

**Course Evaluation Form
Spring 2024 – MATH 450-01
Professor Ryan Alvarado**

1. How often did you:

Prepare for class: **always**

Attend class: **always**

Participate in class: **always**

Complete assignments: **always**

Meet with professor(s) outside of class: **often**

2. Using specific examples, please briefly describe what you did that you feel was particularly effective for improving your learning in this course?

Before starting each homework assignment, I would often read through the details of the relevant proofs/concepts covered in class. This would simultaneously help me digest what was done in class (which was often technical/detail-heavy) and set my brain up for better internalization of the homework problems and the various ways of approaching them.

3. In what ways did this course and instructor stimulate or shape your intellectual interests, thinking, and/or imagination?

Unlike most of the math classes I've taken, this class has a very compelling mathematical narrative to it. It feels like a conceptual adventure, filled with fascinating developments, plot twists, and reveals (e.g. the introduction of the Vitali set and the comparison of Lebesgue and Riemann Integration that's taking place right now).

4. Please describe the most significant skills and/or knowledge that you gained or further developed during this course.

In addition to the somewhat straightforward answer of the content covered, I think this class has given me a greater appreciation for analysis as a whole. When I first heard about how mathematics could broadly be divided into algebra, analysis, and topology (I knew this was a crude/imprecise division and that mathematicians should be well-versed in all three, but it was an image that stuck with me nonetheless), I thought for certain I would dislike analysis the most of the three by a noticeable margin, but I think this class really broadened my perspective of how interesting/fun analysis could be. Beneath all of the messy inequalities and technicalities (which I've also come to appreciate), there are some very beautiful concepts to explore.

5. Considering the overall design of the course, how did the pace, presentation of information, clarity of expectations, assignments, activities, and/or discussions in the course impact your learning?

I have no real complaints about the design of the course. The information was presented effectively and at a good pace, expectations were laid out clearly, and assignments were appropriate. If there was one thing I would maybe add to the course, it would be some hard bonus questions on the homeworks. There were times when a few friends and I would try to prove theorems/results that we either hadn't gotten to in class or that we left as independent reading, which was always a lot of fun, so I think having a collection of those kinds of questions that we could work on and ask about during office hours would be great.

6. Please describe the nature of your interactions with the instructor in this course, including the instructor's engagement with student questions and ideas in class, their cultivation of an inclusive learning environment, their availability outside class, and the feedback you received on your course work.

Professor Alvarado has been a pleasure to work with and talk to over the course of this semester. Both in and out of class, he is very open to questions and is a huge reason why I've become as interested in the content of this course as I am now. There are many topics in math that I think I would have come to like and internalize fairly well by reading about them independently, but I

think this course and Professor Alvarado were essential for me to learn and enjoy measure theory.

Additional comments.

This class has been a blast, and I hope it continues to be offered in future semesters.

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2. Using specific examples, please briefly describe what you did that you feel was particularly effective for improving your learning in this course?

I found that doing some of the exercises that were left to the class was very helpful in improving my understanding of the concepts discussed while still having a framework provided by other in-class examples. Also, creating theorem-definition sheets every week as part of the course helped me go back to review my notes on a regular basis, reinforcing the material in a meaningful way.

3. In what ways did this course and instructor stimulate or shape your intellectual interests, thinking, and/or imagination?

I found that Professor Alvarado was very helpful in motivating my intellectual interests, showing how various tools we learned could be used in other scenarios. I thought that learning the specific way to think about difficult problems was very helpful to my mathematical maturity, and I am excited to see how this framework can support new ideas in the future.

4. Please describe the most significant skills and/or knowledge that you gained or further developed during this course.

The most significant skills I developed during this course were related to my understanding of the tools of analysis and higher-level mathematical reasoning. Specifically, the logic of reasoning with inequalities and comparisons was something that I wasn't comfortable with before, and this course helped improve my confidence in this aspect of mathematics. Also, I improved upon my proof-writing skills, becoming more precise and conscious of my arguments.

5. Considering the overall design of the course, how did the pace, presentation of information, clarity of expectations, assignments, activities, and/or discussions in the course impact your learning?

The course structure generally worked well for me, with the fast-paced lecture and detailed explanations providing a solid understanding of the material. Expectations were clear, with engaging homework assignments that were often challenging yet elegant. There was a consistent dialogue between the students and instructor in the course, which ensured that the course remained exciting throughout the semester. Also, the atmosphere was lively, with questions that clarified tricky points and explored potential expansions.

6. Please describe the nature of your interactions with the instructor in this course, including the instructor's engagement with student questions and ideas in class, their cultivation of an inclusive learning environment, their availability outside class, and the feedback you received on your course work.

Professor Alvarado was always willing to discuss student questions and ideas in class, welcoming comments from everyone to ensure that the material was understandable and made logical sense from what we had previously learned. It felt like he was invested in the success of every student and committed significant time to hosting office hours, with appointments and additional hours also available during crucial periods. The feedback from the instructor was helpful and enabled me to identify points of improvement in my work.

Additional comments.

I was very pleased with my learning in the course, and I would absolutely take another course with Professor Alvarado.

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Meet with professor(s) outside of class: **always**

2. Using specific examples, please briefly describe what you did that you feel was particularly effective for improving your learning in this course?

Allotting a lot of time every week for working through the problem sets as carefully and rigorously as possible helped me particularly in understanding how to make use of ideas, theorems, and new proof strategies in Measure Theory.

3. In what ways did this course and instructor stimulate or shape your intellectual interests, thinking, and/or imagination?

This course has, in particular, made me even more interested in Analysis. It's so fascinating to actually be proving/working with the foundations of calculus on higher-dimensional-space! What I particularly appreciate about Professor Alvarado, in this regard, is that when I go to office hours with questions that we wouldn't address (or hadn't yet addressed) in this course, he gives an insightful answer that, while possibly too advanced for me to yet understand, gives me a peek at what "more" looks like, and he gives me enough to think about, work with, and look into on my own.

4. Please describe the most significant skills and/or knowledge that you gained or further developed during this course.

Beyond a solid, introductory understanding of Measure Theory, this course has given me the ability to work with more general metric spaces than just the real line, as well as given me the motivation to start reading more mathematics textbooks on my own. In particular, a few proofs in this course (in the "Outer Measure" unit) made me realize that the only parts of Analysis that I've seen and been uncomfortable with fall under Topology (particularly Metric Space Topology), so I've been reading through a Topology textbook on my own so that I have the foundations ready to go for the next time I need it.

5. Considering the overall design of the course, how did the pace, presentation of information, clarity of expectations, assignments, activities, and/or discussions in the course impact your learning?

I feel like Professor Alvarado struck a near-perfect balance between not moving too fast and not moving too slow in this course. Every day, it felt like we were working through new arguments and ideas, with no two arguments feeling the same (if the arguments were analogous, they were likely left as exercises, which makes for good practice). One of the things that Professor Alvarado does best is motivating ideas and really helping us understand the "why" of certain ideas/properties in mathematics. It never feels like we're going through a topic for no reason, even when we don't yet know how to use it. Also, when particular ideas were new and important, emphasis was placed on slowing down a bit to really get it, which I think was very helpful (especially in a course like Measure Theory where intuition is absolutely clobbered by the subject). The difficulty of the problems in problem sets was very good: it typically wasn't immediately obvious how to do most problems, and there was a clear purpose to each and every problem we answered. I think, if anything, he could've asked another problem or two on each problem set, but I'm satisfied with the problems we got to work through (I genuinely enjoyed the process of working through these problems sets, which has not been true in many of the courses I've taken).

6. Please describe the nature of your interactions with the instructor in this course, including the instructor's engagement with student questions and ideas in class, their cultivation of an inclusive learning environment, their availability outside class, and the feedback you received on your course work.

Professor Alvarado does a good job of making sure everybody knows when/where office hours are happening every week (which are pretty often, and at varied times so that everyone has at least some time where they can attend, if possible). I'm actually very impressed by how often we ended up having discussions about the ideas/proofs we were working on in class; it's very hard to make math lectures feel like they have conversational components, but this class really did feel like a discussion-based course, a lot of the time (which is a very nice change of pace, from most other math courses). Professor Alvarado always engages with questions, usually addressing them in multiple ways to make sure to get across the ideas. Just in general, I loved how Professor Alvarado ran this course; Measure Theory is by far my favorite math course that I've taken, both for the course content and how Professor Alvarado taught it.

Additional comments.

I love how Professor Alvarado turns every mathematics course into a story. There's always clear purpose and motivation to be working through each idea, which keeps me very engaged in everything we work through, and I don't think I've had another professor who's done as good a job as Professor Alvarado in that regard. I also don't think I've had another professor who engages with students as much and as effectively as Professor Alvarado does, both in class and in office hours. I hope you take that into consideration.

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Attend class: **always**

Participate in class: **always**

Complete assignments: **always**

Meet with professor(s) outside of class: **often**

2. Using specific examples, please briefly describe what you did that you feel was particularly effective for improving your learning in this course?

Reviewing online notes before & after class, reading over theorem-definition sheets, asking questions during class about various details of the content presented

3. In what ways did this course and instructor stimulate or shape your intellectual interests, thinking, and/or imagination?

This course taught me a much more expansive view of mathematical analysis, teaching me about a wide variety of objects, concepts, and techniques that I can use to study and understand a wide array of topics in and related to math.

4. Please describe the most significant skills and/or knowledge that you gained or further developed during this course.

This course greatly refined my ability to write rigorous, developed proofs in analysis and use material presented in class in unexpected, insightful ways to deduce all sorts of results, from the obvious to the downright bizarre (e.g. Vitali set). Additionally, I gained a much more comprehensive perspective on analysis and can tackle a much greater variety of mathematical texts and concepts with what I learned in this course. In other words, this course made me much more versatile in understanding advanced math.

5. Considering the overall design of the course, how did the pace, presentation of information, clarity of expectations, assignments, activities, and/or discussions in the course impact your learning?

The course was presented at a somewhat fast pace, which allowed us to build a solid, comprehensive foundation on which more advanced topics were built off of. The online notes were crucial in reviewing content and ensuring that the course kept moving at a manageable pace. Assignments and exams were always clear in intention and style. The pace of this course was the perfect balance of detailed coverage and rigorous speed to build a solid understanding of the subject.

6. Please describe the nature of your interactions with the instructor in this course, including the instructor's engagement with student questions and ideas in class, their cultivation of an inclusive learning environment, their availability outside class, and the feedback you received on your course work.

Prof. Alvarado was a highly enthusiastic and engaged instructor throughout the semester. He was always willing to answer students' questions, giving answers that both clarified the questions and added additional detail to the topic. His lectures were highly informative, providing both a rigorous foundation that exemplified the methods and tools of the subject as well as graphical and algebraic intuition that made advanced concepts transparent. As a result, I was always able to tackle the various challenges of the course and see how different details lined up to build a bigger picture of the subject. Prof. Alvarado's office hours were consistently informative and thoughtful; he was always willing to engage students in ways that helped them no matter how busy he was. Furthermore, he was always understanding of students' circumstances and willing to work with them to make sure that they succeeded in both his course and other parts of students' lives.

Additional comments.

N/A

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Prepare for class: **sometimes**

Attend class: **always**

Participate in class: **always**

Complete assignments: **always**

Meet with professor(s) outside of class: **rarely**

2. Using specific examples, please briefly describe what you did that you feel was particularly effective for improving your learning in this course?

I found it very helpful to reread my lecture notes after class as I was completing homework assignments in order to reinforce my understanding of the logic involved in the arguments. This often helped with homework assignments that required similar arguments.

3. In what ways did this course and instructor stimulate or shape your intellectual interests, thinking, and/or imagination?

The course and instructor expanded and deepened the way I think about sets in metric spaces.

4. Please describe the most significant skills and/or knowledge that you gained or further developed during this course.

The most significant knowledge I gained from this course is an understanding of Lebesgue integration, a new and more rigorous way to think about integration.

5. Considering the overall design of the course, how did the pace, presentation of information, clarity of expectations, assignments, activities, and/or discussions in the course impact your learning?

The pace, presentation, and assignments were all very appropriate for the content and helpful to my learning.

6. Please describe the nature of your interactions with the instructor in this course, including the instructor's engagement with student questions and ideas in class, their cultivation of an inclusive learning environment, their availability outside class, and the feedback you received on your course work.

The professor was very available outside of class, although he only had one office hour a week that did not conflict with one of my other courses. He was also very open to student ideas in class, often diving deeply into students' questions and curiosities. However, I did not receive much feedback on my course work.

Additional comments.

N/A

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Attend class: **always**

Participate in class: **always**

Complete assignments: **always**

Meet with professor(s) outside of class: **always**

2. Using specific examples, please briefly describe what you did that you feel was particularly effective for improving your learning in this course?

Alvarado is a clear and precise lecturer, as well as being very present during class time and office hours.

3. In what ways did this course and instructor stimulate or shape your intellectual interests, thinking, and/or imagination?

N/A

4. Please describe the most significant skills and/or knowledge that you gained or further developed during this course.

Further skills in precise proof writing.

5. Considering the overall design of the course, how did the pace, presentation of information, clarity of expectations, assignments, activities, and/or discussions in the course impact your learning?

At certain times the pace of the course felt a bit rushed, but in exchange, we got further into the course materials which I think for many people was a worthwhile tradeoff

6. Please describe the nature of your interactions with the instructor in this course, including the instructor's engagement with student questions and ideas in class, their cultivation of an inclusive learning environment, their availability outside class, and the feedback you received on your course work.

Prof Alvarado is a very engaged and inclusive professor. He is one of the few math professors I have had who specifically asks for and honors my pronoun choices which meant a lot to me.

Additional comments.

if I had more time I would have written a more thorough note, but I really do believe Alvarado is an important member of the faculty from a student perspective with his attention to detail, inclusivity, and his commitment to helping students to succeed. He makes challenging courses, but he also actualizes his desire for all of us to do well, especially with office hours

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Attend class: **always**

Participate in class: **often**

Complete assignments: **always**

Meet with professor(s) outside of class: **sometimes**

2. Using specific examples, please briefly describe what you did that you feel was particularly effective for improving your learning in this course?

Paying attention and asking questions during class, as well as taking ample time to think out solutions to homework/exam problems in advance was enough to nurture mastery of the material.

3. In what ways did this course and instructor stimulate or shape your intellectual interests, thinking, and/or imagination?

The professor presented a compelling view of some of the problems and methods relevant to the analysis side of mathematics, and helped to reinforce my interest in taking further graduate courses in the field.

4. Please describe the most significant skills and/or knowledge that you gained or further developed during this course.

An in-depth look at the concepts of measure theory, as well as a fleshing out of the usage of analytical problem-solving techniques in mathematics beyond what is done in MATH 355.

5. Considering the overall design of the course, how did the pace, presentation of information, clarity of expectations, assignments, activities, and/or discussions in the course impact your learning?

The pace of the class was much faster than any other class I have taken at Amherst, but the material was still presented with so much clarity that I never felt lost during class or on the assignments. I also appreciated that the material of the course was a special cut/rearrangement of material from the textbook, with extra proofs and examples that helped to motivate and elucidate the concepts and theorems throughout the course.

6. Please describe the nature of your interactions with the instructor in this course, including the instructor's engagement with student questions and ideas in class, their cultivation of an inclusive learning environment, their availability outside class, and the feedback you received on your course work.

The professor was very frequently available outside of class, and always gave just the right amount of help or guidance for any question asked. I was also appreciative and very impressed of how attentive he was of students showing any signs of not completely understanding the material presented right away, always bringing up concerns and resolving them sometimes faster than it would have taken to ask the question in the first place, which helped greatly to improve the pace of the course while keeping everything very clear.

Additional comments.

N/A