Final Exam Review Topics

April 16, 2010

The final exam will be cumulative, but heavily weighted on the material that we have covered in the last third of the course (i.e., the integral calculus). There will be between six and seven problems on the exam, with multiple parts. Each of the three themes below will be represented by a problem:

1. **Integration techniques.** Can you: compute a definite or indefinite integral? use substitution to compute an integral? utilize symmetry or other properties of the integrand to make integration possible? interpret the integral of a rate of change? find the average value of a function?

2. **Area.** Can you: find the net/total area between a curve and the $x$-axis? find the area between two curves? relate the area under a graph of a function to the function?

3. **Volume.** Can you: find the volume of a solid of revolution about the $x$ or $y$ axis? find the volume of a solid that is not obtained from revolution? know when to use the washer or cylindrical shells method?

One of the most important concepts in this final part of the course is the

**Fundamental Theorem of Calculus.**

You should be able to state the theorem, understand what it says, explain why all hypotheses are necessary, and apply it. It will either be tested directly (i.e in a problem separate from the three above) or incorporated into one of those problems. From the beginning 2/3 of the class, each of the three
groupings below will be represented by a problem:

1. **Limits and Continuity.**
   
   - Continuity: definition, properties of continuous functions, which functions are/are not continuous.
   - Intermediate Value Theorem.

2. **The Derivative**
   
   - the limit definition of the derivative and the geometric interpretation of the derivative.
   - Derivative techniques: derivatives of polynomials, exponential functions, logarithmic functions, trig functions, hyperbolic functions, inverse trig functions, inverse hyperbolic functions, chain rule, product rule, quotient rule, sum rule, constant multiple rule, logarithmic differentiation, implicit differentiation.
   - Applications: related rates, optimization.
   - Rolle’s Theorem, Mean Value Theorem.

3. **Functions and Graphing.**
   
   - General shape of: $y = x^n$, trig functions, exponential and logarithmic functions.
   - Properties: symmetry, continuity, differentiability.
   - Domain and range.
   - Fermat’s theorem.
   - Extreme Value theorem.
   - Finding: horizontal/vertical/slant asymptotes, zeros of a function, local/global max/mins, points of discontinuity, points of nondifferentiability.
   - Differentiability implies continuity, but not the other way around.