Math 302 Introduction to Proofs via Number Theory Spring 2026

Instructor Dr. Amites Sarkar

Text There is no textbook for this course.

Overview

Number theory, the "queen of mathematics", has a long and rich history. In this course we will encounter some fundamental ideas of **Euclid** (who lived around 2300 years ago), as well more recent contributions from great mathematicians such as **Fermat**, **Euler** and **Gauss**. Fascinating work in number theory is still being done today, since there are many important unsolved problems. These include the **twin prime conjecture** (are there infinitely many pairs of primes which differ by exactly 2), **Goldbach's conjecture** (is every even number greater than 2 the sum of two primes) and the **Riemann hypothesis** (which is a bit harder to explain, but which has to do with the distribution of prime numbers). Number theory also provides the mathematical basis for modern **cryptography**, some of which we shall study in this course.

However, the main course objective is to introduce you to mathematical **proof**. Moreover, you will learn about proofs not by reading them but by **inventing them yourself**. This will, for most of you, be unlike any other mathematics course you have taken. It will involve investigating on your own, forming and testing hypotheses, and then trying to prove what you believe to be true. This is the true essence of mathematics.

The success of this course will hinge on **your active participation**. You will be asked to present solutions to assigned problems, as well as to discuss and assess other student's presentations.

Exams

Midterm Friday 1 May (during regular class meeting)
Final Tuesday 9 June 8–10 am

Homework

There will be four written homework assignments, but your standard homework assignment will be to prepare presentations for proofs of theorems on the eight theorem sheets, which will be distributed at regular intervals throughout the quarter. I will provide feedback and evaluation of your proofs based on both the mathematical content and the writing style. We will talk more about how to write and present proofs in class.

Grading

Your grade for the course will be based as follows:

Class presentations	30%
Class participation	10%
Written proofs	20%
Midterm	15%
Final	25%

If you feel too ill to take an exam, don't take it, but bring a doctor's certificate to me when you feel better and I will make arrangements.

Office hours

My office hours are 11–11:50 am on Mondays, Tuesdays and Thursdays and 1–1:50 pm on Fridays.

My office is 216 Bond Hall, and my e-mail is amites.sarkar@wwu.edu.

Course objectives

The successful student will demonstrate:

1. Proficiency in writing and presenting clear, complete and correct mathematical proofs.
2. An understanding of the principles of mathematical induction.
3. An understanding of the properties and principles of divisibility, including the Euclidean algorithm.
4. Knowledge of the proof of the Fundamental Theorem of Arithmetic, and its applications.
5. Knowledge of basic facts about the prime numbers, and the proof of the infinitude of primes.
6. Competence in congruence arithmetic and use of the Chinese remainder theorem.
7. Knowledge of the proofs of Fermat's and Wilson's Theorems and their applications.

Sources of help

Please talk with me about any questions or concerns you may have about the course, and make use of my office hours. You are also encouraged to discuss material with other students in class. However, if you have had substantial assistance in doing a problem, it should be a matter of honor not to use that problem for your class presentation. You are not allowed to look at other textbooks or the web for solutions to problems or proofs of theorems. That would contradict the spirit of the course.

AI

Use of AI is not allowed for this class. Please submit only original work.

Please don't use AI to draft or complete your work. I will ask you to come talk to me if I have any concerns. If you need support writing proofs or completing assignments, come to my office hours and I'll work with you one on one. My goal is for you to learn how to do this work by yourself. **It is not about the output, but the process.** Violation of this AI policy could lead to a referral to Academic Integrity. So can noncooperation if I send you an email to come talk to me about how you completed your work.