

System of linear equations in two variables

system of equations is a set of two or more related equations

A *solution* for a system of equations in two variables is an ordered pair of real numbers (x,y) that satisfies all of the equations in the system.

Methods to solve a system of linear equations:

- Graphing method ✓
- Addition / elimination method
- Substitution method

System of linear equations in two variables: Addition / Elimination method

Example: Solve the system of equations $\begin{cases} x + y = 3 \\ 3x - 2y = 4 \end{cases}$

- decide what variable to *eliminate*: x or y
- multiply one of the equations by a number and/or another equation by a number such that after the equations are “added” the variable is eliminated
- solve the resulting equation for the remaining variable and
- use its value in any of the original equations to find the value of the variable that was eliminated

System of linear equations in two variables: Addition / Elimination method

Example: Solve the system of equations $\begin{cases} x + y = 3 \\ 3x - 2y = 4 \end{cases}$

System of linear equations in two variables: Addition / Elimination method

Exercise 1:

(1) For the system of equations $\begin{cases} 4x + 3y = -5 \\ 5x + 3y = -8 \end{cases}$,

how can I eliminate variable y ?

System of linear equations in two variables: Addition / Elimination method

Exercise 1:

(2) For the same system of equations $\begin{cases} 4x + 3y = -5 \\ 5x + 3y = -8 \end{cases}$,

how can I eliminate variable x ?

System of linear equations in two variables: Addition / Elimination method

Exercise 1:

(3) For the same system of equations
$$\begin{cases} 4x + 3y = -5 \\ 5x + 3y = -8 \end{cases}$$

I am asked to find the y -value of the solution,
what variable should I eliminate?

System of linear equations in two variables: Substitution method

Example: Solve the system of equations $\begin{cases} 5x - 6y = 21 \\ x = 5 + 2y \end{cases}$

- substitute the expression for x into the first equation: you will get an equation with one variable, y !
- solve the equation in one variable (y)
- use the value of y in the second equation to find the value of x



System of linear equations in two variables: Substitution method

Example: Solve the system of equations $\begin{cases} 5x - 6y = 21 \\ x = 5 + 2y \end{cases}$

System of linear equations in two variables: Substitution method

Exercise 2: Solve the system of equations using substitution method

$$\begin{cases} y = x + 2 \\ 2x + 3y = 21 \end{cases}$$

System of linear equations in two variables: special cases

$$\begin{cases} 3x - 2y = 7 \\ -6x + 4y = -15 \end{cases}$$

this **system** of linear equations **is inconsistent** and has **no solution**

$$\begin{cases} 2x + y = 8 \\ -4x - 2y = -16 \end{cases}$$

this **system** of linear equations **is dependent** and has **infinitely many solutions**

System of linear equations in two variables

Exercise: Solve the system of equations

$$\begin{cases} \frac{1}{4}x - \frac{1}{6}y = 2 \\ \frac{3}{4}x + y = 3 \end{cases}$$