Advanced Algebra – Systems of Linear Equations
Solve by Graphing

Name: Key

What is a system of equations?

- Two or more equations grouped together

Examples:

$2x + y = 4$	$y + 2x = -1$	$x = 2$
$x - 5y = 7$	$-3x + 7y = 9$	$x + y = 7$

What is a solution to a system of equations?

- An ordered pair of numbers (x, y) that satisfies both equations (makes them both true)
- A system of two linear equations can have 0, 1, or an infinite (uncountable) number of solutions

How do I determine if an ordered pair is a solution to a system of equations?

- Plug the ordered pair (x, y) into each equation.
- If each equation is true (2 equal sides), then the ordered pair is a solution to the system.
- If a false statement is reached in one or both of the equations, it is NOT a solution.

Is the ordered pair a solution?

1. (4, -1)

Yes

$3x + 2y = 10$

$3(4)+2(-1)=10$

$10=10$

✓

$x - 5y = 9$

$4-5(-1)=9$

$4+5=9$

✓ $9=9$

2. (3, 7)

No

$5x + y = 22$

$5(3)+7$

$22=22$

✓

$2x - 4y = -34$

$2(3)-4(7)$

$6-28$

$-22 \neq -34$

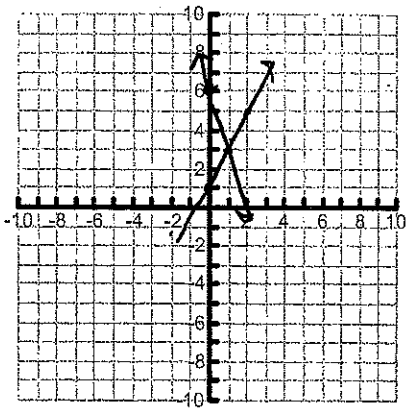
No

How do I find the solutions to system of equations?

- Solve each equation for y.
- Graph each equation using slope (m) and y-intercept (b) in y = mx + b.
- Locate point of intersection if the lines cross and give the coordinates (x, y).

Find the solution to the system. Label the solution (point of intersection).

3. $y = 2x + 1$ $\qquad$ $y = -3x + 6$



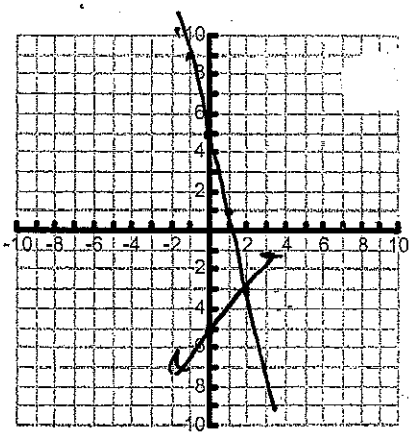
solution: (1 , 3)

4. $4x + y = 5$ $\qquad$ $-3x + 3y = -15$

$y = -4x + 5$

$3y = 3x - 15$

$y = 1x - 5$

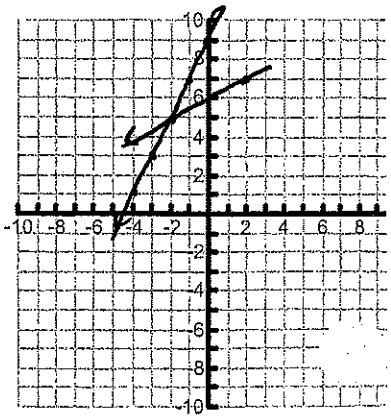


solution: (2 , -3)

5. $-x + 2y = 12$ $\qquad$ $y = 2x + 9$

$2y = x + 12$

$y = \frac{1}{2}x + 6$



solution: (-2 , 5)

6. $2x - 8y = 8$ $\qquad$ $3x + 2y = -18$

$-8y = -2x + 8$

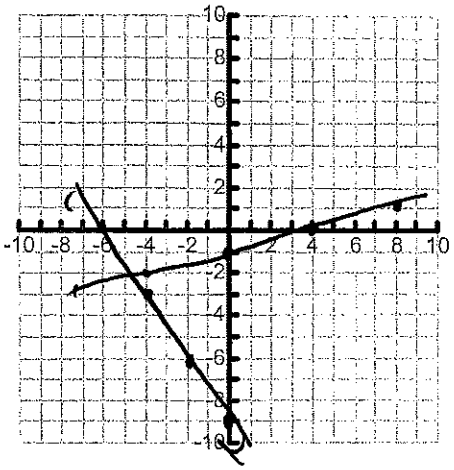
$\frac{-8y}{-8} = \frac{-2x}{-8} + \frac{8}{-8}$

$y = \frac{1}{4}x - 1$

$2y = -3x - 18$

$y = -\frac{3}{2}x - 9$

Use calc.

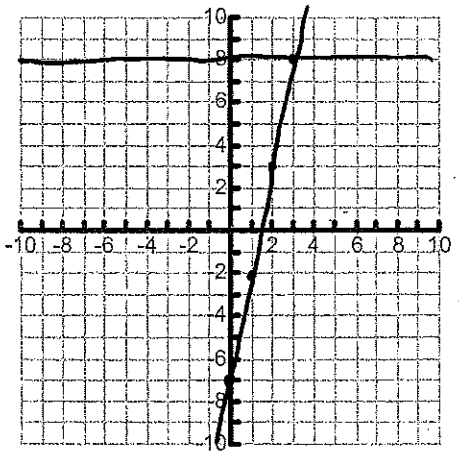


solution: (-4.57, -2.14)

7. $y = 8$ $\qquad$ $-25x + 5y = -35$

$5y = 25x - 35$

$y = 5x - 7$



solution: (3 , 8)

Special Systems

- A system of equations that produces lines that are parallel (same slope) have **NO SOLUTION.**

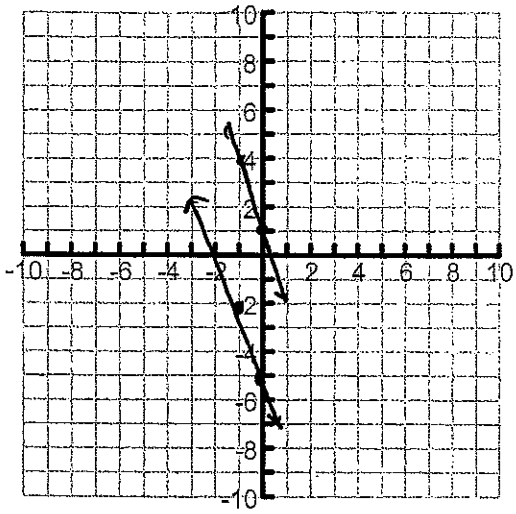
8. $y = -3x + 1$ $\qquad$ $6x + 2y = -10$

$2y = -6x - 10$

$y = -3x - 5$

parallel lines

no solution



- A system of equations that produces lines that are identical (same y = mx +b) have an **INFINITE (uncountable)** number of solutions.

9. $y = -\frac{1}{2}x + 4$ $\qquad$ $-3x - 6y = -24$

$\frac{-6y}{-6} = \frac{3x}{-6} - \frac{24}{-6}$

$y = -\frac{1}{2}x + 4$

Same line

infinitely many solutions