

MATH 321, Advanced Calculus

Fall 2011

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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, many faculty in mathematics consider this course very important for those of you pursuing either a career in secondary education or graduate studies in mathematics. Our goals are few:

- to learn the basic definitions, axioms, and theorems of calculus,
- to develop the skill to carefully read mathematics, and
- to attain proficiency in developing and writing proofs.

You are already familiar with most of the terms we will study in this course: integrals, derivatives, continuity, functions and real numbers. However the level of rigor in this course differs significantly from the introductory calculus 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 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. 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 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 calculus of one variable. 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, you might consider buying one of the many books on “how to do proofs”. I recommend “The Nuts and Bolts of Proofs”.

- “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	2:00-2:50am
Office Hours		Tue, Thu	12:00-12:45pm
		Tue, Thu	3:00-4:00pm
		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 straightforward proofs using standard analytical techniques. Exams will occur approximately every three or four weeks and the last exam might be during the last week of classes rather than during finals week. Tentatively, you should expect the first three exams during weeks 4, 7, and 11 of class.

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

The final 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 30 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 L^AT_EX.

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 and presentation. 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 and sign the following statement: ‘*I pledge that I consulted with no living source other than the course instructor in developing and writing this proof.*

There will be about 10 problems assigned in each of the following three periods.

1. Problems assigned through September 23 can only be (re)submitted up to October 3 at 5:00 PM
2. Problems assigned from September 24 to October 28 can only be (re)submitted up to November 7 at 5:00 PM.
3. Problems assigned after October 28 can only be (re)submitted up to December 14 (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 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 14 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 <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. Stay low, away from doors and windows, and as close to the interior hallway walls as possible. Wait for further instructions.

2.10 Logistical Assignment

(Due Wednesday October 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 that contains the information below.
 - (a) The course number, 321, and your name are in the "Subject" line.
 - (b) Do 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_2011/321Index_Fall2011.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/>