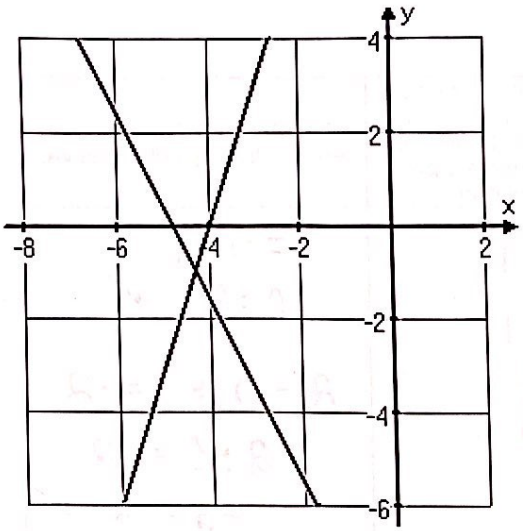
Day 2 – Solving Systems Using Substitution – Notes

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. This is why we have the option to solve systems using algebra. Algebra allows us to find exact solutions, especially if the solution is a messy number that involves fractions or decimals. We will learn two methods: substitution and elimination (also called linear combinations)

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

$-4x + 2(8) = 24$
$-4x + 16 = 24$
$-4x = 8$
$x = -2$

$(-2, 8)$

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

$-2(1) + 8y = 14$
$-2 + 8y = 14$
$8y = 16$
$y = 2$

$\boxed{(1, 2)}$

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 and solve for the other variable. Create a point from your solutions.	**Step 4:** Check the solution in each of the original equations.
So I would pick $y = x + 1$ Since it's the equation that has a variable by itself.	$2x + x + 1 = -2$ $3x + 1 = -2$ $3x = -3$ $\boxed{x = -1}$	$y = x + 1$ $y = -1 + 1$ $\boxed{y = 0}$ Solution $(-1, 0)$	$0 = -1 + 1$ $0 = 0$ ✓ $2(-1) + 0 = -2$ $-2 + 0 = -2$ $-2 = -2$ ✓

Example: Solve the system below:

$2x + 2y = 3$

$x = 4y - 1$

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

$8y - 2 + 2y = 3$

$10y - 2 = 3$

$10y = 5$

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

$\boxed{y = 1/2}$

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

$x = 2 - 1$

$\boxed{x = 1}$

$\boxed{(1, 1/2)}$

Example: Solve the system below:

$y = x + 1$

$y = -2x + 4$

$x + 1 = -2x + 4$

$3x = 3$

$\boxed{x = 1}$

$y = 1 + 1$

$\boxed{y = 2}$

$\boxed{(1, 2)}$

Example: Solve the system below:

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

$-2x - (-3x + 7) = -7$
$-2x + 3x - 7 = -7$
$x = 0$

$y = -3(0) + 7$
$y = 7$

$(0, 7)$

Example: Solve the system below:

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

$3 - y + y = 7$
$3 \neq 7$
False

no Solution

Example: Solve the system below:

$y = -2x + 4$
$4x + 2y = 8$

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

Infinite 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.**