

Solving systems of equations.

5.2 Substitution method

SOLVING A LINEAR SYSTEM BY SUBSTITUTION

- **Step 1:** Solve one of the equations for one of its variables, if needed (x or y, doesn't matter)
- **Step 2:** Substitute the entire expression from Step 1 into the other equation and
- **Step 3:** solve for the other variable.
- **Step 4:** Substitute the value from Step 2 into the revised equation from Step 1 and solve.
- **Step 4b: (optional)** Check the solution in each of the original equations.

Step by step: Substitution example.

Find the solution to the system of equations using the substitution method.

$$\begin{aligned} y &= 2x + 3 \\ 4x + y &= 9 \end{aligned}$$

Step 1) if one is solved for a variable already, use it!

Step 2) Take $(2x + 3)$ which equals y , and substitute it into the other equation.

$$\begin{aligned} 4x + (2x + 3) &= 9 \\ 6x + 3 &= 9 \end{aligned}$$

Step 3) Solve for x .

$$\begin{array}{r} -3 \quad | \quad -3 \\ \hline 6x = 6, \text{ so } x = \underline{1} \end{array}$$

Step 4) Substitute 1 in for x to the easiest equation (top one) and find y .

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

$$y = \underline{5}$$

Your solution is $(\underline{1}, \underline{5})$

Again! Use the substitution method, without steps.

Find the solution to the system of equations using the substitution method.

$$\begin{aligned} x &= -y - 2 \\ 2x - 2y &= 8 \end{aligned}$$

$$\begin{aligned} 2(-y - 2) - 2y &= 8 \\ -2y - 4 - 2y &= 8 \\ -4y - 4 &= 8 \\ \quad +4 \quad +4 & \\ \hline -4y &= 12 \\ \quad -4 \quad -4 & \\ \hline y &= -3 \end{aligned}$$

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

$$x = 3 - 2$$

$$x = 1$$

$$\boxed{(1, -3)}$$

Solve the linear system.

- $y = -4x - 5$ Equation 1

- $3x - y = 5$ Equation 2

$$3x - (-5) = 5$$

$$3x + 5 = 5$$

$$7x + 5 = 5$$

$$\frac{-5}{-5} \quad \frac{-5}{-5}$$

$$7x = 0$$

$$\frac{7}{7} \quad \frac{0}{7}$$

$$x = 0$$

$$y = -4(0) - 5$$

$$y = -5$$

$$(0, -5)$$

Solve using the substitution method.

- Solve the linear system.

- $2x - 5y = -13$ Equation 1

- $x = -1 - 3y$ Equation 2

$$\rightarrow 2(-1 - 3y) - 5y = -13 \quad x = -1 - 3(1)$$

$$-2 - 6y - 5y = -13 \quad x = -1 - 3$$

$$-2 - 11y = -13 \quad x = -4$$

$$\frac{-2}{-11} \quad \frac{-11}{-11} \quad y = 1$$

$$(-4, 1)$$

Practice on your own! Follow the steps.

• 3. $y = x - 1$
 $x - 5y = -15$

4. $y + 5x = 3$
 $3x + 2y = -8$

Application problems

- 1) Think of a verbal model
- 2) Identify your variables
- 2) construct your equations.
- 4) Use substitution and solve.
- 5) Find your solution and put it back into context.

application

An investor bought 225 shares of stock, stock A at \$50 per share and stock B at \$75 per share. If \$13,750 worth of stock was purchased, how many shares of each kind did the investor buy?

Verbal Model

$$\begin{array}{l} \boxed{\text{Amount of stock A}} + \boxed{\text{Amount of stock B}} = \boxed{\text{Total amount of stock}} \\ \boxed{\text{Price of stock A}} \cdot \boxed{\text{Amount of stock A}} + \boxed{\text{Price of stock B}} \cdot \boxed{\text{Amount of stock B}} = \boxed{\text{Total investment}} \end{array}$$

HOMEWORK

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