Math 105: Multivariable Calculus
First Lecture (2/1/13)

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Introduction
and Objectives

Introduction

- Building block course.

- Study how things change / modeling.

- Learn material and techniques.

- General math skills:
  - ⋄ Good notation.
  - ⋄ Asking right questions (see motivation clip).
  - ⋄ Common techniques.
  - ⋄ Brute force vs. elegance.
  - ⋄ Building intuition / special cases.

Extra Credit Problem (due 2/8/13)

Assume team A wins p percent of their games, and team B wins q percent of their games. Which formula do you think does a good job of predicting the probability that team A beats team B? Why?

$$\frac{p + pq}{p + q + 2pq}, \quad \frac{p + pq}{p + q - 2pq}$$

$$\frac{p - pq}{p + q + 2pq}, \quad \frac{p - pq}{p + q - 2pq}$$

Types of problems

- **Physics:** Forces, Newton's laws, partial differential eqs, ...

- **Economics:** Optimization, ...

- **Finance:** Monte-Carlo techniques (dartboard), ...

- **Geometry / Probability:** Areas / volumes, ...

- **Approximation Theory:** Everything!
  - ◇ Discovery of Neptune.
  - ◇ Library trip.

Course Mechanics

- **Pace:** faster than 104, learn by doing / daily HW.

- **Food / Cell phones:** Food okay, hearing cell-phones isn't.

- **Preparation: Read material before class: 5% of grade.**

- **Supplemental lectures:** 12 weeks vs 15 weeks.

- **Office hours:**
  - ◇ Strongly urge to visit.
  - ◇ Strongly urge to go to TAs.

Review Sessions / Office Hours

TAs: Sun 9-10:30pm, Tues 8-10pm, Thurs 9:15-10:45pm in Bronfman.

Math/Science Resource Center: Sunday - Thurs: 8pm-midnight.

Me: Bronfman 202:
http://www.williams.edu/Mathematics/sjmiller/public_html/schedule.htm

SABR / advanced lunches: Time TBD.

Review Dinner: Thursdays, 5:30ish to 7ish, Dennett Private Dining Room (Mission).

Grading
(Controlling your education)

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HW 15%, Midterms 40% (best 2 of 3 or best 1 of 2), Final 45%.

Reading option: Replace 5% (can miss two, honor code).

Scribe option: Replaces 5%.

Quiz option: Replace 5%.

Project option: Replace 5%.

Can do two for 10%, three for 15, four for 20%.

First Homework

First Homework Assignment

Due Monday, Feb 4: Read: Section 11.1, 11.2. Use that time to read the material and make sure your Calc I/II is fresh. Feel free to check out the review videos.

HW problems: (1) What is wrong with the following argument (from Mathematical Fallacies, Flaws, and Flimflam - by Edward Barbeau): There is no point on the parabola $16y = x^2$ closest to (0,5). This is because the distance-squared from (0,5) to a point (x, y) on the parabola is $x^2 + (y - 5)^2$. As $16y = x^2$ the distance-squared is $f(y) = 16y + (y - 5)^2$. As $df/dy = 2y + 6$, there is only one critical point, at $y = -3$; however, there is no x such that $(x, -3)$ is on the parabola. Thus there is no shortest distance! (2) Compute the derivative of $\cos(\sin(3x^2 + 2x \ln x))$. Note that if you can do this derivative correctly, your knowledge of derivatives should be fine for the course. (3) Let $f(x) = x^2 + 8x + 16$ and $g(x) = x^2 + 2x - 8$. Compute the limits as x goes to 0, 3 and ∞ of $f(x) + g(x)$, $f(x)g(x)$ and $f(x)/g(x)$.

Extra Credit (due 2/8/13): Assume team A wins p percent of their games, and team B wins q percent of their games. Which formula do you think does a good job of predicting the probability that team A beats team B? Why? (a) $(p + pq)/(p + q + 2pq)$, (b) $(p + pq)/(p + q - 2pq)$, (c) $(p - pq)/(p + q + 2pq)$, or (d) $(p - pq)/(p + q - 2pq)$.