What you need to know for Exam 2

The exam (in class, Friday, October 28) will cover Sections 2.2–2.6, 2.8, and 3.1. The exam will not explicitly cover material from Chapter 1 or Section 2.1. (For example, there will be no limit problems.) The following is a list of most of the topics covered. **THIS IS NOT A COMPREHENSIVE LIST, BUT MERELY AN AID.** Remember, no calculators, cell phones, etc. in any exams.

You may bring one standard size (8.5x11") "cheat sheet" of notes to the exam

- 2.2: The derivative as a function. Differentiability. How can differentiability fail? Differentiable implies continuous, but not necessarily the other way around. The graph of f' in relation to the graph of f. Higher derivatives.
- 2.3: Differentiation Rules: Sum, Difference, Constant Multiple, Product, Quotient, Power. Know how to use them. Be able to do problems like Exercises 69–74, too.
- 2.4: Know the derivatives of the trigonometric functions.
- 2.5: Chain rule. Know it. Know it well. Know when to use which differentiation rule. Practice a lot; there are tons of problems in the book and the practice problems. (And know not only computations like Examples 1–8, but also stuff like Exercises 61–72.)
- 2.6: Implicit differentiation. To find the tangent line to a curve described by some equation involving x and y, we think of y as a function of x, without knowing the actual formula for $y = f(x)$ (hence, an **implicit**, rather than explicit, function). So if we differentiate with respect to x, we must remember that y is a function of x and use the chain rule (or product rule, or quotient rule) when appropriate.
- 2.8: Related rates. Know the method (either the steps listed in the book, or the steps I listed in class). DRAW A PICTURE!!! Draw it big. Draw a new one if you don't like the way your first one looked. (Don't cross the old one out unless you're *sure* it's wrong, though). Differentiate all variables IMPLICITLY, with respect to TIME (t). DON'T plug in specific values of changing quantities until AFTER differentiating. And practice a lot.
- 3.1: Extreme Values. Know the definitions (critical numbers, absolute extrema, and local extrema), the Extreme Value Theorem, and Fermat's Theorem. Most of all, know when to use, when **not** to use, and how to execute the **Closed Interval Method**.

Some Things You Don't Need to Know

- The limit definition of $f'(x)$ (in Section 2.2).
- The jerk (in Section 2.2).
- The formula $\lim_{x \to 0} (\sin x)/x = 1$ (in Section 2.4).
- y'' in implicit differentiation (end of Section 2.6).
- Geometric formulae (for related rates problems). I will give you a list of any possibly relevant geometric formulae (like the volume of a sphere), so don't waste your time memorizing those.
- Sections 2.7, 2.9
- All proofs of theorems and formulas.

Tips

- As on Exam 1, spend time preparing your "cheat sheet" and do lots of practice problems, and try the practice exams.
- If you get stuck on a problem, just move on and come back to it later. (But **make sure to actually come back** to any problems you skipped!)
- Always take a moment to look for simplifications **before** you start wildly differentiating.
- For related rates problems, DRAW A PICTURE!!! And if you hadn't noticed, this is one of the hardest topics on this exam, so study it well.
- Implicit differentiation is a bit tricky to execute, but **in addition**, you need to be able to recognize *when* you need to use it; I won't necessarily tell you. It comes up in related rates problems, but you also need to know to use it if I ask something like, "Find y' if $x^3 + y^2 = 3xy^5$."
- The **closed interval method** is ONLY for **closed intervals**! (And, less obviously, only for continuous functions and for **absolute** extrema.)