

## MATH 13 MIDTERM 1 STUDY GUIDE, WINTER 2012

This is meant to be a quick reference guide for the topics you might want to know for the first midterm. It probably isn't comprehensive, but should cover most of what we studied in this class. There are no examples, so be sure to consult your old homeworks, notes, or textbook for those. Again, I make no claims to completeness on the list of topics below!

### 1. DIFFERENTIAL CALCULUS (IE, MATH 8 STUFF)

- Vectors, dot products, cross products, properties of dot and cross products.
- Equations for lines, planes in  $\mathbb{R}^3$ .
- Vector-valued functions, finding tangent lines to curves in  $\mathbb{R}^3$ , arc length.
- Partial derivatives, directional derivatives.
- Gradient vector and its properties.
- Finding tangent planes to surfaces, either of the form  $z = f(x, y)$  or  $F(x, y, z) = 0$ .

### 2. DOUBLE INTEGRATION

- Geometric interpretations of double integrals (area, volume, average value, etc.)
- Integration over rectangles.
- Integration over more general domains in the plane.
- How to interchange order of integration (Fubini's Theorem), and when it might be a good idea to do so.
- Polar coordinates, integration using polar coordinates.
- Applications of double integration to finding area, mass of lamina, center of mass, probability.

### 3. STRATEGIES FOR SOLVING PROBLEMS

A list of strategies we have learned for solving various types of problems.

- If you run into an iterated integral which you can't seem to evaluate, try switching the order of integration or changing coordinate systems. If the problem is really tricky, you might have to think in terms of geometry!
- Polar coordinates are probably useful when dealing with circles, sectors of circles, annuli, or other geometric figures related to circles.
- If the region of integration of a double or triple integral looks complicated, try drawing a picture. If you have trouble drawing a picture, try drawing small pieces of it first (for instance, in a 3D picture, try keeping one variable constant, and see what a 2D cross-section looks like).

## 4. TIPS FOR PREPARING

The following suggestions may or may not help you prepare for the test.

- Take a look at all your old homework assignments, and learn how to solve them all by yourself. This is especially true if you received assistance or took many attempts to correctly answer questions – at this point, you should be able to solve every old homework problem, correctly, on your own.
- For additional practice problems, try solving random questions from the text.
- Make sure you are precise with arithmetic and algebra. Being able to do both these accurately, by hand, is an important skill to cultivate.
- Make sure you are well-rested and not hungry during the exam. You may also want to bring a light coat, in case the room is too cold. Also make sure you bring enough pencils or pens to the test site.
- This isn't a tip, but PLEASE turn off all cell phones and other portable electronic devices during the exam. Even phones on vibrate settings are a nuisance to nearby test takers.
- Try to keep the time limit in mind as you take the exam. Do not spend too much time obsessing about a small number of problems if it will be detrimental to your performance on the remaining problems.
- For multiple choice questions, if you can't figure out how to solve a question, sometimes you can eliminate some answers. Don't guess completely randomly; eliminate some obviously incorrect ones first! (I'm assuming everyone knows how this works; it is a basic technique taught for the SAT.)
- For non-multiple choice questions, show all your work, and try to be organized and neat when you write your solutions. This will make it easier for the graders to follow your line of thought, and may help you earn (more) partial credit if you cannot completely solve a question correctly.