The final exam for this course is on Thursday, December 16, from 8:30 to 11:30 AM. It will be held in our regular classroom. You can expect the exam to be about seven pages long. Most people will probably be able to complete it in two hours or less.

The exam will cover the entire course, with some extra emphasis on material that was covered since the third test. The questions on the exam will be similar to those on the tests, although some of them might be longer than would be possible on a one-hour test. You should review the information sheets for the three in-class tests. You can find copies of them on the course web page: http://math.hws.edu/eck/math130

As usual, a calculator and scrap paper will be provided to you; you only need to bring a pencil. You will also be given a **formula sheet** with formulas for the derivatives of common functions, including trigonometric, inverse trigonometric, logarithmic, and exponentiation functions. It will **not** have the basic rules such as the product, quotient, or chain rules. The sheet will also include any needed rules for complicated indefinite integrals that don't follow immediately from the derivative rules. (For example, you don't need a rule for the indefinite integral of $\sin(x)$, since it follows easily from the derivative rule for $\cos(x)$.)

I will have office hours from 11:00 to 12:00 and 1:30 to 3:00 on Monday, December 13, during Reading Period. I will also have office hours from 11:00 to 3:00 on Wednesday, December 15, the day before the exam. I can also be available for appointments at other times, if necessary.

The math intern will continue to hold hours until the afternoon of the first day of exams. The times are as follows: Sunday, December 12, 3:00 to 5:30 and 6:30 to 10:30 PM; Monday, December 13, 3:00 to 5:30 and 6:30 to 10:30 PM; and Tuesday, December 14, 3:00 to 5:30 PM.

Some terms and ideas covered since the third test (Sections 4.4, 4.6, 4.7, 4.8):

max/min problems ("Optimization problems")

using *constraint equations* in max/min problems

the Mean Value Theorem

if $f'(x) = 0$ on an interval I, then f is constant on I

if $f'(x) = g'(x)$ on an interval I, then f and g differ by a constant on I

if $f'(x) > 0$ on an interval I, then f is increasing on I

L'Hôpital's Rules for finding limits

indeterminate forms

the basic indeterminate forms for L'Hôpital's rule: $\frac{0}{0}$ and $\frac{\infty}{\infty}$

other indeterminate forms and how to handle them: $0 \cdot \infty$, $\infty - \infty$

growth rates of functions; what it means to say "$f(x)$ grows faster than $g(x)$ as $x \to \infty$"

antiderivatives

the family of antiderivatives, $F(x) + C$, of a function $f(x)$ on an interval I

indefinite integrals

verifying that an indefinite integral formula is correct by taking a derivative

simple differential equations and initial value problems

Some important named theorems that you should know:

Squeeze Theorem. Suppose f, g, and h are functions that are defined on an open interval containing a, except possibly at a itself. Suppose that $f(x) \le g(x) \le h(x)$ for x near a, and that $\lim_{x\to a} f(x) = \lim_{x\to a} g(x)$, then $\lim_{x\to a} g(x)$ exists and is equal to $\lim_{x\to a} f(x)$ (and to $\lim_{x\to a} g(x)$).

Extreme Value Theorem. If f is a continuous function on a closed interval $[a, b]$, then f has an absolute maximum and an absolute minimum on that interval. (These extreme values can occur only at critical points in the interval and at the endpoints of the interval.)

Intermediate Value Theorem. If f is a continuous function on a closed interval $[a, b]$ and if M is some number between $f(a)$ and $f(b)$, then there is at least one c in $[a, b]$ such that $f(c) = M$.

Mean Value Theorem. If a function f is continuous on the closed interval $[a, b]$ and is differentiable on the open interval (a, b), then there is at least one c in (a, b) such that $f'(c) = \frac{f(b)-f(a)}{b-a}$.

Some of the salient terms and ideas from earlier in the course:

interval (of real numbers); open and closed interval

the problem of defining velocity at an instant of time and how limits solve this problem

average velocity and instantaneous velocity

secant lines and tangent lines

limits; meaning of $\lim_{x\to a} f(x)$; one-sided limits, from the left or right

infinite limits and vertical asymptotes; the meaning of $\lim_{x\to a} f(x) = \infty$, $\lim_{x\to a^+} f(x) = -\infty$, etc

limits at infinity and horizontal asymptotes; the meaning of $\lim_{x\to\infty} f(x)$ and $\lim_{x\to-\infty} f(x)$

finding asymptotes of rational functions

continuity; definition in terms of limits

formal definition of derivative: $f'(x) = \lim_{h\to 0} \dfrac{f(x+h) - f(x)}{h}$, or $f'(a) = \lim_{x\to a} \dfrac{f(x) - f(a)}{x - a}$

what the formal definition of derivative means

if a function is differentiable at a, then it is continuous at a

second derivatives, third derivatives, fourth derivatives, etc.

various notations for derivatives

position, velocity, and acceleration

mathematical models, such as models of population growth

implicit functions and implicit differentiation

related rates problems

extreme values; local maxima and minima; absolute maxima and minima

critical points

First Derivative Test and Second Derivative Test

graphing (asymptotes, increasing/decreasing, concavity, max's and min's, inflection points)

reading information from graphs (about limits, continuity, differentiability)