

8-2

NAME _____ DATE _____

Substitution (Pages 462–468)

To solve a system of equations without graphing, you can use the **substitution method** shown in the example below. In general, if you solve a system of equations and the result is a *true* statement, such as $-5 = -5$, the system has *infinitely many* solutions; if the result is a *false* statement, such as $-5 = 7$, the system has *no solution*.

EXAMPLE

Use substitution to solve the system of equations $x + y = 1$ and $2x + y = -1$.

Step 1: Solve one of the equations for x or y .

$$x + y = 1 \quad \text{Solve the first equation for } x \text{ since the} \\ x = 1 - y \quad \text{coefficient of } x \text{ is } 1.$$

Step 2: Substitute this value into the other equation.

$$2x + y = -1 \quad \text{Use the second equation.} \\ 2(1 - y) + y = -1 \quad \text{Substitute } 1 - y \text{ for } x. \\ 2 - 2y + y = -1 \quad \text{Distribute.}$$

Step 3: Solve this equation.

$$2 - 2y + y = -1 \quad \text{Solve for } y. \\ -y = -3 \text{ or } y = 3$$

Step 4: Find the value of the other variable using substitution into either equation.

$$x + y = 1 \quad \text{Use the first equation.} \\ x + 3 = 1 \quad \text{Substitute } 3 \text{ for } y. \\ x = -2 \quad \text{Solve for } x.$$

The solution to the system is $(-2, 3)$.

Check: Substitute -2 for x and 3 for y in each of the original equations and check for true statements.

Try These Together

Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has no solution or infinitely many solutions.

- | | | | |
|------------------|-----------------|-----------------|------------------|
| 1. $3x + y = 19$ | 2. $2x - y = 7$ | 3. $y = 2x - 4$ | 4. $y = -5x + 3$ |
| $x - 2y = -10$ | $8x + y = 3$ | $y = 2x + 2$ | $y = 3x - 3$ |

HINT: If possible, choose to first solve an equation for a variable that has a coefficient of 1.

PRACTICE

Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has no solution or infinitely many solutions.

- | | | | |
|------------------|--------------------|-------------------|-------------------|
| 5. $5x + 4 = y$ | 6. $3y + x = -1$ | 7. $6x - y = 0$ | 8. $3y - 4x = 2$ |
| $y - 3x = 7$ | $2x + 6 = -3y$ | $3x + 4y = 18$ | $8x = 6y - 4$ |
| 9. $2x - y = -4$ | 10. $5x - 2y = -6$ | 11. $3x + y = 28$ | 12. $5x - y = 98$ |
| $-x + y = -9$ | $2x + 3y = 9$ | $x + 3y = -12$ | $-2x + 3y = 5$ |



- 13. Standardized Test Practice** All CDs in the budget bin are priced the same. Packs of AA batteries are on sale. Keisha's total bill (before tax) for 3 CDs and 1 pack of AA batteries was \$39. Eduardo's total for 2 CDs and 3 packs of batteries was \$33. What was the price of a single CD?

- A** \$3 **B** \$10 **C** \$12 **D** \$13

Answers: 1. (4, 7) 2. (1, -5) 3. no solution 4. $(\frac{4}{3}, -\frac{4}{3})$ 5. $(\frac{1}{2}, 11\frac{1}{2})$ 6. $(-5, \frac{3}{4})$ 7. $(\frac{3}{2}, 4)$ 8. no solution 9. (-13, -22) 10. (0, 3) 11. (12, -8) 12. (23, 17) 13. C