Teaching Statement – Joshua Mirth

My purpose when teaching is to get students to participate in doing mathematics. Having taught every course in the calculus sequence at Colorado State University I have worked with students from freshmen to seniors and from an even broader set of cultural, social, and economic backgrounds. It is my belief that mathematics can enrich all of their lives and can belong to all of them if they choose to take hold of it. Below I describe four ways through which I encourage them to make this choice.

1. **Remove Fear:** I try to break down the fear and intimidation which math often carries with it. One thing I have done is to develop a homework policy in which I allow plentiful revisions of assignments. By not requiring perfection on the first try, students are more willing to engage with and explore new ideas, and are less likely to be stressed or stay up all night working on an assignment. Yet it also means they can spend more quality time with their work, because they cannot get away with turning in a mostly right solution. I require completely correct solutions by the end of their revisions, so they end up deeply engaging with and understanding concepts.

2. **Active Participation:** I create a classroom where every student is encouraged, welcome, and an active participant in exploring the material. At the simplest this means pausing often to ask for questions and trying to give every one a thoughtful response. Sometimes it involves more student activity—having a volunteer demonstrate a"warm-up" problem at the beginning of class. At other times it can be elaborate. One of my favorite class activities is to have a problem-solving session where students work problems on the blackboards in groups, and then all but one person from each moves to a new group where they have to learn to solve the new problem with the remaining individual's help. This inevitably generates many questions, but also means gives them the opportunity to explain, which is ultimately the best test of understanding.

3. **Narrative:** I emphasize the narrative of mathematics. I have had the opportunity to refine our curriculum for Introduction to Ordinary Differential Equations, in particular developing the standard set of lecture notes and homework assignments for that course over the past two years. A major goal of mine was to emphasize the interconnectedness of topics in a course that sometimes can feel like a mess of different computational tricks. The approach I took was to tell a story about the exponential function. Every ODE encountered in an introductory course like this is either linear or depends upon finding an integrating factor through a linear equation. And every linear ODE is solved by exponentiating! Students are more likely to care when there is a story, when the same characters keep appearing, when there is tension (a new type of seemingly difficult equation) and satisfying resolution (when a method is found and it involves a familiar element).

4. **Challenge:** I believe in my students and their ability to succeed at mathematics. This means giving them challenging problems, and being willing to teach advanced ideas when appropriate. But it also means balancing difficulty with accessibility. For example, I make sure that every homework assignment begins with attainable problems. More importantly, when explaining a difficult topic, I demand of myself an extra effort to make that topic as clear and as simple as possible, and challenge myself to find ways to teach better.

Lastly, with my research background in applied topology, I would be excited to teach courses on topological data analysis as part of SUNY Albany's graduate Data Science Program. At the same time, I would be interested in teaching more traditional courses on topology at the graduate or undergraduate level, as well as other topics with relations to data science, such as linear programming or optimization.