8.1A Systems of Linear Equations in Two Variables

▼ Definition of a System of Linear Equations in Two Variables

A **system of linear equations in two variables** is the collection of two linear equations in two variables considered simultaneously. The solution to a system of equations in two variables is the set of all ordered pairs for which both equations are true.

▼ Example: System of Linear Equations in Two Variables

$$\begin{cases} 3x - 2y = -9 \\ x + y = 2 \end{cases}$$

▼ Consistent vs Inconsistent

If a system has at least one solution is it considered to be **consistent**.

If the system does not have any solutions it is said to be **inconsistent**.

▼ Verify or Check Solutions to a System of Linear Equations

Show that the ordered pair $(-1, 3)$ is a solution to the system.

$$\begin{cases} 3x - 2y = -9 \\ x + y = 2 \end{cases}$$

▼ Solving with Graphing

▼ Solving a System of Equations Using the Method of Graphing

Step 1: Graph the first equation. (All solutions to the first equation)

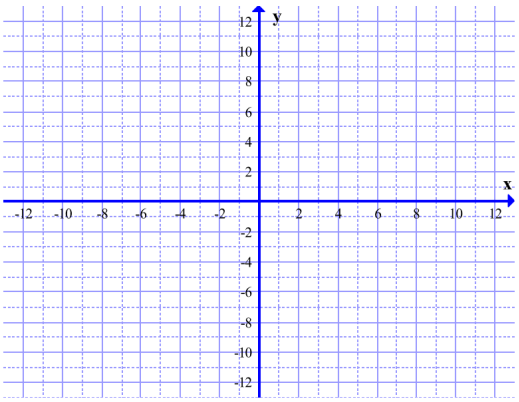
Step 2: Graph the second equation on the same coordinate plane. (All solutions to the second equation)

Step 3: The intersection points (points on both lines) are solutions to the system of linear equations.

Step 4: Check.

▼ Example: Solve a System with Graphing

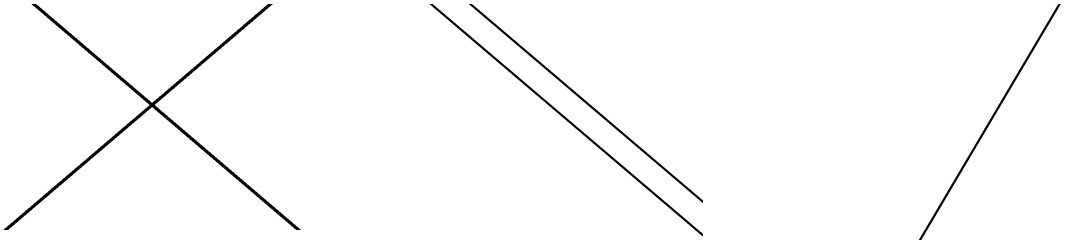
$$\begin{cases} y = 2x + 3 \\ 2x + 3y = 6 \end{cases}$$



▼ Solution

$\left(-\frac{3}{8}, \frac{9}{4}\right)$

▼ Visual Representation of Solutions in two variables



▼ Solving with Substitution

▼ Solving a System of Equations Using the Method of Substitution

Step 1: Choose an equation and solve for one variable in terms of the other.

Step 2: Substitute the expression from step 1 into the other equation. (This gives an equation with only one variable)

Step 3: Solve the equation for one variable. This gives part of the ordered pair solution.

Step 4: Substitute the value from step 3 into one of the original equations (any equation with two variables) to find the value of the other variable

Step 5: Check

▼ Example: Solve a System with Substitution

$$\begin{cases} 5x - 4y = 9 \\ x - 2y = -3 \end{cases}$$

▼ Solving with Elimination

▼ Solving a System of Equations Using the Method of Elimination

Step 1: Arrange the equations so the variables and most importantly the **equal sign** is lined up. Choose a variable to eliminate.

Step 2: Multiply one or both equations by an appropriate nonzero constant so that the sum of the coefficients of one of the variables is zero.

Step 3: Add the equations together to obtain an equation in one variable since 1 variable will eliminate.

Step 4: Solve the equation in one variable. This gives part of the ordered pair solution.

Step 5: Substitute the value from step 4 into one of the original equations (any equation with two variables) to find the value of the other variable.

Step 6: Check.

▼ Example: Solve a System with Elimination

$$\begin{cases} 3x - 4y = 11 \\ -3x + 2y = -7 \end{cases}$$

▼ Example: Solve a System with Elimination

$$\begin{cases} 3x + 2y = 48 \\ 9x - 8y = -24 \end{cases}$$

▼ Solving a System of two equations with Infinite Solutions

$$\begin{cases} y = 3x - 2 \\ 15x - 5y = 10 \end{cases}$$

▼ Solving an Inconsistent System

$$\begin{cases} 4x + 6y = 12 \\ 6x + 9y = 12 \end{cases}$$

▼ Application of Systems of Equations

Together, teammates Tommy and Jay got 2682 base hits last season. Tommy had 276 more hits than Jay. How many hits did each player have?