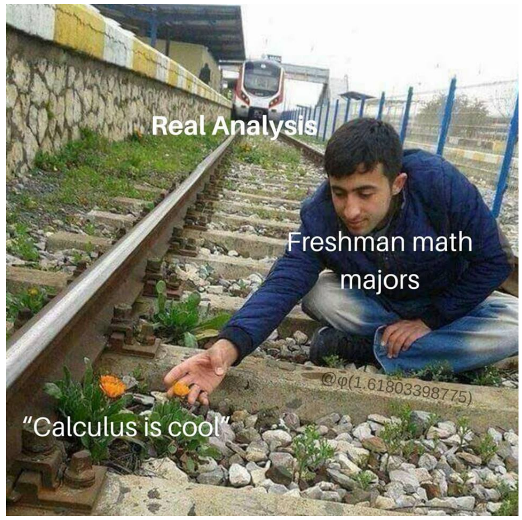
Brief Introduction to MTH 311/411



Greetings everyone and thanks for taking Real Analysis with me! What exactly is Real Analysis?

Analysis is one of the principle areas in mathematics. It provides the theoretical justification of the calculus you know (and love). In your calculus courses, you gained an intuition about limits, continuity, differentiability, and integration. Real Analysis is the formalization of everything we learned in Calculus. Throughout the course, we will be formally proving and exploring the inner workings of the Real Number Line (hence the name Real Analysis). Our job is to understand how to formally describe closeness and the process of getting closer and closer (remember limits?). This course starts with very abstract concepts and gets more concrete as the semester goes on. First, we will discuss bounds of real numbers which allows us to prove that there is in fact a unique limit we want to reach. We then explore sequences which we will use to get as close as we can to these numbers/bounds. We will also talk about basic topology of real numbers (closed, open, compact sets). Next we discuss closeness in a function setting along with continuity. We need continuity later for our integration and special derivative theorems. We then we revisit and use sequences and functions to discuss rate of change (derivatives) and optimization. If time permits, we end with the Riemann Integral.

In this class we will do lots of writing and proving, so get ready. A proof is a demonstration that a certain statement or proposition is true. It is nothing more than an argument, written in the language of the writer (in our case, English), that presents a line of reasoning explaining why the statement follows from known facts. Although a proof may contain symbols, equations, or calculations as the author tries to present a line of reasoning, it is first and foremost an argument. Consequently most proofs contain many more words than symbols. A mathematical proof is judged on the degree to which it is:

(1) Correct:

The reasoning in a mathematical proof must be correct. No untrue statements should be made, definitions should be used properly and precisely, and the rules of logic should be followed.

(2) Clear:

When you write up a proof of a statement, you should consider it to be an argument as to why that statement is true.

(3) Concise:

Write as simply and directly as possible. Avoid the use of ponderous or pretentious prose, and remove any unnecessary words or phrases. It is surprising how often one can take a piece of writing and improve it merely by removing portions. This does not mean that your final product must be short, or that you must leave out details. Instead, you should write so that every word, phrase, and sentence contributes to what you are trying to communicate.

Recall that I have provided you with two papers – *On writing mathematics* and *On Proofs* – so, make sure to read them.

I look forward to meeting you and guiding you through this wonderful material.

Best regards,
Dr.C.