Review Guide/Sample Problems for Final.

Given Dec 7.

Objectives: The midterm will be given at Dec 15 8:00-9:50 AM, closed book, no calculators allowed. The timing is strict, no extensions for late comers.

The purpose of this handout is to give you a clear idea what I am going to examine you. The sample problem is a typical 1 hour closed-book exam covering some of the topics for the midterm. The actual midterm is about 10-12 problems. You should use it as a checklist of what you need to prepare for the midterm. You may want to practice to improve your speed as well. The midterm will count 25-30% of your final grade.

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

Limits and Continuity: Finding limits of elementary expressions.

l'Hospital's Rule.

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

Differentiation: 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.

Elementary differential equation ('Elementary' means those that I have taught you in class).

Tangent lines and normals.

Linearization and differentials.

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

Removable singularity.

Advance problems: 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. A careful review of the Homework assigned by myself would also help.

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)