

# Quiz #1 Review

Robot Chicken

October 3, 2007



*Hi kids! Bwwwoookkk! I'm the famous robot chicken from the popular TV show stepping out of the laboratory to bring you a review sheet for your upcoming quiz on October 11th. For each quiz and/or test, Corey calls on some of his friends who know more math than he does to write these review sheets... Usually, it will just be a running list of each section that will be covered on the quiz/test, along with some of my commentary as to what sorts of things you should remember from that section. Keep in mind that there will be one or more sections that the exam will cover, in addition to those listed below, and that Corey will make that information readily available. Why would Corey ask others to do his work? Well, the people he asks are usually better writers than Corey is, and Corey simply doesn't have the time. For instance, Corey asked me to write this sheet over the weekend while I was embarrassing him at golf. Bet you all didn't think a chicken could play golf. Well, I'm a ROBOT chicken! ROCK ON!*

1. Section 5.1: Introduction to double integrals. In this section we were introduced to integrals over a rectangle as a way of understanding the volume of a solid trapped by the boundary of the rectangle and a smooth surface defined by a function  $z = f(x, y)$ . We also saw that iterated integrals were a way to evaluate these volumes, and what you should really take away from this section is an understanding of the process of evaluating a double integral over a rectangle. The homework questions are excellent practice questions to study.

2. Section 5.2: The double integral as a Riemann sum. If you all think that this section wasn't really that different from the last section, you're right. Corey, of course, thinks differently. He thinks that there is a significant difference between these sections, and it's centered around the idea that we hadn't really defined the double integral in Section 5.1 as anything other than an expression of volume. Well, in Section 5.2 we discussed the double integral as a more mathematical object by discussing it as a limit of Riemann sums. I guess Corey has a point, since, now we can integrate non-negative functions and not freak out if we get a negative "volume". The integrals are just limits. In fact, we studied much more. Since we now have defined these double integrals as a limit of a certain Riemann sum, we can all run and hide when we realize: not all limits exist. We have a great Theorem (Theorem 2) that tells us when functions are *integrable* (i.e., when this limit exists), and Fubini's theorem that tells us that, more or less, in these cases we can expect that it not matter which order we integrate in. In addition, it was interesting that the area of a rectangle  $R$  was the double integral  $\int \int_R 1dA$ . The homework really centers around more examples of the evaluation of double integrals, and the problems that are computational in nature are wonderful problems to practice for the upcoming quiz.
3. Section 5.3: Integration over more general regions. Corey spent a lot of time telling and retelling us of that way that we can extend the notion of integrals of certain functions on a rectangle to integrals over more general regions. Of course, the regions can't be too screwed up, otherwise we're in a place where few people really venture. But the  $x$ -simple and  $y$ -simple regions provide a wonderful place to start, and we learned how to integrate functions over these regions by the trick Corey explained in class. Similar to the last section, it was interesting that the area of a region  $D$  was the double integral  $\int \int_D 1dA$ . The homework problems are great practice, in particular, the homework problems which are calculational in nature.
4. One more note: Most of the questions Corey will ask will be computational in nature. Occasionally Corey would ask some questions that are theoretical in nature, but he assures me that these questions will not be tricky, difficult, or misleading. Of course, I'm a robot chicken, so my view of difficult and misleading may differ from yours, but I hope you all get the idea. ROCK ON!