Systems of linear equations

What is a system? A system is a group of related parts, like the parts of an engine. A system of equations is two or more equations considered together.

What are we looking for? Here, two linear equations use the same x and y. Each equation graphs as a line. A solution is an ordered pair (x, y) that makes BOTH equations true: x first, y second.

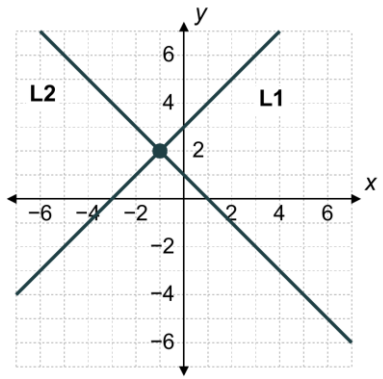
Why learn this? Systems help us meet two conditions at once—for example, finding when two price plans cost the same. Written steps help us explain and check an answer, including one suggested by AI.

Read the completed examples. L1 and L2 label Lines 1 and 2. Each small square is 1 unit.

(a) Exactly one solution

Line 1: $y = x + 3$

Line 2: $y = -x + 1$



Read the crossing: (−1, 2).

Use x = −1 and y = 2 in BOTH equations.

$$2 = (-1) + 3 = 2$$

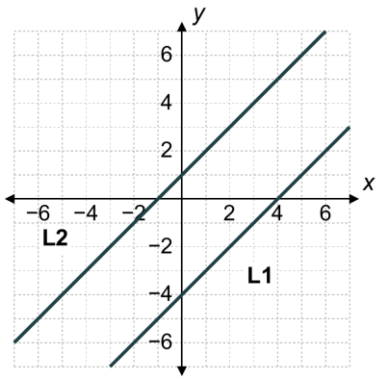
$$2 = -(-1) + 1 = 2$$

Both are true, so (−1, 2) is a solution. There is only one because the lines cross once.

(b) No solution

Line 1: $y = x - 4$

Line 2: $y = x + 1$



The lines are different and parallel.

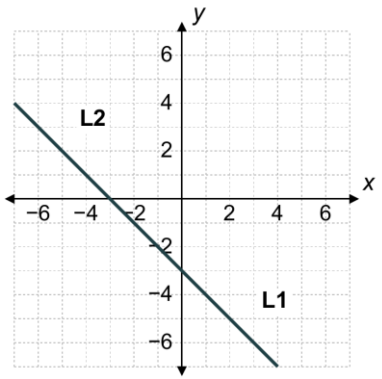
They never meet, even if we extend them. There is no shared point, so no ordered pair makes both equations true.

Each line has many points. The system has no solution because none belongs to BOTH lines.

(c) Infinitely many solutions

Line 1: $y = -x - 3$

Line 2: $x + y = -3$



Both equations describe the same line.

Coincident lines lie on top of each other.

Subtract x from both sides:

$$x + y = -3 \rightarrow y = -x - 3$$

Every point ON this line makes both equations true. A line has infinitely many points, so the system has infinitely many solutions.

TOPIC ID: **27-C3**	TOPIC TITLE: Systems of linear equations from graphs	FORESTHILL HIGH SCHOOL
NAME:	BLOCK:	DATE: _____

Read the graphs and explain how you know

Three systems of linear equations are shown. For each system, choose the best description of its solution.
If the system has exactly one solution, give its solution.

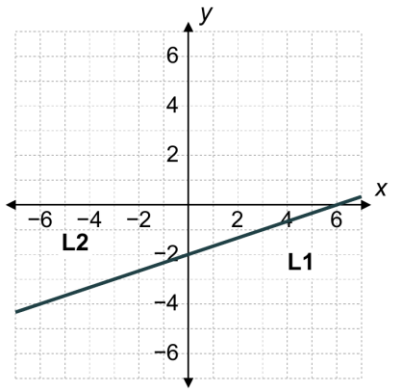
Show your reasoning. For one solution, check the pair in BOTH equations. Otherwise, explain your choice using the graph.

Try each problem first; use the front if needed. L1 and L2 label Lines 1 and 2. Each square is 1 unit.

(a)

Line 1: $y = \frac{1}{3}x - 2$

Line 2: $-x + 3y = -6$



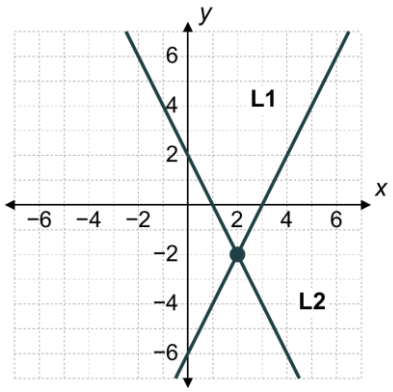
○ The system has exactly one solution.
Solution: (_____ , _____)
○ The system has infinitely many solutions.
○ The system has no solution.

Show how you know

(b)

Line 1: $y = 2x - 6$

Line 2: $y = -2x + 2$



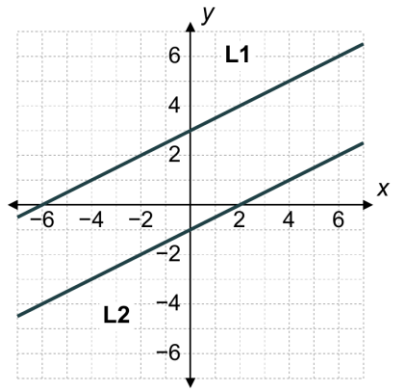
○ The system has exactly one solution.
Solution: (_____ , _____)
○ The system has infinitely many solutions.
○ The system has no solution.

Show how you know

(c)

Line 1: $y = \frac{1}{2}x + 3$

Line 2: $y = \frac{1}{2}x - 1$



○ The system has exactly one solution.
Solution: (_____ , _____)
○ The system has infinitely many solutions.
○ The system has no solution.

Show how you know