MATH 900-3A, HOW TO THINK THE CALCULUS WAY
Summer 2004

Instructor: Brian Munson
Meeting Place: Room 061 J.W. Wilson
Meeting Times: Monday to Friday, 10:30-12:00 and 1:00-2:30
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Required texts: Single Variable Calculus. Early Transcendentals, by James Stewart, 5th edition; reading packets to be handed out in class.
Web page: `http://math.stanford.edu/~munson/ma9003A.html`. *Nearly everything* for this course is available on the web page. This includes all homeworks, extra problems, homework guidelines (it is extremely important that you read this), and literature reaction guidelines. I will provide you with copies of everything else, including worksheets and reading packets.
COURSE DESCRIPTION AND GOALS: Calculus has enjoyed tremendous success in its ability to describe and help us solve many complex processes. It is the primary tool in helping us understand how to design bridges, buildings, automobiles, aircraft, computers, cell phones, you name it. If it was "engineered", then what makes it work is best described using mathematics, and usually in the context of calculus. Aside from these gradiose claims that calculus is the greatest thing ever, why do I feel it's important to teach you this stuff? My main goal is to teach you how to think better and express these thoughts more clearly, and calculus provides an accessible framework in which to achieve these goals. For this reason we are going to talk about how to write proofs. I feel that learning some basic proof writing techniques will help give you a more systematic way of attacking questions, and it will help you understand what you don't understand a lot quicker. You'll be surprised at how much easier it is to identify problems you might be having when you pay attention to expressing yourself clearly. This will also help you in learning calculus, as the most interesting problems often require better conceptual than computational skills, something you might not be used to. But don't worry, you'll be doing plenty of computations over the next three weeks! Another reason to have you learn how to write proofs is to get you to concentrate on expressing yourself clearly in writing. If you can express yourself clearly and logically to somebody else, then you are probably writing well. This is a skill that whose importance stretches far beyond mathematics, and it is the very precise nature of mathematics makes it a great subject in which to develop this ability. Despite all of the mathematical notation you might be using, your solutions should read like complete sentences, and one statement should follow from the next. To help instill this in you, we will have a few short writing projects (see below). As far as the mathematical content of the course is concerned, we will extensively talk about derivatives and their applications, and more briefly about integrals and the relationship between a function and the derivative of its integral.

WORKSHEETS: I can't spend the entire class lecturing. It's just not that fun for anybody. Besides, you will learn the most when you actively engage the material, and so we will regularly have worksheets. This is your time to start to digest what we've been talking about, and ask each other and me what you find confusing. You might not know you're confused until you actually try to do it yourself! You will be allowed and encouraged to work in groups. Sometimes you can learn more from your peers than you can from me.

HOMEWORK: I will regularly assign homework, and it will be collected almost every day. This is an intensive course, and so you should start the homework as soon as possible to minimize the risk of falling behind. Do not fall behind. It will make this experience a miserable one.

WRITING PROJECTS: You will receive several reading packets from me, and will be required to write roughly a one page account of your reading, as well as be prepared to discuss it in class. This discussion will take place once or twice a week (depending on how much you have to say). Details will be supplied separately.

CLASS PARTICIPATION: Absolutely required. This class will be both more fun and fulfilling if we as a class are having a conversation. This means you must be intellectually engaged with the topic as much as possible. Thinking is hard, but that's what you're here to practice and improve! Mathematics is traditionally a very solitary pursuit, because ultimately you always need to "figure it out yourself". And figuring it out yourself usually consists of time spent thinking hard, interspersed with bouts of staring at the wall. Often this time can be cut down by talking to others, explaining your problem, and getting them to think about it. Besides, what good is all that newfound knowledge if you can't share it with somebody else? One final comment: Mathematics has a reputation for making people feel stupid, and so people are often reluctant to talk in a math class. One reason is that math is hard, but perhaps just as often the reason can be explained by the very goal of math itself: To get to the heart of what makes something work, to make facts "obvious". And it is this feeling of "Oh, of course, that's so obvious!" that we get that makes us feel stupid. However, we should remember to feel like we've accomplished something when we feel that way, since that means we've learned something!

FINAL EXAM: That's right, there will be a test during the last week of the course.