311:09 **The last four meetings** **11/22/94**

The last four meetings of the course should be useful applications of the methods we've developed to the principal ideas of calculus: the derivative and the integral. There are many aspects of calculus which are explained quite well in such routine sources as textbooks and (even!) the classes of large lecture courses. Among these are the logical development of the Mean Value Theorem, Taylor's Theorem, many aspects of the Fundamental Theorem of Calculus and certainly most of the routine algorithms. I will restrict my attention therefore to matters which I feel can benefit the most from our systematic and logical analysis in the limited time we have available. These topics are customarily given less emphasis because dealing with them directly involves some logical intricacy, which we can now easily endure. An outline of what will be covered, what you can expect, and what you should do follows.

The Derivative (two lectures)

- The definition with appropriate examples (x^n and more interesting ones); differentiability and continuity: 6.1.
- Derivatives of compositions (the chain rule): 6.1.
- Derivatives of inverse functions: 6.1.
- The Mean Value Theorem; functions with continuous derivatives are Lipschitz on closed, bounded intervals: 6.2.
- Convergence of Newton's method: 6.4 (if time permits).

The Integral (two lectures)

- The definition, with all of its complicated apparatus (including lower sums, upper sums, lower integral, upper integral); examples both pleasant and unpleasant: 7.1.
- Riemann's criterion for integrability and a few applications (the sum of integrable functions): 7.1 and a small piece of 7.2.
- Monotonic functions are integrable; continuous functions are integrable: 7.1.
- How to detect if a non-negative continuous function is actually zero everywhere: 7.1.
- Approximating the definite integral of Lipschitz functions with evenly spaced Riemann sums: 7.1.

Comments

It's my hope that the content of these four lectures will seriously expand the intellectual "payoff" of the course and that you will believe more strongly that the voyage from the basic specification of $\mathbb{R}$ as a complete ordered field up to what will be presented is worthwhile. Opinions may differ, of course, but remember that until late on the evening of Thursday, December 15 (see the reverse of this sheet), you will remain in the custody of a mathematical fanatic!

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Timetable of further significant events and duties for the course

- Problems for classes on the derivative (to be handed in on Tuesday, December 6, and returned on Thursday, December 8): 6.1: 1b,1c, 4, 6, 14; 6.2: 8.
- There will be a workshop on Tuesday, November 29, primarily devoted to derivatives. The second exam should be returned then. Workshop writeups resulting from this evening's meeting should be handed in on Tuesday, December 6, and returned on Thursday, December 8.
- There will be a workshop on Tuesday, December 6, primarily devoted to integrals. The end of the workshop will be signaled by student evaluations of the instructor and the course.
- Problems for classes on the integral: 7.1: 2, 7, 9, 14.
- The last class on Thursday, December 8, will be a raucous celebration (at least after the lecturing is finished); a sample final exam reproduced from one given to a section last year will be handed out, along with some hints about our final.
- The time and place for this section's **Final Exam** is as follows:

  Thursday, December 15, from 8:00 to 11:00 PM, in HH-A4

  and I will have office hours on Tuesday, Wednesday, and Thursday (December 13, 14, and 15) from 1 PM to 4 PM in Hill 542 on Tuesday and Thursday and from 11 AM to 2 PM on Wednesday. I will be accessible by e-mail (`greenfie@math.rutgers.edu`) as usual.

  Good luck!