Study suggestions for Midterm 1

September 25, 2009

All exam questions will be free response (no true/false, no multiple choice, etc.). Some of the questions will just ask you to compute things, others might ask you to give an example, to apply a theorem, etc. This is what I expect you to be able to do:

Know the definitions: To “know a definition” means that you can state it precisely, give an example of something that satisfies it, give an example of something that fails to satisfy it, and justify that your examples are correct. You should remember the following definitions: function, domain, range, injective, inverse function, the epsilon-delta definition for finite limits, horizontal asymptote, vertical asymptote, $f$ is continuous at a point, $f$ is continuous on an interval, $f$ is differentiable at a point/on an interval, the derivative of a function at a point.

Know the theorems: To “know a theorem” means that you can state it precisely, that you understand which parts of the theorem are the premises and which are the conclusion, that you can show an example in which the theorem applies, and that you can give examples to show why each of the premises is necessary to make the theorem true. I will not ask you to prove these theorems in the midterm.

- the limit laws theorem
- $f(x) \leq g(x)$ and the two limits for $x \to a$ exist $\Rightarrow \lim_{x \to a} f(x) \leq \lim_{x \to a} g(x)$
- Squeeze theorem
- which functions are continuous (where?)
- Intermediate Value theorem

Functions: Know when a graph represents the graph of a function, determine domain and range, graph functions using facts about translation, stretching and reflection, find the composition of two function and other combination of functions (sum, product,...), find the inverse of a function or explain why it doesn’t exist, remember the graphs of the basic functions we reviewed in class (linear functions, $x^n$, $\frac{1}{x}$, $\sqrt{x}$, exponential, logarithm, trig functions and inverse trig functions)
Limits:

- Compute limits: “plug in” (and when is it allowed), simplify, “rationalize”, limit laws, know how to deal with absolute value, squeeze theorem, remember which functions are continuous

- Compute limits at infinity: factor out $x^n$, know the basic limits e.g. $\frac{1}{x^n}$, $e^x$, etc.

- Compute infinite limits: know the basic limits we spoke about e.g. polynomials $\frac{1}{x^n}$, $n^{th}$ square root, log

- Be able to recognize when something does not have a limit (e.g. when the left and right hand limits do not coincide, or when the function oscillates indefinitely)

- Use the $\varepsilon – \delta$ definition to prove that a linear function has a given limit

- Determine whether a given function is continuous, show that a function is continuous at a point

- Use the Intermediate Value theorem to find a root of a function