Systems of Linear Equations

Objective 1: Decide Whether a Given Ordered Pair is a Solution of a System

Procedure: To determine whether the ordered pair (a, b) is a solution to a system of equations, plug in a into x and b into y for both equations. If you get true statements for both, then (a, b) is a solution to the system.

Example 1: Determine whether $(3, 2)$ is a solution of the system of equations.

$$\begin{cases} 5x - 2y = 11 \\ 2x - 4y = -2 \end{cases}$$

Example 2: Determine whether $(-4, 7)$ is a solution of the system of equations.

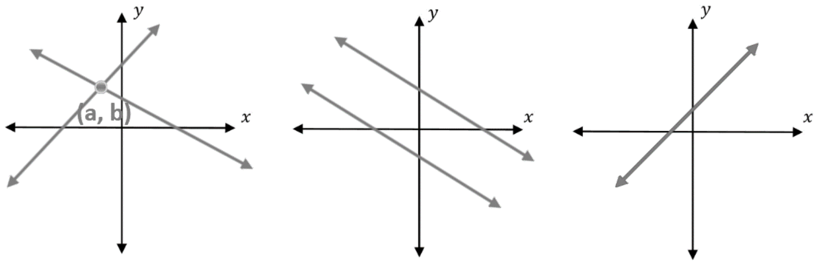
$$\begin{cases} -3x + y = 19 \\ 2x + 5y = 25 \end{cases}$$

1. Determine whether $(-3, 4)$ is a solution to the system.
$$\begin{cases} -4x + y = 16 \\ 2x + 5y = 14 \end{cases}$$

2. Determine whether $(2, -3)$ is a solution to the system.
$$\begin{cases} x - 3y = 11 \\ 3x + 4y = 18 \end{cases}$$

Objective 2: Solve Systems of Equations by Graphing

There are three possible answers when we solve a system of equations.



one solution (a, b)	parallel lines never intersect, so there are no solutions	the two lines are the same, so every point on the line is a solution and you have an infinite number of solutions.

Procedure: To solve a system of linear equations by graphing,

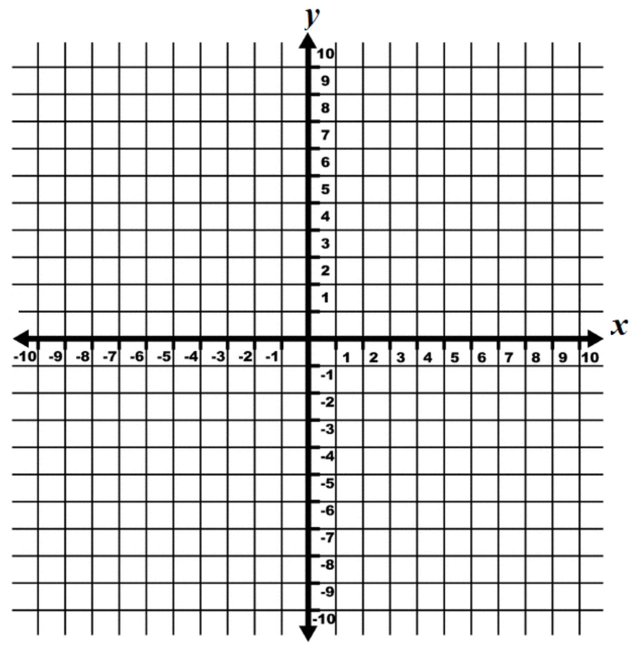
1. Graph both lines using one of the methods:
    a. Table of Points
    b. Plotting x — and y —intercepts.
    c. Using the Slope and the y —intercept.

2. Find where the lines intersect.
    a. If the lines intersect at a single point, this will be the solution to the system.
    b. If the lines are parallel, then there are no solutions to the system.
    c. If the lines are the same, then there are infinitely many solutions.

3. If the lines intersected at a single point, then check your answer (Objective 1).

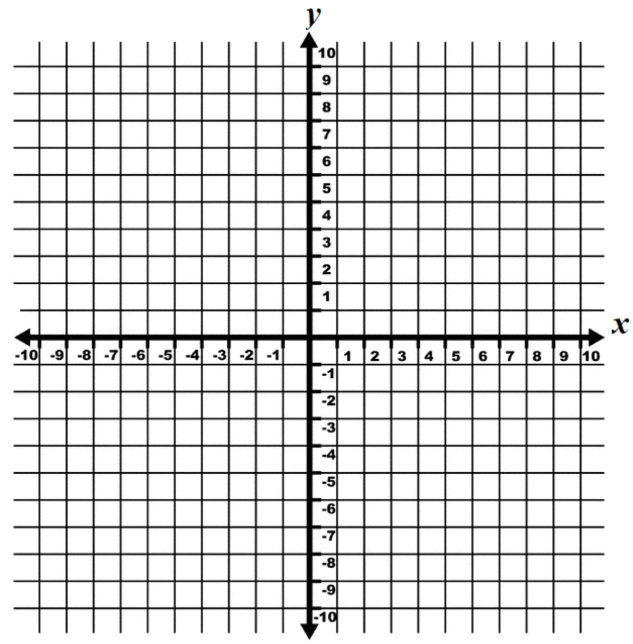
Example 1: Solve the system by graphing.

$$\begin{cases} 3x + 2y = 6 \\ x + 4y = -8 \end{cases}$$



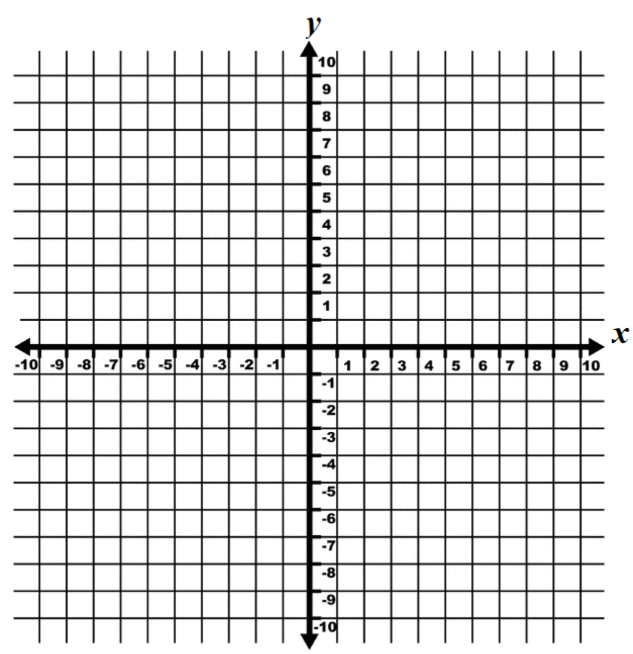
Example 2: Solve the system by graphing.

$$\begin{cases} 4x + 2y = 12 \\ -12x - 6y = 36 \end{cases}$$



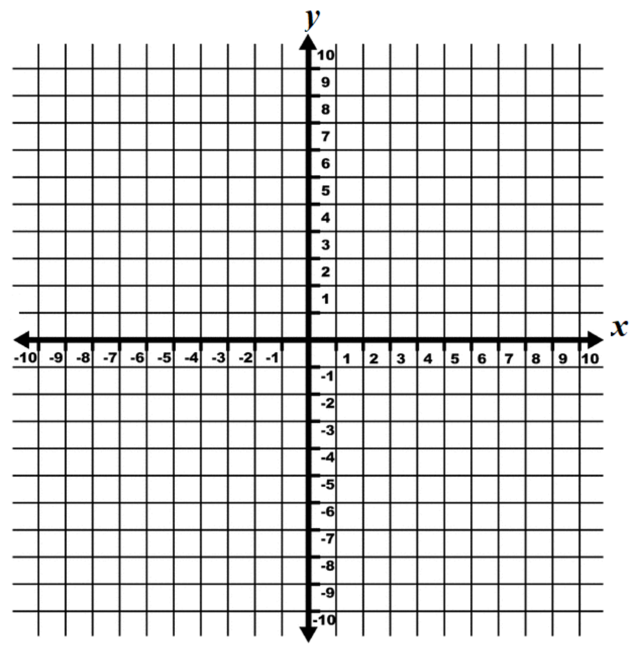
Example 3: Solve the system by graphing.

$$\begin{cases} 3x - 3y = 12 \\ -2x + 2y = -8 \end{cases}$$



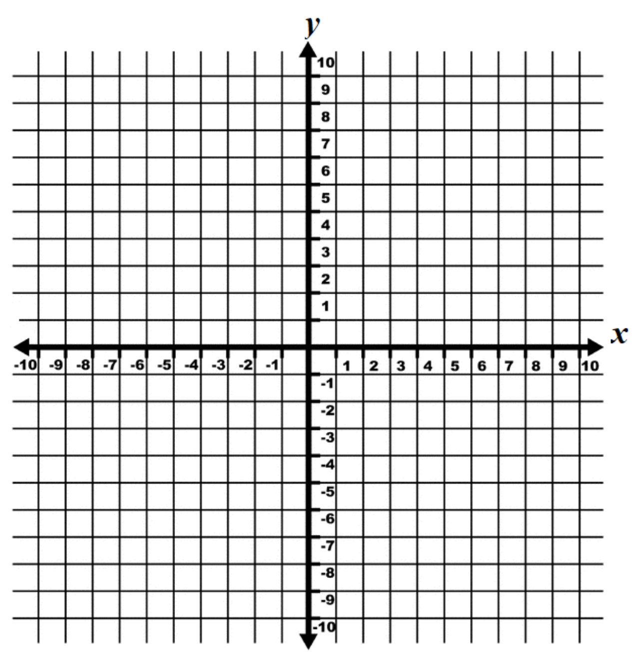
1. Solve the system by graphing.

$$\begin{cases} -5x + 5y = -5 \\ -8x + 4y = 8 \end{cases}$$



2. Solve the system by graphing.

$$\begin{cases} 4\text{x} + \text{y} = 12 \\ 12\text{x} + 3\text{y} = 12 \end{cases}$$



Objective 3: Solve Systems of Equations by Substitution

Procedure: To solve a system of linear equations by substitution,

1. Solve one of the equations for one of the variables.
2. Plug what you got in Step 1 into the other equation and solve for the remaining variable.
3. Plug this value into the equation from Step 1 and solve for the other variable.
4. Check your answer (Objective 1).

Example 1: Solve the system using the substitution method.

$$\begin{cases} 3x - y = 6 \\ -4x + 2y = -8 \end{cases}$$

Example 2: Solve the system using the substitution method.

$$\begin{cases} 2x - 4y = 12 \\ 3x - 6y = 18 \end{cases}$$

1. Solve the system by substitution.

$$\begin{cases} 4x + y = 11 \\ 7x - 4y = 2 \end{cases}$$

2. Solve the system by substitution.

$$\begin{cases} 5x + 10y = 15 \\ 4x + 16y = 20 \end{cases}$$

Objective 4: Solve Systems of Equations by Elimination

Procedure: To solve a system of linear equations by elimination,

1. Rewrite each equation so that it is in standard form $Ax + By = C$.
2. Multiply one or both of your equations so that the coefficients of one of the variables are opposites.
3. Add the equations. (At this step, one of the variables should be eliminated.)
4. Solve the equation from Step 3 for the remaining variable.
5. Plug the value that you found in Step 4 into either of the original equations.
6. Check your answer.

Example 1: Solve the system using the elimination method.

$$\begin{cases} 2x + 5y = -1 \\ 3x = -4y + 2 \end{cases}$$

Example 2: Solve the system using the elimination method.

$$\begin{cases} 3x - y = 4 \\ 6x - 2y = 5 \end{cases}$$

1. Solve the system by elimination.
$$\begin{cases} -2x + y = -5 \\ 6x = 3y + 15 \end{cases}$$

2. Solve the system by elimination.
$$\begin{cases} 3x + 6y = 12 \\ 6x + 5y = 3 \end{cases}$$