Math 53 – Section 1 – Multivariable Calculus – Fall 2017

Denis Auroux – MWF 2-3pm, Room 155 Dwinelle

Announcements Course info & policies FAQs Homework Exams Syllabus Sections

Instructor: Denis Auroux (auroux@math.berkeley.edu)

Office: 817 Evans.
Office hours: Mondays and Tuesdays, 10:30-12 (+ RRR week: also Wed and Fri, 1:30-3:30)

Lectures: Mondays, Wednesdays and Fridays, 2–3pm, 155 Dwinelle
Discussion sections: Mondays, Wednesday and Fridays, at various times. See list.

See below for important **course information** and **policies.**

Announcements

- **(12/13)** The final exam has been graded. Your score (out of 200) is available in bCourses. The median score was 140 out of 200. The quartiles were 116 and 158. Rough cut-offs: A-/B+ = 165, B-/C+ = 130, C-/D = 100.
- **(12/9)** Office hours on Monday Dec 11 will be 10:30-12 as usual. No office hours on Tuesday Dec 12, sorry. Please remember that your final exam will be in either Dwinelle or Pimentel depending on discussion section, see below.
- **(12/1)** The **final exam** will take place on Tuesday Dec 12, from 11:30 to 2:30pm, in **155 Dwinelle** if your GSI's first name starts with the letter J (Jasper Deng, Jingyi Wang, Jeff Hicks, Justin Brereton: discussion sections 106, 107, 110, 112-116); in **1 Pimentel** for everyone else (GSIs Nima Moini, Ritwik Ghosh, Kyeonsik Nam, Michael Yeh, Ahmad Zareei: sections 101-105, 108, 109, 111, 117, 118).
- **(12/1)** Jingyi Wang's office hour today is cancelled. Prof. Auroux's office hours during RRR week: Monday and Tuesday 10:30-12, Wednesday and Friday 1:30-3:30, in 817 Evans.
- **(11/16 11:45pm)** Grading is complete, and you can find your graded midterm 2 in Gradescope. Statistical data and grade cut-offs will be announced in lecture tomorrow and posted here. Regrade requests will be open starting Friday night and through the weekend.
- **(11/15)** Grading is under way. Solutions to the midterm are available here. (The two versions are extremely similar and differ only in minor numerical values.)
- **(11/4)** Two **practice midterms** for midterm 2 are available below. However I recommend waiting until we have covered surface integrals and flux in 3D to attempt them.
- **(10/13)** I will be out of town on Tuesday Oct 17; my office hours on that day are cancelled.
- **(10/3)** Midterm 1 has been graded; you can access your graded paper by logging in to Gradescope (you should have received an e-mail from Gradescope). Regrade requests: first check carefully against the solutions and, if needed, talk to your GSI on Wednesday to figure out why your answer didn't get full credit. If there are still unresolved issues, regrade requests will be accepted via Gradescope from Wednesday night until Friday night.
- **(10/2)** Grading is still in progress. Solutions to the midterm are available here.
- **(9/27)** I will have additional office hours on Friday 9/29 from 3:10 (or as soon as I can get to my office after lecture) to 4:30pm.
- **(9/25)** Here are notes of today's lecture in case you were unable to attend.
- **(9/21)** Two **practice midterms** for midterm 1 are available below. I suggest you first review the material, and only attempt the practice midterms, with the indicated time limits, once you feel ready.
- **(9/21)** We will plan to **hold class as usual** during "free speech week", as long as it is safe to do so. Please allow extra time to get to class as a detour to avoid the Sproul Plaza area may be necessary. Regarding discussions: there will be a quiz on Monday as planned, and homework 5 remains due Wednesday 9/27. If you feel unsafe coming to class, ask your GSI for alternative arrangements. Our policy is to encourage you to attend class if at all possible, but you will not be penalized for missing class on Monday or Wednesday. Stay safe!
- **(9/1)** The slides shown in lecture today are here.
- **(8/25)** The GSI for sections 106-107 has changed. Jasper Deng will be teaching those two sections from now on.
- **(7/17)** The math department is aware that both sections of Math 53 are full. See this page for updates on the department's attempts to keep up with demand.
- **(6/2)** Welcome to Math 53! Make sure to read the course policy and the detailed syllabus.

Course information and policies

Section enrollment/changes are performed via CalCentral. Instructors have no control over the enrollment process. Due to serious issues with the new Student Information System's waitlist handling, the math department no longer uses waiting lists for lower-division classes; once the class fills up you will need to keep checking in CalCentral and hope that some space opens up.

Textbook

The textbook for Math 53 is: **Stewart**, *Multivariable Calculus: Early Transcendentals,* UC Berkeley custom edition, 8th edition, Cengage Learning. (ISBN: 978-1-305-75645-8)

This is a custom edition containing chapters 10 and 12-16 of Stewart's "Calculus: Early Transcendentals", 8th edition; the regular edition is also fine. The 7th edition is also acceptable, but you will need to watch for differences in the numbering of assigned homework problems.

Other resources:

- **Video lectures:** MIT's OpenCourseWare project has a nice set of video lectures for MIT's multivariable calculus class, taught by a familiar instructor. The overall course topics are roughly the same, but they are covered in a different order and not quite in the same manner, so don't use this as a replacement for attending lectures! There are also various sets of video lectures for Berkeley's Math 53.
- **Student Learning Center:** The Student Learning Center offers an adjunct course and drop-in tutoring for this class.

Grading and course policy

Weekly homework and quizzes 25%; two midterms 25% each; final exam 25%; the lowest midterm can be dropped and replaced by the final exam grade. There will be **no make-up exams**. This grading policy allows you to miss one midterm, but check your schedule to make sure you have no conflict for the final exam.

Make sure to read the detailed **course policy** for important information.

Frequently asked questions

Q: I really want to get into the class, but the sections that fit my schedule are full, please help me!

A: Instructors have no control over the enrollment process. I cannot get you into the class magically if it is full. Keep in mind that, even if there is space in the lecture, you cannot enroll in a discussion section that is full. Due to serious issues with the new Student Information System's waitlist handling, the math department no longer uses waiting lists for lower-division classes; once the class fills up you will need to keep checking in CalCentral and hope that some space opens up.
If you really need to take this class, you should look for any remaining spaces at the less popular discussion section times, or look into Math 53 Section 2 with Prof. Frenkel, and/or consider rearranging your schedule of classes as needed. The math department is aware that both sections of Math 53 are full as of mid-July, and is working to add sections. See this page for updates on the department's attempts to keep up with demand. Keep checking CalCentral regularly to see if any space has opened up; there is always a bit of movement at the start of the semester, though I do expect that many discussion sections will remain full. In cases of genuine hardship (rather than personal preference), try to meet with a student services advisor to discuss your scheduling constraints; the math department's advisors are in 964-965 Evans.

Q: Can I attend a different discussion section than the one I'm registered for, which doesn't fit my schedule?

A: Unfortunately not. GSIs for this class already face a very heavy workload, and cannot reasonably be asked to deal with additional students. In addition, many discussion classrooms are not large enough to accommodate extra students.

Q: Can I use an older edition of the textbook?

A: The 7th edition of Stewart is fine; watch for alternative problem numbers in footnotes of homework assignments. The non-"early transcendentals" version should also be okay, you will just need to shift all chapter numbers by one (and adjust page numbers). Older editions of Stewart are not recommended because you'll need to borrow someone else's book to figure out what problems are assigned.

Q: I don't have my final exam schedule yet. How can I tell if there is a conflict?

A: As a general rule, final exams for classes with lectures at different times in the week are scheduled at different times during finals week. See the registrar's website for final exam groups. Final exams for MWF 2-3pm classes are scheduled for Tuesday Dec 12, 11:30-2:30pm. If you don't have a conflict for the lecture then you shouldn't have a conflict for the final. Unfortunately, the math department does not have the resources to provide alternative exam times; if you are worried about multiple back-to-back finals, check your schedule carefully and make the necessary adjustments to your course selections.

Q: What are your policies about assignments, midterms, and grading?

A: See **here**.

Q: Why is the homework harder than the quizzes and midterms?

A: Quizzes test your ability to quickly apply the concepts seen in class to routine problems. Homework is an occasion to think more deeply about the material, going slightly beyond the content of the lectures and exams. This is key to achieving a greater level of understanding, and to ensuring that you really master the concepts. This difference is also the reason why quizzes take place before the homework due date: by Monday you should have reviewed the week's material, attempted the homework problems, and solved at least the straightforward ones, but the more challenging homework problems may require some clarifications from your GSI in Monday's discussion or in office hours.

Q: Do you have any study tips?

A: First and foremost, stay on top of the material. If you fall behind, it is very hard to catch up in this class. Do the homework in installments, attempting it early on so you can ask questions at the Friday and Monday discussions if needed. Make use of resources available to you: office hours (both mine and your GSI's), study groups, etc. If you need extra help, look into extra resources such as the Student Learning Center. If you work with others, make sure that you arrive at your own understanding and can do the work yourself (you'll be on your own for exams!).

If you are worried about exam stress or time pressure on midterms and final exams, practice under real conditions, with a timer and without study materials, possibly together with a classmate, whenever you get the chance. Try to finish your GSI's weekly quizzes as fast as you can (then use the leftover time to make sure you got it right). Replicating test-taking situations as closely as possible even when you are not taking a test can go a long way towards overcoming testing anxiety.

After quizzes and midterms, review your answers to understand what you missed: not just what the correct solution was, but also how you went wrong, what clues in the statement of the problem or along your path of solution should have alerted you that something was wrong, or, if you were stuck, how you should have gotten started. Ask yourself if there were multiple ways to approach the question -- which ones were correct, which ones weren't, and why. And, once again, if you are confused about something, ask about it in office hours, in discussion, etc.

Q: Are grades curved?

A: Yes and no. Curves are used to compare scores on midterms and on the final, and to adjust for their relative difficulty levels, so that "dropping the lowest midterm" means the midterm on which you performed worst relatively to the class as a whole. Curves are also used to adjust quiz scores so that discussion sections with harder quizzes are not penalized. See detailed policy. On the other hand, overall course grades are not curved on any fixed scale, and the grade cut-offs are not predetermined in any manner. If the class performs strongly as a whole, there will be more A's. However, the grade distribution is usually centered on B-, consistent with other lower-division math classes. Please do not try to second-guess the grading process, instead ask me if you think there may be an error and want a detailed accounting of your grade in the course.

Homework

Homework assignments are due each Wednesday in section; they will be posted here.

- Homework 1 (due Wednesday 8/30) and solutions
- Homework 2 (due Wednesday 9/6) and solutions
- Homework 3 (due Wednesday 9/13) and solutions
- Homework 4 (due Wednesday 9/20) and solutions
- Homework 5 (due Wednesday 9/27) and solutions
- Homework 6 (due Wednesday 10/4) and solutions
- Homework 7 (due Wednesday 10/11) and solutions
- Homework 8 (due Wednesday 10/18) and solutions
- Homework 9 (due Wednesday 10/25) and solutions
- Homework 10 (due Wednesday 11/1) and solutions
- Homework 11 (due Wednesday 11/8) and solutions
- Homework 12 (due Wednesday 11/15) and solutions
- Homework 13 (due Wednesday 11/29) and solutions

Exams

There will be two midterms, on **Monday 10/2 and Wednesday 11/15 (2-3pm)** in the usual lecture room.
The final exam will be on **Tuesday December 12, 11:30-2:30pm.**

Practice exams and solutions to midterms will be posted here. I recommend that you first review the material carefully, and only attempt the practice midterms, with the indicated time limits, once you feel ready. Attempting a practice midterm under conditions that closely replicate an actual exam (closed book, no documents, with time limit) is a good way to prepare, but only works if you already know the material.

- Practice midterm 1A and solutions
- Practice midterm 1B and solutions
- Midterm 1 solutions
- Practice midterm 2A and solutions
- Practice midterm 2B and solutions
- Midterm 2 solutions: version 1, version 2
- Practice final and solutions

The **final exam** will take place on Tuesday Dec 12, from 11:30 to 2:30pm, in **155 Dwinelle** if your GSI's first name starts with the letter J (Jasper Deng, Jingyi Wang, Jeff Hicks, Justin Brereton: discussion sections 106, 107, 110, 112-116); in **1 Pimentel** for the other sections (GSIs Nima Moini, Ritwik Ghosh, Kyeonsik Nam, Michael Yeh, Ahmad Zareei: sections 101-105, 108, 109, 111, 117, 118); DSP students will receive e-mail information.

Midterm 2 score distribution: the quartiles are 57, 71, 83. (i.e.: 25% of the class got above 83, 25% got between 71 and 83, 25% got between 57 and 71, 25% got below 57). Individual scores and graded papers can be found in Gradescope. A very rough estimate of what this might mean in terms of letter grades: cut-off between A- and B+ = somewhere around 83-85; cut-off between B- and C+ somewhere around 64-66; cut-off between C- and D somewhere around 48-50.

Midterm 1 score distribution: the quartiles are 60, 76, 86. (i.e.: 25% of the class got above 86, 25% got between 76 and 86, 25% got between 60 and 76, 25% got below 60). Individual scores and graded papers can be found in Gradescope. A very rough estimate of what this might mean in terms of letter grades: cut-off between A- and B+ = somewhere around 86-88; cut-off between B- and C+ somewhere around 68-70; cut-off between C- and D somewhere around 52-54.

Remember your lowest midterm score will be dropped and replaced by your final exam score if that one is better; make sure to go over the things you missed, review any concepts that may be giving you trouble.

Syllabus

Date	Topics	Book
Wed 8/23	Vectors, dot product	§ 12.1, 12.2, 12.3
Fri 8/25	Dot product continued; determinant	§ 12.3
Mon 8/28	Determinant and cross product	§ 12.4
Wed 8/30	Equations of lines and planes	§ 12.5
Fri 9/1	Parametric equations and vector functions	§ 10.1, 13.1
Mon 9/4	NO CLASS (Labor Day)	
Wed 9/6	Parametric equations: velocity, acceleration	§ 10.2, 13.2, 13.4
Fri 9/8	Parametric equations: arc length; further examples	§ 10.2, 13.3
Mon 9/11	Functions of several variables	§ 14.1
Wed 9/13	Partial derivatives	§ 14.2, 14.3
Fri 9/15	Tangent plane, linear approximation	§ 14.4
Mon 9/18	Chain rule	§ 14.5
Wed 9/20	Gradient, directional derivatives	§ 14.6
Fri 9/22	Partial differential equations; max-min problems	§ 14.7
Mon 9/25	Max-min problems continued	§ 14.7
Wed 9/27	Non-independent variables, Lagrange multipliers	§ 14.8
Fri 9/29	Review	
Mon 10/2	**MIDTERM 1**	
Wed 10/4	Polar coordinates	§ 10.3, 10.4
Fri 10/6	Double integrals	§ 15.1, 15.2

Mon 10/9	Double integrals in polar coordinates	§ 15.3
Wed 10/11	Applications of double integrals	§ 15.4
Fri 10/13	Change of variables in double integrals	§ 15.9
Mon 10/16	Triple integrals	§ 15.6
Wed 10/18	Triple integrals in cylindrical coordinates; applications	§ 15.7
Fri 10/20	Triple integrals in spherical coordinates	§ 15.8
Mon 10/23	Vector fields	§ 16.1
Wed 10/25	Line integrals	§ 16.2
Fri 10/27	Gradient fields, fundamental theorem for line integrals	§ 16.3
Mon 10/30	Green's theorem	§ 16.4
Wed 11/1	Curl and divergence, Green's theorem revisited	§ 16.5
Fri 11/3	Surface area	§ 16.6
Mon 11/6	Surface integrals and flux	§ 16.7
Wed 11/8	The divergence theorem	§ 16.9
Fri 11/10	NO CLASS (Veterans' Day)	
Mon 11/13	Review	
Wed 11/15	**MIDTERM 2**	
Fri 11/17	Stokes' theorem	§ 16.8
Mon 11/20	More on partial differential equations	
11/22, 11/24	NO CLASS (Thanksgiving Break)	
Mon 11/27	More on divergence and Stokes; applications	
Wed 11/29	Final review	
Fri 12/1	Final review	
Tue 12/12	**FINAL EXAM (11:30-2:30)**	

Discussion sections

Sec	Time	Room	Instructor	E-mail	Office hours
101	MWF 8-9am	70 Evans	Nima Moini	nima	Tu 9-11 / 1010 Evans
102	MWF 8-9am	105 Latimer	Ritwik Ghosh	ritwikghosh	TuTh 9-10 / 866 Evans
103	MWF 9-10am	70 Evans	Nima Moini	nima	Tu 9-11 / 1010 Evans
104	MWF 9-10am	105 Latimer	Ritwik Ghosh	ritwikghosh	TuTh 9-10 / 866 Evans
105	MWF 10-11am	105 Latimer	Kyeonsik Nam	namgoood	MW 12:30-1:30 / 1020 Evans
106	MWF 10-11am	B51 Hildebrand	Jasper Deng	windowsuser	Tu 11:30-12:30, F 1-2 / 781 Evans
107	MWF 11-12pm	B51 Hildebrand	Jasper Deng	windowsuser	Tu 11:30-12:30, F 1-2 / 781 Evans
108	MWF 11-12pm	B56 Hildebrand	Kyeonsik Nam	namgoood	MW 12:30-1:30 / 1020 Evans
109	MWF 12-1pm	105 Latimer	Michael Yeh	yehm	TuTh 12-1 / 1064 Evans
110	MWF 12-1pm	70 Evans	Jingyi Wang	jingtian	MF 3-4 / 866 Evans
111	MWF 1-2pm	105 Latimer	Michael Yeh	yehm	TuTh 12-1 / 1064 Evans
112	MWF 1-2pm	70 Evans	Jingyi Wang	jingtian	MF 3-4 / 866 Evans
113	MWF 3-4pm	70 Evans	Jeffrey Hicks	jeff.hicks	M 12:30-1:30, F 1-2 / 853 Evans
114	MWF 3-4pm	105 Latimer	Justin Brereton	jbrere	TuTh 2:10-3:15 / 835 Evans
115	MWF 4-5pm	70 Evans	Jeffrey Hicks	jeff.hicks	M 12:30-1:30, F 1-2 / 853 Evans
116	MWF 5-6pm	70 Evans	Justin Brereton	jbrere	TuTh 2:10-3:15 / 835 Evans
117	MWF 5-6pm	105 Latimer	Ahmad Zareei	zareei	M 6-8pm, Hesse Hall GSI Rm
118	MWF 4-5pm	4 Evans	Ahmad Zareei	zareei	M 6-8pm, Hesse Hall GSI Rm

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