MAC2234: Exam 1 Review Hints *June 06, 2014*

Topics	N1	C1	C2	N2

This document contains hints for the problems on the exam review to help you if you get stuck. I recommend trying each of the problems for at least 10 minutes before looking at the hint.

Topic N1: Single-Variable Integration Techniques

P1. There's no hint here - this is just a grind. The only reason to do these problems is if you need to practice meticulous-ness while using your algebra. Don't go through the trouble if you are comfortable with your ability to do this.

P2. Don't do any work. Try drawing a picture.

P3. Don't do any work. Try drawing a picture.

Topic C1: Numerical Integration

P1. Figure out a way to do this using numerical integration. What integral do you need to approximate?

P2. I didn't give you an M, and it's too hard to find it yourself, so you can't calculate your accuracy directly. How can you be sure that you are accurate enough for practical purposes? One way is to guess the number of subintervals you might need and compute the approximation. Then, increase the number of subintervals (I recommend doubling it), compute the approximation again, and see whether the estimate has changed significantly or not.

P3-**P6**. These are in the book (and easy to find online), so if you can't remember, read the proof, then go back and try to write it on your own.

P7. You have all the information here to do Simpson's rule (or Trapezoid) with four intervals. If you don't believe me, write $g(x) = f(x^2)$, and then write out the formula without putting numbers into it.

P8-**P9**. Think about $\int_a^b f(x)\,dx = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx$. Try drawing a picture.

Topic C2: Multivariate Optimization

P1. You're probably having trouble because your only critical point is at $(0, 0)$, and it's a saddle point. When we maximize a function over an interval in one variable, we check the value of the function at the critical points *and also* the value of the function at the endpoints of the interval. In the same way, when we maximize a multivariable function over a region, we check the value at the critical points *and also* the value on the border of the region. The border of the region is the unit circle, $x^2 + y^2 = 1$. Now, what method would you use to find the minima and maxima of that function on the border?

P2. Represent the operating costs by a function $P(x, y)$, where x and y are potential coordinates for the new power plant. The distance from the power plant, at (x, y), to Little Hall, at $(2.02, 1.38)$, is

$\sqrt{(x-2.02)^2+(y-1.38)^2}$, so the cost per hour to send power to Little Hall is

$$\left(\sqrt{(x-2.02)^2+(y-1.38)^2}\right)^2 = (x-2.02)^2+(y-1.38)^2.$$

Now, we have to send power to all three buildings, so compute the total cost, $P(x, y)$, and determine the point at which it is minimized.

P3. Your constraint is easy: the volume of a cylinder is $\pi r^2 h$, so $g(r, h) = \pi r^2 h - 0.267$. Now, set up the Lagrange multiplier to be the production cost. First, figure out how much tin you will need (look up the surface area of a cylinder if needed) and multiply it by the price of tin. Then, figure out how much cardboard you need (there are three cardboard inserts, how tall are they? how long?) and multiply it by the price of cardboard. Then figure out how much of each type of popcorn you will need (each gets a third of the tin, how much is a third of the volume of a cylinder?) and multiply by the given prices. Now you can use the method of Lagrange.

P4.

(a)-(b) Try drawing.

(c) Try drawing. If you want to try to solve it, you may notice that you can easily come up with x as a function of r the side length of the square x