

Systems of Equations: Number of Solutions

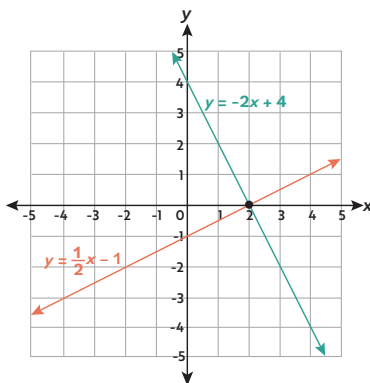
A **solution** to a system of linear equations is a point where the lines intersect. Systems of linear equations can have one solution, no solution, or infinitely many solutions.

If the lines intersect at exactly one point, then the system has **one solution**. This will happen if the slopes of the two lines are different.

For example, consider this system of equations:

$$y = -2x + 4$$

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



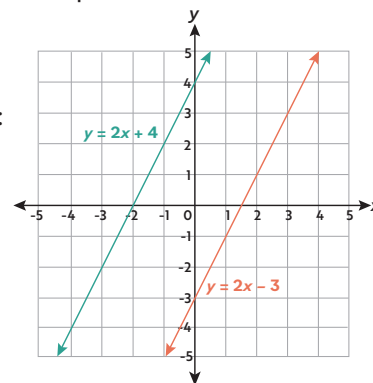
Since the slopes of the lines are different, the lines intersect at one point. So, this system has one solution.

If the lines never intersect, then the system has **no solution**. This will happen if the lines are parallel. Parallel lines have the same slope but different y -intercepts.

For example, consider this system of equations:

$$y = 2x + 4$$

$$y = 2x - 3$$



Since the slope of the lines are the same and the y -intercepts are different, the lines are parallel. So, this system has no solution.

If the lines intersect at every point, then the system has **infinitely many solutions**. This will happen if the equations in the system represent the same line.

For example, consider this system of equations:

$$y = -4x + 3$$

$$12x + 3y = 9$$

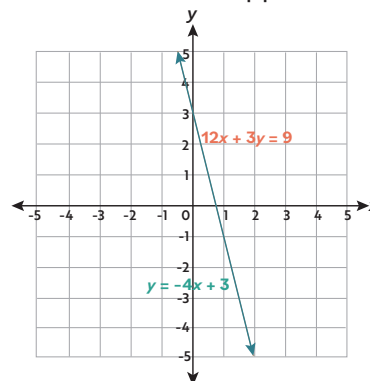
Solve the second equation for y to find the slope and y -intercept.

$$12x + 3y = 9$$

$$3y = -12x + 9$$

$$y = -4x + 3$$

Since the equations represent the same line, this system has infinitely many solutions.



Practice! Determine if each system has one solution, no solution, or infinite solutions. Circle your answer. Then explain how you know.

$$y = 3x + 2$$

$$y = 2x + 2$$

One solution

No solution

Infinite solutions

Explain: _____

$$y = 5x + 4$$

$$y = 5x - 2$$

One solution

No solution

Infinite solutions

Explain: _____

Systems of Equations: Number of Solutions

Keep going! Determine if each system has one solution, no solution, or infinite solutions. Circle your answer. Then explain how you know.

$y = -4x + 1$ $y = 1 - 4x$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>	$4x - y = 2$ $y = x - 8$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>
$y = -2x + 5$ $6x + 3y = 15$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>	$2x + y = 7$ $3y = -6x + 9$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>
$y = 1.2x - 0.2$ $y = 3.8x - 0.2$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>	$-\frac{7}{2}x + \frac{1}{2}y = 4$ $y = 7x + 8$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>
$24x + 8y = 3.2$ $y = -3x + 0.2$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>	$6y = 9x + 1.8$ $1.5x - y = -0.3$ <p>One solution No solution Infinite solutions</p> <p>Explain: _____ _____</p>