MATH 321, Advanced Calculus
Fall 2012

Bryan Smith

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Contents

1 Introduction

The only formal prerequisite for this course is Linear Algebra (Math 290). This means you should be familiar not only with the standard methods and techniques for thinking about and solving proof-oriented mathematical problems but also with the basics of developing and writing proofs. Although there are few prerequisites, this course is essential for those of you considering graduate studies in mathematics and is highly desirable if you are looking at a career in secondary education or mathematical finance. It also provides a deep explanation of the mathematical methods and tools used in physics, chemistry, economics and certain areas of biology and geology.

In the broad sense, our primary goals are to learn the basic axioms, definitions, and theorems of calculus, develop the skill to carefully read mathematics, and to attain proficiency in developing and writing proofs. More specifically, we will be gaining an in-depth understanding of all the calculus terms that were introduced to you in the Freshman calculus sequence: series, sequences, integrals, derivatives, continuity, limits, functions and real numbers. However the level of rigor in this course differs significantly from that introductory sequence. We will prove essentially every theorem of calculus starting from the definitions and axioms. In spirit, this is what you did in your linear algebra course when you studied vector spaces. But proofs in

"mathematical analysis" look very different from proofs in algebra. The most obvious difference is that, in analysis, almost all proofs involve some use of numerical inequalities applied to some version of a "limit". Hence, we will begin our studies with a careful look at the field of real numbers because much of calculus is just the exploitation of the inequality and "limit" properties of that field.

For an official description of this course, see the department's MATH 321 Syllabus[3].

2 Course Information

2.1 Textbook

The textbook is *Advanced Calculus, Second Edition*, Patrick M. Fitzpatrick, American Mathematical Society, ©2006. This semester we will cover the calculus of one variable (essentially, Chapters 1-8). In the Spring, Math 322 will focus on multivariate calculus.

You should already feel comfortable with the standard approaches to constructing a mathematical proof. However, if you would like to have a resource at hand, I recommend: "The Nuts and Bolts of Proofs", Antonella Cupillari [5]

2.2 Basic Information

You can find information pertinent to all of my classes at the link below and, once there, information specific to this class by clicking on the Math 321 link.

`http://math.ups.edu/~bryans/` [1]

2.2.1 Logistics

Bryan Smith	TH 390D	879-3562	bryans[at]ups.edu
Math 321	TH 374	M,T,Th,F	2:00-2:50pm
Office Hours		Tue, Thu	8:00-8:30am
		Tue, Thu	10:30-11:00am
		Tue, Thu	3:00-3:30pm
		Tue	3:30-4:30pm
		Other	By Appointment

2.3 Examinations

Since the homework problems will be used to facilitate deep understanding, tests will be used more as a basic check of your knowledge. Hence, there will be four, "straightforward" examinations. In them you will be asked to give correct statements of important definitions and theorems and to develop proofs using the analytical techniques explored in class. Exams will occur approximately every three or four weeks and the last exam will occur during the final exam period. Tentatively, you should expect the first three exams during weeks 5, 9, and 12.

2.4 Final Examination: Wednesday, December 12 at 4:00pm

The final is cumulative and cannot be rescheduled so do not plan plane flights (or anything else) that will conflict with it.

2.5 Homework

I will assign a number of homework problems from the textbook but will only designate about 35 of them to be turned in. Most of the problems require developing and writing proofs and will be marked both for correctness and presentation.

At least two of your acceptable problems **must** be typed using LaTeX.

When you submit a problem, I will mark it as acceptable if the argument is valid and is presented in a standard format. If the problem is not acceptable, I will return it for revision and resubmission. If it is acceptable, I will assign a score from 7 to 10 on the basis of style, presentation and minor errors. Precision and conciseness will receive more points than loose or rambling arguments.

Some of the problems will be designated as "group" and others as "individual". I encourage you to discuss the "group" problems with others in the class but you are not to collaborate when writing the proofs. For "individual" problems you may consult only with me. When you submit these problems you must include the "cover" sheet (additional copies on my website: `http://math.ups.edu/~bryans/`).

There will be about 12 problems assigned in each of the following three periods. Use one cover sheet for each period.

1. Problems assigned through September 26 can only be (re)submitted up to October 8 at 5:00 PM
2. Problems assigned from September 27 to October 31 can only by (re)submitted up to November 9 at 5:00 PM.
3. Problems assigned after October 28 can only be (re)submitted up to December 12 (the Wednesday of finals week) at noon.

2.5.1 Submission Restrictions

1. You may not submit more than three attempts on any day.
2. I will evaluate and return an attempt by 5:00 pm of the second class day after it was submitted. For example, if you submit an attempt on a Monday, I will evaluate and return it by that Thursday at 5:00 pm.

2.6 Project

The course project consists of understanding the material and doing selected problems from Sections 2.5, 5.2 and 5.3 of the text. We will not cover this material in class. Problems from the course project will be due on Wednesday December 12 at noon (the Wednesday of finals week).

2.7 Course Information Updates

If you wish, I will post (and update) a grade report on your current standing in the class on my university web page. You should keep track of your grades on the various assignments and check them against these reports. If there are any discrepancies they should be dealt with immediately.

To have your information posted you need to print your name, the date, the class (MATH 321), and a code on a sheet of paper. Then sign the paper and physically hand it to me. The code is to be a sequence of up to 23 symbols I can type on a keyboard.

2.8 Total Points

Problems	50%
Examinations	40%
Project	10%

2.9 Emergency Response Information

Please review university emergency preparedness and response procedures posted at www.pugetsound.edu/e ¡http://www.pugetsound.edu/emergency/¿. There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.

If building evacuation becomes necessary (e.g. earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do not return to the building or classroom until advised by a university emergency response representative.

If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.

2.10 Logistical Assignment

(Due Friday August 31 at 5:00 P.M.)

1. Look over both my university web page `http://math.ups.edu/~bryans/` [1] and the course webpage for MATH 321 you'll find there.

2. Send an e-mail message to me at bryans [at] ups.edu mentioning that you are in Math 321 and telling me if you have any schedule conflicts on Tuesday or Thursday from 3:00 to 3:30 pm.

References

[1] Bryan Smith's Homepage
`http://math.ups.edu/~bryans/`

[2] Math 321A Course Webpage
`http://math.ups.edu/~bryans/Current/Fall_2012/321Index_Fall2012.html`

[3] Department Syllabus for MATH 321
`http://www.math.ups.edu/~matthews/Syllabi/MA321Syllabus.pdf`

[4] William Rapaport's "How to Study"
`http://www.cse.buffalo.edu/~rapaport/howtostudy.html`

[5] "The Nuts and Bolts of Proofs", Antonella Cupillari
`http://www.amazon.com/exec/obidos/tg/detail/-/0120885093/`