Calculus 1 — Outline for Exam 3

Main ideas

A. *Related rates* word problems

B. Using derivatives to find absolute extrema of a function on an interval

C. Using derivatives to find intervals of increasing/decreasing, local extrema, concavity, inflection points

D. L'Hôpital's rule

E. Mean Value Theorem

Skills you should have

1. Be able to solve related rates problems
   - **(a)** Pay close attention to what is constant with respect to time and what is not
   - **(b)** Make sure to practice finding relating equations, e.g. Pythagorean Theorem, similar triangles, area formulas, trig. formulas, etc. (I will give you volume formulas if you need them.)

2. Be able to find the absolute maximum and minimum of a function on a closed interval
   - **(a)** Find the critical numbers and endpoints—then test in original function

3. Be able to use the first and second derivatives of a function f to understand the behavior of f
   - **(a)** Connection between f' positive/negative and f increasing/decreasing
   - **(b)** Connection between f'' positive/negative and f concave up/down
   - **(c)** Be able to determine when critical numbers are local maximums, local minimums, or neither
   - **(d)** Be able to find inflections points
   - **(e)** Be able to use all of this information (and intercepts, asymptotes,...) to sketch graphs

4. Be able to use L'Hôpital's rule to compute limits
   - **(a)** The rule only applies to limits of the form $\frac{0}{0}$ or $\frac{\infty}{\infty}$
   - **(b)** Know how to deal with limits of the form $0 \cdot \infty$ by "flipping something over"
   - **(c)** Know how to deal with limits of the form $\infty - \infty$ (often by finding a common denominator)
   - **(d)** Know how to deal with limits of the form 0^∞, 1^∞, 0^0, and ∞^0 using logarithms

5. Understand the Mean Value Theorem (and Rolle's Theorem), see Section 4.2
   - **(a)** Be able to state the Mean Value Theorem
   - **(b)** Have a working understanding of the Mean Value Theorem

How to study

I. Review core topics

II. Work *lots* of problems all of the way through—focus on WebAssign problems and Group Work problems

III. Practice doing several problems in a short amount of time (by timing yourself)

IV. Come talk with me if you have any questions