

~~Algebra~~ Algebra<sup>2</sup> - Systems of Linear Equations  
Solve by Substitution or Elimination

Name: Key

How do I find the solution to a system of equations using substitution?

1. Solve one of the equations for either x or y if necessary.
2. Substitute the expression you got for the variable solve for in the first step into the other equation.
3. Solve for the lone variable in the equation that you substituted into.
4. Plug the value you got for the variable you solve for in the previous step into either of the equations and solve for the second variable.

Find the solution to the system.

1.  $x - 2y = 8$   
 $y = -4x + 5$

→  $y = -4(2) + 5$

$x - 2(-4x + 5) = 8$

$y = -8 + 5$

$x + 8x - 10 = 8$   
+10 +10

$y = -3$

$9x = 18$

$(2, -3)$

$x = 2$

2.  $2x + 5y = 6$   
 $x - 5y = -12$

→  $2(5y - 12) + 5y = 6$

↓  
 $x = 5y - 12$

$10y - 24 + 5y = 6$   
+24 +24

$15y = 30$

$y = 2$

↓  
 $x = 5(2) - 12$

$x = -2$

$(-2, 2)$

$$3. \quad \begin{aligned} 4x + 5y &= 11 \\ 3x - y &= 24 \end{aligned} \longrightarrow \begin{aligned} 4x + 5(3x - 24) &= 11 \\ 4x + 15x - 120 &= 11 \\ +120 & \quad +120 \end{aligned}$$

$$\downarrow$$

$$\begin{array}{r} -y = -3x + 24 \\ -1 \quad -1 \quad -1 \end{array}$$

$$y = 3x - 24$$

$$y = 3(6.89) - 24$$

$$y = -3.33$$

$$19x = 131$$

$$\frac{19x}{19} = \frac{131}{19}$$

$$x = 6.89$$

$$(6.89, -3.33)$$

### Special Systems

- A system of equations that, when solved by substitution, results in an equation that is ALWAYS true ( $0 = 0$ ,  $7 = 7$ , etc.) has an infinite number of solutions.

$$4. \quad \begin{aligned} y &= 3x - 2 \\ 12x - 4y &= 8 \end{aligned}$$

$$12x - 4(3x - 2) = 8$$

$$12x - 12x + 8 = 8$$

$$8 = 8$$

*infinite many solutions*

- A system of equations that, when solved by substitution, results in an equation that is NEVER true ( $0 = 6$ ,  $7 = 4$ , etc.) has NO SOLUTIONS.

$$5. \quad \begin{aligned} -15y + 3x &= 9 \\ -2x + 10y &= 8 \end{aligned} \longrightarrow \begin{aligned} 3x &= 15y + 9 \\ x &= 5y + 3 \end{aligned}$$

$\downarrow$

$$-2(5y + 3) + 10y = 8$$

$$-10y - 6 + 10y = 8$$

$$-6 \neq 8$$

*no solutions*