Math 431 - Real Analysis I
Final Review Sheet

Logistics: Our test will occur on Wednesday, December 12. It will be a 120 minute, no notes, no calculator test. Please bring blank paper on which you will write your solutions.

The successful test-taker will have mastered the following concepts.

Uniform Continuity

- Use the $\varepsilon - \delta$ definition to show that a function is uniformly continuous on a given set.
- Understand how you can combine uniformly continuous functions to create new uniformly continuous functions (like scaling a uniformly continuous function, adding uniformly continuous functions, etc).
- Understand why any uniformly continuous function on A is also continuous on A.
- Use the fact that a continuous function on a compact set A is uniformly continuous on A.

Definition of the Derivative

- Use the definition of the derivative to compute the derivative of a function
- Prove a function is or is not differentiable at a point or on a set
- Understand the relationship between continuity and differentiability

Mean Value Theorem

- Understand the importance of the various hypotheses in the Mean Value Theorem
- Use the Mean Value Theorem to prove statements about derivatives
- Verify that the Mean Value Theorem is true for various specific examples of functions and intervals

Series

- Understand the definition of convergence and divergence of a series
- Use the definition of convergence (with partial sums) to prove that a series does or does not converge
- Understand how the Cauchy condition is equivalent to the convergence of a series
- Know how to use the Divergence Theorem to prove that a series divergs

Comparison Tests

- Understand the Comparison Theorem (and Generalized Comparison Theorem) and how to use it to prove that certain series converge or diverge
- Understand how to prove the Limit Comparison Test using the Comparison Test
- Use the Comparison Test and known convergent/divergent series to quickly show a series converges/diverges.

Integral Tests

- Use the Alternating Series Test to prove that a series converges

- Use the Integral Test to prove that a series converges/diverges
- Use the p-series Test to prove that a series converges/diverges
- Use the Ratio Test to prove that a series converges/diverges
- Use the Root Test to prove that a series converges/diverges

Absolute and Conditional Convergence

- Provide examples of absolute and conditionally convergent series
- Understand the relationship between convergence, absolute convergence, conditional convergence, and divergence.