MATH 111: MIDTERM REVIEW

We have a midterm on Friday, 17 October on the subjects we've covered in the readings, homeworks, and lectures during the first seven weeks of the course. The test will be closed book, closed notes, no calculator.

Study tips. A large and growing body of research indicates that *repetition* and *sleep* are essential study habits. Cramming doesn't work. Following are some recommended practices to prepare for the exam:

- Identify topics you're good at. Review the topics below, your homeworks, and your quizzes and figure out what you can do with ease.
- Identify topics you need to work on. Ditto, but identify things that trip you up. Is a term unfamiliar? Did you get low scores on particular types of exercises? You'll need to work on those skills.
- Do problems. The odd-numbered exercises in the book have solutions in the back. Use these to practice your skills. Do a little bit of practice on your easy topics and a lot of practice on the harder topics. Make sure you put an *honest* attempt into the problem before turning to the solution.
- Ask questions. If a particular topic never seems to stick, talk to me, a peer, or a tutor and try to understand what's holding up your understanding.

The process described above should start this weekend and you should aim to study *at least* three times before the exam. Research shows that multiple shorter sessions are much better than one or two binges, and cramming is one of the least effective strategies, especially for genuine learning that will last beyond the exam.

Finally, make sure you get some good sleep in the upcoming week: it's essential for consolidating the topics you're studying into memory.

Review topics. Following is a non-comprehensive but still pretty darn good list of need-to-know items. Items marked with a $\star$ will *definitely* appear on the exam.

Limits.

- $\star$ You will be asked the definition of the limit of a function.
- Use the definition of limit to prove that the limit of a linear function is what it's claimed to be. (That is, do an ε-δ proof for this sort of function.)
- Know the limit theorems in §1.3 of the book and how to use them to calculate limits of actual functions.

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- Know how to use basic properties of absolute values (triangle inequality!) to give an ε-δ proof that the limit of a sum is the sum of the limits.

Continuity.

- ⋆ You will be asked the definition of continuity.
- Know the precise statement of the Intermediate Value Theorem and how to use it.
- Know how our limit theorems imply basic theorems about continuity.

Derivatives.

- ⋆ You will be asked the definition of the derivative and what it means for a function to be differentiable at a particular point.
- Use the limit definition of the derivative to compute the derivative of an uncomplicated function (without recourse to any of our differentiation theorems).
- Know the differentiation theorems from the Essential Derivatives handout (linearity, product rule, quotient rule, chain rule).
- Know (or be able to derive) the derivatives of x^r, $\sin(x)$, $\cos(x)$, and $\tan(x)$.
- Use the differentiation theorems and known derivatives to compute the derivatives of more complicated functions.
- Compute the equation of a tangent line to the graph of a function at a given point. Be able to use this to approximate $f(x)$ when x is close to a point at which the value of f and f' is known.
- ⋆ You will be asked to provide the precise statement of the Mean Value Theorem.
- Know how to do related rates problems.
- Know how to use derivatives to optimize functions, find extrema, and sketch curves.