Lesson 5.2
Solving a System of Linear Equations by Substitution

Methods for solving systems

5.1 Graph

5.2 Substitution

Solution : (x, y)

Solving a System of Linear Equations by Substitution

Step 1: Solve one of the equations for one of the variables

Step 2: Substitute the expression from step 1 into the other equation and solve

Step 3: Substitute the solution from step 2 into one of the original equations and solve.

Step 4: Check the solution ✓

Solve with Substitution

$$y = x + 17$$
$$y = 4x + 2$$

Solution (x, y)

Step 1: Solve one of the equations for one of the variables {What does that mean?}

$y = x + 17$

$y = 4x + 2$

Solved for y

step 1 done for us

Step 2: **Substitute** the expression from step 1 into the other equation and solve {What does that mean?}

EQ 1 $y = x + 17$

EQ 2 $y = 4x + 2$

$1x + 17 = 4x + 2$

$-x \quad -x$

$17 = 3x + 2$

$-2 \quad -2$

$15 = 3x$

$\frac{15}{3} = \frac{3x}{3}$

$x = 5$

Step 3: Substitute the solution from step 2 into one of the original equations and solve. {What does that mean?}

$y = x + 17$ $\quad y = 5 + 17 \quad x = 5$

$y = 4x + 2$

$y = 4(5) + 2$

$y = 20 + 2$

$y = 22$

Solution for the system $(5, 22)$

Step 4: Check the Solution

Substitute the solution into both equations.

$y = x + 17$ $(5, 22)$ $y = 4x + 2$

$22 = 5 + 17$

$22 = 22$ ✓

$22 = 4(5) + 2$

$22 = 20 + 2$

$22 = 22$ ✓

Solve with Substitution

$$6x = 30y + 18$$

$$2x + 4y = 20$$

Step 1: Solve one of the equations for one of the variables {What does that mean?}

$$6x = 30y + 18$$

$$2x + 4y = 20$$

Solve for x

$$\frac{6x}{6} = \frac{30y}{6} + \frac{18}{6}$$

$$x = 5y + 3$$

Solve for y

Step 2: Substitute the expression from step 1 into the other equation and solve {What does that mean?}

$x = 5y + 3$

$2x + 4y = 20$

$2(5y+3) + 4y = 20$

$10y + 6 + 4y = 20$

$14y + 6 = 20$

$-6 \quad -6$

$14y = 14$

$y = 1$

Step 3: Substitute the solution from step 2 into one of the original equations and solve. {What does that mean?}

$2x + 4y = 20$

$6x = 30y + 18$

$y = 1$

$6x = 30(1) + 18$

$6x = 30 + 18$

$\frac{6x}{6} = \frac{48}{6}$

$x = 8$

Solution for the system (8,1)

Step 4: Check the Solution

Substitute the solution into both equations.

$$6x = 30y + 18$$

$$2x + 4y = 20$$

$(8, 1)$

$6(8) = 30(1) + 18$

$48 = 30 + 18$

$48 = 48$ ✓

$2(8) + 4(1) = 2$

$16 + 4 = 20$

✓ $20 = 20$

Khan Academy Video

Solve A System by Substitution

https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-systems-topic/cc-8th-systems-with-substitution/v/solving-systems-by-substitution-3

(click on the link, video will load in a minute and open in a separate window.)

Real-Life Application

You buy a total of 50 turkey burgers and veggie burgers for $90. You pay $2 per turkey burger and $1.50 per veggie burger. Write and solve a system of linear equations to find the number x of turkey burgers and the number y of veggie burgers you buy.

x=turkey burgers

y=veggie burgers

The system is:

$$x + y = 50$$ Equation 1

$$2x + 1.5y = 90$$ Equation 2

Solve the System. $x + y = 50$ Equation 1

$2x + 1.5y = 90$ Equation 2

Step 1: Solve Equation 1 for x.

$x + y = 50$

$x = 50 - y$

Step 2: Substitute $50 - y$ for x in Equation 2.

$2x + 1.5y = 90$

$2(50 - y) + 1.5y = 90$

$100 - 2y + 1.5y = 90$

$-0.5y = -10$

$y = 20$

Step 3: Substitute 20 for y in Equation 1 and solve for x.

$x + y = 50$

$x + 20 = 50$

$x = 30$

Step 4:

∴ You buy 30 turkey burgers and 20 veggie burgers.

Homework

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#1-3, 9-11,

14-22 even

and #24

Watch Kahn Academy Video for help while doing your homework.