Review Guide/Sample Problems for Midterm.

Given Nov 04.

Objectives: The midterm will be held at Nov 06 10:10-12:00 AM. Extension possible subject to room availability. It will be a closed-book exam, no calculators allowed. Be sure to arrive on time. No further extension is allowed for late comers. The purpose of this handout is to give you a clear idea what I want you to learn for this exam. You should use it as a checklist of what you need to prepare for the midterm. You shoukd ask yourself, item by item on the list, the following questions:

What is it?

How do I compute it (or apply it)?

What are the assumptions/restrictions?

You may want to practice to improve your speed as well.

The midterm will count 30% of your final grade.

Coverage: Chapter 2, 3, 4, 6(partially).

Limits and Continuity: Formal definition of limits and continuity (the ϵ - δ business).

l'Hospital's Rule.

Intermediate Value Theorem.

Differentiation: (IMPORTANT) Derivative of combinations of elementary functions, including polynomials, trigonometric functions and their inverse, exponential and logarithm, hyperbolic functions and their inverse, etc.

Implicit differentiations.

Application of Derivatives: Graphing.

Optimization.

Misllaneous: Newton's method.

Tangent lines and normal lines.

Linearization and differentials.

Relative rate of growth, big "O" and small "o".

Removable discontinuity.

Advance problems (10-20%): To prepare for this part of the exam, it would help to read the statements of the Theorems carefully, paying attention to the assumption of the Theorems and try to give counter examples when the assumptions are violated.

Sample Problems:

(1): State the Sandwich Theorem and prove it using the ϵ - δ arguments.

(2): Find the limits of the following expressions, distinguish between the cases when the limit is ∞ or $-\infty$ and the limit does not exist.

(a): $\lim_{x\to\infty}(\frac{3}{x^2} - \sin\frac{1}{x})(1 + \cos\frac{1}{x})$

(b): $\lim_{x\to\infty}(x - x^2 \ln(1 + \frac{1}{x}))$

(3): Graph $y = \frac{3}{4}(x^2 - 1)^{2/3}$ over the interval $|x| \leq 2$, indicate critical points and inflection points, and determine whether the critical points are local extremums.

(4): Find dy/dx for the following functions:

(a): $y = \frac{\sin^2 x}{\sin x^2}$

(b): $y = e^x + e^{e^x} + e^{e^{e^x}}$

(5): Solve for $\frac{d^2y}{dx^2} = -g$ with $y(0) = 0$, $y'(0) = 1$ and find the global maximum of $y(t)$ for $t \geq 0$. What is the interpretation of this differential equation in terms of acceleration?

(6): Prove that $\sinh x = 1 - x$ has exactly one root and write down the Newton's formula for solving it. (the numerical answer is not required)