

# **MAT 307 - Multivariable Calculus with Linear Algebra Fall 2014**

Welcome to Mat 307!

Click on the top for more information:

The [Info](#) section contains times and locations of the lectures and recitations, information about the textbook, contact details of your instructors, etc.

The week-by-week progress of the lectures and the weekly homework assignments are posted in the [Schedule & Homework](#) section.

Information about the exams is contained in the [Exams](#) section.

# Info

## About the course:

Despite algebra and analysis seem very different languages, multivariable calculus and linear algebra are intimately related subjects. In calculus one approximates smooth functions with linear ones by taking their derivative. For functions of more than one variable, the linear objects themselves require some further study and this is the purpose of linear algebra.

The topics we will cover are: vectors, matrices, systems of linear equations, dot product, determinants, differential and integral calculus in more than one variable, divergence and curl, line and surface integrals, theorems of Green, Gauss, and Stokes.

Together with MAT 308, the course forms a 2-semester sequence covering the same material as the 3-semester sequence of MAT 205, MAT 211 and MAT 305 at a slightly more theoretical level. This means that we are going to move quickly and the course requires a considerable amount of work from you.

A grade of C or better in this course fulfils the Science, Technology, Engineering, and Mathematics (STEM+) objective in the Stony Brook Curriculum.

Prerequisite: MAT 127 or MAT 132. MAT 307 satisfies the STEM+ requirements building on the Master Quantitative Problem Solving (QPS) learning objectives met in these earlier courses.

## Textbook:

*Multivariable Mathematics*, by R. Williamson and H. Trotter, 4th edition, Pearson.

We will cover Chapters 1, 2, 4, 5, 6, 7, 8, 9 of the book. For a precise list of the sections covered in each chapter see the [Schedule & Homework](#) section.

The book is densely written and it might take more than one reading to fully

understand it. On the other hand, there is a lot of material on the textbook that cannot be covered during the lectures, so you are required to read the relevant sections in the book. Do insist and be patient and this will eventually pay off! You should contact me if you still have problems reading the textbook.

### Lectures and recitations:

You are expected to attend both lectures and recitation every week.

Lectures give some basic understanding of the topics covered in the course. They should be taken as a guide through the materials of the textbook and a chance for you to ask questions about what you have read in the book.

Recitations will focus on examples and exercises. They are very important because one learns mathematics only by doing it.

Lectures	MW 4.00 pm - 5.20 pm	Library E4320	Lorenzo Foscolo
Recitation	M 5:30 pm - 6:23pm	Hvy Engr Lab 201	Shalin Parekh

### Homework:

Homework is assigned weekly. As much effort you put in reading the textbook should be directed to solve exercises. This is the only way for you to really understand the topics discussed during the lectures.

Every week I will assign a list of 15/16 exercises from the textbook. Homework assignments will appear on the [Homework & Schedule](#) page. Homework is due at the recitation meeting the following week and must be handed in to your recitation instructor. No late homework will be accepted.

A random selection of 7 exercises will be graded each week and will count towards the Homework grade (see below for the grading policy).

### Office hours:

The lecturer and the recitation instructors hold office hours every week. You are

encouraged to see your lecturer or recitation instructor to discuss homework and other questions. You can also contact us via email to schedule an appointment at a different time.

Lorenzo Foscolo

Office hours: M 3-4pm, W 5.30-6.30pm in Math 2-121

Tue 11am-12 noon in the Math Learning Center

Room 2-121, Math Tower

Tel.: (631)-632-2807

E-mail: [lorenzo.foscolo@stonybrook.edu](mailto:lorenzo.foscolo@stonybrook.edu)

Shalin Parekh

Office hours: Tue 2-3pm + Thu 1-2pm & 3-4pm in the Math Learning Center

E-mail: [shalin.parekh@stonybrook.edu](mailto:shalin.parekh@stonybrook.edu)

### Grading policy:

There will be two midterm exams worth 25% of the final grade each, a final exam (35%) and weekly homework (15%).

Homework policy is explained above. The dates of the exams are:

Midterm I	Wed October 1	4.00 pm - 5.20 pm	Library E4320
Midterm II	Wed November 12	4.00 pm - 5.20 pm	Library E4320
Final Exam	Tue December 9	8.30 pm - 11.00 pm	TBA

Make sure that you can attend the exams at the scheduled times as make-up exams will not be given. If one midterm exam is missed because of a serious (documented) illness or emergency, the semester grade will be determined based on the balance of the work in the course.

Information about the exams (topics covered, exam rules, etc.) will appear in the [Exams](#) section.

Other important dates are on the university [Fall 2014 academic calendar](#).

If you need math help:

Your recitation instructor and lecturer are happy to help. Come to our office hours with questions on homework and lectures or write us an email. Additional help is also available at the [Math Learning Center](#).

Disability Support Services (DSS) Statement:

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: <http://www.stonybrook.edu/ehs/fire/disabilities> ]

Academic Integrity Statement:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at [http://www.stonybrook.edu/commcms/academic\\_integrity/index.html](http://www.stonybrook.edu/commcms/academic_integrity/index.html)

Critical Incident Management Statement:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.

# Schedule & Homework

## **Week 1, Aug 25 – 31**

Reading: Sections 1, 2, 3 and 4 of Chapter 1.

Homework: 2, 10, 12 in §1 + 2, 6, 8 in §2 + 2, 6, 8, 18, 22 in §3 + 2, 4, 6, 8, 14, 16, 18 in §4 + 2, 8 in §5 (+ 8 and 10 in §6, optional).

## **Week 2, Sep 1 – 7**

Reading: Sections 4 and 5 in Chapter 1.

## **Week 3, Sep 8 – 14**

Reading: Sections 1, 2 and 3 in Chapter 2.

Homework: 4, 6, 8, 10, 12, 16, 18 in §1A + 2, 7, 12, 14, 30 in §2ABC + 6 in §2D + 10, 12, 16, 48 in §3.

## **Week 4, Sep 15 – 21**

Reading: Sections 4 and 5 in Chapter 2, section 1 in Chapter 4.

Homework: 5, 8, 13 in §4 of Chapter 2 + 2, 6, 7, 12, 24 in §5 of Chapter 2 + 4, 14, 15, 19, 24, 42 in §1ABCD of Chapter 4 + 6, 12 in §1F of Chapter 4

## **Week 5, Sep 22 – 28**

Reading: Sections 2, 3 and 4 of Chapter 4.

Homework: 4, 5, 10, 16 in §2AB + 10, 14, 18 in §2D + 8, 10, 12, 29, 30 in §3 + 2, 16, 18 in §4

## **Week 7, Oct 6 – 12**

Reading: Chapter 5 (excluding section 5).

Homework: 23, 26, 33 in §1 + 2, 4, 12, 14, 18 in §2 + 4, 8, 10, 22 in §3 + 2, 18, 20, 27 in §4

**Week 8, Oct 13 – 19**

Reading: Chapter 6, sections 1, 2 and 3.

Homework: 2, 5, 8, 12, 28, 38 in §1ABC + 2, 6, 13, 14 in §2A + 4 in §2B + 4, 14, 15 in §3

**Week 9, Oct 20 – 26**

Reading: Chapter 6, sections 4, 5.

Homework: 4, 8, 14, 16, 20, 24, 29 in §6.4ABCD + 4, 8, 12 in §6.4E + 5, 6, 7, 8, 9, 11, 12 in §6.5

**Week 10, Oct 27 – Nov 2**

Reading: Chapter 7, sections 1, 2, 3 and 4.

Homework: 4, 8, 12, 21 in §7.1 + 4, 8 in §7.2 + 2, 4, 10 in §7.3 + 4, 5, 10, 15, 17, 22 in §7.4

**Week 11, Nov 3 – 9**

Reading: Chapter 7, sections 5 and 6; Chapter 8, section 1.

Homework: 6, 9 in §7.5 + 5, 6, 9, 13, 14 in §7.6 + 11, 12, 13, 21, 56 in Chapter 7 REVIEW (pp. 363-366) + 2, 3, 6, 14, 15, 25 in §8.1

**Week 12, Nov 10 – 16**

Revision and Second Midterm exam.

**Week 13, Nov 17 – 23**

Reading: Chapter 8, sections 2, 3 and 4.

Homework: 4, 10, 14, 15 in §8.2 + 2, 4, 8, 10 in §8.3 + 1, 2, 6, 7, 8, 9, 11 in §8.4

**Week 14, Nov 24 – 30**

Reading: Chapter 9, sections 1 and 2.

Homework: 1, 2, 9, 10, 11 in §9.1 + 3, 4, 5, 6, 10, 11, 12, 13, 20, 21, 23, 24 in §9.2

**Week 15, Dec 1 – 7**

Reading: Chapter 9, sections 3, 4, 5.

Homework: 3, 9 in §9.3

5, 7, 11 in §9.4

3, 5, 7, 9 in §9.5



# Exams

Midterm I                      Wed October 1                      4.00 pm - 5.20 pm                      Library E4320

The first midterm exam will cover the materials of Chapters 1, 2 and 4 in the textbook with the exclusion of: section 6 in Chapter 1; section 1B in Chapter 2; sections 1E, 2C, 4C in Chapter 4.

There will be three problems in the exam.

One is about lines, planes and vectors: parametric representations and equations of lines and planes; calculation of projections, distances and angles using the dot product.

A second problem is about systems of linear equations: study the set of solutions using row operations, determinants, inverses, etc.

A final problem is about parametrized curves and surfaces: curves on surfaces, partial derivatives, tangent lines and tangent planes, length of curves, etc.

Some suggestions to prepare for the exam are: review your notes, the textbook and the homework assignments. Work through the examples in the textbook and your notes on your own, make sure you understand homework corrections. Most important of all, do plenty of exercises (there are extra exercises at the end of every chapter in the textbook).

Midterm II                      Wed November 12                      4.00 pm - 5.20 pm                      Library E4320

The exam will cover Chapters 5, 6 and 7 and section 8.1. A more detailed description of what will be in the exam and what sections in each chapter you can skip is given below. I have also indicated exercises in the textbook which might be useful. Of course you are not required to do all of them, but it is a good idea to solve as many as possible. In order to prepare well for the exam, you should also review the textbook, your notes and past homework assignments. You are encouraged to meet me or Shalin during office hours next week for any doubt and to come to the lecture and recitation on Monday Nov 10 ready to ask plenty of questions.

## Chapter 5.

Limits. Continuity. Differentiability. Directional derivatives.

Section 5 is not included in the exam.

Exercises from the Review of Chapter 5 (pp. 250-251): 10-34.

## Chapter 6.

Interpretation of the gradient of a function. The chain rule. Implicit differentiation. Critical points of a function and second derivative criterion to find extreme points. Method of Lagrange multipliers. Change of coordinates: polar, spherical and cylindrical coordinates; the Jacobian matrix.

Sections 1D and 4F are not included in the exam.

Exercises from the Review of Chapter 6 (pp. 309-311): 1-6, 9, 15, 18-22, 24-27, 29-38, 40-44, 46.

### Chapter 7.

Iterated integrals. Definition of integrals as limits of Riemann sums. Change of variables. Improper integrals.

Section 7 is not included in the exam.

Exercises from the Review of Chapter 7 (pp. 363-366): 1-39, 46-61.

### Section 8.1.

Definition of line integrals. Fundamental Theorem of Calculus and its consequences.

You can skip the section "Equivalent parametrizations" on p. 373.

Exercises 1-16 on p. 376.

Final Exam                      Tue December 9                      8.30 pm - 11.00 pm                      Library E4320

The final exam is cumulative, covering everything we have studied during the semester. However, extra emphasis will be given to Chapters 8 and 9.

See the info about midterm exams for what you can skip in Chapters 1, 2, 3, 5, 6 and 7, with one change: section 6 in Chapter 1 (the cross product) is a prerequisite for some of the material in Chapter 9, so you should be familiar with it.

### Chapter 8.

Definition of line integrals. Fundamental Theorem of Calculus and its consequences.

Arc-length parametrization. Curvature. Divergence and curl of a vector field.

### Chapter 9.

Green's theorem. Path independence principle. Gauss's and Stokes's Theorems in the plane. Area of a surface. Integral of a vector field on a surface. Gauss's Theorem. Stokes's Theorem.

You can skip section 3D and the whole of section 6.

Here's a list of exercises from the REVIEW at the end of each chapter which might be useful to do before the exam:

Chapter 1 (pp. 44-45): 17-26 and 31-35.

Chapter 2 (pp. 99-101): 21-24, 29-32, 43-44.

Chapter 4 (pp. 214-215): 1-10, 24.

Chapter 5 (pp. 250-251): 10-34.

Chapter 6 (pp. 309-311): 1-6, 9, 15, 18-22, 24-27, 29-38, 40-44, 46.

Chapter 7 (pp. 363-366): 1-39, 46-61.

Chapter 8 (pp. 395-396): 1-8, 21-22.

Chapter 9 (pp. 457-459): 1-3, 5, 7-8, 10, 12, 14, 16-17.

I will hold office hours as follows:

Fri Dec 5, 11am-2pm in my office Math 2-121;

Tue Dec 9, 11am-noon in the MLC, noon-1pm in my office.

Office hours on Monday Dec 8 at 3pm are cancelled.

Writing an email to ask a quick question or to schedule an appointment outside of these hours is also possible.

Shalin also will hold exceptional office hours:

Mon Dec 8, 3-6pm in the MLC.

He will also take part in a tutoring session organised by the Math Club:

Tue Dec 9, 5-8.30pm in P-131 in the Math Tower.

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Exam Rules:

Calculators are not allowed.

All electronic devices (except watches) must be turned off. In particular, cell phones are not allowed. If you take your cellphone out for any reason (even just to check the time), you will be asked to turn in your exam paper and to leave the room.

Notes, textbooks, etc. are not allowed. Only the test paper and pens/pencil/eraser should be on your desk.

No consultations with others. Please raise your hand if you have any question.

No bathroom breaks are allowed. Please use the restroom before the test starts.

Please bring your college ID; it will be checked when you hand in your exam paper.

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