Using Solver in Excel 2013

The Solver in Excel can perform many of the same functions as EES and MathCAD. It can be used to solve single equations (for example $x^2+3x-22=5$) or multiple equations (for example $x^3-14x=z$, $z^{12}-1=x^2+1$). Solver also has the ability to perform calculations where you are trying to minimize a certain value while solving, such as in linear regression. This paper is a guide to performing basic calculations.

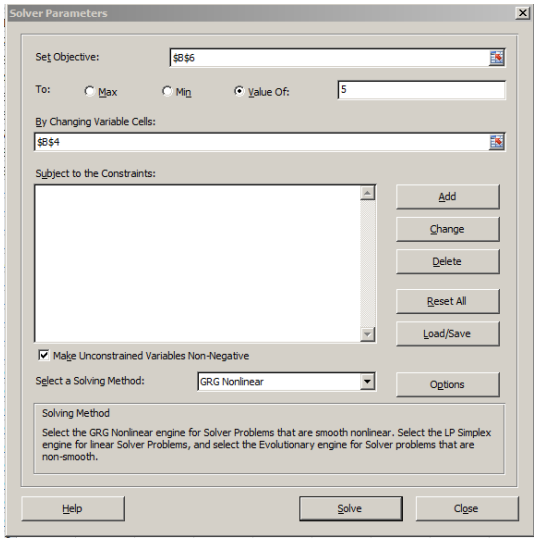
To enable Solver, go to FILE > Options > Add-Ins. Then click Solver and press Go… Check off all of the boxes and press OK. Now, Solver should be under the DATA tab, in the Analyze group.

Solving a Single Equation

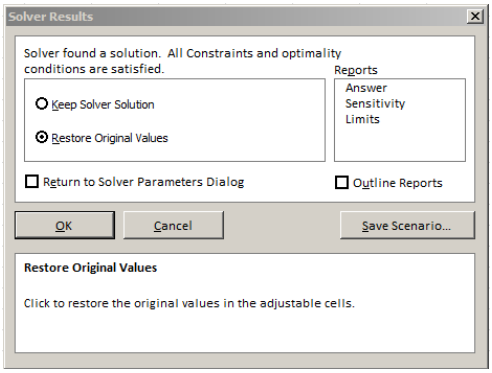
For this example, we are going to solve the sample problem mentioned above of $x^2+3x-22=5$. Enter the variable name with which you are working into a cell. Enter your beginning guess value in the cell directly below the variable name, in this example we began with a guess of 0. In a different cell, enter your formula using the cell reference with the guess as the variable. The formula begins with an equal sign. To reference a cell, click on the cell when it is needed and press **F4** to make the cell address fixed. An example setup is shown below:

	A	B	C	D
2				
3			x	
4			0	
5				
6			=$C$4^2+3*$C$4-22	
7				
8				

We are now ready to run Solver. On the **Data** tab, in the **Analyze** group, click **Solver**. The cell containing the equation you wish to solve should be entered into the **Set Objective** box. In our case, we want the value of the equation set to 5. Therefore, click on the **Value of:** circle and enter 5. The cell containing the guessed value of the variable being solved for needs to be entered in the **By Changing Variable Cells** box.



Now hit the **Solve** button. After pressing Solve, a box resembling the one below should appear:



The Solver Results window will either give a solutions found or will give a No Solution Found report. If it has found solutions it will give you the option to keep it, in which it replaces the value you initially guessed, or to Restore Original Values, in which it keeps the value you initially guessed. In using solver, the value you initially guessed affects the solution if there is more than one solution. This example was a quadratic equation; thus it has two solutions. The solution you should have received was (3.90) for the initial guess being (0). If you enter an initial value of –11, the solver will give the other root of the equation (-6.9).

<u>Solving a Set of Equations with More than One Variable</u>

Using the same methods as above, enter both of the variable names and initial guesses. Enter all of your equations in the format of a formula equal to 0. Using the example equations from the introduction, $x^3-14x=z$, $z^{12}-1=x^2+1$, these should be entered as

$$x^3-14x-z=0 \text{ and } z^{12}-1-x^2-1=0.$$

Since these equations now equal to the same value (0), they can be set equal and the resulting equation can be set to 0.

i.e. $x^3-14x-z= z^{12}-1-x^2-1$

and $x^3-14x-z-(z^{12}-1-x^2-1)=0$.

This final equation is put into solver to find the solution and guesses are made for the initial values of x and z (in this case 0). The examples below are setups of the Excel sheet.

This is an example of the equations.

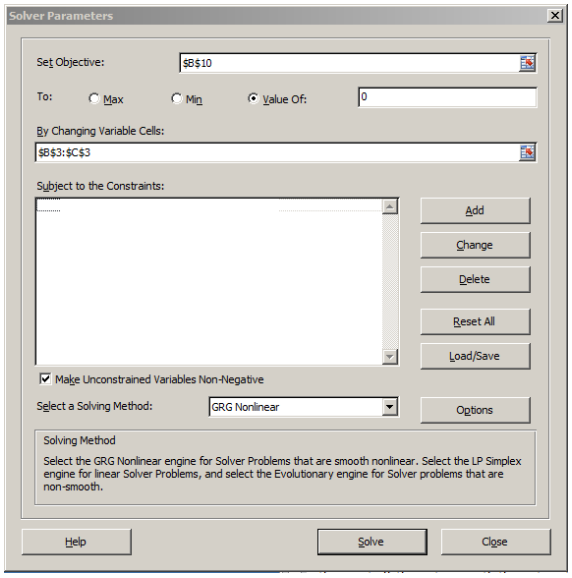
	A	B	C	D	E	F
1						
2		x	z			
3		0	0			
4						
5		=$B$3^3-14*$B$3-$C$3				
6		=$C$3^12-1-$B$3^2-1				
7						
8		=$B$5-$B$6				
9						
10						
11						
12						
13						
14						

This is what your page should look like.

	A	B	C	D	E	F
1						
2		x	z			
3		0	0			
4						
5		0				
6		-2				
7						
8		2				
9						
10						
11						
12						
13						

The Solver can now be run with the final equation entered as the **Objective** and the guessed values of x and z entered in the **By Changing Variable Cells** box.

Example:



After pressing solve, the solver will again tell you if it was able to find solutions and if they met all the criteria with the option to keep the solutions it found or to keep your entered values. The values produced by the solver are still dependent on the initial guess (because Solver uses an iterative algorithm). The answers you will get are (x=0.144, z=0.010), and will make the final equation not equal to zero exactly, but close.