Inspiring Greatness

INDEPENDENCE SCHOOL DISTRICT

Math Virtual Learning

Grade 8

Solving Linear Systems: Elimination

May 22, 2020

Math 8

Lesson: May 22, 2020

Objective/Learning Target:

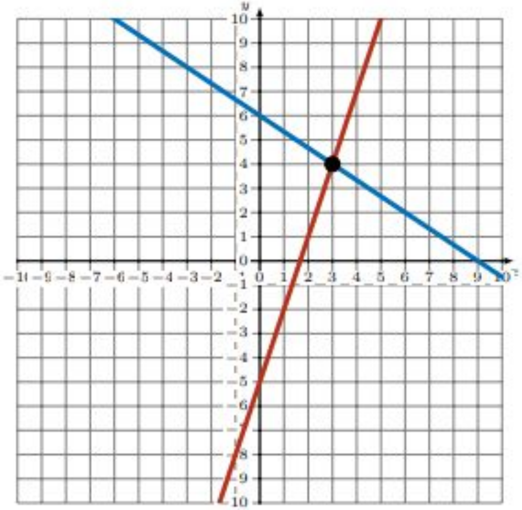
I can solve linear systems by elimination.

Warm-Up:

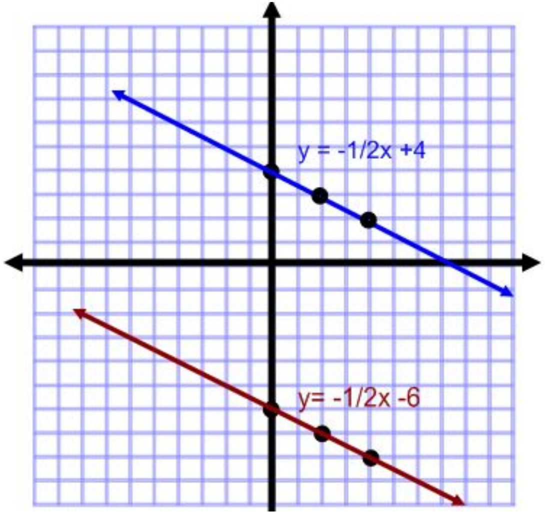
Answer Provided

State whether each system has one solution (state the point of intersection), no solution, or infinitely many solutions.

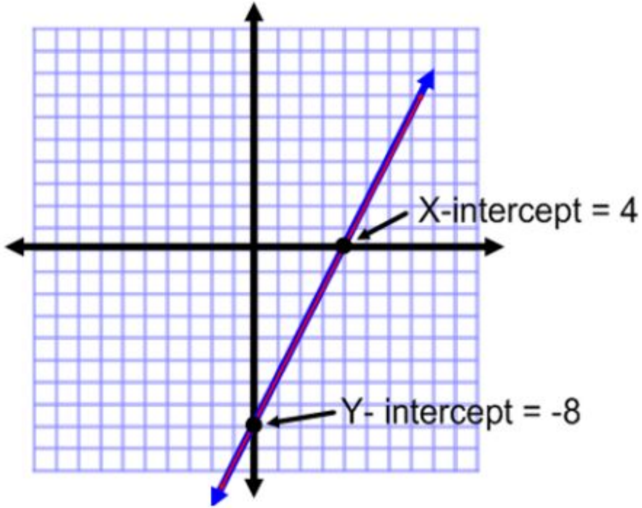
A



B



C



Answers: Graph A: One solution: (3, 4) Graph B: No Solution Graph C: Infinitely Many Solutions

Review: Number of Solutions

One Solution

$$5x = 2x + 21$$
$$-2x = -2x$$
$$3x = 21$$
$$\frac{3x}{3} = \frac{21}{3}$$
$$x = 7$$

Infinite Solutions

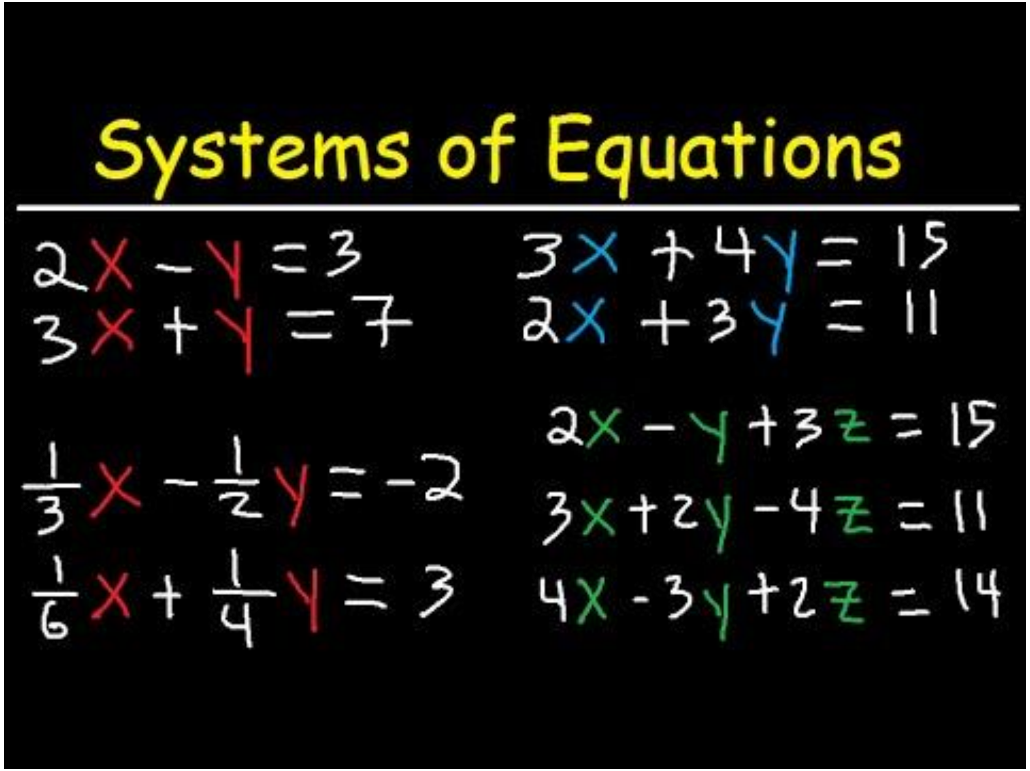
$$3x + 5 = 2x + 5 + x$$
$$3x + 5 = 3x + 5$$
$$-3x \qquad -3x$$
$$5 = 5$$

No Solution

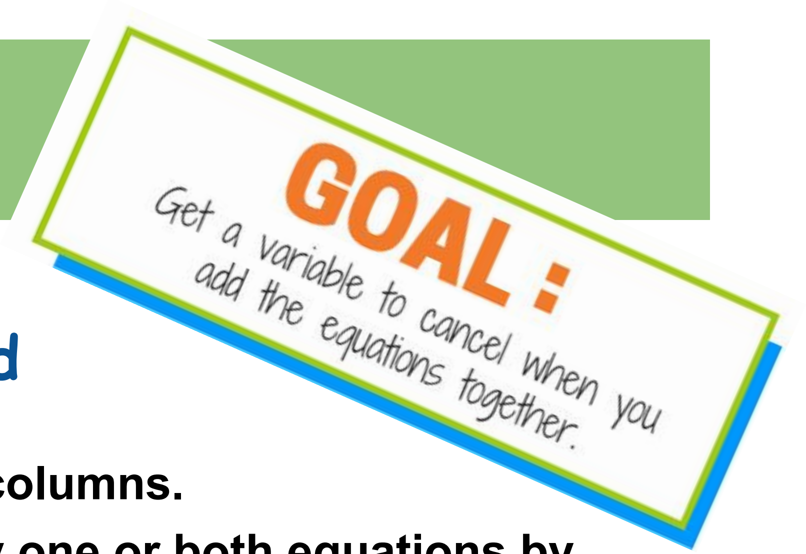
$$5x + 15 = 5x + 8$$
$$-5x = -5x$$
$$15 = 8$$

Video:

Take notes on a piece of paper as you watch this video.



Elimination Method



Steps for Using Elimination Method

- **Arrange the equations with like terms in columns.**
- **Analyze the coefficients of x or y. Multiply one or both equations by an appropriate number to obtain new coefficients that are opposite.**
- **Add the equations in a column and solve for the remaining variable.**
- **Substitute the value into either orginal equation and solve.**
- **Check the solution.**

How To: Solve a System of Equations using Elimination

$$x + y = 10$$
$$x - y = 14$$

① You want one set of **coefficients to be opposites**.

Notice that **y** *and* **-y** *are already* **opposites**.

② **Add the two equations.**

This has been done in **orange** *and the result is 2x = 24.*

$$\begin{array}{rcl} x + y & = & 10 \\ x - y & = & 14 \\ \hline 2x & = & 24 \end{array}$$

③ **Solve for x.**

Divide both sides by two and you will get **x = 12**.

$$\frac{2x}{2} = \frac{24}{2}$$
$$x = 12$$

④ **Solve for y.** Substitute the value for x into one of the original equations and solve for y.

$$\begin{array}{rcl} 12 + y & = & 10 \\ -12 & = & -12 \\ \hline y & = & -2 \end{array}$$

⑤ Write your answer as an **ordered pair.**

You can check that your solution is correct by plugging it into both equations. You must plug in the x and y values.

Example 1: Elimination with Opposite Coefficients

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

$$4x + 3y = 5$$
$$+2x - 3y = 7$$
$$6x = 12$$
$$\frac{6x}{6} = \frac{12}{6}$$
$$x = 2$$

$$4(2) + 3y = 5$$
$$8 + 3y = 5$$
$$-8 \qquad = -8$$
$$3y = -3$$
$$\frac{3y}{3} = \frac{-3}{3}$$
$$y = -1$$

Step 1: You want one set of coefficients to be opposites. This problem already has opposites (+3y and - 3y). Add like terms

Step 2: Solve for x

Step 3: Find the value of y. Substitute x = 2 back into an original equation and solve.

Step 4: Write your answer as an ordered pair.

Solution to the system is: (2,-1)

How to: Elimination Without Opposite Coefficients

$x - 4y = 5$
$3x + 2y = 29$

$-3(x - 4y = 5)$
$= -3x + 12y = 15$

$-3x + 12y = -15$
$3x + 2y = 29$

$14y = 14$

$\frac{14y}{14} = \frac{14}{14}$

$y = 1$

$x - 4(1) = 5$
$x - 4 = 5$
$+4 \quad +4$
$x = 9$

Step 1: Notice that this system does not have coefficients that are opposites. However, we can multiply the entire 1st equation by -3 to get opposite coefficients. Our new equation is $-3x - 12y = 15$

Step 2: Line up the two equations and add the columns.

Step 3: Solve for y

Step 4: Use your solution for y to find the solution for x by substituting 1 for y in the original equation.

Step 5: Write your solution as an ordered pair.

Solution: (9, 1)

Example 2: Elimination without Opposite Coefficients *and No Solution*

$3x + 12y = -36$
$x + 4y = -6$

$-3(x + 4y = -6)$
$-3x - 12y = 18$

$3x + 12y = -36$
$-3x - 12y = 18$

$0 + 0 = -18$
$0 = -18$

Step 1: Notice that this system does not have coefficients that are opposites. However, we can multiply the entire 2nd equation by -3 to get opposite coefficients. Our new equation is $-3x - 12y = 18$

Step 2: Line up the two equations and add the columns.

Step 3: Notice that we end up with a false statement. When you get an untrue statement such as $0 = -18$ there is no value of x that will work in the problem.

There is NO SOLUTION

Practice 1:

Answers on next slide

Use elimination to solve and find the solution(s) to each of the systems.

1. $3x + 4y = 7$
   $3x + 4y = 9$

2. $-2X + y = 6$
   $2x + 3y = 10$

3. $3x + 4y = 40$
   $X + 4y = 24$

4. $9x - 3y = 63$
   $3x - y = 21$

Practice 1: ***Answer Key***

1. No solution
2. (-1, 4)
3. (8, 4)
4. Infinite solutions

Additional Resources:

[Solving Systems with Elimination - Lesson and practice]

[Solving Systems with Elimination - Practice problems]

[Online Practice]