Math 130-04, Fall 2010 — Third Test Info

The third test for this course will be given in class on Friday, November 19. The test will cover Sections 3.7 through 4.3.

You will not need a calculator for the test. *A basic non-graphing calculator will be provided to you, and you will be permitted to use only the calculator that is provided. Scrap paper will also be provided. All you need is a pencil (or pen).*

In addition to my usual office hours this week, I will be available in my office on Thursday from 10:00 to 11:00 AM and from 1:30 to 4:00 PM.

Derivative Rules

You should know the basic rules for differentiation: the constant multiple rule, the sum and difference rules, the quotient rule, the product rule, and the chain rule. You should also be able to use implicit differentiation and logarithmic differentiation. You do not need to know the derivative of every basic function, but you should have memorized the following rules:

$$\frac{d}{dx}x^k = kx^{k-1} \text{ for a } \textbf{constant } k \qquad \frac{d}{dx}e^x = e^x$$

$$\frac{d}{dx}b^x = \ln(b)\,b^x, \text{ for a } \textbf{constant } b \qquad \frac{d}{dx}\tan(x) = \sec^2(x)$$

$$\frac{d}{dx}\sin(x) = \cos(x) \qquad \frac{d}{dx}\cos(x) = -\sin(x)$$

$$\frac{d}{dx}\ln(x) = \frac{1}{x} \qquad \frac{d}{dx}\ln(|x|) = \frac{1}{x}$$

$$\frac{d}{dx}\sin^{-1}(x) = \frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}\tan^{-1}(x) = \frac{1}{x^2+1}$$

Here are some terms and ideas that you should be familiar with for the test:

implicit function

implicit differentiation

finding the slope of a tangent line using implicit differentiation

using implicit differentiation of $y^n = x$ to prove that $\dfrac{d}{dx}\,x^{\frac{1}{n}} = \frac{1}{n}\,x^{\frac{1}{n}-1}$

normal lines [exercises 59–64 in Section 3.7]

using implicit differentiation of $e^y = x$ to prove that $\dfrac{d}{dx}\ln(x) = \dfrac{1}{x}$

logarithmic differentiation

finding derivatives of functions of the form $f(x)^{g(x)}$, such as x^x or $\sin(x)^{x^2+1}$

the inverse trigonometric functions $\sin^{-1}(x)$ and $\tan^{-1}(x)$ and their domains and ranges

related rates problems

finding rate relationships by differentiating a formula with respect to t

extreme values (extrema); minima and maxima

absolute minimum; absolute maximum

local minimum; local maximum

if f has a local minimum or maximum at $x = c$, and if $f'(c)$ exists, then $f'(c) = 0$

critical points

local minima and maxima can occur only at critical points

absolute minima and maxima can occur only at critical points and endpoints

Extreme Value Theorem:
A continuous function on a closed interval has an absolute minimum
and an absolute maximum on that interval.

increasing function on an interval; decreasing function on an interval

if $f'(x)$ exists for all x in an interval I and $f'(x) > 0$ for all x in I,
then f is increasing on I

if $f'(x)$ exists for all x in an interval I and $f'(x) < 0$ for all x in I,
then f is decreasing on I

concavity; concave up; concave down

inflection point

if $f''(x)$ exists for all x in an interval I and $f''(x) > 0$ for all x in I,
then f is concave up on I

if $f''(x)$ exists for all x in an interval I and $f''(x) < 0$ for all x in I,
then f is concave down on I

First Derivative Test

Second Derivative Test

techniques for graphing functions

- vertical asymptotes, horizontal asymptotes, and end behavior
- intercepts and other values of the function and its derivatives
- the first derivative, increasing/decreasing, and local maxima and minima
- the second derivative, concave up/down, and inflection points
- special features: cusps, corners, vertical tangent lines, slant asymptotes