STATEMENT OF TEACHING PHILOSOPHY

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As a mathematics instructor, my philosophy has always been that the most important goals for the students in my courses should be to gain a fundamental understanding of the concepts behind the material, and to know how and when these concepts may be applied, both within mathematics and beyond it. In helping the students to achieve these goals, I employ a variety of techniques to accommodate the different backgrounds, learning styles, and academic and career goals of the students in my courses, and also to make the course as enjoyable as possible, even for students who are usually averse to mathematics.

The students in the mathematics courses I have taught as both a graduate student and as a postdoctoral associate have ranged from aspiring mathematics majors and people who simply enjoy mathematics and wish to study it further to science, engineering, and business students who are taking the course with the primary goal of applying the concepts in other courses. As such, I tailor the classes to cater to the different interests of the students rather than focusing too narrowly on one group. Many of the students who are taking the course for enjoyment may plan to take further mathematics courses, so for these students I try to include some insight into the theory behind the concepts of the course, such as short proofs of some of the major results. As the students who are taking the course with an eye to applying the material to their chosen majors come from a variety of subjects, I also demonstrate sample applications from diverse subjects. For example, I have shown how one may use vectors to determine the net force acting on an object, or how one may use first derivatives to maximise the revenue from sales of a product. As well as explaining *how* a given concept or technique may be applied to a real world situation, I also emphasise *when* a given technique could, and should, be used. In applications (and often on quiz and exam questions), the students will rarely, if ever, be explicitly told which mathematical device will be most helpful, so in demonstrating why a particular technique is effective, I try to give an overview of other situations in which it may be applied so that the students will recognise them when they see them. For example, when teaching a first course in calculus, I point out that the Chain Rule is generally applicable to situations in which they are trying to determine the rate of change over time of a quantity which depends in turn on other quantities which are changing over time, not just to the specific examples being demonstrated in the lectures.

As the students embody a variety of different learning styles, I make a point of using a variety of methods geared toward the different styles. As well as giving lectures on the important concepts of the course, I also distribute handouts and e-mails for the students who learn more readily by reading than by hearing. For example, to help the students in a multivariable calculus class unravel the tangled web of techniques they could employ to solve line and surface integrals, I distributed e-mails to the class list explaining in detail which techniques applied to which situations and why. As some students, particularly those who plan to apply the material to real world situations, learn more easily by seeing than by hearing or reading, I make a point of including visual aids in my lectures and handouts. For example, when teaching the students about integrals, I often draw pictures to illustrate the regions being described by a given integral so that they can make a connection between an apparently perplexing formula and a physical object. In multivariable calculus courses where a two-dimensional picture is often insufficient to illustrate such concepts as gradients, I have made extensive use of computer modelling programs such as Maple. Some students find using

Maple a struggle, so I also distributed e-mails to the students explaining in detail how to use the program to solve a given problem or category of problem, particularly those involved in required assignments for the course. These e-mails were so well received that I even received requests for copies of the e-mails from students in other multivariable calculus sections who had heard about them from the students in my section. Most importantly, I urge all of my students, particularly those who learn most easily by doing, to work through sample problems so that they can see the concepts of the course in action and gain a better understanding of how and when they can be applied. I believe that the teacher and the student should bear equal responsibility in the learning process, rather than that one or the other should do the lion's share of the work, and I believe that working through sample problems is an excellent way for the student to learn for himself or herself what he or she has seen and heard in the lectures.

It is important to me to know that the students are learning the material, and I use a variety of methods to assess how well they understand what is going on. While explaining a concept or demonstrating a sample problem during a lecture, I often seek input from the students on how they think the concept works or how the solution should proceed, and encourage them to ask questions if they do not understand a particular idea. If time and class size permit, I might ask for volunteers to demonstrate the solution to an assigned problem. I also write and administer weekly quizzes, the questions on which range from simple applications of a formula to real world situations in which they must determine which technique to apply and how. I hold regular office hours during which students may ask questions or seek help with a topic, and if students cannot attend the regular office hours, I encourage them to e-mail me or, time and class size permitting, arrange a meeting outside office hours. In interacting with the students in this way, I make a point of treating them fairly and equally, irrespective of their background or their level of mathematical inclination. It is by gathering feedback from the students in this way that I can determine whether and how I need to adjust my teaching style for a given course. For example, I have used quizzes and interaction with students in lectures and office hours to determine topics which might perhaps require further explanation in the lectures, or whether or not I need to present the material at a faster or slower pace. I also use these methods to determine which students are struggling to follow the course and might perhaps need extra outside help, either from me directly or from other sources such as the Mathematics Laboratory.

Most importantly, I try to make the courses I teach a pleasant and enjoyable experience for my students. I recognise that not all of the students share my own love of mathematics, and indeed some of them actively dislike the subject. As such, I try to present the material in lectures with a level of enthusiasm which communicates a love of mathematics, so that they may gain some measure of appreciation of the material, whether they plan to use it primarily as a device in applications or study it for its own sake. I make a point of giving the students enough guidance during and outside lectures that they are able to understand concepts and applications which might otherwise be a frustrating struggle, but not so much that I end up doing all of the work for them, leaving them with only a vague understanding of ideas they will be expected to use in many situations. And I hope that in demystifying these ideas and highlighting some of the reasons why I, or indeed anyone, should find them so fascinating, I can spark some of the same fascination in my students.