

Not all equations can be solved with algebraic methods, and sometimes we simply do not want to take the time to solve an equation algebraically. Have you ever estimated a solution to an equation by graphing it on your calculator and either using the “zero” or “intersect” functions? Excel has something similar, called Goal Seek. With it, we can type in an equation and a guess at its solution and let Excel “guess and check” until it finds a good estimate of the solution.

How does it work? If we wanted to solve the equation $2x + 7 = 5$, we could make a guess that the correct solution was 0. If we let $x = 0$, and calculated $2x + 7$ we would get 7, which is larger than 5. So we might lower our guess to $x = -2$ and calculate $2x + 7$ again and get 3, which is smaller than 5. Then we might guess $x = -1$, calculate $2x + 7$ yet again, and find that it equals 5 and our goal is achieved. Running Goal Seek in Excel does something similar, but very quickly.

There are several ways you can use Goal Seek, but we will focus on one set up to keep things simple.

Say we want to solve the equation $3x + 7 = 5x - 9$. This is an equation with one variable: x and a left side: $3x + 7$ and a right side: $5x - 9$. You may have already figured out that the correct solution is $x = 8$. Notice that when $x = 8$, both the left side and the right side of the equation are equal to 31, and of course $31 = 31$. This is our definition of a solution to an equation; the solution of an equation is a value for the variable that makes the equation true: the left side is equal to the right side. And when the left side is equal to the right side, the difference between the two sides is equal to zero.

Taking the equation $3x + 7 = 5x - 9$, if we started with a guess that $x = 0$ the left side of the equation would be 7 and the right side would be -9, a difference of 16. If we next guessed that $x = 2$ then the left side would be 13, the right side would be 1 and the difference between the two would now only be 12. The difference is getting smaller. If our next guess were $x = 6$ the left side would be 25, the right 21 and the gap is now down to only 4 and we are closing in on the correct solution.

When we run Goal Seek we will give Excel an initial guess for the variable, enter the left side of the equation in one cell, the right side in another cell and then have one extra cell for the difference between the left and right cell. Then we will run Goal Seek by telling Excel to adjust the value of the variable until the cell with the difference between the left and right is zero. Once that gap is zero, we will have a value of x where the left side is equal to the right side.

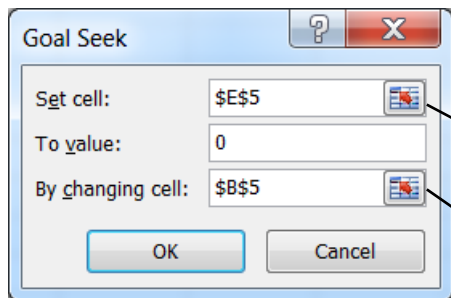
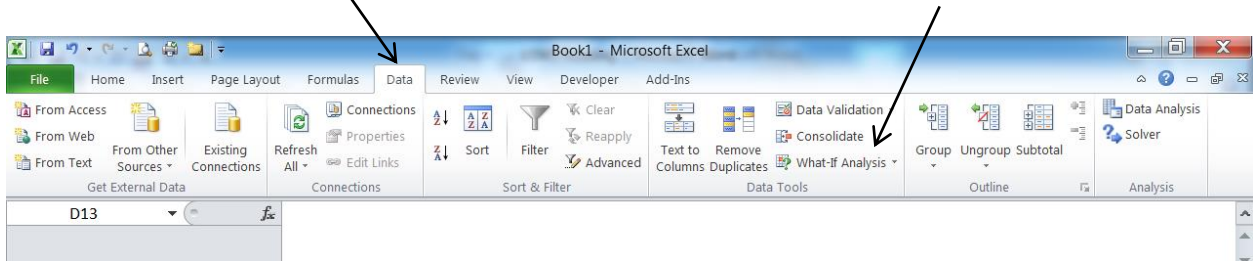
In the setup, first type the equation to be solved in upper left corner, so it is clear what is being solved. Then set up table for x Guess, Left Side, Right Side, Difference. Use shading and borders to keep it nice.

x guess	Left Side	Right Side	Difference

The cell for the x guess is just that, a guess at the solution. It will be a numerical value such as 0, 1, -213. Next, each side of equation will need to be typed in as a formula, replacing the variable with a cell reference to the x guess cell. Last the Difference cell will be the simple formula: =left side – right side.

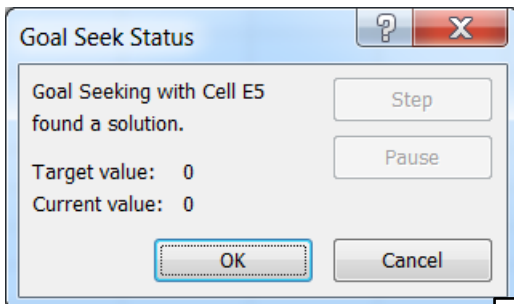
	A	B	C	D	E	F
1						
2		Solve: $3x + 7 = 5x - 9$				
3						
4		x Guess	Left Side	Right Side	Difference	
5		0	=3*B5+7	=5*B5-9	=C5-D5	
6						
7						
8						

To run GoalSeek go to the Data tab, look in the area of Data Tools, What-If Analysis and then GoalSeek.



A menu will pop up and you will enter: set cell = difference cell, to value = 0, by cell = x guess cell

	A	B	C	D	E	F
1						
2		Solve: $3x + 7 = 5x - 9$				
3						
4		x Guess	Left Side	Right Side	Difference	
5		0	7	-9	16	
6						
7						
8						



	A	B	C	D	E	F	G
1							
2		Solve: $3x + 7 = 5x - 9$					
3							
4		x Guess	Left Side	Right Side	Difference		
5		8	31	31	0		
6							
7							
8							

The solution:
 $x = 8$

A couple more thoughts, if an equation has more than one solution, Goal Seek won't look for a second and which solution is found would depend on what guess you started with. One way to deal with this is covered in the video. And also, some equations have no solutions; if this is the case Goal Seek will run awhile and then warn you it may not have found a solution.