2-1

Study Guide

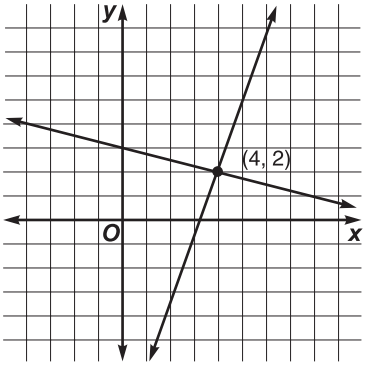
Solving Systems of Equations in Two Variables

One way to solve a system of equations in two variables is by graphing. The intersection of the graphs is called the solution to the **system of equations.**

Example 1 **Solve the system of equations by graphing.**

$\mathbf{3x - y = 10}$

$\mathbf{x + 4y = 12}$



First rewrite each equation of the system in slope-intercept form by solving for y.

$3x - y = 10$ becomes $y = 3x - 10$

$x + 4y = 12$ becomes $y = -\frac{1}{4}x + 3$

The solution to the system is (4, 2).

A **consistent** system has at least one solution.
A system having exactly one solution is **independent.**
If a system has infinitely many solutions, the system is **dependent.**
Systems that have no solution are **inconsistent.**

Systems of linear equations can also be solved algebraically using the **elimination method** or the **substitution method.**

Example 2

Use the elimination method to solve the system of equations.

$\mathbf{2x - 3y = -21}$

$\mathbf{5x + 6y = 15}$

To solve this system, multiply each side of the first equation by 2, and add the two equations to eliminate y. Then solve the resulting equation.

$2(2x - 3y) = 2(-21) \rightarrow 4x - 6y = -42$

$$\begin{aligned} 4x - 6y &= -42 \\ 5x + 6y &= 15 \\ \hline 9x &= -27 \\ x &= -3 \end{aligned}$$

Now substitute -3 for x in either of the *original* equations.

$$\begin{aligned} 5x + 6y &= 15 \\ 5(-3) + 6y &= 15 \qquad x = -3 \\ 6y &= 30 \\ y &= 5 \end{aligned}$$

The solution is $(-3, 5)$.

Example 3

Use the substitution method to solve the system of equations.

$\mathbf{x = 7y + 3}$

$\mathbf{2x - y = -7}$

The first equation is stated in terms of x, so substitute $7y + 3$ for x in the second equation.

$$\begin{aligned} 2x - y &= -7 \\ 2(7y + 3) - y &= -7 \\ 13y &= -13 \\ y &= -1 \end{aligned}$$

Now solve for x by substituting -1 for y in either of the *original* equations.

$x = 7y + 3$

$x = 7(-1) + 3 \qquad y = -1$

$x = -4$

The solution is $(-4, -1)$.