# 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

## 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 $f$ on a closed interval

   **(a)** Find the critical numbers and endpoints—then test in the original function $f$

**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 $0^\infty$, $1^\infty$, $0^0$, and $\infty^0$ using logarithms

## How to study

**I.** Review core topics

**II.** Work *lots* of problems all of the way through—focus on WeBWorK problems and Worksheet 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