

Optimization for the *Awesome* Calculus Student

Okay, so you're a Calculus 1 student. You can do algebra in your sleep. You know the trig functions and know the unit circle like the days of the week. Limits aren't limiting for you and deriving is second nature. Now that you know how to derive using the product, chain, quotient, or power rules and have an understanding of the first and second derivative and what they tell you, it is time for some practical application. You did not think that you were just going to do derivatives and not use them did you? This practical application is called *Optimization*. It is a fundamental, practical use of derivatives that sees daily use throughout the Calculus world. What is it? How does it work? Where do I fit in this calculus world that you speak of? Come along as I show you the marvelous applications oooooooooooooooooooooof...

OPTIMIZATION!!!

Now, before we can begin, let's go over a little background on optimization. Optimization is using derivatives in order to find the largest or smallest value of a function given certain constraints. Constraints could be things like cost or limited resources to work with. The basic structure of an optimization problem is something like this: two functions are employed using given information, substitution and derivatives are employed, and a final solution fitting the given constraints is found and verified to be a functional maximum or minimum.

For example, let me use a simple problem that I came up with entirely on my own (with the help of Paul's Online Math Notes on Optimization).

There is a field that is of needing to be enclosed. There is a total of 500 feet of fencing material at our disposal for this job. Also, there is a building present on one side of the field so no fence needs to go up there. Determine the dimensions of the fence that would enclose the largest area.

Here we are given the task of making a fence. For what purpose? What will this field contain? This is all very pertinent and will be discussed first and foremost because our first step is to...

1. Draw a Picture.