

Assignment #21: Solving by Substitution

We use one equation to solve for one of the variables in terms of the other variable. We will then substitute this expression into the second equation. Thus we will have a single equation with one variable.

This technique is especially handy if one of the equations is already in the form of one variable being solved in terms of the other one, but it works in any case.

Example: Solve $6x+7y=114$ $3x+12y=108$

On the left we will solve $6x+7y=114$ for y . Then on the right we substitute for y .

$$6x+7y=114$$

$$7y=114-6x$$

$$y=\frac{114-6x}{7}$$

$$3x + 12y = 108$$

$$3x + 12 \cdot \frac{114-6x}{7} = 108 \quad \text{Here we replaced } y$$

$$3x + \frac{1368-72x}{7} = 108 \quad \text{with } \frac{114-6x}{7}$$

$$3x + 195 \frac{3}{7} - 10 \frac{2}{7} x = 108$$

$$195 \frac{3}{7} - 7 \frac{2}{7} x = 108$$

$$-7 \frac{2}{7} x = -87 \frac{3}{7}$$

$$x = 12$$

Substituting this value for x into $y=(114-6x)/7$ yields $y=6$ as before.

Note that the one-variable equation we derived, $3x + 12(114-6x)/7 = 108$, was the same as that resulting from the one-variable technique we used at the beginning of this chapter.

Note also the silly results if we substitute $y=(114-6x)/7$ back into the equation from which we found it!

$$6x+7(114-6x)/7=114$$

$$6x+114-6x=114$$

$$114=114$$

The conclusion that 114 equals 114 is reassuring, but not very useful!

We will try the substitution approach on three-variable systems too.

Problems

Find the solution set and graph on a number line.

1. a. $3|1x+3|+1 \leq 7$ b. $4|2x+3|-1 < 7$

2. a. $2|5x-5|+1 > 7$ b. $3|8x-8| \geq 3$

Solve for both variables by linear combinations.

3. a. $-5x+-5y=-26$ $7x+-10y=33$ b. $3x+3y=15$ $-8x+-6y=-36$

4. a. $3x+2y=22$ $5x+3y=35$ b. $2x+-5y=-9$ $5x+-2y=-12$

Solve for both variables by substitution.

5. a. $x+-5y=-8$ $2x+3y=-3$ b. $2x+3y=19$ $x+-3y=-13$

(R). Find the next letter in this series: O S C Y S B T D E ____

(L): How many ways can the letters of the word "GREEN" be scrambled so that the first and last letters are consonants?