Math 1371 – Lecture 16

Bryan Mosher

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1 Nuts and bolts

1. Office hours this week: MW 11-12, and anytime Thursday by appointment.

2. The second exam is Thursday, either 5-6 or 6-7.

2 The main point from Lecture 15 on Wednesday

L’Hôpital’s rule applies to limits of functions of the form $\frac{0}{0}$ and $\frac{\infty}{\infty}$ as $x$ tends to either a finite number or infinity.

3 What’s happening today

1. Finding local extrema

2. Optimization (cost functions)

3. Graph sketching and finding local extrema and inflection points based on first and second derivatives
4 Finding local extrema

Example 1. Find all local extrema of $f(x) = |x^2 - 1| + |x^2 - 4|$.

5 Optimization

Example 2. We want to manufacture a rectangular storage container with a square top and bottom that encloses 1000 cubic feet. The material for the sides costs $10 per square foot, and the material for the top and bottom costs $5 per square foot. Find the dimensions of the container that minimize the cost of material to make the container.
6 Graph sketching, etc.

In many problems, we are given information about the sign of the first and second derivatives of a function, and we are asked to either

- sketch a graph of the function, or
- determine the critical points, local extrema, and inflection points.

Near $x = a$, there are a small number of pictures that can arise. Let’s try to categorize all of them so that we will be able to handle any situation...

7 We’ll start with this on Wednesday:

Example 3. We want to manufacture a rectangular storage container with a square top and bottom that encloses 1000 cubic feet. The material for the sides costs $10 per square foot, and the material for the top and bottom is free for the first 200 square feet of material, and then for larger top and bottom they cost $40 per extra square foot of material after 200. Find the dimensions of the container that minimize the cost of material to make the container.