STATEMENT OF TEACHING EXPERIENCES AND INTERESTS

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As a postdoc at UC–Davis, I have taught calculus for two quarters and an upper division course in convex geometry. This quarter, I am also teaching calculus. While a graduate student at UC–Berkeley, I also served as a teaching assistant for calculus, linear algebra, and an introductory computer science course. In addition I had the benefit of learning from excellent teachers while an undergraduate at Williams College.

I must admit that I still have much to learn about teaching. I am currently teaching the first quarter of calculus for the second time, and I have completely rethought the first two lectures to emphasize the idea of functions as machines operating on numbers. I had found last time that many students had not seen this way of thinking about functions and that this way of thinking about functions is crucial to how I think about and teach calculus. For example, a proper understanding of functions helps distinguish between the number 3 and the constant function which assigns 3 to every input. I am hoping it will also help when we discuss implicit differentiation and related rates. The way I assign grades has also changed, in the hopes that the new system is more transparent to the students, while still setting sufficiently high expectations for them.

I am better with answering questions than with lecturing, since a question lets me know what actually needs to be explained, and frequently what incorrect or incomplete picture the questioner has of the topic at hand. Therefore I leave plenty of room for questions in my lectures, even if doing so leaves occasional uncomfortable silences.

In general, I think the way I learned calculus and the ways I know to teach it have caught up neither to the widespread availability of systems for graphing and symbolic computation, nor to the growing use of calculus in biology, business, and the social sciences, whose mathematical needs are somewhat different than those of physics and chemistry. In addition to continuing to modify my courses as I see what students learn and fail to learn, I also hope to make modifications as I come to better understand what students studying other disciplines really need to learn in lower division mathematics courses. The availability of computer algebra systems also allows us to spend less time teaching symbol manipulation and more time on helping students learn the basic concepts and how they work.

In all my courses I try to give the students some exposure to mathematical research. In a calculus course, I try to spend an hour at some point explaining in general terms a problem I am thinking about. The purpose is to give students some idea of what pure mathematicians might do research on. In my course on convex geometry, I spent two weeks on the number of faces of various dimensions in 4-dimensional polytopes, and discussed various constructions with extremal properties. This is a topic of current research. While this topic may have few

obvious applications, it also paints an accurate picture of what research in pure mathematics is frequently like. In particular, any complete characterization on possible numbers of faces is likely to be horrendously complicated, so research focuses on less complete characterizations.

I am also interested in supervising undergraduates in research. Most of my actual research work can be explained using only elementary combinatorics and linear algebra, although the motivations may be far deeper. Furthermore, an undergraduate starting on similar problems can use computers to help in understanding small cases and generating conjectures. This is particularly true both for research on enumerative questions around new forms of pattern avoidance and for research on some combinatorial free resolutions. Details on these areas of research are found in my research statement.

Especially in a calculus course for students who will most likely not be studying mathematics in depth, I give examples not only of situations where mathematics can be used, but also of situations where mathematics can be misused or is plain useless. I also occasionally ask students to work out such examples on homework and think about them on exams. Such examples ask students to reflect on the material they are learning rather than merely memorizing and reproducing facts and procedures. I consider it important in any college course to encourage students to consider carefully how and why the ideas they are learning have come to be accepted, and how these ideas are connected to other ideas they have encountered. In an upper division course we can expect students to have some understanding of the nature of mathematical proof, and most connections are within mathematics. In calculus the connections extend more widely, and society accepts these mathematical ideas for reasons beyond mathematical ones. Indeed, many of the ideas of calculus were historically given proofs which would not hold up by contemporary standards.

Though I have no experience doing so, I would be interested in teaching a course where students learn to read and write proofs. I enjoy writing and editing, and believe many techniques generally used to teach writing would be useful in such a course. I am also particularly interested in teaching advanced undergraduate courses on topics not always found in the standard curriculum. Possibilities include courses on graph theory or combinatorics, or on symmetric functions and the representation theory of the symmetric group. Although the latter is usually first taught at the graduate level, it can be made accessible to students with less background.

I hope to continue to improve as a teacher by teaching and reflecting on my teaching experiences, and through discussions with colleagues and feedback from students. While I enjoy doing research, I also consider teaching to be an at least equally important part of my future professional life. Especially considering my interests are truly in pure mathematics, I find my research not sufficiently clearly useful to make it the only focus of my career. As a teacher of mathematics, one has the opportunity to help many students become better at thinking logically, detecting fallacies, and communicating effectively. I look forward to teaching mathematics for many years to come.