Basic Calculus I

Class 22

Monday 10/26/98

Extrema, and Optimization: "putting it all together".

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1. To find **local** minima and maxima:

Step 1. Find all **C**ritical **P**oints.
Step 2. For each **CP** decide if it's a local max or min or neither.

Step 1. To find CPs:
Find all points IN THE DOMAIN OF $f(x)$ where $f'(x)$ is zero or undefined.
Don't forget: at the endpoints $f'(x)$ is automatically undefined. Why?
So, the endpoints—if there are any—are automatically CPs. Why?

Step 2. To determine whether each CP is a local max or min or neither:
For each CP $x = a$,

(i) if $f'(a) = 0$, use the first or the second derivative test, whichever seems quicker.

(ii) if $f'(a)$ is undefined, then the second derivative test will NOT work (why?), so use the first derivative test. (We're assuming that f is continuous at a.)

—The second derivative test:
Good news: it's usually quicker than the first derivative test.
Bad news #1: sometimes we're NOT ALLOWED to use it! (When?)
Bad news #2: if $f''(a)$ turns out to be zero, the test is inconclusive. (What can we do then?)

2. To find **global** minima and maxima:
First find all the local minima and maxima.
Then sketch a graph of $f(x)$, and see if any of the local extrema are global extrema as well.

Example 1.
Find all local and global extrema of $f(x) = \dfrac{1}{x(x-2)}$.

Example 2.
Suppose we want to build a fence for a rectangular garden. On the Western and Eastern sides, we need to use fencing that costs 10 dollars per foot. On the Northern and Southern sides, we need to use fencing that costs 5 dollars per foot. We want to spend only 80 dollars. What is the largest area we can enclose??

ANNOUNCEMENTS

Your Homework for Wednesday, 10/28/98 is to make a list of everything you don't understand or are even a little confused about, and to bring it with yourself to class.
And don't forget: NO QUESTION IS TOO STUPID TO ASK!

Second midterm: Thursday 10/29, in Lab.