Math 23b - Vector Calculus II Dan Cristofaro-Gardiner
Winter 2018
Lectures: MWF, 8 - 9:05 AM, Kresge 321

Instructor Information:

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Office Hours M 3-4:50, W 2 - 3:10
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Course Description:

In your single variable calculus class, you studied integrals of functions of a single variable. Math 23b is an introduction to integration theory for functions of several variables, which is a topic that has applications across mathematics and the natural sciences. We will focus on the different kinds of integrals that come up in this context, with an emphasis on learning how to compute and interpret representative examples.

For more about the course, please read the "Goals" and "Pedagogy" sections of the syllabus.

Prerequisites:

To take this course, you should have completed Math 23a, or its equivalent, and you should also have completed the prerequisites for 23a.

If you are worried about prerequisites, I would encourage you to speak with me one on one.

Textbook:

The textbook for the course is Vector Calculus, 6th edition, by Marsden and Tromba (ISBN 9781429215084). There is also a solutions manual, by Shanbrom and Tokorcheck. Both the textbook, and the solutions manual, are available in the bookstore.

Teaching assistants:

We have two teaching assistants for this course. They are Gabriel Martins (gmartins@ucsc.edu) and Vinod Sastry (vrsastry@ucsc.edu). They will both have office hours; they will be announcing the time and place of these office hours soon.

Email and Website:

There is a website for this course, at **https://dancg.sites.ucsc.edu/teaching/math-23b-vector-calculus-ii/**. The homework for the course will be posted there, as will any essential announcements. I might also post clarifying notes from time to time; for example, if many students ask me a similar question, I will post a response.

You are encouraged to email me, or the TAs, with any questions that you might have. I will try to respond to all emails with 48 hours.

Discussion section:

Our teaching assistants will be running a weekly section to complement the course. This should be a valuable part of your learning experience, and it is the policy of the math department that for this course attending a weekly discussion session is **required**; you must be enrolled in a section to attend it. There are four sections: M 1:20-2:25 PM, Tu 10:40-11:45 AM, W 9:20 - 10:25 AM, and Th 2:40 - 3:45 PM. Sections begin on Tuesday, **January 16**.

Tutoring:

You are eligible for small group tutoring from Learning Support Services to help with this course. Small group tutoring is optional, but highly encouraged. For more information about small group tutoring, please go to **https://lss.ucsc.edu/programs/small-group-tutoring/index.html**.

Enrollment questions and permission codes:

I can not give permission codes for the course. For these codes, please go to **https://www.math.ucsc.edu/undergraduate/Enrollment/index.html**, or contact Ben Fisher (bfisher1@ucsc.edu).

Academic accommodations:

To receive academic accommodations for a physical or learning disability, please submit an Accommodation Authorization Letter from the Disability Resource Center (DRC) to me as soon as possible (ideally within the first two weeks of the quarter), and contact PBSci Testing at **testing.pbsci@ucsc.edu** for arrangements at least two weeks prior to any exam. If you do not currently have accommodations authorized, you will be referred to the Disability Resource Center (DRC). You may contact the DRC by phone at 459-2089, or by email at **drc@ucsc.edu**.

Major qualification:

You should know that this course is required to declare one or more majors, and your performance could affect your eligibility for these majors.

Grading rubric:

One midterm: 30%
One final: 40%
Weekly quizzes in discussion section: 20%
Homework: 10%

Late work:

Please note that except in exceptional circumstances with appropriate documentation, or in line with an academic accommodation, late homework will not be accepted and missed quizzes or midterms can not be retaken.

Homework:

Homework will be posted to the course webpage, with a due date, and will be due at the beginning of class. The first homework will be due **Wednesday, January 17**, and will be posted **Wednesday, January 10**. Your teaching assistants will grade and return your homework.

Goals for the course:

My hope for you is that by the end of the course you should:

- Understand what double and triple integrals are, and know how to compute many examples with pencil and paper. What do integrals have to do with the "area under the graph", and what does the area under the graph of a function of two variables look like? Why might we want to study integrals of functions of more than 2 variables, and what do these integrals mean?

- Understand what it means to change variables when doing an integration, and be able to identify situations where this might be useful. What is the change of variables formula? How does it work for polar, spherical, and cylindrical coordinates?

- Understand what a vector field is, and understand what it means to integrate a vector field over a line or a surface. How do we compute these vector fields in examples?

- Understand the fundamental theorems of vector calculus. What are the statements of Green's Theorem, Stokes' Theorem, and Gauss' Theorem? How do they relate to the fundamental theorem of calculus, from your single variable calculus class? When is it appropriate to use these theorems?

- Understand a little bit about the connections of integration theory to the natural sciences, especially physics. What do line integrals have to do with work? How can we think about surface integrals physically?

- Find integration theory fascinating, beautiful, and fun!

Pedagogy and advice:

For the most part, I will be lecturing during class time. However, I want to emphasize five principles and tips that I think are very important for this course:

- Ask questions! The more you engage with the material, the better your understanding will be. Often, the deepest understanding comes only after many mistakes.

- Do lots of examples and exercises! We will do examples in class, and I will sometimes have you work on examples in class as well.

- Try to have fun! I will try my best to make the course enjoyable and interesting, and I hope you will enjoy it too.

- Try not to fall behind! I think you will have an easier time if you keep on top of your work

- Come to office hours! It will be great to meet you.

Tentative lecture schedule (very much subject to change!):

- Double and triple integrals (Textbook, Chapter 5): Weeks 1 and 2
- Change of variables and some applications of integration (Textbook, Chapter 6): Weeks 3 and 4
- Line integrals, vector fields, and an introduction to surfaces (Textbook, Chapters 7.1-7.5): Weeks 5 and 6
- Surface integrals of vector fields (Textbook, Chapters 7.6-7.7): Week 7
- Green's Theorem and Stokes' Theorem (Textbook, Chapters 8.1-8.2): Week 8
- Conservative vector fields (Textbook, Chapter 8.3): Week 9
- Gauss' theorem and general review (Textbook, Chapter 8.4): Week 10

Lecture summaries:

I will periodically post very brief summaries of what was covered in lecture, with companion readings. See https://dancg.sites.ucsc.edu/teaching/math-232/math-232-lecture-summaries/ for an example of how this will look.

Key dates:

Midterm: Wednesday, February 7, in class
Final exam: 3/19 12 - 3 PM