

Algebra 1 - Systems of Linear Equations - Lesson

Common Core A-REI.C.5, A-REI.C.6, A-REI.D.11, A-CED.A.3 · maths-pdf.fr/en/

A system of linear equations is two or more equations with the same variables, and its solution is the ordered pair that makes all of them true. You can solve by graphing, by substitution, or by elimination. A system has one solution, no solution, or infinitely many solutions.

Algebra 1 · Common Core State Standards: **A-REI.C.5, A-REI.C.6, A-REI.D.11, A-CED.A.3**

Key facts

- A solution of a system is an ordered pair that satisfies every equation.
- Graphing: the solution is the intersection point of the lines.
- Substitution: solve one equation for a variable and substitute into the other.
- Elimination: add or subtract equations to cancel a variable.
- Parallel lines give no solution; identical lines give infinitely many.

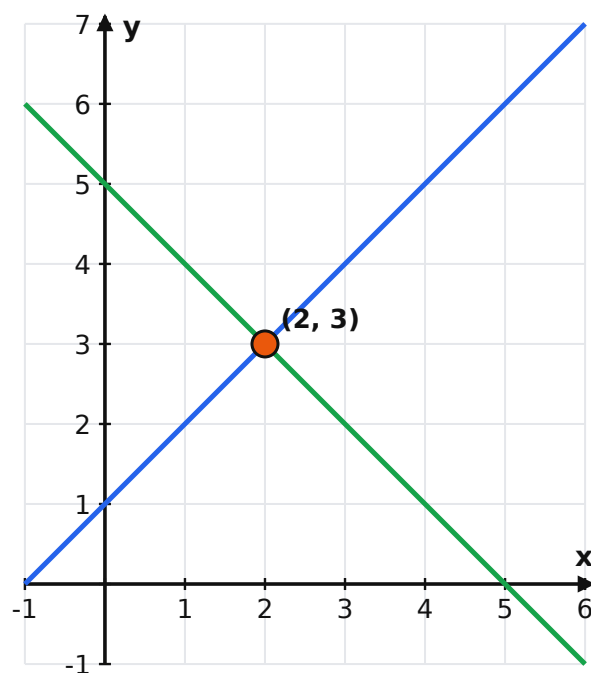
What is a system of linear equations?

System of equations

Two or more linear equations that share the same variables form a **system**. Its **solution** is an ordered pair (x,y) that satisfies every equation at once.

How does graphing find a solution?

Draw both lines in one coordinate plane and read the point where they cross. Always confirm by plugging the coordinates back into each equation.

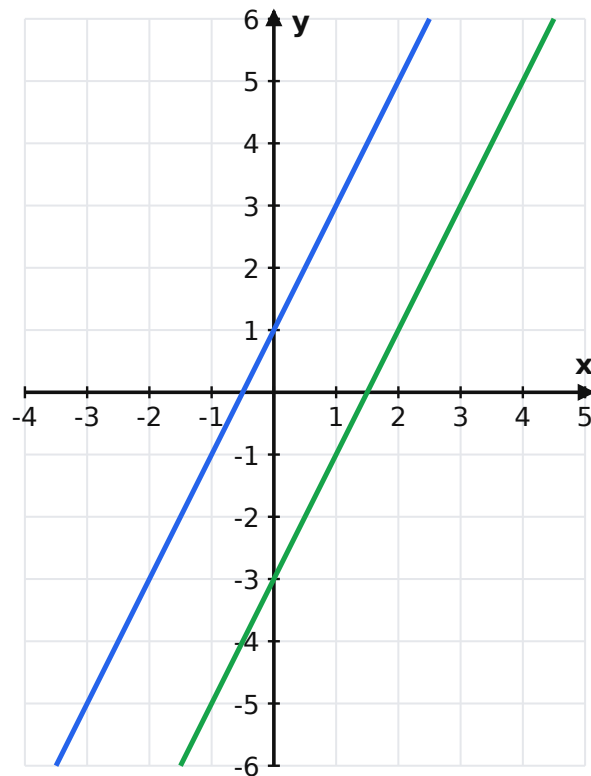


The lines $y = x + 1$ and $y = -x + 5$ cross at $(2, 3)$, the solution of the system.

In this picture, $y = x + 1$ and $y = -x + 5$ both give the same point $(2, 3)$ at the crossing.

Can a system have no answer, or too many?

Two lines in a plane meet at one point, never meet, or lie on top of each other. So a system has exactly one solution, none, or infinitely many.

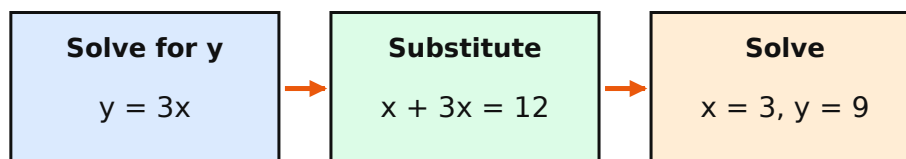


Parallel lines never meet, so the system has no solution.

Parallel lines share a slope but have different intercepts. If your algebra ends with a false statement like $0 = 5$, the lines are parallel. If it ends with a true statement like $4 = 4$, the two equations describe the same line.

What is the substitution method?

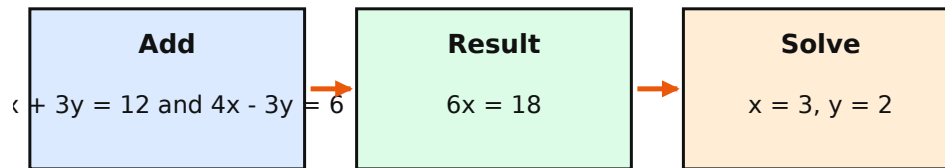
1. Isolate one variable in one equation.
2. Replace that variable in the other equation with the expression you found.
3. Solve the resulting one-variable equation, then back-substitute to get the second value.



Substitution turns two equations into one.

What is the elimination method?

Add or subtract the two equations so that one variable drops out. If no variable cancels, scale one or both equations first. For example, adding $2x + 3y = 12$ and $4x - 3y = 6$ produces $6x = 18$.



Elimination removes one variable by adding the equations.

Worked example: From $6x = 18$ we get $x = 3$. Putting that into $2x + 3y = 12$ gives $2(3) + 3y = 12$, so $y = 2$, and the solution is $(3, 2)$.

How do you set up a word problem as a system?

Name two unknowns, translate each fact into its own equation, and solve. Suppose a theater sold 8 tickets for \$60, with adult tickets at \$9 and student tickets at \$6. With $a + s = 8$ for the count and $9a + 6s = 60$ for the money, the system is ready to solve.

Questions about systems of linear equations

What is the solution of a system of equations?

It is the ordered pair (x, y) that makes both equations true. Graphically it is the point where the lines intersect.

When should you use substitution?

Use substitution when one equation is already solved for a variable or has a variable with coefficient 1, such as $y = 3x$ or $x + y = 12$.

When should you use elimination?

Use elimination when both equations are in standard form $Ax + By = C$ and the coefficients of a variable are equal or opposite, or can be made so by multiplying.

How can a system have no solution?

If the lines are parallel, they have the same slope but different intercepts and never meet. Algebra then gives a false statement like $0 = 5$.

How do you check a solution?

Substitute the ordered pair into both original equations. If both are true, the pair is the solution.