

Grade 8 - Systems of Linear Equations - Lesson

Common Core 8.EE.C.8a, 8.EE.C.8b, 8.EE.C.8c · maths-pdf.fr/en/

A system of linear equations is a set of two equations with the same variables, and its solution is the ordered pair that makes both true. On a graph it is the point where the lines cross. You can solve a system by graphing, by substitution, or by elimination, and it may have one, no, or infinitely many solutions.

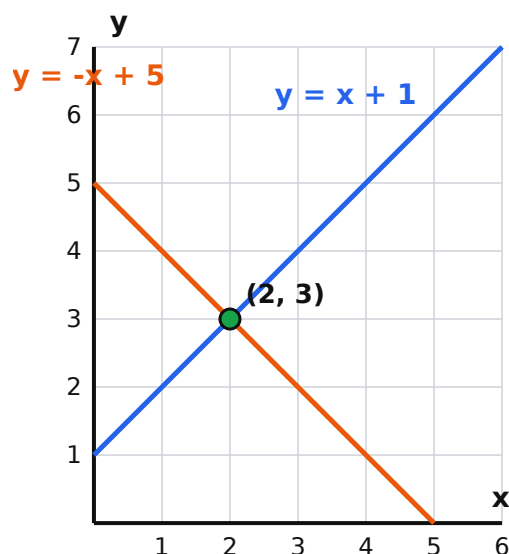
Grade 8 · Common Core State Standards: **8.EE.C.8a, 8.EE.C.8b, 8.EE.C.8c**

Key facts

- The solution of a system is the intersection point of the lines.
- Different slopes: one solution. Same slope, different intercepts: no solution. Same line: infinitely many.
- Substitution: solve one equation for a variable and substitute it into the other.
- Elimination: add or subtract the equations to cancel a variable.
- Always check the ordered pair in both equations.

What is a system of linear equations?

A system of linear equations is two or more equations that use the same variables. A solution of the system is an ordered pair that makes every equation true. Graphically, the solution is the point where the two lines cross.



The lines cross at (2, 3).

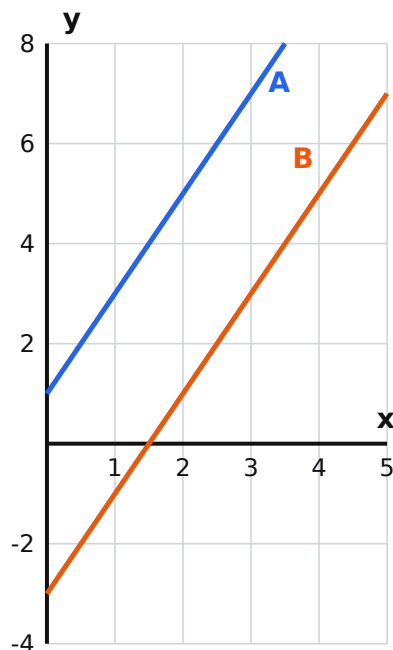
Check by substituting: $3=2+1$ and $3=-2+5$. Both are true, so $(2,3)$ is the solution.

Why does this work? Each point on a line is a solution of that line's equation. A point on both lines satisfies both equations at once, so the intersection point is the only pair of numbers that works for the whole system. Real situations produce systems too: two phone plans, two gym memberships, or two savings accounts all give two equations with a shared answer.

How many solutions can a system have?

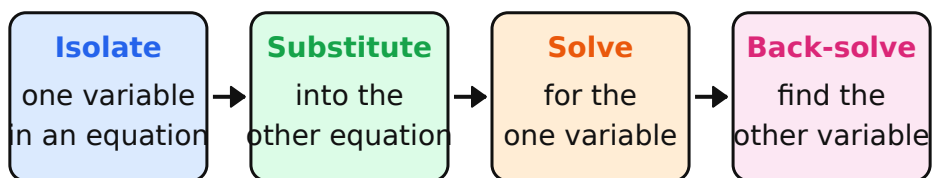
Three possibilities

One solution: the lines have different slopes and cross once. **No solution:** the lines are parallel (same slope, different intercepts). **Infinitely many solutions:** both equations describe the same line.



Parallel lines never meet.

How do you solve by substitution?



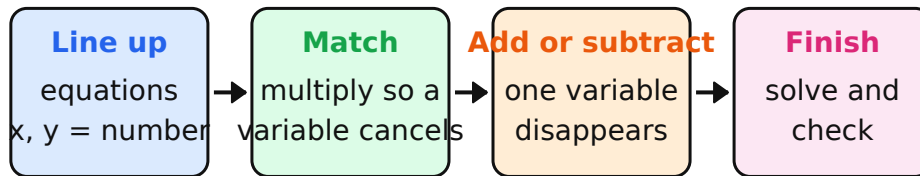
Substitution in four steps.

Example. Solve $y=3x$ and $x+y=12$. Substitute $3x$ for y : $x+3x=12$, so $4x=12$ and $x=3$.

Then $y = 3 \cdot 3 = 9$. The solution is $(3, 9)$.

How do you solve by elimination?

Add or subtract the equations so one variable cancels. If needed, multiply one or both equations first to make the coefficients match.



Elimination in four steps.

Example. Solve $2x + y = 11$ and $3x - y = 9$. Add the equations: $5x = 20$, so $x = 4$. Substitute: $8 + y = 11$, so $y = 3$. The solution is $(4, 3)$. If the equations lead to a false statement like $0 = 5$, there is no solution; a true statement like $0 = 0$ means infinitely many.

Questions about systems of linear equations

How do I check a solution of a system?

Substitute both coordinates into each equation. The ordered pair is a solution only if both equations are true.

When should I use substitution?

Use it when one equation already has a variable alone, like $y = 3x$, or can be solved for one easily.

When should I use elimination?

Use it when both equations are in the form $ax + by = c$ and a variable has matching or opposite coefficients, or can be matched by multiplying.

What does it mean when the lines are parallel?

The lines never meet, so no ordered pair satisfies both equations. The system has no solution.

How do I know the two equations describe the same line?

Simplify both to slope-intercept form. If the slopes and intercepts match, the lines coincide and there are infinitely many solutions.