

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.

$$\begin{array}{r} 4x - y = 7 \\ 2x + y = 5 \\ \hline 6x \quad = 12 \end{array}$$

The y -terms
are eliminated.

2. Solve the resulting equation.

$$x = 2$$

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

$$\begin{array}{r} 2x + y = 5 \\ 2(2) + y = 5 \\ y = 1 \end{array}$$

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

$$\begin{array}{r} 4x - y = 7 \\ 4(2) - 1 \stackrel{?}{=} 7 \\ 7 = 7 \end{array} \qquad \begin{array}{r} 2x + y = 5 \\ 2(2) + 1 \stackrel{?}{=} 5 \\ 5 = 5 \end{array}$$

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.

$$\begin{array}{r} 5c + 3d = 14 \\ 5c - d = 22 \\ \hline 4d = -8 \end{array}$$

The c -terms
are eliminated.

2. Solve the resulting equation.

$$d = -2$$

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

$$\begin{array}{r} 5c + 3(-2) = 14 \\ 5c - 6 = 14 \\ 5c = 20 \\ c = 4 \end{array}$$

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