Homework Assignment 21

Assigned Tuesday March 15; due Monday March 28, 2PM, at SS 1071
(Friday March 25 is Good Friday)

On Term Exam 4. It will take place, as scheduled, during the tutorials on Monday March 21st. You will have an hour and 50 minutes to solve around 5 questions, with no choice questions. The material is everything covered in class until Tuesday March 15th (and not including Thursday March 17th), including everything in the relevant chapters (18–20) of Spivak's book (including the appendix to chapter 19). The material in chapters 1-15 is not officially included, though, of course, what chance have you got answering questions about the Taylor polynomial of $\sin x$ (say), if you aren't yet absolutely fluent with differentiation of sin and cos? Some questions will be taken straight from class, some straight from homework, and some will be fresh. Calculators will be allowed but will not be useful beyond emotional support; no devices that can display text will be allowed. **Good luck!**

Preparing for Term Exam 4.

- Re-read your notes and make sure that you understand *everything*.
- Re-read Spivak's chapters 18–20 and make sure that you understand *everything*.
- You may want to prepare a list of all topics touched in class (you may reach 50 or even 100), and you may want to go over this list several times until you are sure you understand everything in full.
- Make sure that you can solve every homework problem assigned or recommended.
- Take a good look at exams, sample exams and exam solutions from previous years. (Scroll down to the bottom of this class' web site and find the relevant links).
- Come to my office hours Friday 3:30–5:30, at the Math Aid Centre, SS 1071.
- It is much more fun to work in a group!

An often-asked question is "Do we need to know proofs?". The answer is **Absolutely**. Proofs are often the deepest form of understanding, and hence they are largely what this class is about. The ones I show in class are precisely those that I think are the most important ones, thus they are the ones you **definitely** need to know.

Required reading. All of Spivak's Chapter 22.

To be handed in. From Spivak Chapter 22: 1 (odd parts), 2 (odd parts), 5, 13.

In class review problem(s) (to be solved in class on Tuesday March 22). Chapter 22 problem 2(ii): Find

$$\lim_{n\to\infty}\left[n-\sqrt{n+a}\sqrt{n+b}\right].$$

Recommended for extra practice. From Spivak Chapter 22: 1 (even parts), 2 (even parts), 9, 27, 28, 29.

Just for fun. For some constant number c, consider the function $f_c(x) = 4cx(1-x)$. Let A be the set of all pairs (c, y) so that $0 \le c \le 1$ and y is a limit of a subsequence of the sequence $f_c(\frac{1}{2})$, $f_c(f_c(\frac{1}{2}))$, $f_c(f_c(f_c(\frac{1}{2})))$, ... Write a computer program to draw the set A in the plane whose axes are c and y, and if your program and picture are nice, they'll find their place on this class' web site.

It's a hard one, but it's well worth it. The set A is way more complex than you would expect, with parts that scream "structure" and parts that scream "mess". If you've ever heard the word "chaos" in a mathematical context before, this is it. And if you've ever seen pictures of the beautiful "Mandelbrot Set", our A is a close relation.

Advertisement 1. I was asked to distribute the following message (no free food but it's a good cause):

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Date: Wed, 9 Mar 2005 09:40:06 -0500 (EST)

* Please circulate to interested undergraduate students *

Queen's University is proud to host the 12th annual Canadian
Undergraduate Mathematics Conference from July 13th to 17th, 2005.
Undergraduate students in all branches of mathematics, including
statistics, computer science, and applied math, are invited to
attend. The conference provides an opportunity for students to hear
talks by both students and professors, as well as to meet like-minded
students from across the nation.

Students are encouraged to prepare talks in either English or French,
but are not required to do so. In the past, topics have ranged from
philosophy of math, to the Golden Ratio, to game theory, and many
inbetween. Outside of the talks, there will be planty of
opportunities to visit the beautiful city of Kingston and take
advantage of the annual Kingston Buskers Rendezvous, which will be
taking place at the same time.

There is travel support available for students travelling from
western Canada as well as from Atlantic Canada. Please encourage your
students to take advantage of this opportunity.

For more information, please visit our website at cumc.math.ca/, or
e-mail us at cumc@cumc.math.ca. We look forward to seeing you!

Erica Blom
President, CUMC 2005
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Advertisement 2. I was asked to advertise the "Arts and Sciences Option 2005" event, March 17-18 2005. No free food is mentioned at http://www.artsandscience.utoronto.ca/ps/options/.