

## Math 451 - Introduction to Real Analysis, Spring 2018 Course Syllabus

**Instructor:** Brian Leary

**Email:** Brian.Leary1@mail.wvu.edu

**Office:** Learning Resource Center 323K

**Office hours:** Mon 1-2, Tues 2:20-3, Wed 1-3, Thurs 12-1 and 2:20-3, Friday 11-12

**Class Room/Time:** RRC 314, TR 1:00-2:20 pm

**Course website:** [community.wvu.edu/~bal0018/math451S18.html](http://community.wvu.edu/~bal0018/math451S18.html) (as a backup website, I will also try to keep the eCampus site updated)

Homework assignments will be posted on the course website. Course announcements may also be posted on the website or sent via email. Please be sure to check the website regularly, and to regularly check the email address you have on record. You are responsible for any information posted on the course website.

**Textbook:** There are no required textbooks for the course. However, I will be roughly following *Introduction to Analysis*, 5th edition, by Edward D. Gaughan. Another good source is *Calculus, Volume I* by Tom Apostol. I can also give other recommendations for real analysis books upon request, both more advanced and less advanced than this course.

**Catalog Data:** MATH 451. Introduction to Real Analysis 1. (3-0) Credits 3. A study of sequences, convergence, limits, continuity, definite integral, derivative, differentials, functional dependence, multiple integrals, sequences and series of functions.

**Prerequisite:** MATH 283.

**Course material:** This course is more or a less a reread of topics learned in Calculus I and Calculus II, but viewed through the rigorous scope of proof-writing, which illuminates the material in a new and exciting way. The initial part of the course will be to review logic and proof preliminaries, which may include set proofs, proofs of injectivity/surjectivity of functions, proof by induction, countable/uncountable sets, and the axiomatization of the real numbers. The following sections of the course will cover, in order, limits of functions, continuity/uniform continuity of functions, differentiation, and Riemann/Darboux integration. If time permits, we will cover sequences and series of real numbers, followed by sequences and series of functions.

**Course Objectives:** Upon successful completion of the course, the student will be able to do the following:

1. Write an  $\varepsilon$ -based proof to show the limit of a function at a point.
2. Write an  $\varepsilon$ -based proof to show continuity of a function, and know the difference between continuity and uniform continuity.
3. Write an  $\varepsilon$ -based proof to show a function has a certain derivative.
4. Use tools such as the Mean Value Theorem to prove results about differentiable functions.
5. Write an  $\varepsilon$ -based proof to show a function is Riemann-integrable.
6. Time-permitting, write an  $\varepsilon$ -based proof to show the limit of a sequence of numbers or functions.

**Topics:**

1. Preliminaries on Logic and Proofs
2. Limits of Functions
3. Continuity/Uniform Continuity of Functions
4. Differentiation of Functions
5. Riemann/Darboux Integration
6. Sequences and Series of Numbers (if time permits)
7. Sequences and Series of Functions (if time permits)

**Grading:** Your final grade will be based on homework, attendance, two exams during the semester, and the final exam, which will not be cumulative. Your final course score will be computed via the following grading scheme:

- 20% Homework + 5% Attendance + 25% Exam 1 + 25% Exam 2 + 25% Final Exam

**Letter Grade Cutoffs:** A: 90%, B: 80%, C: 70%, D: 60%, F: below 60%

**Homework:** Homework assignments will be posted on the course website. There will likely be about 10-12 total assignments, and your lowest 2 homework scores will be dropped from grade computation. The homework is the most important part of this class. To be more precise, not knowing how to do the homework is the most important part of this class. At this level, mathematics is learned by trying to solve problems and failing over and over again. Therefore, you should be prepared to spend many hours each week in frustration, finding flaws in your arguments, or simply stuck not knowing what to do next! To that end, every student is expected to write out their own solutions for the homework problems. Any verbatim copying of solutions, either from another student or from a textbook or online resource, is prohibited and is considered plagiarism. However, you are permitted and even encouraged to collaborate with each other, as long as each student writes up a final copy of their solutions on their own.

**Exams:** There will be two exams, details TBA. The final exam details are also TBA. Make-up exams will only be given to students with excused absences, and such make-up exams must be scheduled within 24 hours of the missed exam.

**Attendance:** There should be roughly 30 lectures. If you miss 0-5 lectures, you will receive the full 5 attendance points for the semester. If you miss 6-7 lectures, you will receive 4 attendance points. If you miss 8 lectures, you will receive 3 attendance points. If you miss 9 lectures, you will receive 2 attendance points. If you miss 10 lectures, you will receive 1 attendance point. If you miss 11 or more lectures, you will get a 0 for your attendance score.

**Class policies:**

- Graphing calculators will never be allowed during any exams. Scientific calculators will be considered on an exam by exam basis. You may use any calculator to help you do the homework if you wish, but you should keep in mind that you may be required to solve similar problems without a calculator on the quizzes and exams.
- If you believe a problem on a homework assignment or exam has been graded incorrectly, you must notify the instructor of your complaint within 7 days of the date the exam is handed back. If you are unable to retrieve your graded material at the time it is handed back, it is your responsibility to make arrangements with the instructor to retrieve the material at another time.

**Getting Help:** Please feel free to come to office hours or email me if you have questions about the course material. If you are unable to make it to my regularly scheduled office hours, I am willing to make an appointment to meet at another time if possible. Additionally, you can get help in the Math Tutoring Lab in LRC 323 from 8 AM to 4:30 PM. Free tutoring is also available through Student Support Services, located in Benedum 130, and the Student Success Center, located in the library on the second floor of LRC. Finally, I would also encourage the formation of study groups, to learn from each other and help each other learn.

**Academic Integrity:** The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at [http://studentlife.wvu.edu/office\\_of\\_student\\_conduct/student\\_conduct\\_code](http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code). Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter. [Available at: <http://faculty senate.wvu.edu/r/download/15702>]