 3d = 14$$
$$\underline{5c - \;\; d = 22}$$
$$4d = -8$$

$\begin{cases} \text{The } c\text{-terms} \\ \text{are eliminated.} \end{cases}$

2. Solve the resulting equation.

$$d = -2$$

3. Substitute -2 for d in either of the original equations to find c.

$$5c + 3(-2) = 14$$
$$5c - 6 = 14$$
$$5c = 20$$
$$c = 4$$

4. The check in both equations is left for you.

The solution is (4, −2).

9–4 The Addition-or-Subtraction Method (continued)

Solve by the addition-or-subtraction method.

1. $x + y = 6$
   $x - y = 2$

2. $m + n = 12$
   $m - n = 6$

3. $2x + y = 3$
   $x - y = 3$

4. $2x + y = 5$
   $x + y = 4$

5. $3m - 2n = 11$
   $5m + 2n = 13$

6. $12m + 3n = 0$
   $5m + 3n = 7$

7. $6x - 7y = 14$
   $-6x + 3y = -6$

8. $4a - 5b = 10$
   $2a - 5b = 0$

9. $2c + 3d = 3$
   $2c + d = -3$

10. $4x - 3y = -10$
    $2x + 3y = 4$

11. $2x - y = 7$
    $3x + y = 8$

12. $6x - 5y = 1$
    $2x - 5y = 17$

13. $9x + 2y = -22$
    $9x - 10y = 2$

14. $5m + 12n = -1$
    $8m + 12n = 20$

15. $3a + 2c = 30$
    $5a - 2c = 2$

16. $3m + 4n = 7$
    $-3m + 9n = 6$

17. $4x - 2y = -8$
    $4x + 5y = 6$

18. $6a - 5b = 2$
    $4a + 5b = -32$

19. $7x - 11y = -1$
    $13x + 11y = 61$

20. $\frac{1}{2}x + \frac{1}{3}y = 2$
    $\frac{3}{2}x - \frac{1}{3}y = 2$

21. $\frac{3}{4}x - \frac{1}{6}y = -7$
    $\frac{5}{4}x - \frac{1}{6}y = -11$

Solve by either the substitution or the addition-or-subtraction method.

22. $a = 4b$
    $a + 2b = -6$

23. $x - 5y = 3$
    $2x + y = 6$

24. $3x - 8y = 10$
    $2x + 8y = -20$

25. $3(a-2b) = 6$
    $2(a + 3b) = -6$

26. $n = 6m - 2$
    $\frac{1}{2}n - m = -1$

27. $\frac{1}{3}a - \frac{2}{3}b = -2$
    $a + b - 12 = 0$

28. $y = \frac{2}{3}x$
    $2x + 3y = -24$

29. $\frac{a}{3} - \frac{b}{3} = 2$
    $2a + b = 3$

30. $2n - 11 = \frac{m}{4}$
    $n = \frac{m}{-3}$

Mixed Review Exercises

Simplify.

1. $6x^3 + 4x^2 - x + 5x^2$

2. $2 \cdot 3^2$

3. $(2 \cdot 10^3) + (3 \cdot 10^2) + (5 \cdot 10)$

4. $-3[2n - (n + 1)]$

5. $(8x^3y^2)\left(\frac{3}{4}x^2y\right)$

6. $(2a^5)^2$

7. $(-2ab^2)^3$

8. $2x[3x + 2(4 - x)]$

9. $(4ab)(-2ab^2)(5a^2b^3)$

10. $\left(-\frac{1}{12}\right)(60)\left(\frac{1}{5}\right)$

11. $\frac{-6}{\frac{1}{2}}$

12. $\frac{1}{5}(-45m + 30n)$