Department of Mathematics October 8, 2007

UNDERGRADUATE MATHEMATICS SEMINAR

The next meeting of the seminar will be this coming **Thursday October 11,** with refreshments beginning at **4:45** in the Math Common Room, **Bailey 204**, and the lecture following at **5:00 in Bailey 201**.

In this week's seminar, ***Professor Jue Wang*** will present the following talk:

TITLE: Mathematics and Physics Behind Golf Ball Dimples

ABSTRACT: A golf ball can be driven great distances. How is that possible? And why do golf balls have dimples? As we will see, the laminar and turbulent boundary layer separation plays an important role in the flight of a golf ball. We will start by looking at the history of golf balls, how they are related to Platonic solids such as the icosahedron. Then we will derive Bernoulli's equation, look at d'Alembert's Paradox, and explain how lift is formed by the spin imposed on the golf ball. We will also see a similar effect on the seams of cricket, tennis and baseballs.

Research Seminar announcement:

Professor Christina Friedman will be holding a research seminar on Tuesday, Oct 9th, at 9:00am in Bailey 100. While this talk is not designed for undergraduates, advanced math students are welcome to attend.

Where Are They Now? By Tom Mazur '07

This fall I entered the University of Texas at Austin as a graduate student in physics. I am currently struggling with some courses and working as a teaching assistant. As a teaching assistant, I receive a salary, in addition to a tuition waiver, that allows me to support myself as a student. In particular, I am the teaching assistant for a course called "Physics for Nontechnical Students," which sounds pretty offensive in my opinion. As a teaching assistant, I hold office hours and discussion sections where I address questions that students have on the material. In addition, I grade homework and exams, and for this reason, most of the students dislike me.

I hope to join a research group as soon as possible, ideally as a research assistant. As a research assistant, I would receive support, which would free me from the monotony of grading as a teaching assistant. I have spoken to a couple of faculty members about opportunities for joining their groups. Maybe at some point next term I will begin working in a group. I am generally interested in research in the fields of experimental atomic, molecular, and optical physics and condensed matter physics.

Unfortunately, I can't say much else about the program here as school just started about a month ago. I can say that I have more responsibilities than I did in college as a result of living alone. For instance, I actually have to feed myself, although I simplify this issue by eating some combination of cereal and sandwiches for most of my meals. Because I have to feed myself, I actually have to go to a grocery store once a week. Also, I occasionally need to go to a laundromat, although I try to avoid this as much as possible.

At Union, I actually majored in both physics and math. I ultimately decided to study physics for a variety of reasons. In some courses in the physics department, I learned of some research in certain fields that I found especially interesting. Also, I thoroughly enjoyed my senior thesis in physics in which I experimentally studied the quantum behavior of light. I am sad that I am no longer studying math, but I hope to enroll in some courses in the math department in the future and attend some of seminars in the department.

I recommend that all of you consider graduate school. You get paid to study math (or physics in my case), which seems to be a pretty good deal so far. For those of you looking to apply to a graduate program in math or physics, here is some advice that I would offer based on my experiences.

1. Study a lot for the GREs. I made the mistake of only studying for about a week prior to the exam. As a result, I didn't score as highly as necessary in order to get into some of the top programs. In retrospect, had I actually studied for a couple of months (or even a couple of weeks) prior to the exam, I think that I could have done significantly better. The problems on the exams were not nearly as hard as I had anticipated. When you decide to start studying, google for old exams from ETS.

By the way, keep in mind that you need to study for both the subject test and the general exam. I only studied for physics, and my verbal and writing scores suffered as a result.

2. Apply to a lot of schools if you can, even if you know that you

really want to attend a certain program. I got into less than half of the schools to which I applied, and none of these schools were among my top choices. With that being said, however, I only applied to schools that offered research in the specialties that I thought that I would want to study.

In choosing schools, try to find some particular research groups whose work interests you, if possible. If you know the field that you want to study, check out rankings of schools in that field and ask professors at Union for their opinions on programs. Once you get some ideas, check out the websites of the departments at those schools and look around for research groups in that field. If you see something that especially appeals to you, I would recommend applying. Moreover, you might want to think about contacting professors and expressing your interest in their research.

FYI, I applied to one or two "elite" programs (generally ranked in the top 10), a handful of second tier schools (those ranked between 10-30 or so), and a few lower ranked schools.

3. Get involved in research as early as possible. During the orientation for new students at UT, a faculty member told us that the most important credential for admission into the program is research experience. While you should definitely try to get involved in research at Union (outside of your thesis as a senior), think about applying to programs outside of Union, such as REUs.

Hopefully, in the course of your research, your name will wind up on a publication. As I suspect that most people on admissions committees only glance over applications at first, any application that lists a publication will stand out.

4. Apply for fellowships. I was eventually advised against applying for a fellowship because I wasn't likely to receive one, but I regret not tossing in an application. If you are fortunate enough to receive a fellowship, you'll significantly ease your transition into graduate school. For one, as you probably won't have to be a teaching assistant, you will be able to focus on your coursework. And, if you know of a research group that you want to join, you probably can hop in right away. Remember, you have nothing to lose... other than a fee.

Frankly, this is the easy part... Once you get into some schools, good luck on deciding where you want to go. All I can recommend in that regard is that you should think about where you will be the happiest.

Finally, I recommend that all of you apply to Texas. Although I am here to study physics, I know that the math department is very strong. While it gets pretty hot at times, Austin seems like a cool city so far. If you want to visit the program, feel free to contact me -- I have a futon...

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Problem of the Newsletter:
October 8, 2007

Congratulations to **Ronghua Dai**, and **Schuyler Smith** (with an honorable mention to **Tayyab Shaikh**) for submitting correct solutions to last week's problem. You can view a winning solution on the first floor bulletin board in Bailey Hall.

Here is this week's problem:
Calculus Sudoku! This is taken from

http://www.ncaapmt.org/calculus/newsletters/Winter2007/calculusSudoku1.pdf

Feel free to print a larger version from the above website!

Professor Friedman will accept solutions to this problem until 12:00 noon Friday, October 12th. Email your solution to him (friedmap@union.edu) or put it in his mailbox in the Math Department's office on the second floor of Bailey Hall.

CALCULUS SUDOKU #1

	8							Clue #1
	Clue #2	Clue #8	8		9			1
		1	Clue #11	$\int_2^3 2x\,dx$			Clue #3	
8	1	6	7			$\sum_{k=-2}^{2}(2k+1)$		
9					1		Clue #4	
			Clue #9	Clue #5				
	Clue #6				8		Clue #12	Good # to approx π or e
Clue #7							8	
			3	1			Clue #10	6

Clue #1: If $f(g(x)) = (2x^3 - x)^4$, find $g'(1)$.

Clue #2: $\lim_{h\to 0} \dfrac{(2+h)^2 - 4}{h}$

Clue #3: Find $f'(4)$ if $f(x) = \dfrac{x-5}{x-3}$.

Clue #4: The y-intercept of the line tangent to $y = 4\sqrt{x} + \dfrac{8}{\sqrt{x}} - 3$ at $x = 4$.

Clue #5: Find $f'(3)$ if $f(x) = (2x-7)^3$.

Clue #6: Find the slope of the line normal to the curve $(x^2+4)y = 8$ at $(2,1)$. (This curve is called the Witch of Agnesi.)

Clue #7: If $f(x) = (x-1)^{2/3}$, then $f(x)$ is not differentiable at $x =$ ____.

Clue #8: If $f(x) = 8\sin^6 x - \cos^2 x$, find $f'(\pi/4)$.

Clue #9: If $f(x) = \begin{cases} ax^2 + b, & \text{if } x \geq -2 \\ -4x, & \text{if } x < -2 \end{cases}$ is continuous and differentiable at $x = -2$, what is $a + b$?

Clue #10: $\lim_{x\to-\infty} \dfrac{\sqrt{16x^2 + x - 1}}{3 - x}$

Clue #11: The y-intercept of the line tangent to $f(x) = \dfrac{x}{x-1}$ at $(2,2)$.

Clue #12: Find $f'(1)$ if $f(x) = x^3 + x^2$.