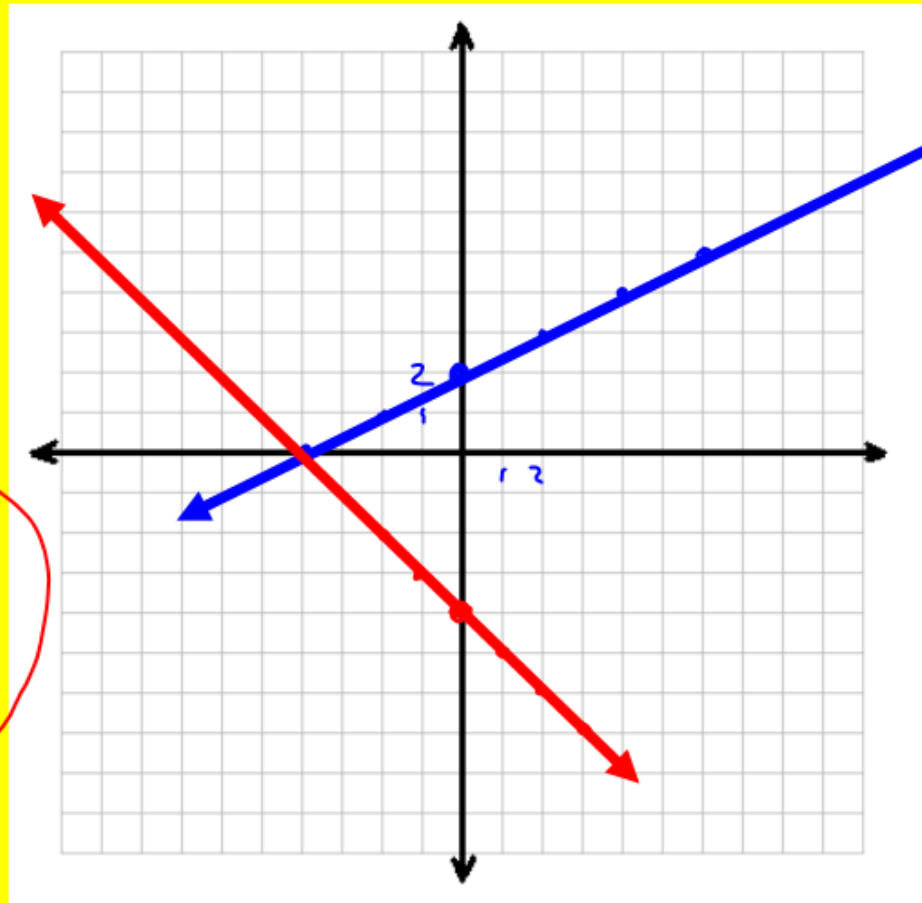Warmup: Solve the following system of Equations by Graphing

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

$$y = -x - 4$$
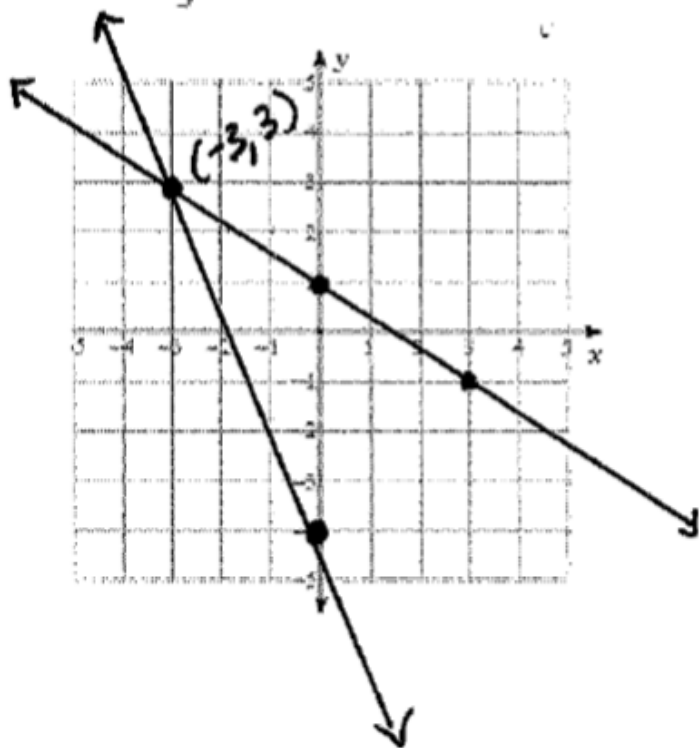
$(-4, 0)$

1.

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

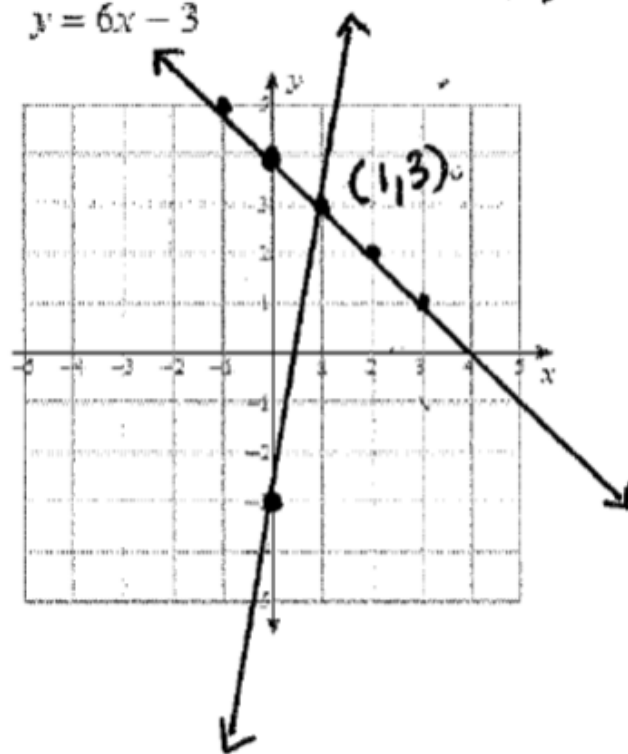$$y = -\frac{7}{3}x - 4$$

$(-3, 3)$

$(-3, 3)$

2.

$$y = -x + 4$$

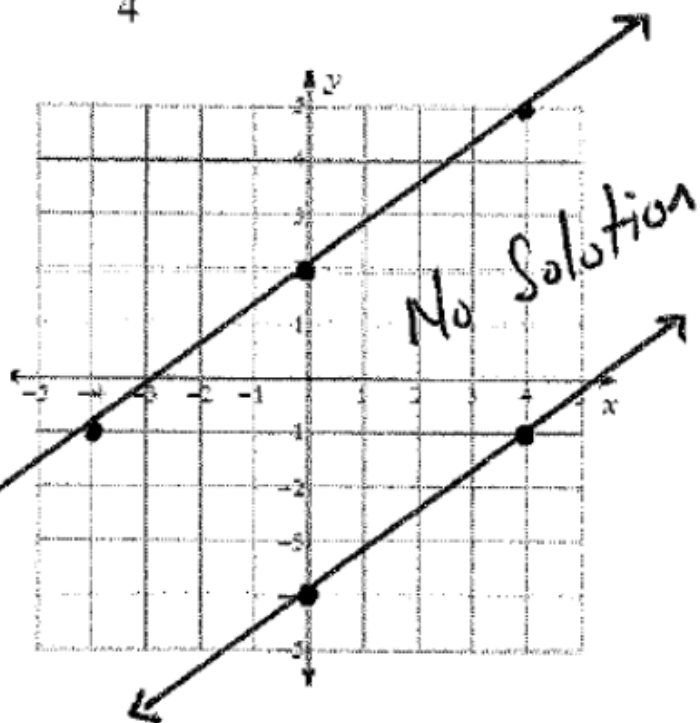$$y = 6x - 3$$

$(1, 3)$

$(1, 3)$

3.

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

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

No Solution

4.

$y = -1$

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

$(-4, -1)$

$(-4, -1)$

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

$x + 2y = 4$

$(-4, 4)$

$(-4, 4)$

6. $x - y = 2$

$x + y = 4$

$(3, 1)$

$(3, 1)$

7.

$$x - y = 1$$
$$3x + 3y = 3$$
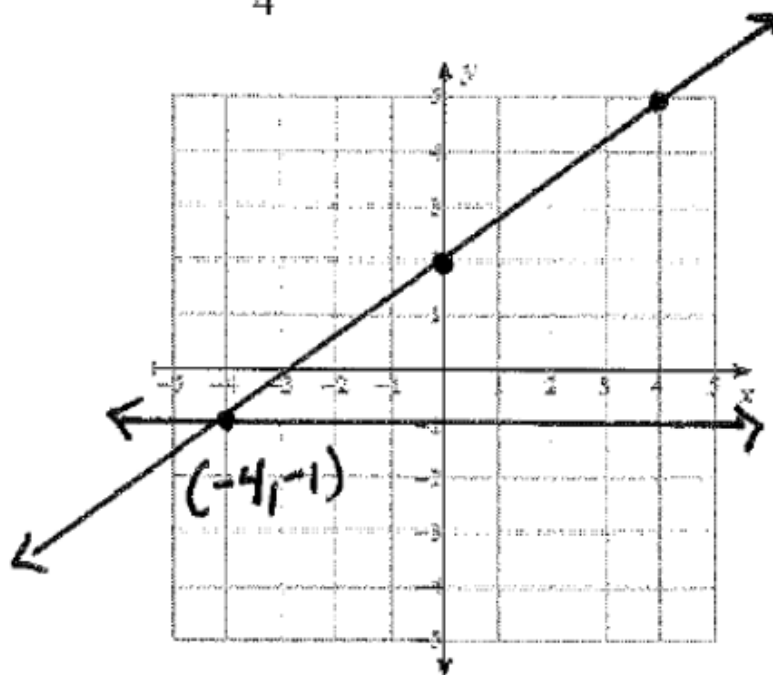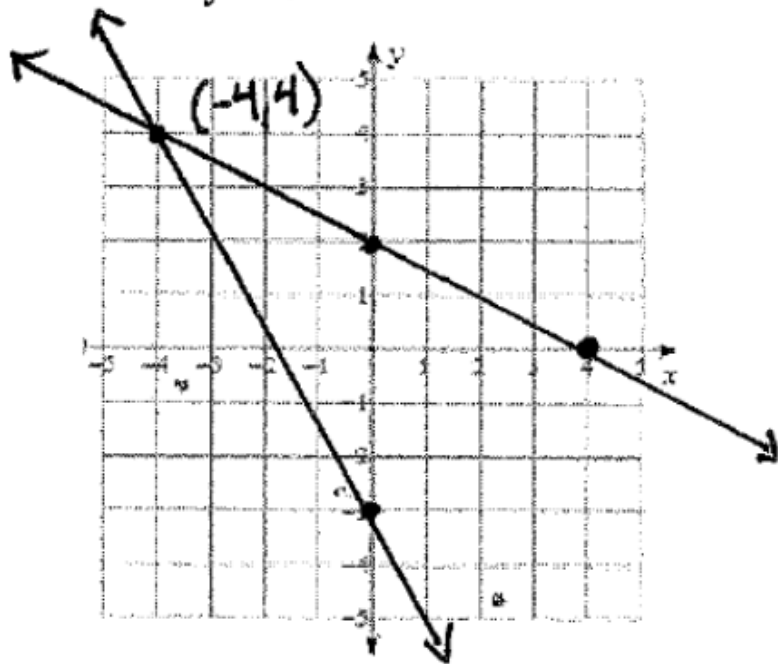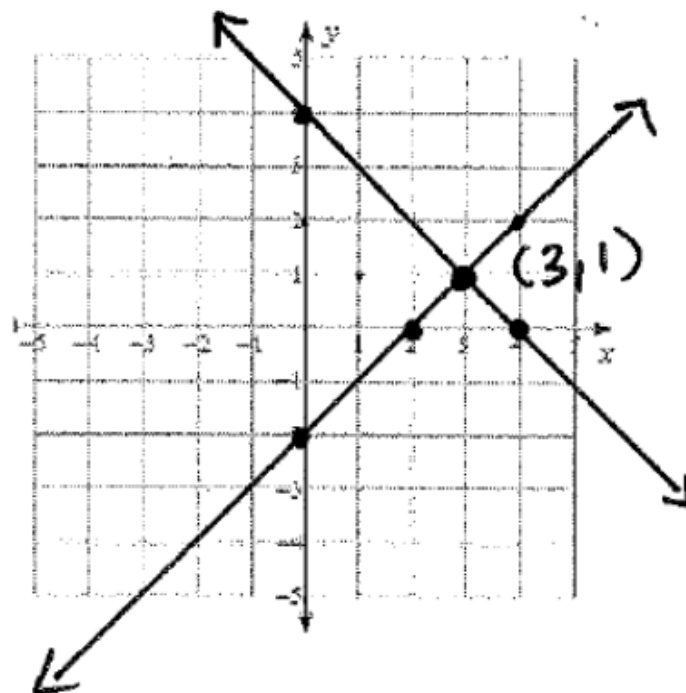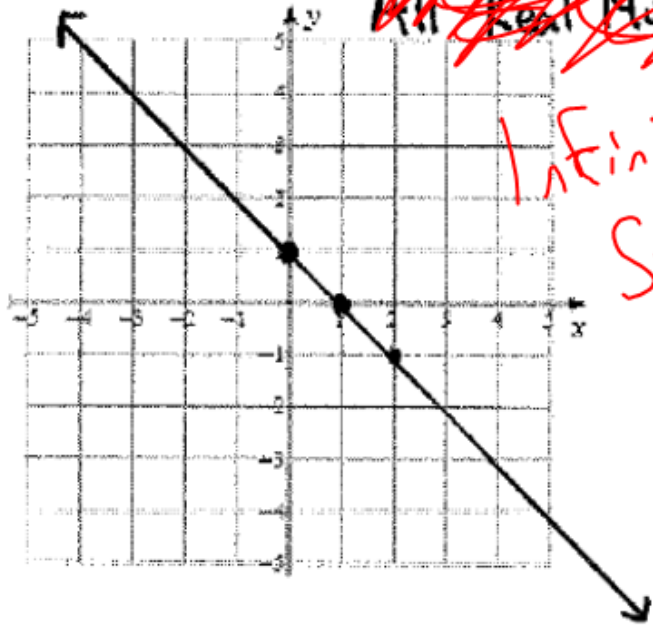
All Real Numbers

Infinite
Solutions

8.

$$4x - 2y = 4$$
$$4x - 2y = 0$$
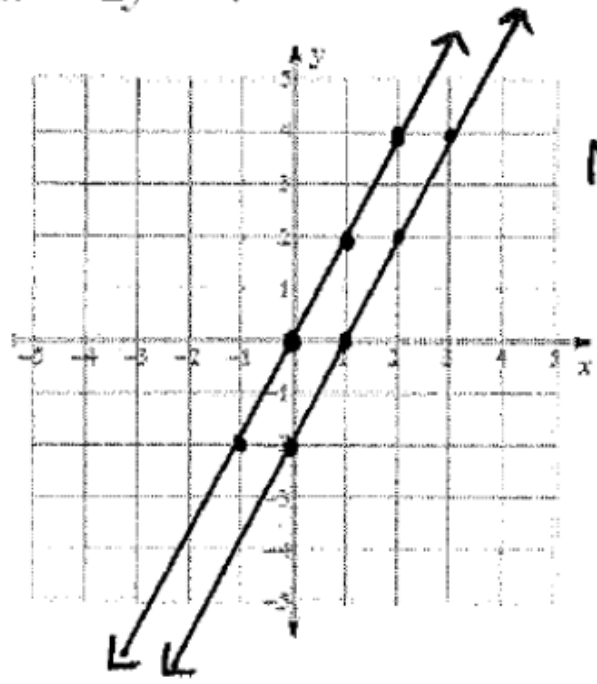
No
Solution

E.Q.:

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

Standard:

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

* Graphing
"Substitution"
* Elimination

$2x + 3 = 4x - 7$

$3 = 2x - 7$

$10 = 2x$

$x = 5 \qquad y = 13$

$y = (2x + 3)$

$y = (4x - 7)$

$y = 2(5) + 3 = 13$

$y = 4(5) - 7 = 13$

$y = (2x + 3)$

$4x + 3y = 10$

$4x + 3(2x + 3) = 10$

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.

Write a system of equations to represent this scenario.

Let s = size of small pitcher (cups)

Let l = size of large pitcher (large)

$$2s + l = 8$$
$$l - s = 2$$

$$l + 2s = 8$$
$$-(l - s = 2)$$

$$3s = 6$$

$$s = 2 \text{ cups}$$

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

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.

SPACE

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.

$$x + y = 5$$
$$3x - y = 7$$

Step 1: Put the equations in Standard Form.

Step 2: Determine which variable to eliminate.

$$4x = 12$$

Step 3: Add or subtract the equations.

1) Solve the system using elimination.

$$x + y = 5$$
$$3x - y = 7$$

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

$$x = 3$$

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

$$3 + y = 5$$

$$y = 2$$

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 / add

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

$2x - 6 = -10$

$2x = -4$

$x = -2$

Try on your own

$$2x - 3y = -2$$
$$+ \quad x + 3y = 17$$
$$\overline{}$$
$$3x \quad = 15$$

$$x = 5$$

$$5 + 3y = 17$$

$$3y = 12$$

$$y = 4$$

2) Solve the system using elimination.

$$4x + y = 7$$
$$4x - 2y = -2$$

Step 1: Put the equations in Standard Form.

Step 2: Determine which variable to eliminate.

Step 3: Add or subtract the equations.

$$4x + y = 7$$
$$-(4x - 2y = -2)$$

$$3y = 9$$
$$y = 3$$

2) Solve the system using elimination.

$$4x + y = 7$$
$$4x - 2y = -2$$

$$y = 3$$

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

$$4x + 3 = 7$$

$$4x = 4$$

Step 5: Check your solution.

$$x = 1$$

Try on your own

$$3x + y = 4$$

$$3x + 4y = 7$$

x/ subtract

$$3x + 1 = 4$$

$$3x = 3$$

$$x = 1$$

$$3x + y = 4$$
$$-3x - 4y = -7$$
$$\overline{}$$
$$-3y = -3$$

$$y = 1$$

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.

LCM = 6x, LCM = 2y

Which is easier to obtain?

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

1) Solve the system using elimination.

$$2x + 2y = 6$$

$$2\left(3x - y = 5\right)$$

Step 3: Multiply the equations and solve.

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

$$2x + 2y = 6$$

$$6x - 2y = 10$$

$$8x = 16$$

$$\boxed{x = 2}$$

$$2(2) + 2y = 6$$

$$4 + 2y = 6$$

$$2y = 2$$

$$\boxed{y = 1}$$

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.

$$-4x - 16y = -28$$
$$4x - 3y = 9$$

$$\frac{-19y}{-19} = \frac{-19}{-19}$$

$$\boxed{y = 1}$$

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

$$\boxed{x = 3}$$

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.

$$x + 4y = 7$$
$$4x - 3y = 9$$

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.

LCM = 12x, 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!!

$$^-5 \begin{pmatrix} 3x + 2y = 14 \end{pmatrix}$$
$$2 \begin{pmatrix} 4x + 5y = 35 \end{pmatrix}$$

$$-15x \quad -10y = -70$$
$$8x \quad +10y = 70$$

$$\frac{-7x}{-7} = \frac{0}{-7}$$

$$y = 7$$
$$x = 0$$

Homework #8

Solving Systems of Equations by Elimination