

Section 19 Systems of Linear Equations and Graphing

Definition: A **system of linear equations** is a set of two or more linear equations that are solved at the same time. A **solution** of a system of linear equations in two variables is an ordered pair that makes both equations true.

Example 1: Checking a solution

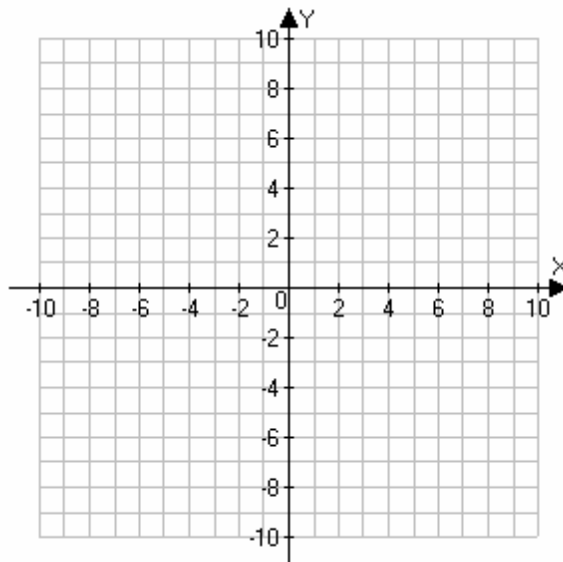
Show that $(2,4)$ is a solution of the system of equations

$$\begin{aligned}4x - 2y &= 0 \\4x + 3y &= 20\end{aligned}$$

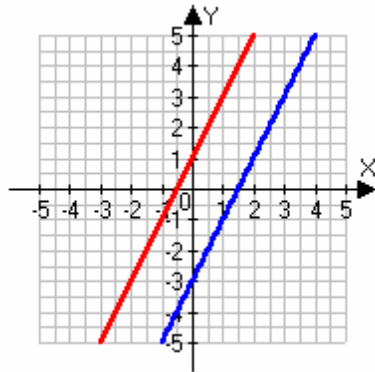
One way to solve a system of linear equations in two variables is by graphing. If both lines are graphed on the same coordinate grid, then any points in common will be solutions of both equations.

Example 2: Solving a system graphically

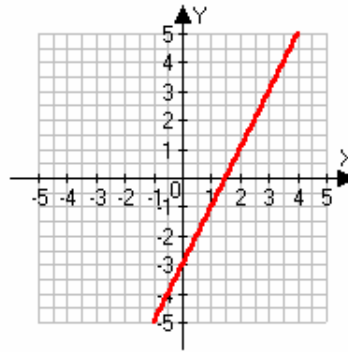
Solve the system $\begin{aligned}x + y &= 7 \\-3x + y &= -1\end{aligned}$ by graphing.



There are three possibilities when graphing a pair of linear equations. The system is consistent and has a single solution as in the last example, or:



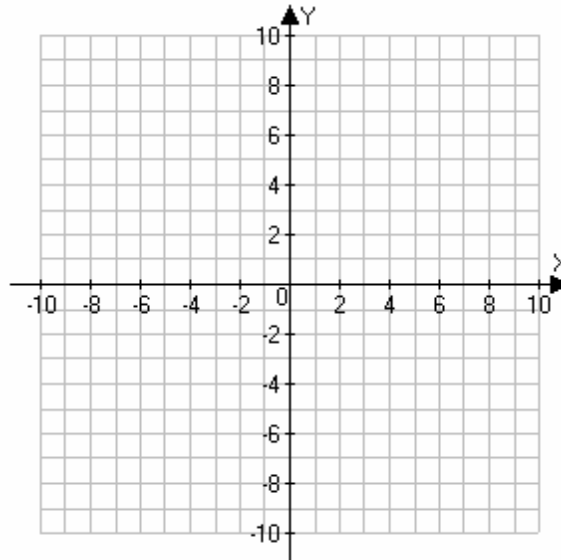
The lines are parallel – no solution. Inconsistent system.



The lines are the same – infinite number of solutions. Dependent system

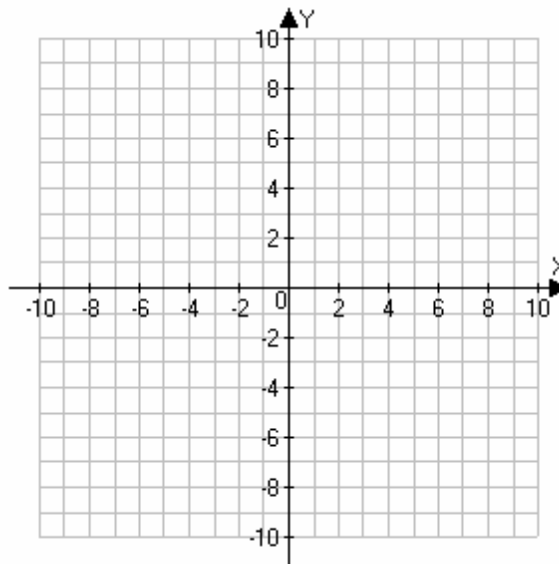
Example 3: Solving a system graphically

Solve the system $6x - 2y = -12$
 $3x - y = -6$ by graphing.



Example 4: Solving a system graphically

Solve the system $\begin{cases} 4x - 20 = 5y \\ 8x - 10y = 12 \end{cases}$ by graphing.

**Solving Systems of Linear Equations using Substitution**

The method of substitution works by solving one of the equations for a variable and substituting the resulting expression into the other equation. This results in a single equation with one variable which we learned to solve earlier.

Example 5: Solving a system using substitution

Solve the system $\begin{cases} x + y = 8 \\ y = 2x - 1 \end{cases}$ using substitution.

Example 6: Solving a system using substitution

Solve the system $\begin{cases} x + y = 9 \\ x = y - 1 \end{cases}$ using substitution.

Example 7: Solving a system using substitution

Solve the system $\begin{cases} 3x + 2y = 2 \\ -2x + y = 8 \end{cases}$ using substitution.

Example 8: Solving a system using substitution

Solve the system $\begin{cases} x - 2y = 1 \\ 3x - 6y = 2 \end{cases}$ using substitution.

Example 9: Word problems involving systems

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Example 10: Word problems involving systems

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Example 11: Word problems involving systems

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Example 12: Word problems involving systems

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Example 10: Word problems involving systems

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