Lesson 7-3

Example 1 Elimination Using Addition

Use elimination to solve each system of equations.

$-4x + 3y = 17$

$4x + y = 3$

Since the coefficients of the x-terms, -4 and 4, are additive inverses, you can eliminate the x-terms by adding the equations.

$-4x + 3y = 17$ — Write the equations in column form and add.

$(+)\underline{4x + y = 3}$

$4y = 20$ — Notice the x variable is eliminated.

$\frac{4y}{4} = \frac{20}{4}$ — Divide each side by 4.

$y = 5$ — Simplify.

Now substitute 5 for y in either equation to find the value of x.

$4x + y = 3$ — Second equation

$4x + 5 = 3$ — Replace y with 5.

$4x + 5 - 5 = 3 - 5$ — Subtract 5 from each side.

$4x = -2$ — Simplify.

$\frac{4x}{4} = \frac{-2}{4}$ — Divide each side by 4.

$x = -\frac{1}{2}$ — Simplify.

Check In each equation, replace x with $-\frac{1}{2}$ and y with 5.

$-4x + 3y = 17$

$-4(-\frac{1}{2}) + 3(5) \stackrel{?}{=} 17$

$2 + 15 \stackrel{?}{=} 17$

$17 = 17$ ✓

$4x + y = 3$

$4(-\frac{1}{2}) + 5 \stackrel{?}{=} 3$

$-2 + 5 \stackrel{?}{=} 3$

$3 = 3$ ✓

The solution is $\left(-\frac{1}{2}, 5\right)$.

Example 2 Write and Solve a System of Equations

Six times one number added to twice another number is –5. Negative six times the first number minus the other number is 7.

Let x represent the first number and y represent the second number.

Six times one number *added to* *twice another number* *is* –5.

$6x + 2y = -5$

Negative six times the first number *minus* *the other number* *is* 7.

$-6x - y = 7$

Use elimination to solve the system.

$6x + 2y = -5$ Write the equations in column form and add.

$(+)\ -6x - y = 7$

$y = 2$ Notice that the variable x is eliminated.

Now substitute 2 for y in either equation to find the value of x.

$-6x - y = 7$ Second equation

$-6x - 2 = 7$ Replace y with 2.

$-6x - 2 + 2 = 7 + 2$ Add 2 to each side.

$-6x = 9$ Simplify.

$\frac{-6x}{-6} = \frac{9}{-6}$ Divide each side by –6.

$x = -\frac{3}{2}$ Simplify.

The numbers are $-\frac{3}{2}$ and 2.

Example 3 Elimination Using Subtraction

Use elimination to solve the system of equations.

$7a + 3b = 3$

$2a + 3b = 18$

Since the coefficients of the b-terms, 3 and 3, are the same, you can eliminate the b-terms by subtracting the equations.

$7a + 3b = 3$ Write the equations in column form and subtract.

$(-)\ 2a + 3b = 18$

$5a = -15$ Notice that the variable b is eliminated.

$\frac{5a}{5} = \frac{-15}{5}$ Divide each side by 5.

$a = -3$ Simplify.

Now substitute –3 for a in either equation to find the value of b.

$2a + 3b = 18$ Second equation

$2(-3) + 3b = 18$ $a = -3$

$-6 + 3b = 18$ Simplify.

$-6 + 3b + 6 = 18 + 6$ Add 6 to each side.

$3b = 24$ Simplify.

$\frac{3b}{3} = \frac{24}{3}$ Divide each side by 3.

$b = 8$ Simplify. The solution is (-3, 8).

Example 4 Elimination Using Subtraction

Multiple-Choice Test Item

If $2a - b = 4$ and $3a - b = 9$, what is the value of b?

A. 5 **B.** 6 **C.** (5, 6) **D.** (6, 5)

Read the Test Item

You are given a system of equations, and you are asked to find the value of b.

Solve the Test Item

You can eliminate the b-terms by subtracting one equation from the other.

$2a - b = 4$	Write the equations in column form and subtract.
$(-)\ 3a - b = 9$	
$-a = -5$	Notice the b variable is eliminated.
$-1(-a) = -1(-5)$	Multiply each side by -1.
$a = 5$	Simplify.

Now substitute 5 for a in either equation to find the value of b.

$2a - b = 4$	First equation
$2(5) - b = 4$	$a = 5$
$10 - b = 4$	Simplify.
$10 - b - 10 = 4 - 10$	Subtract 10 from each side.
$-b = -6$	Simplify.
$-1(-b) = -1(-6)$	Multiply each side by –1.
$b = 6$	Simplify.

Notice that A is the value of a and C is the solution of the system of equations. However, the question asks for the value of b. The answer is B.