

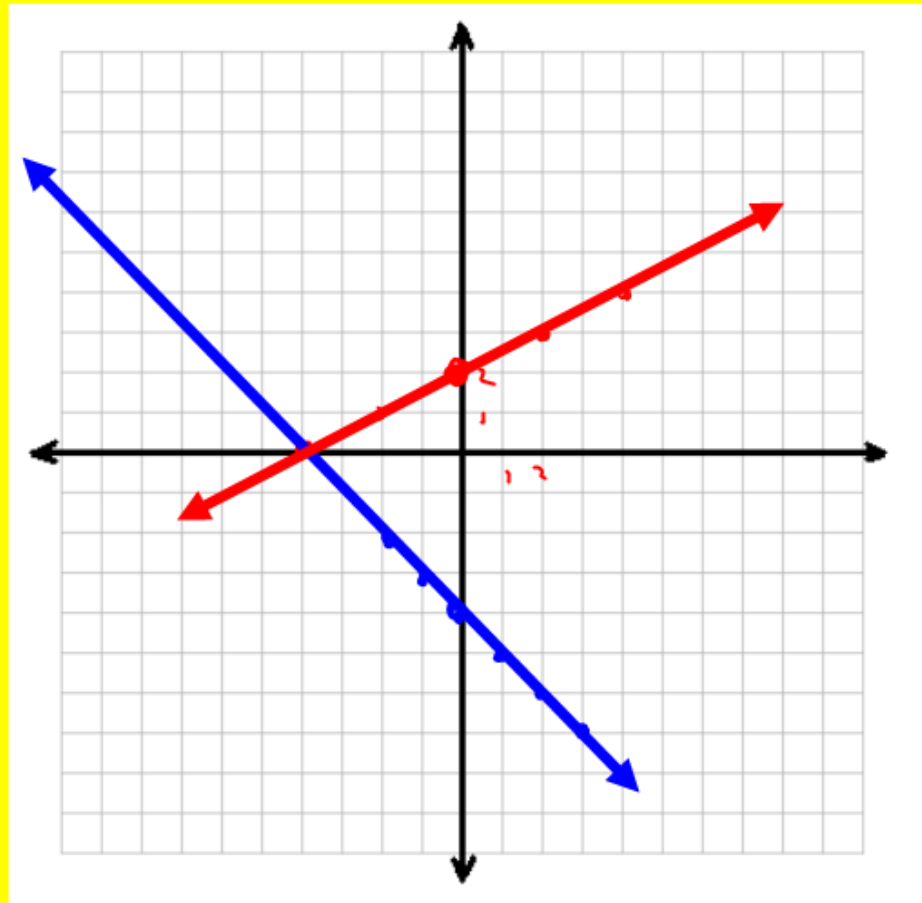
Warmup: Solve the following system of Equations by Graphing

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

$$y = -x - 4$$

$$(-4, 0)$$

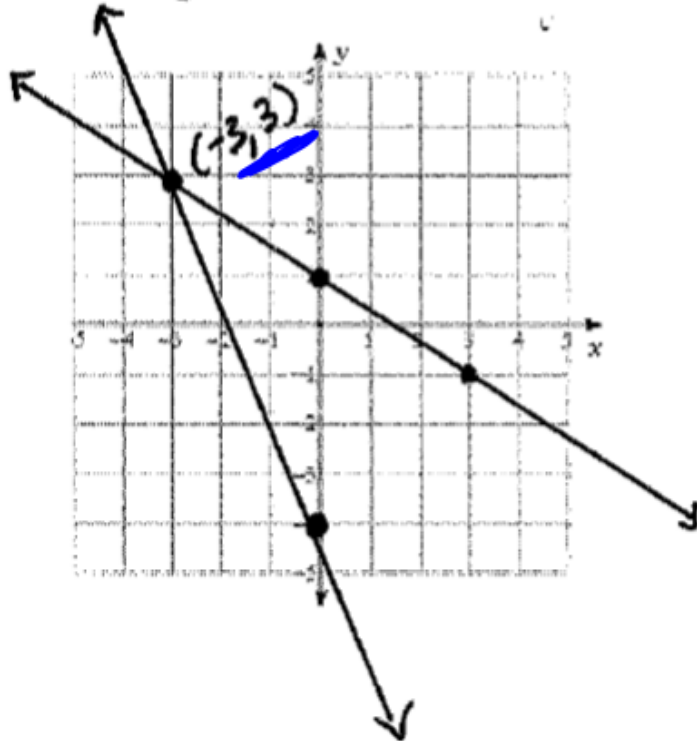
$$x = -4$$
$$y = 0$$



1. $y = -\frac{2}{3}x + 1$

$y = -\frac{7}{3}x - 4$

$(-3, 3)$

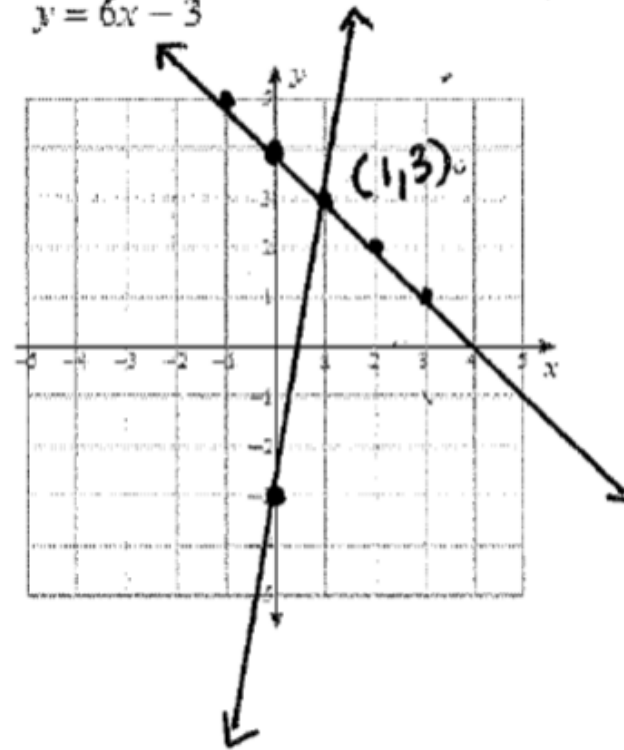


2.

$y = -x + 4$

$y = 6x - 3$

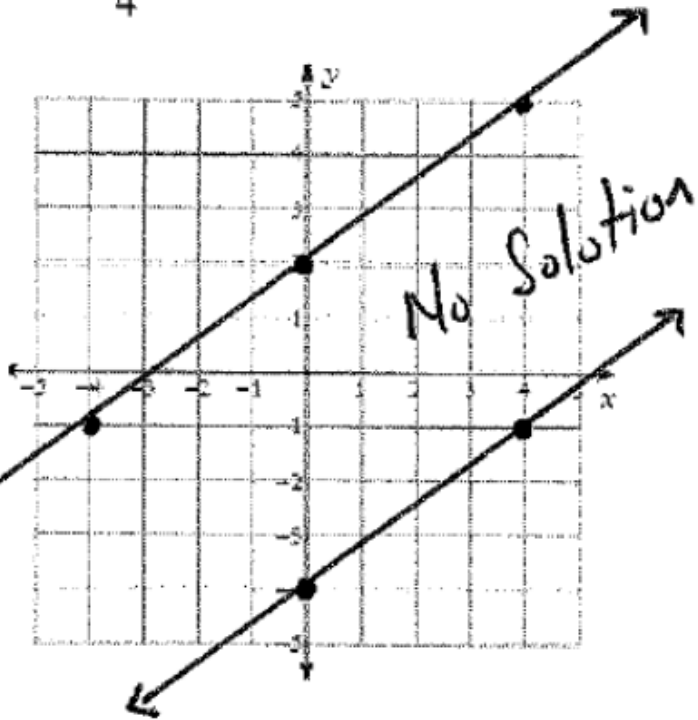
$(1, 3)$



3.

$$y = \frac{3}{4}x - 4$$

$$y = \frac{3}{4}x + 2$$

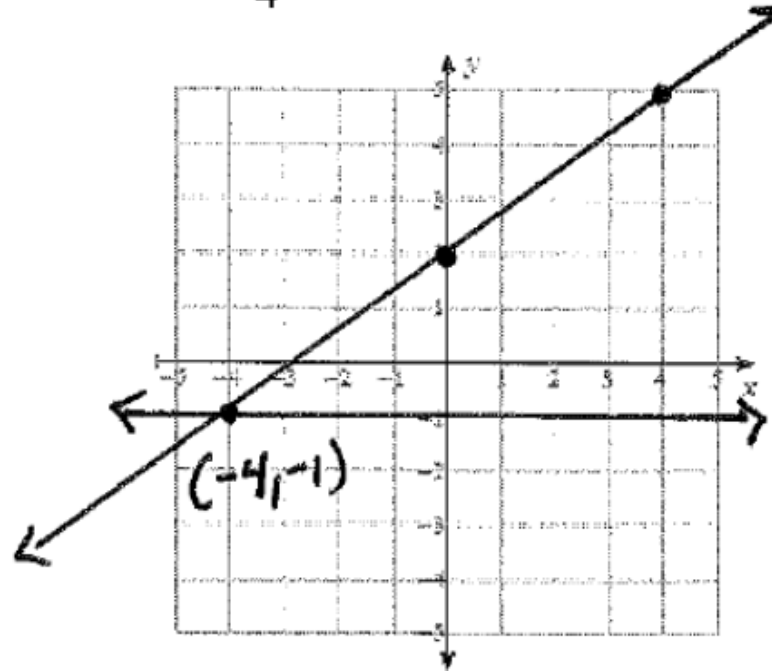


4.

$$y = -1$$

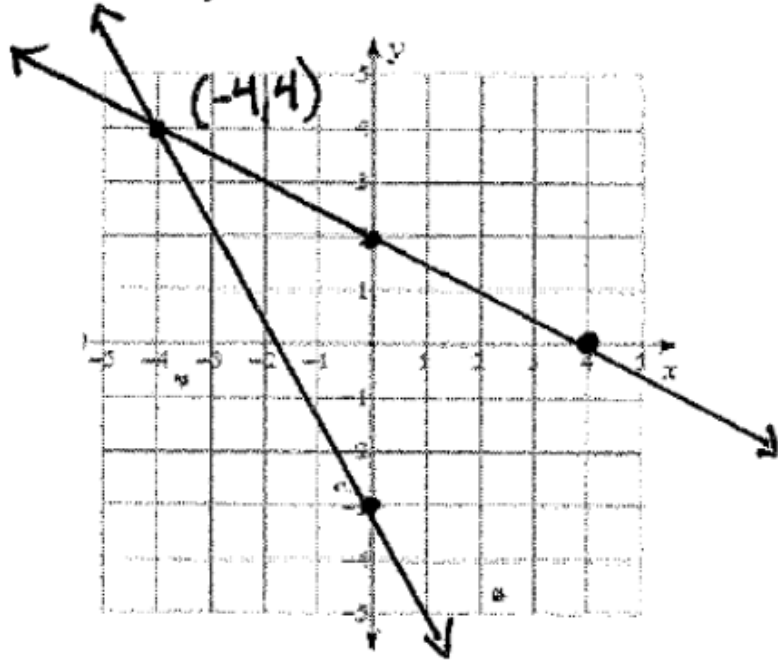
$$y = \frac{3}{4}x + 2$$

$$(-4, -1)$$



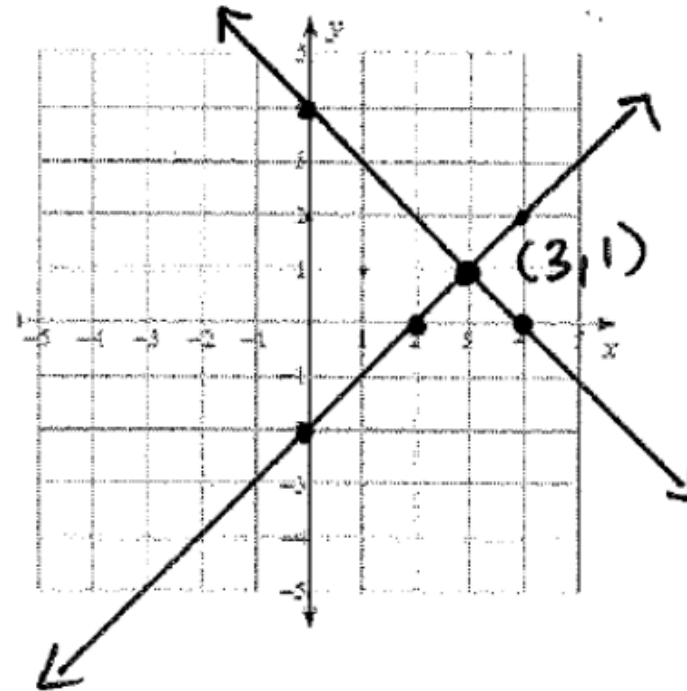
5. $7x + 4y = -12$
 $x + 2y = 4$

$(-4, 4)$



6. $x - y = 2$
 $x + y = 4$

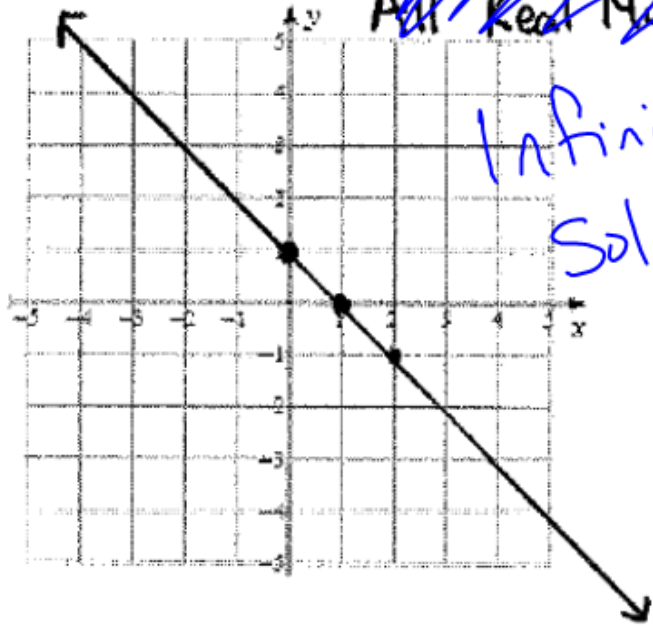
$(3, 1)$



7.

$$\begin{aligned} x + y &= 1 \\ 3x + 3y &= 3 \end{aligned}$$

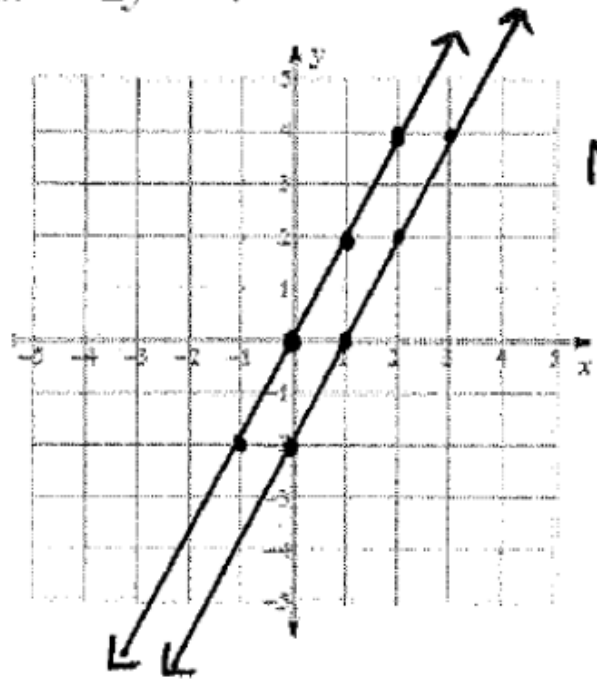
~~\mathbb{R} or~~
 All Real Numbers
 Infinite Solutions



8.

$$\begin{aligned} 4x - 2y &= 4 \\ 4x - 2y &= 0 \end{aligned}$$

No Solution



E.Q.:

How do I solve a system of linear equations algebraically using the elimination method?

Standard:

Graphing
Elimination
"Substitution"

MGSE9-12.A.REI.5 Show and explain why the elimination method works to solve a system of two-variable equations.

$$\begin{aligned} 2x + 3y &= 5 \\ y &= 4x + 6 \end{aligned}$$

$$2x + 3(4x + 6) = 5$$

$$\begin{aligned} 2x + 3 &= 4x - 5 \\ -2x &\quad -2x \end{aligned}$$

$$3 = 2x - 5$$

$$8 = 2x$$

$$x = 4$$

$$y = 11$$

$$\begin{aligned} y &= (2x + 3) \\ y &= (4x - 5) \end{aligned}$$

$$y = 2(4) + 3$$

$$y = 11$$

$$\begin{aligned} y &= 4(4) - 5 \\ &= 11 \end{aligned}$$

Two small pitchers and one large pitcher can hold 8 cups of water. One large pitcher minus one small pitcher constitutes 2 cups of water. How many cups of water can each pitcher hold?



Define your variables.

Let s = size of small pitcher (cups)

Let l = size of large pitcher (cups)

Write a system of equations to represent this scenario.

$$\begin{cases} 2s + l = 8 \\ l - s = 2 \end{cases}$$

$$\begin{array}{r} l - 2 = 2 \\ + 2 \quad + 2 \\ \hline \end{array}$$

$$l = 4 \text{ cups} \quad s = 2 \text{ cups}$$

$$\begin{array}{r} \cancel{l} + 2s = 8 \\ - (\cancel{l} - s = 2) \\ \hline \end{array}$$

$$\frac{3s}{3} = \frac{6}{3}$$

Solving Systems of Equations

- So far, we have solved systems using graphing. These notes show how to solve the system algebraically using ELIMINATION with addition and subtraction.
- ★ ● Elimination is easiest when the equations are in standard form. ★

Solving a system of equations by elimination using addition and subtraction.

Step 1: Put the equations in Standard Form.

Standard Form: $Ax + By = C$

Step 2: Determine which variable to eliminate.

Look for variables that have the same coefficient.

Step 3: Add or subtract the equations.

Solve for the variable.

Step 4: Plug back in to find the other variable.

Substitute the value of the variable into the equation.

Step 5: Check your solution.

Substitute your ordered pair into BOTH equations.

1) Solve the system using elimination.

$$x + y = 5$$

$$\underline{3x - y = 7}$$

✓ **Step 1:** Put the equations in Standard Form.

y **Step 2:** Determine which variable to eliminate.

Step 3: Add or subtract the equations.

$$\frac{4x}{4} = \frac{12}{4} \quad x = 3$$

1) Solve the system using elimination.

$$x + y = 5$$

$$3x - y = 7$$

$$x = 3$$

$$\begin{array}{r} 3 + y = 5 \\ -3 \quad -3 \end{array}$$

$$y = 2$$

Step 4: Plug back in to find the other variable.

Step 5: Check your solution.

The solution is (3, 2). What do you think the answer would be if you solved using substitution?

Let's Do Another

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

$$2x + 3y = -10$$

$$6y = -12$$

$$y = -2$$

$$x = -2$$

$$(-2, -2)$$

x
add

$$2x + 3(-2) = -10$$

$$2x - 6 = -10$$

$$2x = -4$$

$$x = -2$$

Try on your own

$$2x - 3y = -2$$

$$\underline{1x + 3y = 17}$$

$$3x = 15$$

$$x = 5$$

$$5 + 3y = 17$$

$$3y = 12$$

$$y = 4$$

$$\underline{(5, 4)}$$

2) Solve the system using elimination.

$$\begin{aligned} 4x + y &= 7 \\ 4x - 2y &= -2 \end{aligned}$$

$$\begin{aligned} 4x + y &= 7 \\ -4x + 2y &= 2 \end{aligned}$$

✓ **Step 1:** Put the equations in Standard Form.

✗ **Step 2:** Determine which variable to eliminate.

Step 3: Add or subtract the equations.

$$\begin{aligned} \cancel{4x} + y &= 7 \\ -(\cancel{4x} - 2y = -2) & \\ \hline 3y &= 9 \end{aligned}$$

$$y = 3$$

2) Solve the system using elimination.

$$\begin{aligned}4x + y &= 7 \\4x - 2y &= -2\end{aligned}$$

$$y = 3$$

Step 4: Plug back in to find the other variable.

$$4x + 3 = 7$$

$$4x = 4$$

$$x = 1$$

Step 5: Check your solution.

Try on your own

$$3x + y = 4$$

$$3x + 4y = 7$$

Two small pitchers and one large pitcher can hold 8 cups of water. One large pitcher minus one small pitcher constitutes 2 cups of water. How many cups of water can each pitcher hold?



Solving Systems of Equations

- What happens when the coefficients are not the same?
- We multiply the equations to make them the same! You'll see...

Solving a system of equations by elimination using multiplication.

Step 1: Put the equations in Standard Form.

Standard Form: $Ax + By = C$

Step 2: Determine which variable to eliminate.

Look for variables that have the same coefficient.

Step 3: Multiply the equations and solve.

Solve for the variable.

Step 4: Plug back in to find the other variable.

Substitute the value of the variable into the equation.

Step 5: Check your solution.

Substitute your ordered pair into BOTH equations.

1) Solve the system using elimination.

$$2x + 2y = 6$$

$$2(3x - y = 5)$$

$$2x + 2y = 6$$

$$6x - 2y = 10$$

Step 1: Put the equations in Standard Form.

They already are!

Step 2: Determine which variable to eliminate.

None of the coefficients are the same!

Find the least common multiple of each variable.

$$\text{LCM} = 6x, \text{LCM} = 2y$$

Which is easier to obtain?

2y

(you only have to multiply the bottom equation by 2)

1) Solve the system using elimination.

$$2x + 2y = 6$$

$$3x - y = 5$$

Step 3: Multiply the equations and solve.

*3x
add*

Step 4: Plug back in to find the other variable.

$$\begin{array}{r} 2x + 2y = 6 \\ + 6x - 2y = 10 \\ \hline \end{array}$$

$$8x = 16$$

$$x = 2$$

$$y = 1$$

1) Solve the system using elimination.

$$2x + 2y = 6$$

$$3x - y = 5$$

Step 5: Check your solution.

Solving with multiplication adds one more step to the elimination process.

2) Solve the system using elimination.

$$-4(x + 4y = 7)$$

$$4x - 3y = 9$$

Step 1: Put the equations in Standard Form.

Step 2: Determine which variable to eliminate.

$$\begin{array}{r} -4x - 16y = -28 \\ 4x - 3y = 9 \\ \hline \end{array}$$

$$x + 4(1) = 7$$

$$-19y = -19$$

$$x + 4 = 7$$

$$x = 3$$

$$y = 1$$

add

x

2) Solve the system using elimination.

$$x + 4y = 7$$

$$4x - 3y = 9$$

Step 3: Multiply the equations and solve.

Step 4: Plug back in to find the other variable.

2) Solve the system using elimination.

$$\begin{aligned}x + 4y &= 7 \\4x - 3y &= 9\end{aligned}$$

Step 5: Check your solution.

3) Solve the system using elimination.

$$3x + 4y = -1$$

$$4x - 3y = 7$$

Step 1: Put the equations in Standard Form.

They already are!

Step 2: Determine which variable to eliminate.

Find the least common multiple of each variable.

$$\text{LCM} = 12x, \text{LCM} = 12y$$

Which is easier to obtain?

Either! I'll pick y because the signs are already opposite.

3) Solve the system using elimination.

$$3x + 4y = -1$$

$$4x - 3y = 7$$

Step 3: Multiply the equations and solve.

Step 4: Plug back in to find the other variable.

3) Solve the system using elimination.

$$3x + 4y = -1$$

$$4x - 3y = 7$$

Step 5: Check your solution.

Last One!!

$$\begin{array}{r} 5(3x + 2y = 14) \\ -2(4x + 5y = 35) \end{array}$$

$$\begin{array}{r} 15x + 10y = 70 \\ -8x - 10y = -70 \\ \hline \end{array}$$

$$\frac{7x}{7} = \frac{0}{7} \quad \boxed{x=0}$$

$$\begin{array}{r} \cancel{3(5)} + 2y = 14 \\ 2y = 14 \end{array}$$

$$\boxed{y=7}$$

Homework #8

Solving Systems of Equations by Elimination