Solving Linear Equations: Part 1

Ben Klein

Casio ClassPad 300 & ClassPad Manager Software

Suppose you wanted to solve the two equations $2x + 3y = 5$ and $3x - 5y = 7$ simultaneously, i.e. you wanted to find all pairs (x,y) of values which satisfied both equations. One way to accomplish this is to solve one equation for y in terms of x, substitute into the other equation, solve the resulting equation (in the single variable x) and then go back to determine the corresponding value of y. Here is what this procedure would look like if done with paper and pencil.

1. Solve $2x + 3y = 5$ for y in terms of x: $y = \dfrac{5 - 2x}{3}$.

2. Substitute into the other equation: $3x - 5\left(\dfrac{5 - 2x}{3}\right) = 7$.

3. Solve the resulting equation for x: $\left(3 + \dfrac{10}{3}\right)x - \dfrac{25}{3} = 7 \rightarrow \dfrac{19x}{3} = \dfrac{46}{3} \rightarrow x = \dfrac{46}{19}$.

4. Determine the corresponding value of y: $y = \dfrac{5 - 2x}{3} = \dfrac{5 - 2\left(\frac{46}{19}\right)}{3} = \dfrac{95 - 92}{57} = \dfrac{1}{19}$

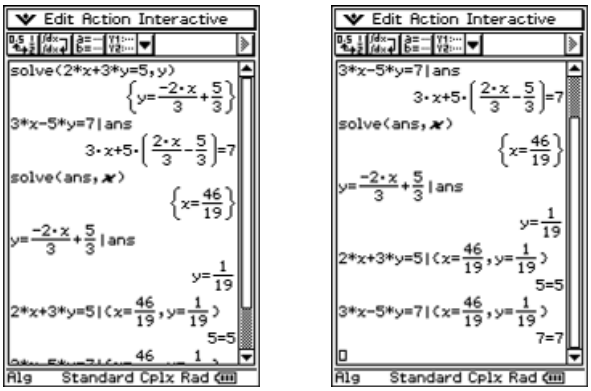
.

Thus, $x = 46/19$ and $y = 1/19$. Of course, we should check our answers to be sure we have not made an error. We see that:

$2x + 3y = 2(46/19) + 3(1/19) = 95/19 = 5$ and $3x - 6y = 3(46/19) - 5(1/19) = 133/19 = 7$

as desired.

Now the ClassPad can do all of the above, including the checking, for you, as seen in the following two overlapping screen captures:

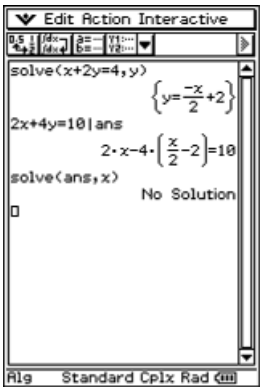


You'll note that we used the with operator (|) repeatedly. It's a very convenient feature. If you are using the ClassPad Manager, you can enter | directly from your computer keyboard or if you are using the ClassPad itself, you can find | in the mth-OPTN keyboard.

What happens if the system of equations has no solutions, as is the case with:

$$x + 2y = 4 \text{ and } 2x + 4y = 10$$

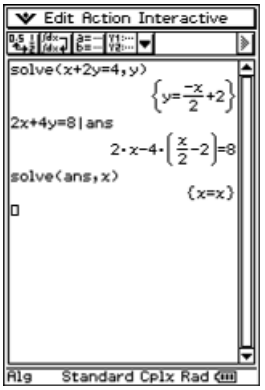
If we apply the method above to this problem, the screen capture at the right shows what the ClassPad gives us, and it is exactly what we want.



Finally, we ask what happens if the system of equations has infinitely many solutions, as is the case with:

$$x + 2y = 4 \text{ and } 2x + 4y = 8$$

If we apply the method above to this problem, the screen capture at the right shows what the ClassPad gives us. The final line tells us that the problem does not have a unique solution.



If all you want is the solution to the system of equations, the ClassPad can also solve the system of equations in just one step, using the powerful features of the solve function. Enter solve ($\{2 \bullet x + 3 \bullet y = 5, 3 \bullet x - 5 \bullet y = 5\},\{x,y\}$) and see what happens.