TEACHING STATEMENT

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Being a teacher is a fundamental part of my identity as a mathematician. An essential part of doing mathematics for me is its communication with others. Research allows us to do so with colleagues, at seminars and at conferences. Teaching provides for a much more structured and grounding platform to communicate the rich ideas that have shaped modern mathematical thought.

This note has three broad parts: my teaching philosophy, some teaching practices I use to implement this philosophy, and a list of the classes I have been instructor for.

**Teaching Philosophy:** I wouldn’t be where I am today without the collective time, energy and inspiration that my teachers have invested in me. Their tremendous influence has largely shaped how I approach teaching. Realizing the importance of clarity in teaching came about from the naive but repetitive feeling of “I wish to understand this piece of mathematics as clearly as them”. Thus, my underlying philosophy for teaching is to present material in its honest simplicity.

The experience and practice that I have received from teaching at Indiana University (IU) has honed my approach to teaching from a possibly over-ambitious outlook to taking much more of a passionate and holistic approach that I hope to explain next.

**Practices**

(1) **Lesson Planning:** Taking advice from Gian-Carlo Rota, while planning lessons, I give students of my class one thing that I would like them to take home at the end of each lecture. Putting it differently, I point out “the heart of the matter” to which developments of that class reduce to. For further clarity, I separate distinct themes to distinct lectures, and connect them naturally to maintain coherence in the class.

(2) **Building Intuition:** Driving home an idea as fundamental requires developing intuition for it in order to “trust” it. I develop intuition through a number of examples to observe patterns, draw numerous pictures as and when possible, and try deducing conclusions from them. I keep this portion of the class extremely interactive, by prompting them to answer small questions along the way.

(3) **An Illustration:** Let us consider a lecture that introduces the notion of limits of functions of a single variable in a calculus class. I first use graphs of a number of well-chosen functions, to drive home the point that we want to understand the behavior of a function near a point, rather than at it. I use metaphors such as “let’s pretend we are driving towards the point $a = 4$ from the right, what’s our shadow along the graph of the function doing?”. I then use the patterns we observed from the many examples to record punchlines towards the end of the class.

(4) **Relevance of Examples:** Examples play a crucial role in our lives as mathematicians, and as teachers. I display a variety of examples that exhibit the underlying phenomena, making sure they are relevant. To clarify what I mean by relevance of an example, particularly in the context of introductory classes, let us return to the setting of a calculus class. While discussing word problems on applications of derivatives, I find it crucial to select the right examples to appreciate applications of the magnificent idea of derivatives: it is perhaps common sense to run and prevent a ladder leaning against a wall from slipping rather than to calculate the rate at which the foot of the ladder might be slipping away from the wall.

The Physical and social sciences are filled with and have motivated a number of developments in math. Students of calculus have most often encountered a number of these in high school science or economics classes: using examples that build up on such knowledge makes them...
substantially less contrived and more in the spirit of how these ideas came about in the first place.

(5) **Improvisation:** I allow myself to a certain amount of improvisation in class: I arrive a few minutes early to class to ask questions that students might have, and adapt my lectures to shoot off from their questions. With practice, this has come to feel increasingly more natural.

(6) **Outside Class:** Our role as teachers does not end at the classroom. I invest significant thought in designing homework sets that illustrate the ideas discussed in class. I use homework as an opportunity to display many more examples and counterexamples than the lecture hour might permit. I maintain a friendly and pleasant environment in class making it more inviting for students to visit office hours with questions.

(7) **Extra-Curricular Activities:** I have found that students appreciate it when they are occasionally told interesting things outside of their curricula: being an analyst with a keen eye for applications of mathematics, I enjoy explaining to my calculus students in admittedly vague terms how integrals, via the Fourier transform, helps break up complex signals from their phones into simpler ones that are easier to process and transmit. I frequently give them extra-credit challenges: in my pre-calculus class, showing them a geometric proof of the algebraic identity for \((x + y)^2\), I encouraged them to come up with one for \(x^2 - y^2\), or better still, \((x + y)^3\).

**List of Classes Taught:** Here are the classes that I have been an instructor for, along with a brief description about them. For each of these classes, I was responsible for preparing lecture notes, setting homework assignments, writing and grading exams, holding office hours, and assigning a final letter grade. Early in my stint as graduate student, I enrolled in a teaching seminar offered by the math department. This seminar helped with practical issues that come up in and around the classroom.

1. **M025 Pre-Calculus:** *Fall 2015.* This class is preparation for the Calculus for business studies course, and covers algebraic operations, polynomial, exponential and logarithmic functions, conic sections, systems of equations and inequalities. I took the opportunity to emphasize the importance of understanding each of these concepts via graphs and pictures, foreseeing the intuition they would need in a Calculus class.

2. **M800 Problem solving for Analysis Qualifying Exam for Graduate students:** *Spring 2016.* I was selected by the then Director of Graduate Studies to design and lead a problem solving class to assist entering graduate students pass the analysis qualifying exam. This was an enriching as well as challenging experience for me. I attempted to integrate studying “Baby Rudin” with active problem solving. To this end, I came up with a large collection of problems that often consisted of examples and counterexamples to help bridge the abstract and the concrete. I drew problems from previous exams, and other real analysis textbooks. I emphasized that inequalities and estimates were at the heart of analysis, and the course was replete with opportunities that drove home this point.

3. **M119 Brief Intro to Calculus for Business and Social Sciences** *Summer 2016.* This was a fast-paced 6 week class that met daily, and examined the applications of derivatives and integrals to economics and pricing.

4. **J113 Brief Intro to Calculus** *Fall 2016 and Spring 2017.* This was a fast paced class that met everyday throughout the semester- one of the most challenging aspects of the class. The class forms the highest level math course for the “Groups Program”. The Groups Program, within the Mathematics Department, is a sequence of courses starting from elementary arithmetic, specially designed for first generation underrepresented Indiana resident college students. I enjoyed teaching this class, since it gave me the opportunity to discuss such sophisticated notions as limits and derivatives in detail. Teaching this class twice gave me an opportunity to retain things that went well the first time, but anticipate difficulties and be better prepared the second time.

In conclusion, I look forward to teaching a wide variety of classes during my postdoctoral stint.