Newberger Math Analysis 361A Fall 03
Final Exam Review

This exam covers material from Sections 2.2, 2.3, 3.1-3.5, 3.7, 4.1, 5.1, 5.4, 6.1. Approximately 30% of the final will be comprised of material covered after Exam 3, the rest will be cumulative over the sections listed above.

Non-cumulative part: 30%

(1) You should know all of the vocabulary below. You **will be asked** to give precise mathematical statements for the vocabulary that appears in boldface type below.
   - **Uniformly continuous** (Definition 5.4.1 page 137).
   - Lipschitz (Definition 5.4.4 page 138).
   - **Differentiable**.

(2) You should be familiar with all of the following theorems. The proofs provide examples on which you can base your own proofs, and you may call on these theorems in your arguments.
   - Uniform Continuity Theorem 5.4.3 page 138.
   - Nonuniform Continuity Criteria 5.4.2 page 138.
   - Lipschitz implies uniformly continuous 5.4.5 page 139.
   - Theorem 5.4.7 (uniformly continuous image of a Cauchy sequence is Cauchy) page 140.
   - Theorem 6.1.2 (differentiable implies continuous) page 159.
   - Theorem 6.1.3 (differentiation laws) page 159.
   - Caratheodory's Theorem 6.1.5 page 161.
   - Chain Rule 6.1.6 page 162.

(3) **About the exam:**
   - You may be asked to prove a given function is uniformly continuous or is not uniformly continuous on a given set.
   - You may be asked to prove a given function is or is not differentiable.
   - You may prove a relationship between derivatives of functions (like in Theorem 6.1.3).

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Cumulative part: 70% You should be familiar with all of the vocabulary and theorems listed on the review sheets for Exams 2 and 3 and those from Exam 1 from Sections 2.2 and 2.3. I will not ask you to state the definitions of the vocabulary from these exams, but you will need to know those definitions so that you can use them in your proofs.

About the cumulative part of the exam:

Types of problems:

(1) *Computing with given examples.* You will be asked to check that particular examples satisfy given definitions. For example, you may be asked to prove that a given function is continuous or uniformly continuous, or for that matter, discontinuous.

(2) *Creating examples.* You will be asked to give examples that show given statements are false. This means giving examples that satisfy the hypotheses of the statement but do not satisfy the conclusion.

(3) *Proving abstract statements.* You will be asked to prove statements using the vocabulary in the course. Tip: Begin your proof by writing down what you want to prove and explaining how you will go about proving it.

Content:

(1) You will be asked about sequences. You may be asked to prove a sequence converges or does not converge. You may be asked to prove a sequence is Cauchy or is not Cauchy. You may be asked to prove a statement that has the convergence of a sequence in the assumptions. Know the relationships between the related vocabulary: convergence, monotone, bounded, Cauchy.

(2) You will be asked about series. Be able to use the n^{th}-term test, the Comparison Test, the Limit Comparison Test. Know the convergence properties of the p-series and the geometric series. Know the relationship between related vocabulary: partial sums, convergence, divergence.

(3) You will be asked about limits of functions and continuity. You may be asked to prove a function does or does not have a limit at a given point. You may be asked to prove a statement that has the existence of a limit in the assumptions. Know the relationships between the related vocabulary: sequential criterion, continuous, uniformly continuous, derivative.