Excel Review

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1 Introduction

Try to get solver before the session, but we can go over it also.

Link for mac users: https://www.solver.com/welcome-mac-users-solver-now-included-excel-2011

Link for windows: https://support.microsoft.com/en-us/office/load-the-solver-add-in-in-excel-612926fc-d53
~:text=On%20the%20Tools%20menu%2C%20select,to%20locate%20the%20add%2Din.

2 Finding Max & Min of Functions / Unconstrained Optimization

Last week we went through how to find the maximum and minimum of a function using calculus. Now we'll see how to do it in excel using solver (which we will use in class).

2.1 Example One

Find the x that maximizes $f(x) = x - x^2$.

1.) Use row A as a label for x and $f(x)$ (Figure 1)

	A	B
1	Example's from calc review	
2		
3	Example 1	
4	_x	
5	f(x) = x - x^2	
6		

Figure 1

2.) Type in a random guess for the x and the formula for $f(x)$ in row B.

A helpful trick! Naming cells:
To do this, there is a very helpful excel trick we should utilize. We can name the cell \$B\$4 '_x' so that we can easily write our formula for $f(x)$ in cell \$B\$5.

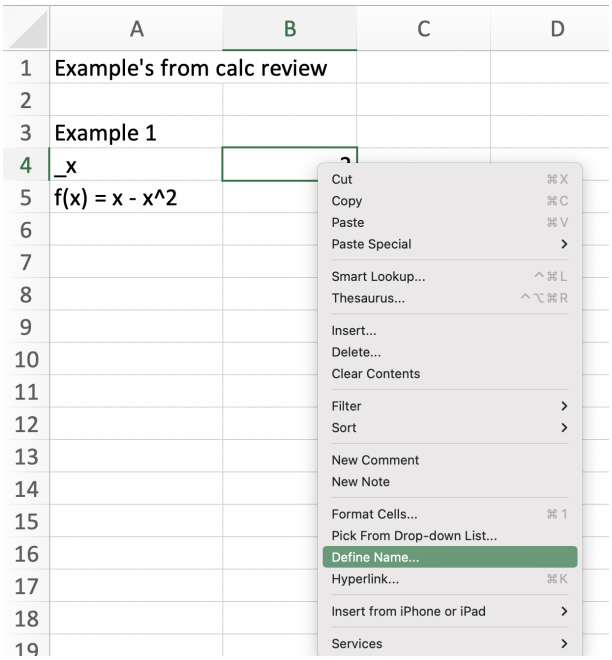


Figure 2

Right click B4 and select "Define Name" (Figure 2).

Then name the cell B4 '_x' so that we can type '_x' in while writing our equation rather than B4. (Figure 3). This doesn't matter as much for a problem this straight forward, but can make debugging big excel problems a lot easier because your equations will be easy to read!

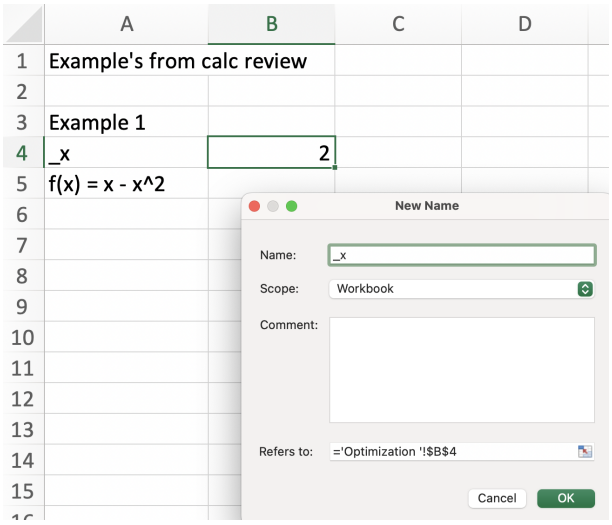


Figure 3

Now, we can type in our equation so that it's easier to read (figure 4).
You can name B5 'f_x' if you'd like.

3.) Use solver to optimize $f(x)$.

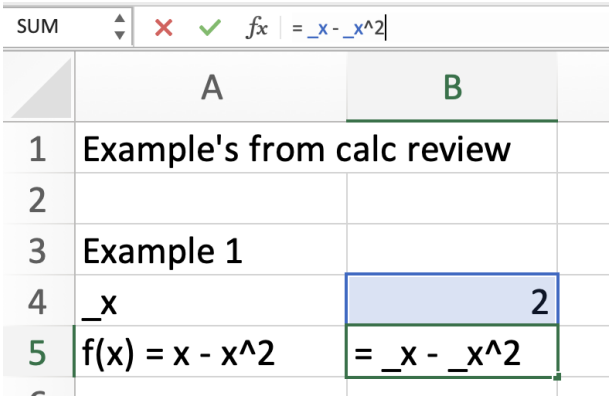


Figure 4

3.1) Click on Data tab
3.1) Click on Solver
3.1) Set the objective cell to be B5 (or 'f_x' if you renamed it), and maximize it by changing B4 (or '_x'). Solve (figure 5)!

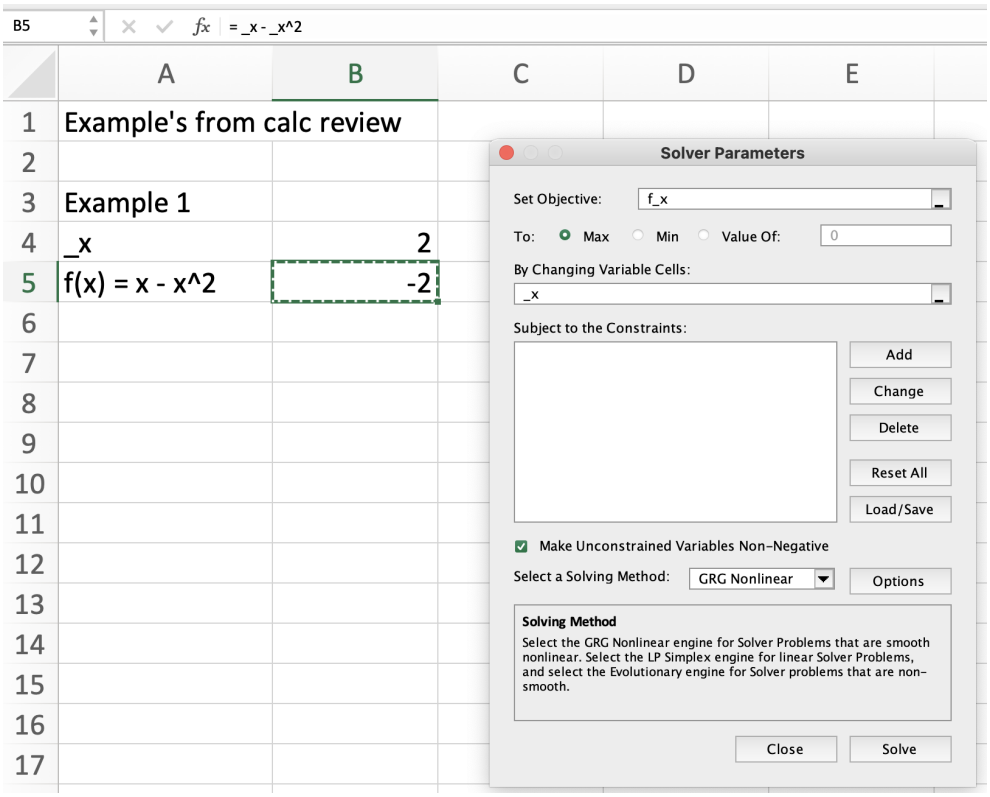
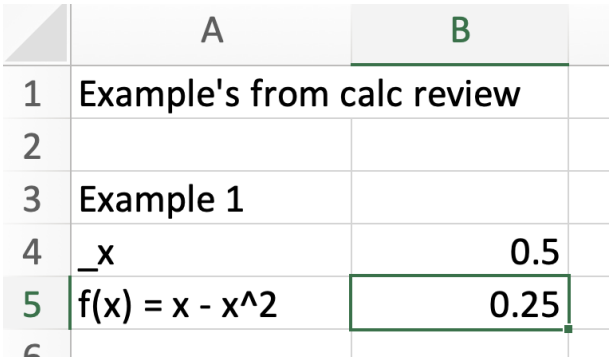


Figure 5

4.) We should get that the x that maximizes $f(x)$ is $x^* = 0.5$ and the max value is $f(x^*) = 0.25$ (check calc review to verify the answer is the same) (figure 6).



	A	B
1	Example's from calc review	
2		
3	Example 1	
4	_x	0.5
5	f(x) = x - x^2	0.25

Figure 6

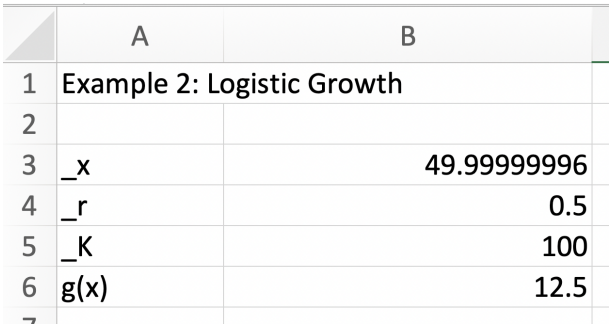
2.2 Example Two: Logistic Growth Equation

Let's consider an example that we saw in the calculus review. Consider the manager who wants to find the population level that leads the fastest growth rate for a population of fish. She knows that the growth rate takes the following form

$$g(x) = rx(1 - \frac{x}{K}).$$

She also know that $r = 1/2$ and $K = 100$.
Steps:

1. Use row A to label r, K, x and $g(x)$
2. In row B, Enter values for r, K, a random guess for x and the equation for $g(x)$
3. Optional: name the cells in in row B
4. Use Solver to maximize $g(x)$ by changing x
5. You should find that the optimal value of $x^* \approx 50$ and $g(x^*) \approx 12.5$



	A	B
1	Example 2: Logistic Growth	
2		
3	_x	49.99999996
4	_r	0.5
5	_K	100
6	g(x)	12.5

Figure 7