Essential Question 2/2/2021

- How can solve systems of equations by substitution?

Learning Target

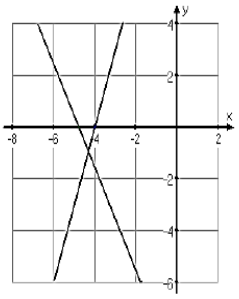
Solving Systems of Equations by Substitution

Day 2 – Solving Systems Using Substitution

Standard(s):

MGSE9-12.A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

Name the solution of the systems of equations below:



Were you able to figure out an exact solution???

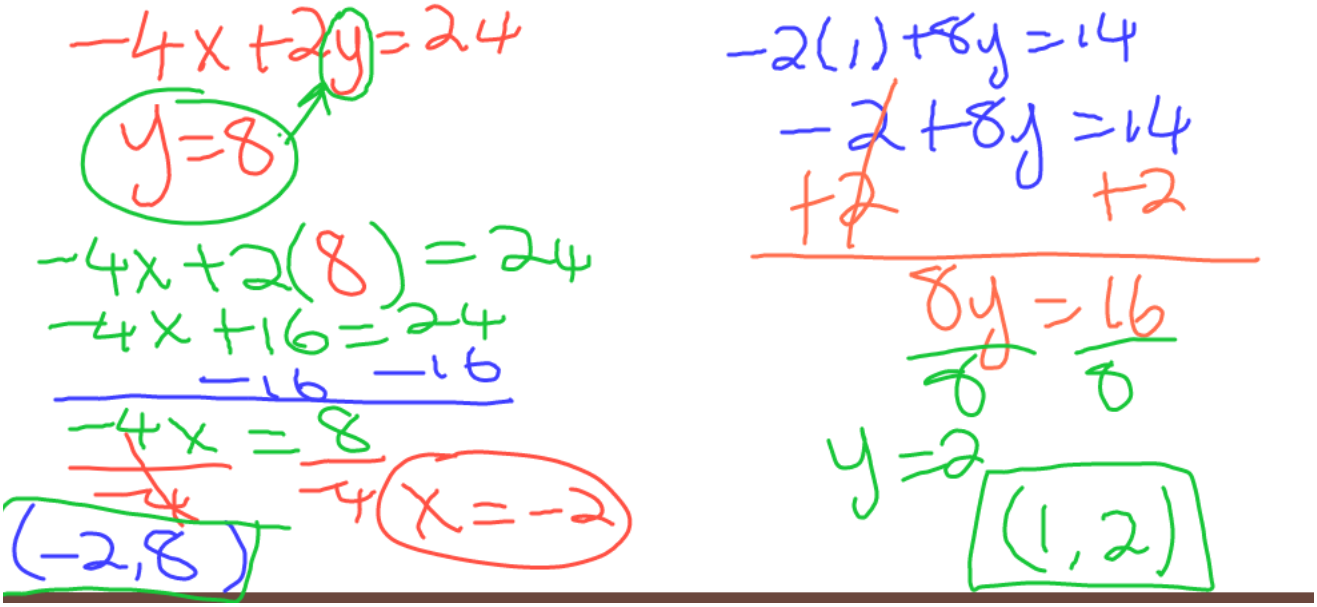
- Unless a solution to a system of equations are integer coordinate points, it can be very hard to determine the solution.
- Therefore, we need algebraic methods that allow us to find exact solutions to Systems of Equations.
- We will learn two methods: **Substitution** and **Elimination**

Think About It

How would you find the x and y values for the following systems (i.e a point or solution to the systems)?

a. $-4x + 2y = 24$
$y = 8$

b. $x = 1$
$-2x + 8y = 14$



Steps for Solving a System by Substitution

Example:
$y = x + 1$
$2x + y = -2$

Step 1: Select the equation that already has a variable isolated.	**Step 2**: Substitute the expression from Step 1 into the other equation for the variable you isolated in step 1 and solve for the other variable.	**Step 3**: Substitute the value from Step 2 into the revised equation from Step 1 & solve for the other variable. Create an ordered pair (x, y).	**Step 4**: Check the solution in each of the original equations.
$y = x+1$	$2x + x + 1 = -2$ $3x + 1 = -2$ $-1 \quad -1$ $\frac{3x}{3} = \frac{-3}{3}$ $x = -1$	$y = -1 + 1$ $y = 0$	$(-1, 0)$ ✓ $x \quad y$ Check $0 = -1 + 1$ ✓ $2(-1) + 0 = -2$ $-2 + 0 = -2$ ✓

Practice - We Do

Example 1: Solve the system below:

$2x + 2y = 3$

$x = 4y - 1$

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

$8y - 2 + 2y = 3$

$10y - 2 = 3$

$+2 \quad +2$

$\frac{10y}{10} = \frac{5}{10}$

$y = \frac{1}{2}$ or 0.5

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

$x = 4\left(\frac{1}{2}\right) - 1$

$x = 2 - 1$

$x = 1$

Solution: $(1, 0.5)$

Practice - You Try

Example 2: Solve the system below:

$y = x + 1$

$y = -2x + 4$

$x + 1 = -2x + 4$

$+2x \quad +2x$

$3x + 1 = 4$

$-1 \quad -1$

$3x = 3$

$\frac{3x}{3} = \frac{3}{3}$

$x = 1$

$y = x + 1$

$y = 1 + 1$

$y = 2$

Solution: $(1, 2)$

$$x+1=-2x+4$$

$$x+2x=4-1$$

$$\frac{3x}{3}=\frac{3}{3}$$

$$x=1$$

Practice - You Try

Example 3: Solve the system below:

$x = 3 - y$

$x + y = 7$

$3 - y + y = 7$

$3 = 7$? false statement

No solution

Practice - You Try

Example 4: Solve the system below:

$y = -2x + 4$

$4x + 2y = 8$

$4x + 2(-2x + 4) = 8$

$4x - 4x + 8 = 8$

$8 = 8$ ✓ True statement

Infinitely many solutions.

When the variables drop out and the resulting equation is **FALSE**, the answer is **NO SOLUTIONS.**

When the variables drop out and the resulting equation is **TRUE**, the answer is **INFINITE SOLUTIONS.**

Class Work 2/2/2021

$y=mx+b$

a. **Review:** Solve the equation: $x - 1 = 5x + 3x - 8$

$x-1=5x+3x-8$

$x-1=8x-8$

$x-8x=-8+1$

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

$x=1$

b. **Review:** Put into slope intercept form: $4x - 5y = -20$

$4x-5y=-20$

$\frac{-5y}{-5}=\frac{-4x-20}{-5}$

$y=\frac{4}{5}x+4$

Solution $\Rightarrow$ (x,y)

Directions: Solve each system using substitution. Write your solution as an ordered pair unless the system has no or infinite solutions.

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

$x + x - 1 = 3$
$2x - 1 = 3$
$2x = 3 + 1$
$\frac{2x}{2} = \frac{4}{2}$
$x = 2$

$y = 2 - 1$
$y = 1$

Solution: (2,1)

2. $4x + y = 0$
   $x = -2y - 7$

$x = -2(-4) - 7$
$x = 1$

$4(-2y - 7) + y = 0$
$-8y - 28 + y = 0$
$-7y - 28 = 0$
$\frac{-7y}{-7} = \frac{28}{-7}$
$y = -4$

Solution: (1,-4)

3. $x = -5y + 4$

$3x + 15y = -1$

$3(-5y+4) + 15y = -1$

$-15y + 12 + 15y = -1$

$12 = -1$

Solution: No Solution

4. $y = -x - 2$

$y = 4x + 3$

$-x - 2 = 4x + 3$

$-x - 4x = 3 + 2$

$-5x = 5$

$x = -1$

$y = 4(-1) + 3$

$y = -4 + 3 = -1$

Solution: $(-1, -1)$

5. $x + y = 16$

$y = -x + 1$

$x + (-x + 1) = 16$

$x - x + 1 = 16$

$0 + 1 = 16$

$1 = 16$? false statement

No solution!

Solution:

6. $y = 3x - 7$

$3x - y = 7$

$3x - (3x - 7) = 7$

$3x - 3x + 7 = 7$

$7 = 7$

Many solution.

Solution:

Closing:

How much have you learned?

Solve this system

1. $\begin{cases} y = 4x - 5 \\ y = -2x + 7 \end{cases}$

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

$4x + 2x = 7 + 5$

$\frac{6x}{6} = \frac{12}{6}$

$x = 2$

$y = 4(2) - 5$

$y = 8 - 5$

$y = 3$

Solution: $(2, 3)$