

7.2 Substitution Method

The second method for solving a system of equations is the substitution method.

A substitute is a stand-in; something that replaces something. In algebra, we substitute a variable with an equivalent expression.

Here's how we solve a system with substitution:

Example: $\begin{cases} 10x + 2y = 10 \\ \#1. y = -10 \end{cases}$

Step 1: Solve one equation for 1 of the variables

This one is already solved for y. Sometimes you need to solve for variable first.

#2. $10x + 2(-10) = 10$

#3. $10x - 20 = 10$
 $\quad +20 \quad +20$

$$\frac{10x}{10} = \frac{30}{10}$$

$$(x = 3)$$

Step 2: Replace expression into other equation's variable

Step 3: Solve for remaining variable.

Since we already know $(y = -10)$ we don't need to find y.

Answer: $(3, -10)$

Step 4: If necessary put answer back in to get remaining variable

Example #2:

$$\begin{cases} 10x + 2y = 10 \\ y = 3x - 3 \end{cases}$$

$$\begin{aligned} 10x + 2(y) &= 10 \\ 10x + 2(3x - 3) &= 10 \\ 10x + 6x - 6 &= 10 \\ 16x - 6 &= 10 \\ 16x &= 16 \end{aligned}$$

$$(x = 1)$$

$(1, 0)$

$$\begin{aligned} y &= 3x - 3 \\ y &= 3(1) - 3 \\ y &= 3 - 3 \\ (y = 0) \end{aligned}$$

Example #3:

$$\begin{cases} 3x+y=4 \\ 5x-7y=11 \end{cases}$$

easier to solve for y.

★ Make general observations first.

1. Is one equation easier to solve for one variable than another?

$$\begin{array}{r} 3x+y=4 \\ -3x \quad -3x \\ \hline (y=-3x+4) \end{array}$$

Now make a substitution!

$$\begin{aligned} 5x-7y &= 11 \\ 5x-7(-3x+4) &= 11 \\ 5x+21x-28 &= 11 \\ 26x &= 39 \end{aligned}$$

$$x = 1.5$$

NOT DONE YET

$$\begin{aligned} y &= -3x+4 \\ y &= -3(1.5)+4 \\ y &= -4.5+4 \\ y &= -.5 \end{aligned}$$

NOW YOU'RE DONE

(1.5, -.5)

Classwork: Pg 329 (19-18) + #32

H.W. (19-28), #33.

Grapher 3-D graph -

Have fun with this: $(x^2 + \frac{9}{4}y^2 + z^2 - 1)^3 - x^2z^3 - \frac{9}{80}y^2z^3 = 0$