

Instructor	Dr. Amites Sarkar
Text	There is no textbook for this course.
Credits	4
Class dates	Monday 27 June – Thursday 4 August
Class time	1:00–2:20 pm Monday, Tuesday, Wednesday and Thursday (if participating synchronously)

Preface

This course will take place online through Canvas and Zoom. My priorities are to make the course accessible, and the grading fair. The ideal way to participate is synchronously, at the regularly scheduled meeting time of 1pm on Mondays, Tuesdays, Wednesdays and Thursdays (I will host a Zoom meeting and invite everyone on the class list). However, I will record each class meeting, and make the recordings available through Canvas, so it will be possible to complete the class asynchronously, if need be. The grading will be based entirely on homework; see below for details.

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). Number theory also provides the mathematical basis for modern **cryptology**, 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.

Homework

There will be eight written homework assignments, based on the eight theorem sheets, which will be posted online at regular intervals throughout the quarter. You should send me your solutions through Canvas. 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 proofs in the first week of class.

Grading

The first 4 homework assignments will be worth 10% of the final grade, and the second 4 homework assignments will be worth 15% of the final grade.

Office hours

My office hours are 12–12:50pm on Mondays, Tuesdays, Wednesdays and Thursdays. These will occur using Zoom. 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 let me know about any questions or concerns you may have about the course. You are welcome to discuss material (e.g. online) with other students in class. However, if you have had substantial assistance in doing a problem, please indicate this in your written solution. You are not allowed to look at textbooks or the Internet for solutions to problems or proofs of theorems. That would contradict the spirit of the course.