

Optimization

Introduction

There are an infinite number of examples of optimization in everyday life.

Give at least two examples in your life that you might try to optimize.

In order to optimize, we see that points in which a function is a maximum or a minimum is when the derivative is either zero or undefined. We call the collection of points where the derivative is undefined or zero *critical points*. To solve an optimization problem,□□□

- Read the problem, and try to draw a picture (if relevant).
- Label the picture with everything you know. For those quantities that are unknown, give a variable to represent them.
- Find a relationship using the picture that ties together the pieces of information that you know and what it is you are trying to optimize.
- If the relationship contains more than one variable, look again and try to find another relationship that will allow you to reduce your optimization equation in terms of just one variable.
- Determine the critical points, and find your extreme.
- Use the second derivative test to verify that you indeed found the extreme for which you were looking.

Why do we need to verify that our critical point is indeed the extreme point for which we were looking? To answer this, consider building a fence around a backyard. The person building the fence may have a different perspective on the amount of materials to use than the lumberyard selling the materials, right? In this case, one may wish to maximize and the other minimize! The equation of the perimeter will not change, so you have to be careful to verify that what you found was indeed the extreme for which you were looking.

Activity

This module is a step-by-step walk through of an optimization problem. Read through the calculations, and make sure you understand them all. Find an appropriate corner in your building, and work the same problem. Take your measurements; find the extreme; etc. Once you believe that you have the solution, cut a rod (use a dowel at your local lumberyard) to see whether you are correct!