NAME _____ DATE _____

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.

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

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.

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

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.

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

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).

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

Solve by the addition-or-subtraction method.

1. $x + y = 6$, $x - y = 2$ **(4, 2)**
2. $m + n = 12$, $m - n = 6$ **(9, 3)**
3. $2x + y = 3$, $x - y = 3$ **(2, −1)**
4. $2x + y = 5$, $x + y = 4$ **(1, 3)**
5. $3m - 2n = 11$, $5m + 2n = 13$ **(3, −1)**
6. $12m + 3n = 0$, $5m + 3n = 7$ **(−1, 4)**
7. $6x - 7y = 14$, $-6x + 3y = -6$ **(0, −2)**
8. $4a - 5b = 10$, $2a - 5b = 0$ **(5, 2)**
9. $2c + 3d = 3$, $2c + d = -3$ **(−3, 3)**
10. $4x - 3y = -10$, $2x + 3y = 4$ **(−1, 2)**
11. $2x - y = 7$, $3x + y = 8$ **(3, −1)**
12. $6x - 5y = 1$, $2x - 5y = 17$ **(−4, −5)**
13. $9x + 2y = -22$, $9x - 10y = 2$ **(−2, −2)**
14. $5m + 12n = -1$, $8m + 12n = 20$ **(7, −3)**
15. $3a + 2c = 30$, $5a - 2c = 2$ **(4, 9)**
16. $3m + 4n = 7$, $-3m + 9n = 6$ **(1, 1)**
17. $4x - 2y = -8$, $4x + 5y = 6$ **(−1, 2)**
18. $6a - 5b = 2$, $4a + 5b = -32$ **(−3, −4)**
19. $7x - 11y = -1$, $13x + 11y = 61$ **(3, 2)**
20. $\frac{1}{2}x + \frac{1}{3}y = 2$, $\frac{3}{2}x - \frac{1}{3}y = 2$ **(2, 3)**
21. $\frac{3}{4}x - \frac{1}{6}y = -7$, $\frac{5}{4}x - \frac{1}{6}y = -11$ **(−8, 6)**

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

22. $a = 4b$, $a + 2b = -6$ **(−4, −1)**
23. $x - 5y = 3$, $2x + y = 6$ **(3, 0)**
24. $3x - 8y = 10$, $2x + 8y = -20$ **(−2, −2)**
25. $3(a-2b) = 6$, $2(a + 3b) = -6$ **(0, −1)**
26. $n = 6m - 2$, $\frac{1}{2}n - m = -1$ **(0, −2)**
27. $\frac{1}{3}a - \frac{2}{3}b = -2$, $a + b - 12 = 0$ **(6, 6)**
28. $y = \frac{2}{3}x$, $2x + 3y = -24$ **(−6, −4)**
29. $\frac{a}{3} - \frac{b}{3} = 2$, $2a + b = 3$ **(3, −3)**
30. $2n - 11 = \frac{m}{4}$, $n = \frac{m}{-3}$ **(−12, 4)**

Mixed Review Exercises

Simplify.

1. $6x^3 + 4x^2 - x + 5x^2$ **$6x^3 + 9x^2 - x$**
2. $2 \cdot 3^2$ **18**
3. $(2 \cdot 10^3) + (3 \cdot 10^2) + (5 \cdot 10)$ **2350**
4. $-3[2n - (n + 1)]$ **$-3n + 3$**
5. $(8x^3y^2)\left(\frac{3}{4}x^2y\right)$ **$6x^5y^3$**
6. $(2a^5)^2$ **$4a^{10}$**
7. $(-2ab^2)^3$ **$-8a^3b^6$**
8. $2x[3x + 2(4 - x)]$ **$2x^2 + 16x$**
9. $(4ab)(-2ab^2)(5a^2b^3)$ **$-40a^4b^6$**
10. $\left(-\frac{1}{12}\right)(60)\left(\frac{1}{5}\right)$ **−1**
11. $\frac{-6}{\frac{1}{2}}$ **−12**
12. $\frac{1}{5}(-45m + 30n)$ **$-9m + 6n$**