Midterm 2 Conceptual Review

Math 500: Intermediate Analysis, Spring 2017

- The exam will focus on **Chapters 3 and 4**, and **Section 5.1**, in our text.
- You may use both sides of a 3" x 5" **note card** (or paper) during the exam (but **no calculator**).
- You are **highly encouraged** to come to the instructor with questions! Look for **office hours** posted on the course website. If you can't make them, feel free to **make an appointment**.

- **Continuity** (§§3.1 – 3.2)
  - **Concepts**: continuity of a function at a point in its domain, continuity of a function on a domain, characterization of continuity in terms of sequences; Intermediate Value Theorem (IVT)
  - **Goals**: identify the natural domain of a function (or composition of functions); decide whether a given function is continuous at a point/for all point in its domain, and prove it; prove statements about continuous functions using the definition of continuity; apply the IVT
  - **Homework problems**: §3.1: #1, 3, 4, 8, 9; §3.2: #1, 4, 7, 9, 11
  - **Additional practice problems**: §3.1: #5, 11; §3.2: #5, 8, 10
- **Uniform continuity** (§3.3)
  - **Concepts**: uniform continuity of a function on a domain
  - **Goals**: decide whether a function is uniformly continuous on a domain, and prove it, using either the definition, or by applying a theorem
  - **Homework problems**: §3.3: 1 - 5
  - **Additional practice problems**: §3.3: #8
- **Uniform convergence** (§3.4)
  - **Concepts**: (pointwise) convergence of a sequence of functions on a domain to a limit function, uniform convergence of a sequence of functions on a domain to its limit function
  - **Goals**: determine whether a sequence of functions on a domain has a (pointwise) limit function, and if so, decide whether this sequence converges uniformly to the limit function, using the definition or by applying theorems
  - **Homework problems**: §3.4: #1, 2, 4, 5
  - **Additional practice problems**: §3.4: #3
- **Limits of functions** (§4.1)
  - **Concepts**: the limit of a function as its input approaches a value in an open interval, one-sided limits, infinite limits
  - **Goals**: Use the definition, or limit theorems, to find the limit of a function (including one-sided and infinite)
  - **Homework problems**: §4.1: #1, 3, 6, 8, 14
  - **Additional practice problems**: §4.1: #4, 5, 9, 12
- **The derivative** (§4.2)
  - **Concepts**: the derivative of a function at a point in an open interval subset of its domain, the derivative function, differentiability, derivative rules, the derivative of an inverse function
  - **Goals**: compute the derivative at a point, compute the derivative function, decide whether a function is differentiable, compute the derivative of the inverse of a function
  - **Homework problems**: §4.2: #1, 2, 7, 11, 12
  - **Additional practice problems**: §4.2: #8

- **The Mean Value Theorem** (§4.3)
  - **Concepts**: critical points, the Mean Value Theorem (MVT), monotone functions
  - **Goals**: find minima and maxima, decide where functions are increasing and decreasing, apply the MVT
  - **Homework problems**: §4.3: #1, 2, 7, 8
  - **Additional practice problems**: §4.3: #3, 6
- **L'Hôpital's Rule** (§4.4)
  - **Concepts**: Cauchy's Mean Value Theorem, L'Hôpital's Rule
  - **Goals**: find limits using L'Hôpital's Rule, including limits that are not necessarily expressed as quotients of functions
  - **Homework problems**: §4.4: #1, 6, 7, 11, 13
  - **Additional practice problems**: §4.4: #8, 9, 10, 12
- **The integral** (§5.1)
  - **Concepts**: partition, refinement of a partitiion, Riemann sum, upper sum, lower sum, upper integral, lower integral, Riemann integral
  - **Goals**: Calculate Riemann sum corresponding to a partition, calculate upper sum and lower sum, show that limit of the difference between the upper and lower sums equals zero, calculate the Riemann integral as a limit of a Riemann sum
  - **Homework problems**: §5.1: #1 - 5, 8
  - **Additional practice problems**: §5.1: #6, 9