Homework 1 - due January 16th

1. It is 2030 and you are a professor at the Institute for Writing And Research Mathematics (WARM). After class at WARM one day, one of your students asks you to look over their “proof” for the problem

You have a white box with 60 white balls and a black box with 60 black balls. You take 20 balls from the white box, put them in the black box, mix the balls around and then randomly take out 20 balls and put them in the white box. In the end, which is larger: the number of black balls in the white box, or the number of white balls in the black box?

Proof. The numbers are the same because however many black balls move to the white box, that’s how many white balls move to the black box. For example, say the batch of 20 balls we move back to the white box has 11 black balls and 9 white balls, then 11 white balls stayed in the black box, by induction.

(a) In which of the following ways is this not a proof? Explain your answer.

- It is too vague to be a rigorous proof.
- It uses irrelevant concepts.
- It restates the claim we are tying to prove using it as an explanation.
- It is an example.

(b) Prove that for every positive integer $n$,

$$1^3 + 2^3 + \cdots + n^3 = \left( \frac{n(n + 1)}{2} \right)^2.$$

Homework 2 - due January 23rd

2. One day in the coffee room, one of your fellow professors at WARM comes up to you and says “All positive integers are even! I have a proof!”

What is wrong with the following proof that they give you?

Proof. We are going to do a strong induction on the positive integers.

Assume that every positive integer up to and including $n$ is even. Then we want to show that $n + 1$ is even. By the induction hypothesis we know that $n - 1$ is even. Therefore $n - 1 = 2m$ for some integer $m > 0$. Hence $n + 1 = n - 1 + 2 = 2m + 2 = 2(m + 1)$ is even, and the result follows by induction.
Homework 3 - due January 30th

3. For LaTeX practice, transcribe all of your research journals so far into one long document in LaTeX to hand in. Do the following.

- Each weekly entry should start a new page. It should say which journal entry it is as a title. Your name and student number should also be on this page.

- There should be three sections within each entry: What I did; Why I did it; What obstacles I encountered and my research plan for the following week.

- From now on: Please latex up all submissions including your homework to hand in, and your journal entry to email. In all cases submit the PDF created. Thank you.

Homework 4 - due February 6th

4. Interview one of your mathematics professors (past or present, but not me as we have talked about this together already) for about 15 minutes. Ask them the following.

(a) Where do they get ideas for a new problem to work on, and how do they start working on it?

(b) What do they do if they get stuck?

Write up a summary in LaTeX of who you interviewed, and what did they say, to hand in.

Homework 5 - due February 27th

5. Beamer presentations: Using the two downloadable files on Beamer as a resource, make 2-3 Beamer slides on your hobby or interest you spoke on in class.

- Have at least one pause in it.

- By 9.30am: Please email me the .pdf file at steph@math.ubc.ca so I can run the slides on my computer, instead of handing in. Thank you.

Homework 6 - due March 5th

6. Write a short biography of about 250 words on one of the following professors:

It should include their name, current position at UBC, upbringing and education and positions before UBC, and notable career achievements in research/teaching/service to the community such as prizes. You may also include a fun fact about them.

You can obtain the information via an interview in person or email giving the date, or other sources that you must cite such as websites.

Please let me know by email the name of the professor you would like to write on asap. Names will be allocated on a first come first served basis, with no more than 2 students assigned to any one professor.

Note: The best biographies graded by content and writing quality will be turned into posters by the She, They and Allies Committee to be put on display in the Math Department and MLC!