TEACHING STATEMENT
JAMES RATH

My teaching has been heavily influenced by teachers I had growing up. Beginning with third grade, I had a wonderful teacher who brought an infectious enthusiasm for mathematics. He always showed us wonderful puzzles and was excited about what we learned next. From there I was very lucky to have a long string of excellent teachers who nurtured and encouraged me and provided me with the curiosity and tools I needed to succeed. I hope that I can provide the same environment for my students, fostering an enthusiasm for mathematics and a desire for discovery. Most of my experience has been with large classes (over 100 students). To keep their attention, I put a lot of effort into making each class entertaining as well as educational.

Most of my students have not been mathematics majors so I keep lessons relevant to the subjects they study (mostly science and engineering). For instance, I was fascinated recently by a presentation by Klaus Schulten from the Theoretical and Computational Biophysics Group in the Beckman Institute at UIUC; he spoke about molecule-level modeling of biological structures. This past fall when I was teaching calculus and the class was first learning about integration, I used some of the animations from Dr. Schulten's group as demonstrations in class. Despite of the complexity of Dr. Schulten's work, the basic principles at work were Newton's first law and integration. I showed the class how precise knowledge of accelerations can be used to compute positions over incremental time steps, a basic example of (numerical) integration.

It is sometimes useful to try to draw analogies between high-level concepts and everyday experience. To that end, a more low-tech example of my teaching style can be found in a banana. To demonstrate computing volumes by slices, I brought a banana to class one day along with a kitchen knife, and proceeded to cut the banana into parallel slices. While holding up a single slice, I noted that the slice was roughly cylindrical, and that its volume was easy to estimate. I also noted while collecting all the slices in hand that the banana could be re-"integrated" and the banana's total volume obtained by adding up the volumes of the slices. I supplemented this low-tech exercise by computing the volume of the banana-shaped solid whose cross-sections in one direction are circles, and whose principle cross-section in a perpendicular direction is the crescent-moon shape bounded by the parabolas $y = x^2$ and $y = 2 + (1/2)x^2$. I also illustrated the solid and its cross-sections using Mathematica, projected an animated illustration

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in class, and posted the code on the web so that the students could manipulate the code and the 3-D illustration themselves.

In class I sometimes make mistakes. Usually I am quick enough on the ball to catch my own mistakes, but occasionally one slips by. As a remedy, I make my students an offer at the beginning of the semester: if they catch a mistake before I do, I give them a Hershey bar. This serves the dual purpose of getting students to pay attention (and rewarding them for doing so) and getting mistakes in my lectures corrected (nothing is more frustrating when learning new material than to sit in class and wonder whether the instructor made a mistake or if I myself am not understanding). I dress the bars up in my own wrappers made with math-appropriate cartoons. I also make a point of creating a scene when presenting the first one; this calls attention to it, and creates a sense that the students are really receiving a special prize when they get one. It builds momentum for the semester so the bars are not just mentioned, then forgotten, and never presented again after the first week.

I have taught different varieties of two-semester and three-semester calculus sequences, and introductory differential equations class, and an introductory linear algebra class. This spring I am teaching my first upper division class, the second semester of a numerical analysis sequence, and I have only eleven students. I am excited about the possibilities that this brings. Given the opportunity, I would happily teach every class in an undergraduate curriculum.

I enjoy teaching, and over the years I have improved my teaching ability. I get generally good reviews by students in my classes, and I won an award for good teaching. I have gained by observing my own teachers along the way, and I have also benefited from observing my own students and getting feedback from them. I hope to continue to improve and expand my teaching abilities.