

Math 131/135/194, Fall 2004

Applied Calculus

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Course Description

Applied Calculus (Math 194) is a relatively new course at Macalester that has been offered for the last two years. It is part of a two-course sequence; the follow-up course is Introduction to Statistical Modeling (Math 155). These two courses have been developed to treat mathematics and statistics as part of an interdisciplinary education closely linked to applications and the disciplines in which the mathematics will be used.

Applied Calculus is an introductory calculus course. But whereas the traditional Calc I is about functions of a single variable, Applied Calculus covers functions of multiple variables and a related subject, linear algebra, that is very useful in applications but not traditionally taken by non-mathematics majors. With skills in these areas, students are much better equipped to carry out work in the scientific disciplines that are interesting to them.

The course's emphasis on functions of multiple variables, and the orientation of the course to the mathematical topics that are needed in many scientific disciplines, means that Applied Calculus is generally the appropriate first calculus course both for those who have never studied calculus, and those who have already had some calculus in high school.¹

Why are there 3 course numbers?

This sheet lists three course numbers: Math 131, 135, and 194. The reasons for this are historical. Students in Kaplan's course are enrolled in Math 194, students in Flath's course are enrolled in 131.

The mathematics department decided in January 2004 that it would replace some topics in the traditional Calculus I course with the new topics from Applied Calculus, and unify the two courses into Applied Calculus as the mainstream introductory calculus course. We are starting that transition this semester. But the department's decision came after the registrar's deadline for setting the schedule, so we had to use the old course numbers. The new course will eventually be numbered 135, to allow it to be distinguished from the historical 131 on former students' transcripts.

¹Students who have had enough calculus in high school to be prepared for Calc III, should usually take Calc III instead of linear algebra. Students who are well prepared for Calc II, and who intend to major or minor in mathematics, physics, or chemistry, should take Calc II, which will prepare them for the further study in mathematics that they will need in that discipline. But, all students who are required to take statistics for their intended major, and students who do not intend eventually to study Calc III or linear algebra, should take Applied Calculus, regardless of their previous mathematics background.

Course Materials

The textbook for the course will be *Applied Calculus, 2nd Ed.* by Deborah Hughes-Hallett, et al. The term *et al.* is short for the Latin *et alii* and means "and others." One of the others is Prof. Flath.

We will also make use of computer software in the course. There will be 6 computer-lab assignments. The software used is a package called "R" designed for doing advanced statistical analysis. It also works well for our calculus course. R is installed on campus computers, and is available for free to install on any computer you like: PC, Mac, or Linux. The software can be found at www.r-project.org. You do not need to have any previous experience with computers to take this course: we will teach you what you need to know.

Grading

Your grade in the course will be based on several components:

Mid-term I	15%
Mid-term II	15%
Final exam	25%
6 computer-lab reports	25%
Weekly homework assignments and class participation	20%

Homework assignments and computer-lab reports are due at 5PM on the indicated day.

The homework assignments should be written individually by you, in your own words. The computer-lab reports may be written individually by you, or you can work together with one other student and hand in a joint report. You are encouraged to form study groups and work together on the homework, but each report should be written and handed in individually.

On every homework report, please make sure to indicate clearly your name and the assignment number. Each individual problem should be clearly labelled with its problem number.

Syllabus

Here are some important dates along with the first few class days' readings and the first assignment:

Wednesday 8 Sept. Topic: Introduction, Modeling.

Friday 10 Sept. Topic: Functions, domain, range, composition, graphs, tables. Readings for class: AC 1.1, 1.8

Monday 13 Sept. Topic: Units and conversions, linear functions. Readings for class: AC 1.2, 1.3 Assignment 1 DUE: Submit: 1.1#2, 4, 8. 1.8#4, 20, 34. p. 69#2.

Wednesday 15 Sept. Topic: Modeling dynamics; recursion. Readings for class: AC 1.4.

Friday 17 Sept. Computer Lab 1: Introduction to R.

Friday 24 Sept. Computer Lab 2: Parameters from data.

Wednesday 6 Oct. Mid-term Exam I.

Friday 22 Oct. Computer Lab 4: Fitting and optimization

Friday 5 Nov. Mid-term Exam II.

Friday 19 Nov. Computer Lab 5: Differential equations on the phase plane.

Friday 3 Dec. Computer Lab 6: Linear combinations of vectors.

Note that Computer Lab 3 is one that you will do on your own, not during a class session.

Computer Labs

Five times during the semester, the class will meet in the PC computer lab in the math department. The class is larger than is ideal for a computer lab, so we will offer several sections of each of the labs. One of these sections will be during the regular class hour, always on a Friday. Another section will be on the previous Thursday at 10:45. A third will be set at a time to be arranged. We anticipate that the session during the regular class hour will be the most crowded, so you are encouraged to go to one of the other sessions if you can. Students from Math 131 will be attending the same computer lab sessions.