

Grade 8 · Systems of Linear Equations · Lesson

Common Core 8.EE.C.8a, 8.EE.C.8b, 8.EE.C.8c · mathovore.fr

A system of linear equations is two linear equations with the same variables, and its solution is the ordered pair that makes both equations true. On a graph, the solution is where the lines cross. You can find it by graphing, substitution or elimination, and a system can have one solution, none or infinitely many.

Grade 8 Common Core: 8.EE.C.8a · 8.EE.C.8b · 8.EE.C.8c

Key facts:

- Standards 8.EE.C.8a, 8.EE.C.8b and 8.EE.C.8c: solve systems of two linear equations in two variables and use them in real-world problems.
- The solution of a system is the point where the two graphs intersect.
- Substitution replaces one variable with an expression; elimination adds or subtracts equations to cancel a variable.
- Parallel lines (same slope, different intercepts) mean no solution; the same line twice means infinitely many.
- Always check the ordered pair in both original equations.

What is a system of linear equations?

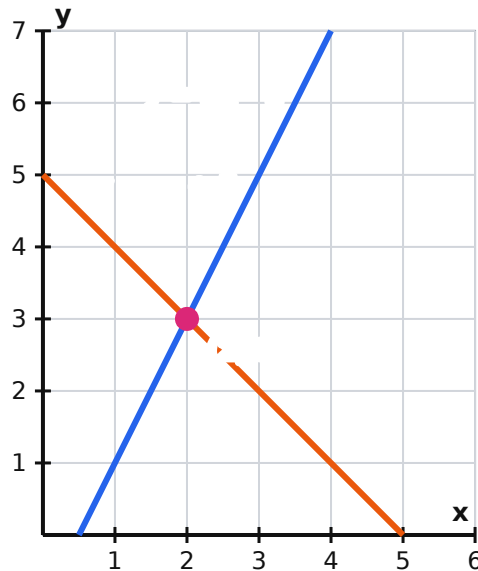
A **system of linear equations** is a set of two or more linear equations that use the same variables. A **solution** is an ordered pair (x,y) that makes every equation true at the same time. On a graph, it is the point where the lines cross.

Vocabulary

System: two equations solved together, such as $y = 2x - 1$ and $y = -x + 5$.

Solution: the ordered pair that satisfies both equations.

Elimination: adding or subtracting equations to remove one variable.



The lines cross at $(2,3)$, so $x=2$ and $y=3$ solve the system.

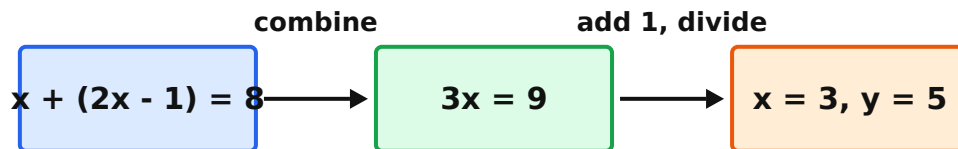
How do you solve a system by graphing?

1. Graph both lines on one coordinate plane.
2. Find the point where they cross.
3. Substitute that point into both equations to check it.

In the graph above, $2(2)-1=3$ and $-2+5=3$, so $(2,3)$ works in both equations.

How do you solve a system by substitution?

Replace a variable with an expression from the other equation. To solve $y=2x-1$ and $x+y=8$, put $2x-1$ in place of y : $x+(2x-1)=8$. Then $3x=9$, so $x=3$ and $y=2(3)-1=5$.



Substitution turns two variables into one equation.

How do you solve a system by elimination?

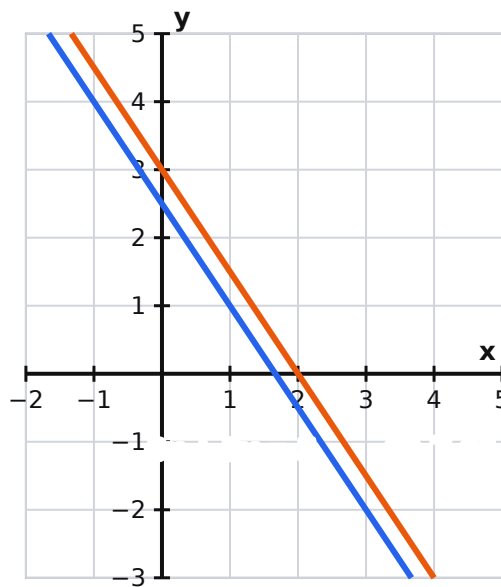
Add or subtract the equations so one variable drops out. For $x+y=11$ and $x-y=3$, adding gives $2x=14$, so $x=7$. Then $7+y=11$ gives $y=4$. If no variable cancels, multiply one or both equations by a number first.

$x + y = 11$	
$+$	$x - y = 3$
$2x = 14$	

Adding the equations cancels y .

Can a system have no solution or infinitely many?

Yes. Lines with the same slope and different intercepts are parallel and never meet, so there is **no solution**. By inspection, $3x+2y=5$ and $3x+2y=6$ cannot both hold, because the same expression cannot equal 5 and 6. If both equations describe the same line, such as $y=x+1$ and $2y=2x+2$, there are **infinitely many solutions**. Otherwise the lines cross exactly once.



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

How do you use a system in a word problem?

Noah buys 6 items at the school store for \$14. Pens cost \$1 and notebooks cost \$3. Let p be pens and n be notebooks. Then $p+n=6$ and $p+3n=14$. Subtract the first from the second: $2n=8$, so $n=4$ and $p=2$.

Item	Count	Cost
Pens	2	\$2
Notebooks	4	\$12
Total	6	\$14

Check: $2+4=6$ items and $2(1)+4(3)=14$ dollars.

Systems of Linear Equations: frequently asked questions

What does the solution of a system of equations mean?

It is the ordered pair that makes both equations true. On a graph it is the intersection point of the two lines. For $y = x + 1$ and $y = -x + 5$, the solution is $(2, 3)$.

When should I use substitution instead of elimination?

Use substitution when one equation already has a variable alone, such as $y = 3x$. Use elimination when both equations are in the form $Ax + By = C$ and a variable can cancel.

How can I tell that a system has no solution without graphing?

Compare slopes and intercepts. If the slopes are equal and the intercepts differ, the lines are parallel. For example, $y = 2x + 1$ and $y = 2x - 3$ never meet.

What if elimination ends with a true statement like $0 = 0$?

Both equations describe the same line, so every point on it is a solution. The system has infinitely many solutions.

How do I check my answer to a system?

Substitute both x and y into each original equation. If both equations are true, the pair is correct. Checking only one equation is not enough.