Lesson 3–2

Example 1 Solve by Using Substitution

Use substitution to solve the system of equations.

$2x - y = -5$

$3y - 5x = 14$

Solve the first equation for y in terms of x.

$2x - y = -5$	First equation
$-y = -5 - 2x$	Subtract $2x$ from each side.
$y = 5 + 2x$	Multiply each side by –1.

Substitute $5 + 2x$ for y in the second equation and solve for x.

$3y - 5x = 14$	Second equation
$3(5 + 2x) - 5x = 14$	Substitute $5 + 2x$ for y.
$15 + 6x - 5x = 14$	Distributive Property
$15 + x = 14$	Simplify.
$x = -1$	Subtract 15 from each side.

Now, substitute the value for x in either original equation and solve for y.

$2x - y = -5$	First equation
$2(-1) - y = -5$	Replace x with –1.
$-2 - y = -5$	Simplify.
$-y = -3$	Add 2 to each side.
$y = 3$	Multiply each side by –1.

The solution of the system is (–1, 3).

Example 2 Compare Values of *x* and *y*

Quantitative Comparison Test Item

Compare the quantity in Column A and the quantity in column B. Then determine whether:

A. the quantity in Column A is greater,
B. the quantity in Column B is greater,
C. the two quantities are equal, or
D. the relationship cannot be determined from the information given.

$$x + 3y = -8$$
$$-3x + y = 4$$

Column A	Column B
x	y

Read the Test Item

You are asked to compare the values of x and y. Since this is a system of equations, you may be able to find the exact values for each variable.

Solve the Test Item

Step 1 Solve the first equation for x in terms of y since the coefficient of x is 1.

$x + 3y = -8$	First equation
$x = -3y - 8$	Subtract $3y$ from each side.

Step 2 Substitute $-3y - 8$ for x in the second equation.

$-3x + y = 4$	Second equation
$-3(-3y - 8) + y = 4$	Substitute $-3y - 8$ for x.
$9y + 24 + y = 4$	Distributive Property
$10y + 24 = 4$	Simplify.
$10y = -20$	Subtract 24 from each side.
$y = -2$	Divide each side by 10.

Step 3 Now replace y with -2 in either equation to find the value of x.

$x + 3y = -8$	First equation
$x + 3(-2) = -8$	Substitute -2 for y.
$x - 6 = -8$	Multiply.
$x = -2$	Add 6 to each side.

Step 4 Check the solution.

Replace x with -2 and y with -2.

$$x + 3y = -8$$
$$(-2) + 3(-2) \stackrel{?}{=} -8$$
$$-2 - 6 = -8 \ \checkmark$$

$$-3x + y = 4$$
$$-3(-2) + (-2) \stackrel{?}{=} 4$$
$$6 - 2 = 4 \ \checkmark$$

Step 5 Compare the values of x and y to answer the original problem.

$x = -2$ and $y = -2$
$-2 = -2$
So, $x = y$.

The answer is C.

Example 3 Solve by Using Elimination

Use the elimination method to solve the system of equations.
$3p + 4q = 0$
$p - 4q = -8$

The coefficients of q for the first equation and the second equation are additive inverses. This means that when you add them the result will be 0 and the variable q will be eliminated.

$3p + 4q = 0$	
$\underline{(+)\ p - 4q} = -8$	
$4p = -8$	Add the equations.
$p = -2$	Divide each side by 4.

Now find q by substituting -2 for p in either original equation.

$3p + 4q = 0$	First equation
$3(-2) + 4q = 0$	Replace p with -2.
$-6 + 4q = 0$	Multiply.
$4q = 6$	Add 6 to each side.

$q = \frac{3}{2}$ Divide each side by 4 and simplify.

The solution is $\left(-2, \frac{3}{2}\right)$.

Example 4 Multiply, Then Use Elimination

Use the elimination method to solve the system of equations.

$2x + 3y = 6$

$5x - 5y = 65$

Multiply the first equation by 5 and the second equation by 2. Then subtract the equations to eliminate the *x* variable.

$2x + 3y = 6$	Multiply by 5.	$10x + 15y = 30$	
$5x - 5y = 65$	Multiply by 2.	$(-)\ 10x - 10y = 130$	
		$25y = -100$	Subtract the equations.
		$y = -4$	Divide each side by 25.

Replace *y* with –4 and solve for *x*.

$2x + 3y = 6$	First equation
$2x + 3(-4) = 6$	Replace *y* with –4.
$2x - 12 = 6$	Multiply.
$2x = 18$	Add 12 to each side.
$x = 9$	Divide each side by 2.

The solution is (9, –4).

Example 5 Consistent and Dependent System

Use the elimination method to solve the system of equations.

$3x - 2y = 4$

$-\frac{3}{4}x + \frac{1}{2}y = -1$

Use multiplication to eliminate *x*

$3x - 2y = 4$		$3x - 2y = 4$	
$-\frac{3}{4}x + \frac{1}{2}y = -1$	Multiply by 4.	$-3x + 2y = -4$	
		$0 = 0$	Add the equations.

Since 0 = 0 is always true, the system is dependent and it has infinitely many solutions.