

## MATH 235: Modern Concepts of Mathematics - Dr. Miller - Course Info SUMMARY - Fall 2018

Meeting Times/Place: MWF 2:00-2:50 in VSC Room 203

Course Description/Content: (The Department-approved Student Outcomes are attached also.)

- SRU catalog: Basic logic and set theory, and methods of proof, induction, relations and functions.
- This course builds heavily on material from MATH 131 - Discrete Mathematics.
- Our primary focus is the reasoning necessary to create and understand mathematical proof.
- This course requires you to learn to write formal proofs and is very VERBALLY oriented.

Prerequisites and Follow-Ups:

- Prerequisites: MATH 225 – Calculus I and MATH 131 - Discrete Mathematics
- Mathematics majors must have a C or better in both of these prerequisite courses.
- Follow-up coursework: Mathematics majors must earn at least a C in this course to enroll in upper-division mathematics coursework.

Text: *A Transition to Advanced Mathematics* by Smith, Eggen, and St. Andre (8th ed., teal cover)

Contact and Office Hours: Email: lyn.miller@sru.edu - Phone: 724-738-2878 - Office: Room VSC 200B

- My web page is [granite.sru.edu/~lmiller](http://granite.sru.edu/~lmiller) . (No “www.” and no D2L except for exam grades)
- Assignments, other information will be posted regularly on the sub-page for our course (not D2L).
- Drop-in Office Hours will be posted online and on my door soon. I’m also available by appointment or “capture.”
- In person or email, **SEEK HELP EARLY AND OFTEN!**

Classroom environment: I teach via hand-written info on the whiteboard; take detailed notes.

- I CANNOT ALLOW FOOD/DRINKS in the classroom due to SRU-documented disability.
- See me if this restriction conflicts with your own documented accommodations.
- Don’t distract yourself with cell phone or computer use during class.

Grading:  $A = 90 - 100\%$ ;  $B = 80 - 89\%$ ;  $C = 70 - 79\%$ ;  $D = 60 - 69\%$ ;  $F = 0 - 59\%$ .

- Course total = 550 points: HW Score = 100 pts, Exams 1-3 = 100 pts each, Final = 150 pts
- Students with SRU-documented test or HW accommodations should notify me ASAP.

Homework: Worth 100 points (scaled): lowest score (or maybe two) will be dropped at end of semester

- HW is due every Friday (except near exams); proofs take MUCH time, so start early!
- This course is quite verbal, so write legibly and leave plenty of room for me to comment.
- **Make-ups - NONE**, nor any late. Dropping your lowest score allows for travel, illness, etc.
- This is like earning “personal days” at work; everybody is allowed to miss, but choose wisely.
- Turning in HW early or via email when you’ll be absent is usually approved, but ask first.
- You may collaborate: **do not COPY** from others, the web, solution manuals, past semesters, etc.
- Inappropriate collaboration may result in a score of 0 for all involved, regardless of intent.
- Solutions (sometimes partial) will typically be posted outside my office door.
- To honor copyright and other laws, do NOT share solutions on social media or web sites.

Mid-Term Exams: Worth 300 points total: 100 each for Exam #1, #2, #3, no collaboration

- Topics List will be provided in advance. Study thoroughly, based on that List.
- Answers without work do not earn full credit. When asked, justifications must be rigorous.
- Justifications/work are graded on correct MATH knowledge, notation, reasoning, and style.

- Make-up approval requires prior notification, and documentation. **The Final is your make-up.**
- Tentative midterm exam dates are posted online.
- Occasionally, NON-TEXT-BASED (non-graphing) calculators will be allowed. Buy or borrow one.

**Final Exam:** cumulative, worth 150 points total, no collaboration

- You **MUST** take the Final at the scheduled time: Wednesday, Dec. 12, 3:30-5:30 pm.
- Students with SRU-documented disabilities must submit exam paperwork one week in advance.

**Attendance:** A sign-in sheet circulates daily, but attendance does NOT count toward your grade.

- If you are absent, YOU must make arrangements to catch up for the next class.
- Get contact info for at least one classmate. If you're absent, get notes from them.
- (I lecture from a basic outline, so I don't \*have\* any written materials to xerox if you're absent.)
- Assignments and announcements are available via my web page [granite.sru.edu/~lmiller](http://granite.sru.edu/~lmiller).

**Student Outcomes - Math 235 - Modern Concepts of Mathematics**  
*SRU Department of Mathematics - Spring 2014 (PDF version)*

1. Students will demonstrate an understanding of and competence in working with logic. This includes the following topics.
  - (a) Propositional calculus
  - (b) Quantifiers
  - (c) Methods of proof
2. Students will demonstrate an understanding of and competence in writing proofs relating to sets. This includes the following topics.
  - (a) Operations on sets
  - (b) Infinite families of sets
3. Students will demonstrate an understanding of and competence in using mathematical induction and recurrence in proofs.
4. Students will demonstrate an understanding of and competence in writing proofs relating to relations and functions. This includes the following topics.
  - (a) Equivalence relations
  - (b) Operations on relations
  - (c) Orders
5. Students will demonstrate an understanding of and competence in writing proofs relating to countable and uncountable sets. This includes the following topics. (optional)
  - (a) Cardinality
  - (b) The Schroder Bernstein and Cantor theorems

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**Important University-wide policy statement on sexual violence, required on all course syllabi:**

“Slippery Rock University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University’s Title IX Coordinator. The only exceptions to the faculty member’s reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University protection of minors policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: <http://www.sru.edu/offices/diversity-and-equal-opportunity/sexual-misconduct-and-victim-resources>.”

**The full SYLLABUS is attached AND available online and describes my course policy in greater detail.**  
**YOU ARE RESPONSIBLE for reading it in its entirety.**

• **What This Course Is About, Why You Need It, and How It's Taught**

**Content and Rationale:** To mathematicians, the word “proof” has a very deep meaning that is often difficult to define. A proof is not just a list of computations that ends up with some numeric result or in some desired form of symbols. Rather, a proof is a clear, connected set of mostly verbal statements (but often mingled with equations or other notation) that justifies why some particular behavior will happen or some quality will be true. Writing a proof is the art of nailing down a guarantee in some sense about things that are not always specific. The purposes of this course are to help you (1) identify what the “guarantee” really is in any given reasoning setting, (2) recognize sentences or notation that **MUST** be included in order to meet that aim of “connecting” your statements, and (3) sharpen your attention to verbal and notational detail that will make your proofs “clear.” **FORMAL** use of language and notation aren't just nit-picky choices by one instructor vs. another, but rather are the true building blocks of mathematical proof in all courses. It can be tough to make the switch from computational-type thinking and work that served you well in courses like algebra and calculus, to grappling simultaneously with both the information that you need to say **AND** the way you need to say it, and many math students say that writing proofs is one of the hardest things they try to learn. It is also extremely satisfying, though, like learning any new but challenging skill. Also, reading and writing proofs opens the doors to understanding **WHY** so much of what we were taught in grades K-12 really is true or has to work in a particular way. Proving makes **SENSE** of rules that many people just grudgingly accept as somebody's annoying whim. And mathematics at its most basic could be described as making sense (predictions, rules, guarantees, truth!) of the world around us.

**Pedagogy:** In any proof-based course, **YOU** will definitely be writing lots of original proofs. On my end, I still lean toward the lecture-as-model style of teaching, with quite a bit of discussion thrown in. I typically teach in this manner because I hope it lets you slowly work through each step of a proof as we build general styles that will be needed in many of your further coursework. This course is not so much about learning specific math ideas, though, as it is about learning specific reasoning patterns. In order to see enough examples to recognize a pattern, lecture can give you a model (at least, if the professor is good at it!) for how the material is logically organized and flows most clearly and even elegantly. However, there's also a potential weakness to lecture: during a polished lecture, even an excellent one, you typically don't get to see the professor **DOING** mathematics; you only get to see him/her **PRESENTING** mathematics. Most students may not realize that there's a difference. So we math professors face a dilemma: how do we in the same course demonstrate often what a good finished product of a proof should look like while also demonstrating how to arrive at one from scratch, with all the fits and starts, back-tracking and just plain re-booting that the process entails? There are a lot of valuable approaches and philosophies for attempting this, but in the end, most math faculty agree that we should each teach according to our own strengths. For me, that is still presenting proofs and techniques at the board with lots of annotation (discussion) about the rationale for each step, and expecting you to internalize that rationale so that you can recognize and use it in similar situations in this class and others. I hope this teaching technique will be successful in helping you to learn the material and the broader reasoning and proof skills the course is used to develop.

- **What the Class Environment Is Like:**

**Physical Environment:** We meet MWF 2:00-2:50 in Room VSC 203. I write on the long side board and occasionally use the front projector screen. Seat yourselves so everyone can see and hear well. Try to avoid having 4 to a table, as well as shunning the table nearest the cabinets: the viewing angle is rather bad in those arrangements.

**Cognitive Environment:** You're math majors, so you already know the importance of staying focused during class: don't use cell phones or other technology during class, and don't distract your classmates with off-topic conversation. I encourage collaboration in and out of class, but collaborating isn't the same as copying (cheating) from a partner nor even having an entire group agree on a common response. You should always arrange your own work in your own way and give proofs in your own words, for when you don't, you set yourself up to do poorly in settings where you are expected to work alone, like on exams or in your own classroom. Also, remember that while one professor may allow collaboration in a course, another may not, or someone may allow collaboration on some tasks but not others in the same course. Always check to see whether working together is allowed in a math class.

**Health Environment:** **I CANNOT PERMIT FOOD OR DRINKS** in our classroom due to serious respiratory allergies. Unflavored water is allowed, but no other beverages. See me immediately if this health accommodation conflicts with your own documented needs, so that we can work to craft appropriate adjustments. In your future careers, you will likely be involved in situations necessitating accommodations for co-workers, clients, or even visitors with disabilities in your own workplace; federal law protects the rights of the disabled, including those with health disabilities. Start now to become more aware of such situations.

- **Background and Materials You Need for the Course:**

**Pre-/Post-Requisites:** The course prerequisites are a C or better in MATH 225 - Calculus I and also in MATH 131 - Discrete Mathematics. You all need a C or better in THIS course to go on to the higher-level required proof courses in the BS in Math program.

**Texts:** Our text is the teal-colored book [A Transition to Advanced Mathematics](#) by Smith, Eggen, and St. Andre. This text is a tried-and-true standard in courses like ours, but each new edition has some changes, so beware if you choose to use an older edition!

**Online Tools:** Online notices and extra materials are posted daily on my web page at [granite.sru.edu/~lmiller](http://granite.sru.edu/~lmiller) (no "www.") but NOT on D2L. D2L's password-exclusive nature prevents others outside our course from viewing materials I'd like to share freely. I try to post your current course scores and grade on the D2L gradebook immediately after each exam, but be aware that SRU considers D2L gradebooks unofficial. Only the grade submitted by your professor on Banner is official.

**In-Class Tools:** You ARE permitted to use a calculator for our rare computational tasks in this course, but it can't be your cell phone and on exams I may institute appropriate procedures to account for the text-based memory of the typical graphing calculator, such as asking you to clear your memory. If you prefer not to do so, a basic calculator with square root and exponentiation capabilities will be sufficient for our purposes. Calculator covers must be put away during exams.

- **How You Can Contact Me Or Get Extra Help:**

**Getting Help From Me:** I am always willing and happy to work with students who need extra help. You should make a good-faith effort to organize your thoughts before seeing me, however. The student who comes to me asking for help or extra practice on a specific problem or topic that he/she has already looked over will benefit much more than the student who has not tried to study for days and simply says “I’m lost; can you teach me everything again?”

**Office Hours and Contact Info:** My drop-in office hours for this semester will be posted online and on my door; occasional health issues and other conflicts may require me to reschedule, which I’ll announce in advance when possible. We can also make an appointment to meet at other mutually convenient times, and I am available “by capture” for students in our course. This means that if I am in my office with the door open, you can ask me for help; be aware that sometimes, I may have to ask you to come back another time, though. My email address is [lyn.miller@sru.edu](mailto:lyn.miller@sru.edu); my office phone number is 724-738-2878. My office is 200-B VSC inside the Mathematics Department office suite. Please do not bring food or beverages into my office; there is a kitchenette counter a short distance from my door where you can leave such items.

**Other Sources of Help:** Remember, you are allowed and encouraged to study together for this course, but make sure you write up assignments in your own words. Please refrain from using solution manuals or web searches to look up answers, proofs, or solutions. Doing so deprives you of the opportunity to improve your own skills. I’ve often been told that my proof-based exams require students to “think on their feet,” so losing out on genuine individual practice will probably put you at a noticeable disadvantage for exams.

- **How Your Grade Is Determined**

**Overall:** Your grade for the course is based on HW (scaled to 100 points total), three midterm exams (100 points each), and a final exam (150 points), for a semester total of 550 possible points. The letter grade designations are awarded by 10% increments:

$$A = 90 - 100\%; B = 80 - 89\%; C = 70 - 79\%; D = 60 - 69\%; F = 0 - 59\%.$$

I typically round to the nearest whole percent, so for instance an 89.7% rounds up to an A (90%) while an 89.4% rounds down to a B (89%). Students with SRU-documented disabilities should see me ASAP to discuss accommodations for which you have been approved on any of these components to your grade.

**HW:** I plan to collect HW roughly weekly in the course, usually on Fridays to allow for the weekend to grade. I try to give ample time between handing out an assignment and the intended due date, but you’ll be most successful if you work on it incrementally, rather than trying to do it all the night before (or day of) its due date. For computational or procedural courses such as calculus, problems are short enough that math majors can often put in just one attempt at your assignment near its due date and still be very successful. Proof-writing HW is NOT like that: first, it’s unlikely that your first draft will be perfect, so get into the habit of rereading your assignments very critically to see whether you’ve left anything out or made any logical leaps that aren’t supported. However, in order to get that critical eye really working, you need to let your first attempt “rest” for a bit: rereading it right after you wrote it is unlikely to

help you spot something that, a few hours or a day later will jump up and tell you "hey, wait a minute - that doesn't make sense." So start your HW in this course (and other proof courses) early, and plan to reread it before you turn it in to see whether it still makes sense. It's also helpful to have a classmate critique, for an even more unbiased opinion.

I can't grade every problem on your HWs, but will choose a variety to spot-check for correctness, honest effort, completeness, mathematical precision, and logical rigor. If you have multiple pages, you should staple them (there is a stapler at the front of our classroom and in the Math Office suite - VSC 200). You may work together on HW, but do NOT copy from each other nor from the book, manual, or other sources - use your own words and organization of work. Any work that looks too identical - even accidentally - will count as a 0 for all involved.

Each homework assignment is worth 20 points, but your final total is scaled to be out of 100 COURSE points. To allow for the occasional missed or just poor assignment, I will be dropping your lowest 1-2 assignments, like having personal days at work. **I DON'T ACCEPT LATE HW** as they make grading criteria less uniform and delay feedback for everyone else in the class. I will try to return assignments as quickly as possible, sometimes the very next class day, but as this is a proof-based course, it usually takes me more than one class day to properly read and assess your proofs. Come in for help before an assignment is due if you have trouble with material on HW - I expect you to turn it in at the very START of class the day it's due.

**Exams:** Exams require you to state key definitions, explain or apply covered concepts, and prove both new and occasionally familiar results. I don't often reuse problems. You'll get a Topics List naming what's on each exam one week prior to its date; however, the List does not summarize nor give practice problems. Past successful students say the best way to use the Topics List is to make your own study guide, where you copy down **precise** statements and fully-worked examples or known proofs as well as cautions about the items listed. This requires you to review your own notes, reading, and HW to see what we have said/done about each item. Old exams on my web page are good examples of length or sources of a few practice problems, but they are NOT templates for this semester's exams - I seldom teach a course identically to the past! You need to let this semester's Topics Lists guide your study in order to do well. Each exam takes the whole period, and some may have a take-home component, or we may need to split them over two days, not just one. I'll let you know the format in advance. You will be permitted to have your pen/pencil and a calculator out during exams, but nothing else: no cell phones, no water bottles/mugs, and you'll have to put away your calculator cover too. If I see evidence of dishonesty, everyone involved gets a 0.

**Final Exam:** The Final Exam is cumulative and will have its own Topics List. It is administered in our regular classroom, but on the date and time specified in SRU's official Final Exam Calendar. Honesty is expected, as above. **You MUST take the Final at the scheduled time for our course.** Do NOT plan travel or other activity that conflicts with it; make sure your family and employers understand this also. Our Final is Wednesday, Dec. 12, 3:30-5:30 p.m.

**Attendance:** Attendance, effort, and other subjective considerations do NOT count toward your grade. Regular, prompt attendance and meaningful effort to do your best

are necessary for learning effectively, so it's artificial to include those as separate point-earning/losing components of your grade. If you are absent, it is YOUR RESPONSIBILITY to get the notes and materials from a classmate and the web site, make an effort to review them on your own first, and then see me for help – BEFORE the next class. Again, my assessment of your mathematical knowledge is based on objective standards, so I do NOT give extra credit assignments just to boost performances in the course. However, on a rare occasion, I may choose to encourage other highly valuable aspects of our discipline through SMALL rewards for participating in mathematical events on or near campus. Such opportunities will be equitably offered to all students in the course, will be limited to events that I believe should merit such exceptional reward, and will be announced in advance.

**Make-Ups:** Approval to make up a MISSED EXAM SCORE requires that you make meaningful efforts to contact me ASAP when you learn you'll be absent, and provide a documented, University-approved reason for your absence. If approved, you will NOT take an alternative exam at that time, though: waiting until after an absent classmate can take a make-up exam delays the return of everyone else's feedback. Rather, at the end of the semester, your Final Exam percentage will also count as that missed exam score. As already stated, if you miss handing in a HW or taking a quiz, you will not make those up or turn them in late; instead, I drop your lowest 1-2 scores. Be aware that faculty extend to you the privilege of make-up assignments in certain instances; we are NOT required to do so. You must fulfill your obligations in order to merit that privilege.

- **Important University-wide policy statement on sexual violence:**

The University requires the following statement to be included in all course syllabi. As members of an educational community, you will appreciate the importance of protecting minor-aged children from harm inflicted by adults. The statement below specifically outlines the University's stance toward sexual violence directed toward minors:

“Slippery Rock University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University protection of minors policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: <http://www.sru.edu/offices/diversity-and-equal-opportunity/sexual-misconduct-and-victim-resources>. ”