

SyMan Lesson 1: Solving Linear Equations

SyMan is a computer program designed to help you solve almost any sort of mathematical problem. This particular exercise will help you to learn to use SyMan to solve algebraic equations like " $7x+5 = 38-4x$ " much more easily than if you were using a pencil and paper.

As you follow along with the example below, be sure to read the explanation after each step. These explanations tell you why you are doing each step, and give further helpful advice.

Step 1 Type the equation " $7x+5 = 38-4x$ " and then press the return key. (Don't type the quotation marks around the equation!)

As you type, you'll see everything you type appear in the box in the lower left corner of the screen. If you make a typing mistake, you can erase it by pressing the backspace key located at the top right corner of the keyboard.

Step 2 There are several small buttons in the top left corner of the screen— use the mouse to point the arrow at the one marked "-", then click and release the mouse button.

You are trying to solve the equation by changing it into something like " $x=-4$ " or " $x=7$ ". To do this, you must first get rid of the 5 on the left side of the equation. You may be used to getting rid of the 5 by moving it over to the right and changing the sign; however, with SyMan you must do this by subtracting 5 from both sides of the equation.

Step 3 The computer will ask you what you want to subtract from both sides of the equation— type the number 5 and then press return.

The active equation in the upper right corner of the screen should change from the original " $7x+5 = 38-4x$ " to " $7x+5-5 = 38-4x-5$ ".

Step 4 Use the mouse to point the arrow at the "simp" button located in the top left corner of the screen, then click on this button.

The active equation in the upper right corner should simplify to " $7x = -4x+33$ ", which is the same as what you would end up with if you had just "moved the 5 over." In this case, the " $7x+5-5$ " on the left side simplified to $7x$ because the 5 and the -5 add up to zero.

Step 5 Click on the "+" button in the top left corner of the screen.

The next step is to deal with the $-4x$ on the right side of the equation.

Step 6 The computer will ask you what you want to add to both sides of the equation— type $4x$ and then press return.

To get rid of the $-4x$ on the right side, we will add $4x$. This is basically what you did to get rid of the 5. You are just adding the opposite of each term you want to eliminate, since this forces the terms to add to zero.

Step 7 Click on the "simp" button again.

The active equation in the top right corner should simplify from the previous step of " $7x+4x = -4x+33+4x$ " to " $11x = 33$ ". By adding the opposite, you eliminated the $-4x$ term from the right side.

Step 8 Click on the " \div " button in the top left corner of the screen.

The equation is almost in the form " $x = \dots$ "; all that's left to do is to get rid of the "11" coefficient in front of the x . To do this, just divide both sides by 11.

Step 9 The computer will ask you what you want to divide both sides of the equation by— type the number 11 and then press return.

Step 10 Click on the "simp" button.

The active equation was $\frac{11x}{11} = \frac{33}{11}$. When you simplified, the 11 in the numerator cancelled with the 11 in the denominator on the left, leaving only x. Similarly, the right side became 3 when the computer simplified 33 divided by 11. Finally, the equation became "x=3" and we are finished!

If you had trouble with any part of this example, double-check the instructions to make sure you followed them correctly. If you cannot find your mistake on your own, ask someone near you, or ask your teacher (if he or she is not busy helping someone else at the moment).

If the example worked, answer the following questions:

- 1.) In step 3 of the example, why did you subtract 5 from both sides of the equation?
- 2.) Instead of subtracting 5 from both sides of the equation, what number could you have added and still eliminated the 5 from the left side? (hint: what number, when added to 5, sums to zero?)
- 3.) If our equation were $7x+20 = 38-4x$, what would you have to do to eliminate the 20 from the left side?

- 4.) If our equation were $12x = 60$ after step 8, by what number would you divide?
- 5.) Would you have arrived at the same final answer if you had added $4x$ first, and then subtracted 5? (try it if you are not sure)
- 6.) If you ended up with an equation like " $-x = 5$ ", by what number would you multiply to obtain " $x = -5$ "?
- 7.) Use SyMan to solve for the variable in the following:
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|--------------------|----------------------|
| a) $3x-4 = 11x+20$ | d) $7m+5 = -4m+5$ |
| b) $5x-15 = 2x+6$ | e) $-4q+2 = -q-(-5)$ |
| c) $-y+7 = 3y-9$ | f) $9a-17 = 8a-5$ |
- 8.) Use SyMan to solve the following. The answers are not all integers!
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|-----------------------|--------------------|
| a) $2x-7 = 9+5x$ | d) $12z+5 = 1$ |
| b) $17y+22 = 8y+5-2y$ | e) $6 = 8y+9-y$ |
| c) $-4m+6-m = 3m-2$ | f) $-9+5t-4+t = 0$ |
- 9.) Use SyMan to solve the following. To enter an expression like $\frac{3x-8}{5}$, type $(3x-8)/5$. To solve these problems, you will need to use the "x" button to multiply by the number in the denominator and clear the fraction.
- | | |
|--------------------------|----------------------------|
| a) $x = \frac{3x-8}{5}$ | d) $-3m = \frac{3m+1}{-2}$ |
| b) $y = \frac{-y+2}{2}$ | e) $2p = \frac{-p+8}{5}$ |
| c) $\frac{6z-7}{3} = 4z$ | f) $\frac{4x-4}{4} = 4x$ |

- 10.) There is a faster way to specify the term you wish to add or subtract: point to the term and click the mouse button so that the term is highlighted in black; then, hold down the option key as you click on the "+" or "-" button (this works for multiplying or dividing, too).

Use this shortcut when solving the following equations:

a) $8y-5 = 7y+2$

d) $-7m+4m = 2m-9$

b) $0 = -x+8$

e) $10z+5 = 5z-10$

c) $\text{\f}(3z-4, 7) = 2z$

f) $3x = \text{\f}(8x-5, 6)$

- 11.) In the example, you could have combined several steps into one by adding $4x-5$ right away, instead of separately adding $4x$ and then subtracting 5.

For the following questions, enter a two-termed expression to solve the problem in as few steps as possible:

a) $2x-7 = 19+5x$

d) $2z+5 = -1$

b) $7y+22 = y+5$

e) $16 = 8y+19$

c) $-14m+6 = 3m-2$

f) $-29+5t = 10+t$