Introduction

What is Duke's Laboratory Calculus Course About?

In their 1996 report entitled *Shaping the Future*, the National Science Foundation states that

> we urgently wish for, and urge decisive action to achieve, an America in which all students have access to supportive, excellent undergraduate education in science, mathematics, engineering and technology, and all students learn these subjects by direct experience with the methods and processes of inquiry.

We wholeheartedly endorse this goal, and it is with this purpose in mind that we have designed our laboratory calculus courses. The methods and processes of inquiry in mathematics include much more than mastering a set of techniques and algorithms. The mathematical process also includes: searching for patterns, order and reason; creating models of real world situations to clarify and predict better what happens around us; understanding and explaining ideas clearly; and applying the mathematics we know to solve unfamiliar problems.

In our laboratory calculus courses you will take part in the mathematical processes described above. This participation in "real mathematics" is challenging, and for many of you, it will be contrary to your experiences in more traditional mathematics classes. You will explore, investigate, and explain as often as you will compute, calculate and solve. You will still receive presentations from your instructor, but you will also, at times, work together with your classmates as you explore new concepts or new applications. During these times of exploration and group work, your instructor or lab assistant will be there to help you—not to do the work for you. We want you to become independent thinkers, and we want you to be able to explain clearly your mathematical thinking to others.

Be Prepared!

This calculus course may be quite different from your previous math courses. Even if you have had some calculus, you will probably encounter many new concepts, and you will likely find the presentation and emphasis of this course to be very new to you.

Work outside of class. You will spend a lot of time working outside of class. As a rule of thumb, you should plan, on the average, to spend about three hours out of class (not counting lab time) for each classroom hour.

Tests. The tests will be challenging. Typically, tests will be harder than the average homework problem, because we expect that your understanding and proficiency build as you study a block of material. We will test to see that you have reached

the expected level of understanding. You will also see problems on tests that you haven't seen before, because we want you to be able to assimilate ideas and apply them to new contexts.

<u>Seek help</u>. You should seek help when you need it. You will get stuck on some homework problems, you will not understand all concepts the first time you hear them, and you will need hints on some parts of some labs. There is a paragraph below on how to get assistance.

<u>Understanding requires effort</u>. We expect you to struggle with the material to develop your own understanding of it. Grappling with new concepts is part of the process of understanding mathematical ideas. Memorizing formulas or complicated techniques will not accomplish the goals of this course, and therefore, will not be sufficient to do well in the course; and more important, memorization does not produce long-term retention. Even after you forget details, we want you to remember the ideas and usefulness of calculus.

<u>Writing about mathematics</u>. You will be required to write about mathematics. We ask you to write for two reasons: First, mathematical understanding is useless if you cannot communicate your understanding to others. Second, the way for you and us to be sure that you understand the material is for you to express your understanding in writing. If you ever think, "I understand this idea, but I cannot put it into words," then probably you don't understand the idea as well as you thought.

<u>Working with others</u>. You will be required to work with others. If you have always done your academic work individually, then you will have to learn to deal with challenges such as meeting with people who have busy schedules, planning to share the workload in reasonable ways, helping each other to learn, and compromising.

Structure of Duke's Lab Calculus Courses

Our calculus classes meet for three 50-minute periods each week (or the equivalent thereof) and for an hour-and-forty-five-minute lab each week. Usually, during class time the instructor will lecture, although you may occasionally do some group work, conduct some calculator experiments, or participate in a discussion (perhaps about the implications of material covered in a lab, or about how to write a mathematical report, or about one of the many applications that you will encounter in the course).

In the labs you will either explore an application of calculus or investigate concepts. The applications will show you how the mathematics you have been learning can be used, and the investigations should deepen your understanding of concepts presented in the classroom or introduce you to new, related concepts.

Course Materials

The textbook for the introductory laboratory calculus courses is <u>Calculus</u>, by Deborah Hughes-Hallett, Andrew M. Gleason, et al, fourth edition. You will also need a *Course Pack*, which you are evidently holding. The *Course Pack* contains the labs, additional reading material, and a "Calculator Drill." For the purpose of doing lab work—and participating in some teachers' classroom calculator activities— you will need a graphing scientific calculator[1].

Homework, Lab Reports, Quizzes, Tests, Exams, and Grades.

<u>The Syllabus and Homework</u>. On the first day of class your teacher will give you a syllabus, which is the same for all classes in the course. You are expected to read the references and do the homework problems listed on the syllabus without specific directions from your teacher. Some teachers will collect homework papers, some will collect only some of the assignments, and some may give quizzes on homework. Most teachers will count homework only a very small percentage of the overall course grade, but will include some homework problems—or at least ideas from homework problems—in quizzes and tests.

<u>Lab reports and quizzes</u>. After most labs your teacher or your lab assistant will grade your work. In some cases you may be required to submit a report that consists of several typed pages. In other cases you may be asked to submit a short-answer summary of the lab. Some teachers will give you quizzes on some labs. Before you leave each lab session, be sure you understand what you are expected to do.

<u>Tests</u>. Three major tests are scheduled to be administered during the lab period. Also, the syllabus is structured so that a teacher who wants to give a third, in-class test at the end of the semester may do so.

<u>Final exam and semester grades</u>. During the examination period—after classes end—the Math Department will administer the same final exam to all students in the course. This block final will be reviewed, before it is administered, by all teachers in the course for accuracy and appropriateness. The purpose of the final exam is to ensure that the letter grades assigned by teachers mean the same thing across the different sections. The assignment of an individual student's semester grade is the prerogative and responsibility of the student's teacher, but we ask our teachers to submit aggregate grades consistent with the class's overall grade distribution on the final exam. The real effect of this policy is to cause the teachers to work closely together throughout the semester to ensure that their

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[1]Students are required to have a TI-83 calculator, unless an official waiver has been granted.

expectations are about the same and that their interpretations of the quality of students' work is consistent. Indeed, most students' performance on the block final has been about the same as they had been doing all semester.

The relative weight assigned to each component of this course is decided by the individual teachers, although the Department does offer some suggestions to teachers. It is unlikely that two teachers will assign exactly the same weight to labs, quizzes, homework, tests, and the exam.

There is one exception to the grading described above: the Math Department sets a "mandatory F" on the final exam. If on the final exam a student scores below this mandatory F, which is usually set to be at about 25%, then the teacher must request permission from the Department if the teacher has a reason to submit a passing grade for that student for the course. (It is extremely rare for a student to score so low on the exam and also to be passing the other components of the course.)

Rumors. In the past there have been some ridiculous rumors circulating about grades in calculus. Here are some facts. In the fall of 1999 about 60% of the students taking Math 31L made an A or a B, and only about 2% failed the course. In the spring of 2000 over 50% of the students in Math 32L made an A or a B, and only 2% failed that course. These percentages are typical of our first-year calculus courses, so when you hear wild rumors about calculus grades, you can be comforted with these facts.

Assistance

We expect that most students will need some assistance at some time during the course. The biggest mistake that a student can make in this regard, is not to seek help when it is needed. The Mathematics Department provides assistance in the form of a "Helproom." This Helproom will be staffed by the teachers in the course, the lab assistants in the course, and by some others hired specifically for that purpose. Our teachers participate in the Helproom, rather than providing regular office help, because with the Helproom we can provide many more hours of assistance, and many more points of view, than any one teacher could possibly provide. Early in the semester the Math Department will give you a handout that will list the specific location of the Helproom and its hours of operation.

There are some other sources of help that some students may want to use. The Peer Tutoring Office is a good place to start if you want an individual tutor. More information about tutors and about the Helproom can be found at the Math Department's web site *www.math.duke.edu* ; take the link to "Information for first-year students."

Academic Honesty

You are required, and expected, to live up to the highest standards of academic honesty as described in the University Honor Code. We take issues of academic honesty seriously, and we enforce the Honor Code.

You will be submitting reports, done out of class with others, for grades. If you copy any part of someone else's report, whether a current one or an old one, you are guilty of plagiarism. We expect you to discuss mathematics with each other, and we expect you to get ideas from each other, but your reports and your tests must be your own work. The name of every author of a report should be on the report, and in case some critical component or idea in a report was from another source (such as a friend or lab assistant), then that source must be cited. We ask that you sign each test, quiz, and report that you submit: your signature indicates awareness of and compliance with the University Honor Code.

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