Optimization and how it can be applied

Optimization is a very useful tool that allows us to apply calculus to real world problems in order to maximize (or OPTIMIZE) our resources. If you google the definition for optimize you can see that its definition directly correlates to the end result of its process. Optimize: make the best or most effective use of (a situation, opportunity, or resource). The process is mostly based on your ability to create an equation based on the specific constraints of each given situation.

The best way to begin this is by creating visual representation of your problem. This will allow you to assign proper variables to the missing components of your problem and also provide you both visual and logical insight. Next we must create an equation based on our known and unknown variables and the formula that we must solve for (area, volume, etc). This will require you to use some algebra to relate any unknown variables based on their relationship with the other unknown. Then we can take the derivative of our equation and solve for any critical points to find our minimum and/or maximum.

It is important to keep in mind what numbers are actually possible (in a real domain) based on your given situation. After solving for the critical points we may use our second derivative test and determine whether or not our solutions are maximums or minimums based on their concavity; we can also analyze a graph and/or table to gain a visual understanding of the curve at the given critical points. After solving for our critical points we can then plug those values back into our equation and solve for the unknown variable.

The graph/table analysis was proven to be a necessary procedure during our final in-class optimization exercise. We were told to create a square and a circle given 8 feet of wire. Through calculation we had found an x value of 1.12 as our critical point which would correspond to the length of one side of our square, BUT after analyzing the table from our equation we were able to see that this critical point actually described a minimum area. The maximum area would have been found at x=0 which essentially means not creating a square at all. This highlights the importance of that last step involving the second derivative test (or just explicitly checking whether the extrema is a minimum or maximum).