University of Massachusetts at Amherst,
Department of Mathematics and Statistics

MATH 425.1 ADVANCED MULTIVARIABLE CALCULUS
SPRING 2020

Text :	Text: Vector Calculus by Marsden and Tromba, (5th edition) Ed., W. H. Freeman
Instructor :	Ivan Mirković ("Meerkovich")
Homepage :	google me or: http://people.math.umass.edu/~mirkovic/425/1.html
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Phone :	545-6023
Email :	mirkovic@math.umass.edu
Office Hours :	See the web page.
Homework :	Weekly. Assigned, collected and returned a week later.

The grade is formed according to (as decided in class):

- The first midterm exam is worth **25%**,
- The second midterm exam is worth **25%**,
- the final exam is worth **30%**,
- the homework is worth **20%**

Midterm exams will be announced on the web page. *Sample exams* will appear a week before the exam, and these problems will be discussed at the *review sessions* before the exam, check the web page for the times.

Course policies. The **final exam** will be cumulative, with an emphases on the material covered after the second exam

Please note that the **homework deadlines** will be strictly enforced. This means that the assignments will be due in class on the day I've requested them, and the late homework will not be accepted. Help each other out and discuss difficulties, but do **your own** work. If your solution of a problem uses someone else's work, you should acknowledge this explicitly. You are expected to know the (very serious) difference between shared and copied work.

It is expected that you will **attend** virtually all class meetings. Though I may not control this, any absence is likely to cause difficulties in the course. You should also complete the reading and other assignments on time so that you can participate in class discussions and problem-solving. I will answer *some* questions on homework problems in class, however this may not be very helpful if you have not already tried to solve these problems.

Topics

We will cover material from chapters 5-8. Chapters 1-5 of the book (and some other parts of our course)

- 5. Double and Triple Integrals
- 6. The Change of Variables Formula
- 7. Integrals over Paths and SAurfaces
- 8. The Integral Theorems of Vector Analysis

The nature of the course

The main ideas of calculus are the rate of change (derivatives) and calculating the total of a quantity which is spread over some region with a known density (integrals).

When calculus is extended from functions of one variable to functions of two, three or really any number of variables, the essential new complexity that appears is the complexity of *geometry*. Now one has to consider geometry of regions and shapes in 2 or 3 dimensions (and eventually in spaces $\mathbb{R}^n$ of an arbitrary dimension n).[1]

Since in this course the concepts become as important as algorithmic procedures and computations, one may try new modes of work:

- A careful and critical reading of the text.
- Developing precise understanding of the definitions and concepts.
- **Reading Assignments** It will be especially helpful for you to have read (carefully) the discussion in the textbook before that material is discussed in class. A reading assignment will consist of a reading in the textbook. I will not check your reading assignments but I expect you to make a *sincere effort* to understand what the next lecture is about.

How to Learn Mathematics at the Conceptual Level.)

(1) You start by hearing (or reading) of a new idea, new procedure, new trick.
(2) To make sense of it you check what it means in sufficiently many examples. You discuss it with teachers and friends.
(3) After you see enough examples you get to the point where you think that you more or less get it. Now you attempt the last (and critical) step:
(4) Retell this idea or procedure, theorem, proof or whatever it is, to yourself in YOUR OWN words.[2]

[1] While our physical experience is with a three dimensional space, the mind readilly uses spaces of higher dimension. For instance these appear any time that one considers a problem that involves several parameters. So, spaces of data are an example of higher dimensional spaces.

[2] Trying to memorize someone else's formulation, is a beginning but it is far from what you really need – you should get to the stage where you can tell it as a story, as if you are teaching someone else. When you can do this, and your story makes sense to you, you are done. You own it now.

However, if at some point you find a piece that does not make sense, then you have to return to one of the earlier steps (1–3) above. Repeat this process as many times as necessary.