

MAT 319/320: Basics of Analysis, Spring 2018

General Course Information

Teaching Staff

319 Instructor: Robert Silversmith (rsilversmith@scgp), *OHs:* Tu 2-3, Th 10-11 in SCGP 509
W 11:30-12:30 in MLC

319 TA: Robert Abramovic (rabramo2@math), *OHs:* MW 8:30-9:30 in Math 2-122
M 12-1 in MLC

320 Instructor: Aleksey Zinger (azinger@math), *OHs:* Tu 9:30-11, Th 5-6:30 in Math 3-111

320 TA: Zhuang Tao (zhuang.tao@stonybrook), *OHs:* F 11-12 in Math 2-114
Tu 5-7 in MLC

Course Websites

You can access the course website through *BlackBoard* or directly. The current direct link is

<http://math.stonybrook.edu/~azinger/mat320/>.

After Midterm I, the direct link for MAT 319 will become

<https://www.ic.sunysb.edu/Faculty/rsilversmith/mat319/>.

All homework assignments, exam information, and a lot more will also be posted on the course website. *Please visit it at least twice a week.*

Your grades will be available through *BlackBoard*. Please check them regularly and notify the TA(s) of any inaccuracies quickly. Any issue with a midterm grade must be resolved within 2 weeks of the date of the midterm; any issue with a problem set grade must be resolved within 2 weeks of the problem set due date. There will be *no* changes to the grades after these deadlines.

Key Course Policies

Prerequisite 1: proficiency with formal mathematical proofs (MAT 200)

Prerequisite 2: familiarity with sequences and series (MAT 127/132)

Required textbook: K. Ross, *Elementary Analysis: the Theory of Calculus*, 2nd ed.

Optional supplementary textbook for MAT 320: W. Rudin, *Principles of Mathematical Analysis*, 3rd ed.

<i>Homework</i> 20%, <i>Midterm I</i> 22.5%, <i>Midterm II</i> 22.5%, <i>Final</i> 35%

Midterm I: Thursday, March 1 (snow date: Tuesday, March 6), 11:30-12:50

Midterm II: Thursday, April 5, 11:30-12:50

Final Exam: Tuesday, May 15, 11:15-1:45

This class is not “curved”. Your letter grade for the semester will be determined exclusively by your weighted total. The letter grade cutoffs for the semester will be determined by the difficulty of the three exams and the homework. Please do not ask the instructor to change your semester grade based on what grade you “need” for whatever purposes; this would be completely inappropriate. According to the university policy, a C means “satisfactory work” and A means “superior work”. This has nothing to do with how many people do better or worse than you or with what grade you to “need” for whatever purposes.

Grading Policy Details

Midterm I will be the same for MAT 319 and 320. Midterm II and the final exam will be different and will be held in different locations. The problem sets after Midterm I will likewise be different. The letter grades for the semester in the two courses will be assigned independently.

There will be **no make-up exams**

If you have a *legitimate* and *well-documented* reason for missing a midterm exam, your score on the final exam (scaled relative to maximum scores) will be substituted instead. If you miss Midterm I, you will not be considered for transfer to MAT 320. You must advise the course instructor(s) of your legitimate absence from a midterm and provide supporting documentation as soon as possible; each of these must be done as soon as possible even if it is not possible to do them at the same time. Depending on circumstances “as soon as possible” may be months before the exam or immediately after. Having a conflict with another class is not a legitimate excuse. Since LIRR is notoriously unreliable and road traffic is notoriously unpredictable, any travel disruption of these kinds is not a legitimate excuse either.

Each of the problem set scores will count equally toward the overall homework score, *after* the lowest problem set score (as percentage of the maximum possible score) is dropped. Homework will generally be assigned weekly and due at the start of Wednesday’s recitation. Your solutions must be stapled *before* they are handed in. If they are not stapled, you may receive credit for the problems on only one of the sheets that has your name on it (whichever one the grader sees first, not necessarily the one with the highest number of points). The problems in your solutions must be written in the order they are listed on the assignment (though you can still skip problems); the grader may choose to award no credit for any of the problems done out of order or are ineligibly written in his opinion. Depending on the size of the class, some of the homework problem may not be graded; a small number of points will be awarded for plausible attempts at solutions for such problems. The determination of which problems are graded and how many points the remaining problems are worth will be made by the instructor(s) and conveyed to the TA(s) *after* the deadline for handing in the homework.

NO late homework will be accepted

Once the TA starts the recitation in which a homework assignment is due, he will no longer accept this assignment. The TA has no discretion in this matter; please do not even ask him to break the explicit instructions he has been given. Late homework will **not** be accepted under *any* circumstances; you will not receive a response to any email asking for an extension. If there is *any* chance of you arriving late to the recitation at which a homework is due or if you will be out of town when it is due, you can turn it in (give to the instructor/TA or slip under the TA’s office door) any time before it is due (which you are always welcome to do). If something completely unexpected comes up, then you’ll benefit from the *lowest homework score dropped* policy. Since the homework counts for 20% of the total grade, it is quite possible for a late homework to affect your letter grade at the end of the semester; so *hand in your homework before it is due*.

Bonus for MAT 320, after Midterm I: 1-10 pts (maybe more in extraordinary circumstances) will be added to the corresponding homework score for pointing out typos/mistakes/errors in the textbook, any course notes, and lectures/recitations. Straightforward typos/miswordings will be worth 1pt each; mistakes/errors of mathematical substance will be worth more, depending on their depth and subtlety. Anything already corrected in an erratum is not eligible for the bonus. Only the first person to bring up an issue will receive the bonus.

Caution on the G/P/NC Option

The purpose of this grading option is to encourage exploration of courses that are not directly required for one's degree. It can have unfortunate repercussions if used improperly for courses in which a C is needed for the degree. Before you choose to G/P/NC MAT 319/320 at C+ or higher, please consider whether repeating this course (and potentially delaying your graduation) if you get a C in it is preferable to getting a C on your transcript and being done with MAT 319/320. As you might also be aware, many courses fill up before it is possible to register for them for a second attempt; this could exacerbate any problems arising from improper use of the G/P/NC option even further.

Course Description

There are some organizational differences between the first and second editions of the required textbook. While the contents of the two editions are very similar, all specific references (including reading/homework assignments) will be to the second edition. If you are in the first or second year of studies at SBU and are seriously considering graduate study in pure mathematics afterwards, you are strongly encouraged to acquire the optional textbook and *work through* the corresponding sections in it *in addition* to the assigned sections in the required textbook. There is a reason why Rudin's 1953 book costs 4 times Ross's 1980 book.

The first part of the course (Chapters 1,2 of the required book) combines the sequence/series portion of MAT 127/132 with formal mathematical proofs; after that, the topics get even harder. It would be extremely difficult to pass this course without fulfilling the two prerequisites ahead of time (especially the first one). If the university's electronic safeguards somehow failed to prevent you from registering for MAT 319 without fulfilling either of the prerequisites, you need to leave the course on your own and take it later. Otherwise, the failure of the safeguards may be corrected after you have done some work for this course. All waivers of the formal prerequisites based on alternative appropriate preparation must be approved by the MAT 320 instructor.

MAT 319/320 are proofs-oriented courses rigorously treating the key topics of one-variable calculus: sequences and series, limits, continuity, differentiations, and integration. The two courses run together through Midterm I as MAT 319 and split right after it. After Midterm I, MAT 320 will cover the same topics as 319, but from the perspective of *metric spaces* whenever possible. The notion of *metric space* is essential for pursuing advanced study in pure mathematics and also plays important roles in more theoretically flavored subfields of other disciplines (such as physics, computer science, and economics). It is less relevant for many computationally involved subfields, including some in applied mathematics.

Based on the results of Midterm I and of the first 4-5 problem sets and on your preference (as specified on the midterm), you may be transferred into MAT 320 shortly after Midterm I. If you are expecting to finish your degree soon and/or are intending to pursue a career in math education or in a more applied field, MAT 319 may be the more suitable choice for you. If you are still early in your studies at SBU and are hoping to make it into a decent PhD program in pure mathematics right after SBU, you need to do well enough on Midterm I to qualify for MAT 320 and to do well in it, *regardless* of how much effort this will take. Please feel free to discuss with the MAT 319/320 instructors which course might be more suitable for you as it gets closer to Midterm I.

About Homework Assignments

You *cannot* learn mathematics without working on exercises. Nearly all of the assigned problems will be fairly routine exercises from the textbook. In addition to working on the assigned problems, you should actually do *all* of the problems in the textbook; just looking at them and deciding that you know how to do them is not enough. This will be time-consuming at first, but if you actually figure out what is going on in each section, the exercises will take you minutes to do. This should greatly help you on the exams.

Starting on the homework as soon as possible after each class should save you a lot of time and help pass the course. Try to do every homework problem by yourself first, not “with friends”. If you can’t figure out at least half of the problems *completely* by yourself, you are very unlikely to do sufficiently well on the exams to pass this course. If you are unable to do a problem, even after re-reading the relevant sections from the textbook, then discuss it with someone (other students, course instructors/graders, MLC tutors, etc.). While you are encouraged to compare your answers and solutions to the homework exercises with each other,

you must **write your own solutions** to the problem sets

Make sure to study the proofs and solutions to examples detailed in the required textbook (as some of your homework and exam problems might be similar to these) and any solutions posted on the course webpage (even if you can do all homework problems); this may help you on the exams.

While 20% for the homework may not seem like a lot, in the end it will no doubt make a difference in your letter grade for the semester. If your weighted total for the semester (rounded to one decimal place) falls just .1 below the *C* cutoff, you will receive a *C*– for the semester and would likely need to repeat this course (depending on your department’s policy). You can avoid such an unpleasant scenario by putting more effort into the homework (as well as into the exams) throughout the semester and by making sure you *always* hand in your homework on time. Even more importantly, doing the homework should help you on the exams; you thus should not skip *any* homework assignment, even though the lowest homework grade is dropped. It is also essential that you actually *work* on the homework yourself, instead of copying it from friends or MLC tutors; the latter would help you with the homework grade, but is likely to hurt your exam scores and thus your chances of passing this course.

Please read the assigned sections in the textbook thoroughly and *before* the lecture. Each section contains a number of examples that are worked out in detail. Try to do these examples yourself before going through the book’s explanation; this might help with the homework problems. *You will be responsible for the material contained in the assigned sections of the textbook, whether or not it is directly covered in lecture.* Please do not attempt the homework exercises until you have read the corresponding section in the book.

Since it is not possible to spend much time for review in each lecture, you are expected to be familiar with the material covered in the preceding lectures. Please keep up with the class; it will be harder to catch up later. You are encouraged to discuss any aspect of this class, including the material covered in lectures, the readings, and the homework exercises, with anyone, including other students in the class and the MLC tutors. You can also consult any source that may help you with the class in general and the exercises in particular.

Since this class is not “curved”, please do not hesitate to help each other; by helping others understand the material, you may end up helping yourself as well. However, letting someone copy your solutions to the homework is not helping them, as it will hurt them on the exams.

Special Needs

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or

<http://studentaffairs.stonybrook.edu/dss/>.

They will determine with you what accommodations 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 instructors and Disability Support Services. For procedures and information, please visit the following website:

<https://ehs.stonybrook.edu/programs/fire-safety>.

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another persons 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 and 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/uaa/academicjudiciary/>.

Critical Incident Management

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.

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First-Day Mini-Quiz (12 mins)

1. $10^{\ln 6} - 6^{\ln 10}$ equals

- (A) 0 (B) 1 (C) -1 (D) $4^{-\ln 4}$ (E) $\frac{1}{256}$

Answer only

2. $\frac{x^2 - x - 2}{x^2 - 1}$ equals

- (A) $1 - \frac{1}{x-1}$ (B) $1 + \frac{1}{x-1}$ (C) $1 - \frac{1}{x+1}$ (D) $1 + \frac{1}{x+1}$ (E) $-1 + \frac{1}{x+1}$

Answer only

3. Let a_1, a_2, \dots be the sequence defined recursively by

$$a_1 = 1, \quad a_{n+1} = \frac{a_n + 9}{2} \quad \forall n \geq 1.$$

(a) Use mathematical induction to show that $a_n \leq 9$ for all $n \geq 1$.

(b) Use mathematical induction to show that $a_n \leq a_{n+1}$ for all $n \geq 1$.

(c) Show that the sequence a_n converges and find its limit.