Instructor: Dr. Andrew Koichi Greene
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Office Hours: TWTh 2–3, W 4–5; and by Appointment


Course Description: This course will serve as a bridge between introductory and advanced mathematics. An introduction to the mathematical concepts and techniques of discrete mathematics: Topics include principles of logical argument, modular arithmetic and congruence classes, induction, sets, functions, relations, summations, the binomial theorem cardinality of sets. Topics form the mathematical basis of computer science and are pivotal to the study of advanced mathematics. Math 243 is a 3 credit course. This course meets 3 hours per week. Prerequisite: Math 186 or permission of instructor.

Course announcements and resources will be regularly posted online at [https://cloud.sagemath.com/](https://cloud.sagemath.com/). In addition, a daily schedule and additional information can be found at [http://home.manhattan.edu/~andrew.greene/243/](http://home.manhattan.edu/~andrew.greene/243/).

Attendance: Attendance is mandatory. Four or more unexcused absences must be reported to the dean of your school. If you are late, please notify the instructor at the end of the class.

Grading:

- LaTeX Work: 10%
- Peer Reviews: 10%
- Participation: 15%
- Regular Exams: 45% (15% each)
- Final Exam: 20%

Notes: Midterm grades are due Monday, October 17th. They will not appear on your transcript. The last day to withdraw from a course with a “W” is Friday, November 18th.

Homework:

Written work and reviews: Before each class period, you should read the associated sections in the textbook. Alternatively, there are sreencast videos at [https://www.youtube.com/playlist?list=PL2419488168AE7001](https://www.youtube.com/playlist?list=PL2419488168AE7001). (Tip: I like to play such videos at 2x speed with captions for efficiency, occasionally slowing them down or rewinding confusing parts for better comprehension.) Preparing for class with the book or the videos is vital for your success in this course. Much of class time will
be spent working through collaboratively. I will occasionally deliver mini-lessons, but mostly I will
work individually with student groups to offer clarity and assistance.

One of the main reasons lectures are de-emphasized in this class is that you are being taught
certain mathematical skills related to verbal and written mathematical communication as well as
forming rigorous mathematical proofs.

Since much of classtime will be spent working on exercises, you will find the homework load
very light. Instead, you are expect to use the additional time outside of class reading the textbook
or watching the videos. Each problem is assigned to a particular student who will have about a
week to write up a solution using the gold-standard mathematical typsetting system \LaTeX (using
https://cloud.sagemath.com/). After submission three students are assigned to independently
review the work and offer feedback and corrections (about a half page). The reviews are due a
week later. The original student then has a week to make corrections and submit a final solution
draft. The final drafts will be consolidated in a “student solution manual.” This will benefit you by
showing you the different writing styles and mathematical approaches of your students. Critically
examining the mathematical work of your peers is equally important as figuring out your own
solutions.

**Exams:** There will be three in-class midterm exams. The final exam will be cumulative, and will
be held on the day designated by the Registrar’s Office.

**Extra Help:** It is imperative that you seek extra help as soon as possible if you need it. You can
always come to my office hours, however, please do not feel restricted to those times. If you see
that I’m in my office, feel free to stop by and ask questions. You can also set up an appointment
with me outside of scheduled office hours.

**Make-Up Policy:** No make-ups will be granted unless in the case of an emergency. In such cases
you need to notify the instructor and provide proper documentation detailing the emergency in
order to receive permission to have a make-up.

**Special Accommodations:** Please notify the instructor as soon as possible if you have commit-
ments as an athlete or other special needs. Students with special needs should bring appropriate
documentation to the Specialized Resource Center, Miguel 300,
http://manhattan.edu/academics/specialized-resource-center, to obtain an Academic Ad-
justment/Auxiliary Aid form. Bring the completed form to me as soon as possible, and together we
will decide on how best to fulfill the adjustments and/or aids listed on the form. Student athletes
should bring their event schedules to me as soon as possible.

**Calculators:** You will not need a calculator in this course. No electronic devices, including cell
phones, may be used for any reason during an exam. If you must use the restroom during an exam,
you must place your phone on your desk while you are gone.

**Academic Integrity:** Recall that as students of Manhattan College, you have each signed The
Manhattan College Honor Pledge as a part of the Honor Code:

As a Manhattan College student, I will not lie, cheat, or steal in my academic endeavors,
nor will I accept the actions of those who do. I will conduct myself responsibly and
honorably in all my activities as a Manhattan College student. I am accountable to the
Manhattan College community and dedicate myself to a life of honor.

Whenever you put your name on work to be handed in for grading in this class, you are reaffirming
the above pledge—you are certifying that the work is your own, and that you have not violated the
Honor Code in any way while doing the work. Students who violate the Honor Code are subject to various sanctions, including suspension or expulsion from Manhattan College. Violations of the Honor Code include, but are not limited to, cheating, plagiarism, fabrication, and other forms of academic misconduct. Please see the Manhattan College Community Standards, pp 45-47, for specific examples of the above.

In particular, you may not use, in whole or in part, any fragment of text or \LaTeX code written by someone else or obtained from an internet source. Collaboration, as opposed to mere copying, is a different matter. Everyone in the sciences collaborates extensively, and I urge you to do so as well; it will invariably enhance your understanding and hence the quality of your work. Here the measure of integrity is that you explicitly credit everyone you worked with.

In addition to collaborating, it is common to consult other sources, either other authorities (e.g. other professors), or text or on-line resources, when you are struggling to understand things. This is also entirely appropriate, with the provisos of the previous items: (1) You may not simply copy material, and (2) you must explicitly credit every source you have used. For texts, this means titles, authors, and page references. For internet sources, this means specific URL’s and further navigation information if is is needed to locate the material you consulted.

The absolute prohibition on copying and yet the encouragement for collaboration and consultation requires an additional comment. It is fine to discuss problems with other students and professors, and it is fine to consult mathematical works in search of insights. But what you have to do with the results of these interactions is to digest the information you have obtained and give your own personal account of it. The write-up you submit must be yours alone. The fact that you have processed the material you obtained and have expressed and hopefully elaborated on the results in your own words is what makes these collaborations both worthwhile learning experiences and acceptable submissions in the course.

Course Learning Outcomes: You will have mastered after successful completion of the course:

- Basic facts about mathematical logic: the truth-table definitions of the logical connectives, the concept of logical equivalence, universal and existential quantification, and the ability to negate logical sentences.

- Knowledge of the form of the various types of proof: direct proofs, proofs by contrapositive and contradiction, proofs by cases, and mathematical induction.

- Knowledge of the strategies appropriate to the five categories of proof listed above. How such proofs should begin and end as well as what types of beginnings are incorrect.

- Knowledge of proof strategies appropriate to different types of statements: proving and disproving both universal and existential statements.

- Knowledge of proof strategies appropriate to different subject domains: proofs of basic set-theoretic facts and proofs about basic algebraic properties of integers, rational, and real numbers.

The course also either introduces or expands upon some mathematical subjects, and you will also have mastered:

- Basic set theory. Sets and subsets, unions, intersections, and cartesian products, and the extension of these ideas to indexed families of sets.
• Relations in general, equivalence relations and set partitions in particular, with special attention paid to equivalence modulo \( n \) for integers.

Mathematical proofs are essays, a fact that should not be obscured by the symbols that may be involved or the demands imposed by a strict reliance on logic. First and finally, what you produce is a written document, and as such it is subject to universal standards of correctness, clarity, and coherence. And so it is that any course that introduces mathematical proof must also address the fundamentals of good writing. Successful completion of this course means that you will have obtained certain standards of competent technical writing:

• Ability to produce clear and coherent prose.
• Ability to revise and edit your work critically.
• Avoidance of usage, grammatical, and spelling errors.
• Knowledge of basic mathematics formatting conventions.
• Ability to produce very simple documents, primarily homework problems, using \( \text{LaTeX} \).

Good Luck!