

# Math 1371 – Lecture 16

Bryan Mosher

Monday, October 29, 2007

## 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

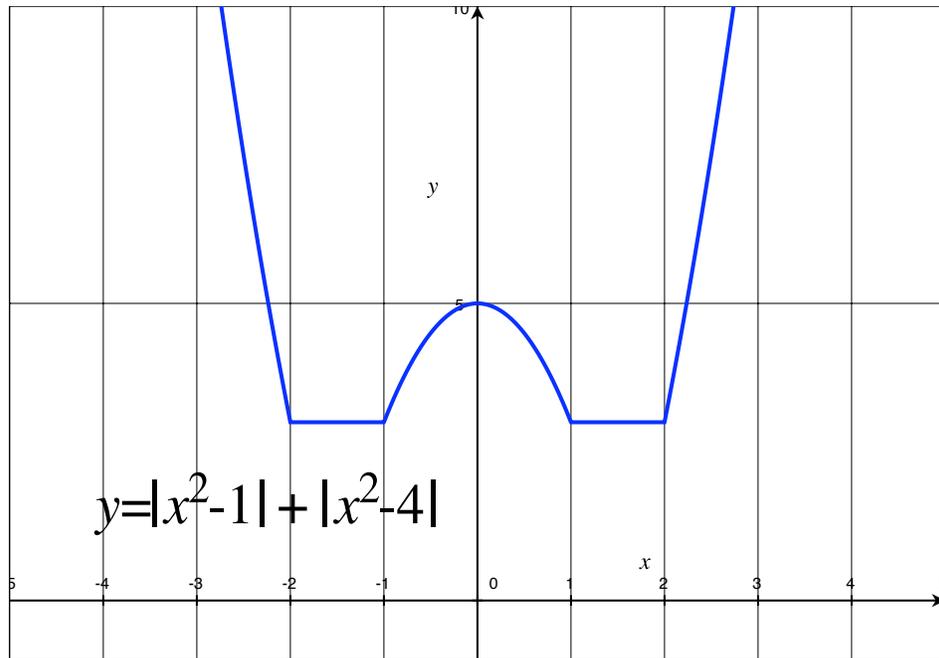
L'Hôpital's rule applies to limits of functions of the form  $\frac{0}{0}$  and  $\frac{\infty}{\infty}$  as  $x$  tends to either a finite number or infinity.

## 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.