NAME _____ DATE _____

13-3

Substitution (Pages 560–565)

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.*

$x + y = 1$ — *Solve the first equation for x since the*
$x = 1 - y$ — *coefficient of x is 1.*

Step 2: *Substitute this value into the other equation.*

$2x + y = -1$ — *Use the second equation.*
$2(1 - y) + y = -1$ — *Substitute $1 - y$ for x.*
$2 - 2y + y = -1$ — *Distributive Property*

Step 3: *Solve this equation.*

$2 - 2y + y = -1$
$-y = -3$ *or* $y = 3$

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

$x + y = 1$ — *Use the first equation.*
$x + 3 = 1$ — *Substitute 3 for y.*
$x = -2$ — *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.

1. $3x + y = 19$
$x - 2y = -10$

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

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

4. $y = -5x + 3$
$y = 3x - 3$

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.

5. $5x + 4 = y$
$y - 3x = 7$

6. $3y + x = -1$
$2x + 6 = -3y$

7. $6x - y = 0$
$3x + 4y = 18$

8. $3y - 4x = 2$
$8x = 6y - 4$

9. $2x - y = -4$
$-x + y = -9$

10. $5x - 2y = -6$
$2x + 3y = 9$

11. $3x + y = 28$
$x + 3y = -12$

12. $5x - y = 98$
$-2x + 3y = 5$

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.** $\left(\frac{3}{4}, -\frac{3}{4}\right)$ **5.** $\left(\frac{3}{2}, \frac{23}{2}\right)$ **6.** $\left(-5, \frac{4}{3}\right)$ **7.** $\left(\frac{2}{3}, 4\right)$ **8.** infinitely many **9.** (−13, −22) **10.** (0, 3) **11.** (12, −8) **12.** (23, 17) **13.** C