MATH 207-01: NUMBER THEORY (3 cr.)

SYLLABUS & COURSE POLICIES

DORDT UNIVERSITY

SPRING 2024

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Instructor:	Dr. Mike Janssen, Professor of Mathematics
Email:	`Mike.Janssen@dordt.edu`; I will endeavor to reply to every email within one school day.
Classroom:	CL 92
Class time:	9:00–9:50 AM MWF
Office:	SB 1612
Office Phone:	(712) 722-6398
Student Hours:	By appointment: `https://fantastical.app/mkjanssen/student-hours`
Required Resources:	*Number Theory Through Inquiry*, 1st ed., by Marshall, Odell, and Starbird Regular access to Overleaf.com for Written Work
Pre/corequisite:	Math 212

Catalog course description: An introduction to the main topics of elementary number theory, including divisibility, prime numbers, factorization, congruences, number theoretic functions, and number theoretic equations. Pre- or corequisite: Mathematics 212; or permission of instructor.

COURSE OVERVIEW

Welcome to Number Theory! I am glad you are here.

In this course, we study properties of the integers. We'll discuss congruence, divisibility, primes, and more. We'll pay special attention to the historical development of the major ideas and consider the role of mathematical studies in fulfilling the cultural mandate.

LEARNING OBJECTIVES

In this course, students will:

be *communicators* through regular presentations to the Math 207 learning community and growing fluency in the writing of mathematical proofs. (CD)

be *explorers* by engaging with in-class activities and regular work outside the classroom. (CD)

be *learners* by leveraging knowledge of logic and proof to explore foundational questions in the study of the integers. (CS)

be *ambassadors* of mathematics by reflecting on the ways the practice of mathematics can promote human flourishing. (RO, CD, CR)

COURSE LITURGIES

In this section, we briefly describe the basic rhythms of the course. It is a truism that **mathematics is not a spectator sport**, and this course is designed with that in mind. There are two types of regular work in this course: daily work, and written work.

DAILY WORK

The work of the course will be primarily driven by you, the student.

PROBLEMS AND PRESENTATIONS

You will be assigned approximately three to seven problems from the text to work on before coming to class. You may not use any outside resources to help you solve these problems—NO BOOKS, NO WEBSITES, NO FRIENDS WHO HAVE TAKEN THIS COURSE BEFORE. Using these resources will constitute plagiarism and will be reported to the Student Life Committee. You *may* work with others currently enrolled in the course, but you will need to ensure that you can completely understand and explain the solutions and proofs you come up with.

One of the main goals of this course is to improve your mathematical communication. Thus, the majority of each class period will be devoted to you PRESENTING YOUR WORK on these problems to the class. You should expect that approximately 90% of the typical class period will consist of presentations and discussion.

By 11:59PM before each class, you will claim on Canvas problems whose solutions you are willing to present. In general, you will be allowed to present at most one problem per class meeting. For the first half of the semester, my intent is for you to be lead presenter on approximately one problem/week.

You will be notified by 7:00AM on Canvas of any problems you are assigned to present.

During class, you will write the problem and solution up on the board, highlight the main points of the proof/solution, and generally lead the class discussion. You should begin with an overview of your solution before delving into the details. The presentation will be **ungraded**, though if a pattern of unpreparedness emerges, your ability to sign up to present will be restricted.

SUPPORT

Not everyone can be assigned the problems they sign up for. However, you may be assigned as *support* for a given problem, typically a problem you've indicated a willingness to present. Prior to the presentation, it is your job to make sure that the presenter's written proof is clear.

SCRIBES

Each presented problem will also have a *scribe* assigned on Canvas. The scribe will have the responsibility of taking notes on the presented proof and asking questions when something is not clear. They then will write up a formal version of the proof AND discussion and post it to our Overleaf document.

PORTFOLIO

A major component of this course will be a portfolio. A significant portion of the portfolio will be a self-summary of your contributions to our classroom learning community. To pass the course, your portfolio must meet the following specifications:

- Include a summary sheet, consisting of:
  - A list of *at least 15* problems you presented, including five productive failures (typically no more than one/week, problem numbers are sufficient), and a short reflection.
  - A list of *at least 15* problems you supported on (typically no more than one/week, problem numbers are sufficient), and a short reflection.
  - A list of *at least 15* questions you asked (typically no more than one/week, problem numbers are sufficient), and a short reflection.
  - A list of *at least 15* problems you scribed (typically no more than one/week, problem numbers are sufficient).
  - A list of *at least 15* scribed solutions you edited (typically no more than one/week, problem numbers are sufficient).
- Include nicely typed (E-quality) solutions to three problems **you presented**, each coming from a different calendar month.
- Respond, in two pages or so, to a reflection prompt (provided later).

A LaTeX template will be provided for you to use. I encourage you to begin work on your portfolio the first week of class, so that you have a ready place to track your ongoing contributions to our learning community over the course of the semester.

An initial draft of the portfolio will be submitted for feedback on March 22.

ACADEMIC INTEGRITY

This course structure effectively models the way professional mathematicians conduct and share their research. Thus, we will abide by the Policy Statement on Ethical Guidelines[1] adopted by the American Mathematical Society, in particular Section I on mathematical research and its presentation. As this statement describes, "[t]he knowing presentation of another person's mathematical discovery as one's own constitutes plagiarism and is a serious violation of professional ethics. Plagiarism may occur for any type of work, whether written or oral and whether published or not." When you present your work in this class, both orally and in writing, you must cite ANY CONVERSATIONS you have had about your problem with ANYONE IN THE CLASS. Looking to ANY RESOURCE outside of the people in our class—including generative AI models like ChatGPT!—for information about the problems at hand constitutes plagiarism and will be reported to the Student Life Committee.

[1] See the AMS website for more: `http://www.ams.org/about-us/governance/policy-statements/sec-ethics`.

WRITTEN WORK

Roughly every other week (other than the weeks we have exams), you will be assigned three problems to solve, write up, and submit online by 11:59pm on **Jan. 24; Feb. 7, 21; Mar. 20; Apr. 3, 17**. These will be written in LaTeX, and will generally not be problems that have been presented in class (though they may have been assigned as daily work). Each problem will be graded on a four-level scale (each explained more fully on the proof rubric distributed on Canvas) as:

> **E**xceeds expectations. Dr. Janssen would be happy to post this as the official class solution.
>
> **M**eets expectations. The logic is generally correct and it is reasonably well written, but there is room for improvement.
>
> **R**evision needed. Some major gaps in logic, misuse of notation, or unclear communication requires revision.
>
> **N**ot assessable. This is difficult to read, abuses notation, or contains significant mathematical flaws. Probably best to start over.

Writing proofs is as much art as science, and initially it can seem daunting and confusing. In order to aid your growth, you will have the opportunity to revise your work **once** after Dr. Janssen returns the graded version provided the work was (a) submitted on time and (b) received an initial assessment of R or higher.

In short, your submissions will go through the following workflow (with the number representing the number of days since the Wednesday submission):

> Day 0: Initial submission due 11:59pm Wednesday
>
> Day N: Initial assessment and feedback returned
>
> Day $7 + N$, $1 \leqslant N \leqslant 7$: Revised problems submitted to Dr. Janssen, to be graded within a week.

Your written work *must* include an acknowledgments section or it will be returned ungraded. **You are encouraged to work on this homework with others in the course**, but if you discuss ANY mathematical content of any problem with another person, you *must* include their name in the acknowledgments, and ensure that your final writeup is completely your own. EVEN IF YOU DISCUSS A PROBLEM WITH SOMEONE AFTER YOU TURNED THE ASSIGNMENT IN, but before the assignment is due, you should resubmit the assignment and acknowledge the conversation! Looking to ANY RESOURCE outside of the people in our class for information about the problems at hand constitutes plagiarism. Failure to meet these criteria will constitute academic dishonesty and will be reported to the Student Life Committee.

Work submitted more than 24 hours late or work initially assessed at an N requires a meeting with Dr. Janssen and short accompanying reflection on why the work was assessed at an N and how such assessments will be avoided in the future. If earning an N becomes a regular occurrence on written assignments due to perceived lack of effort, you may lose the grace afforded by the revision process and only be allowed a single submission.

PROJECT

Mathematics is a human enterprise carried out in response to the cultural mandate, and, as such, was done by real people! Exploring the historical development of creation reveals both God's wondrous design and the creativity exercised by humans as image-bearers. We'll take some time during the semester to explore the origins of the Prime Number Theorem by reading some primary sources and engaging in mathematical tasks related to its development.

FINAL EXAM

There will be an oral final exam, worth 75 points. The exam will average with the project to form a component of your final grade.

OTHER POLICIES AND ADVICE

I am generally fairly accepting of late work, with a built-in 24-hour grace period for any non-classroom activities. Additional time beyond the 24-hour grace period must be approved ahead of time.

Student hours are your time to ask questions about all aspects of the class and college life. Please check online for an appointment. If you can't find one, send me an email! I will do my very best to accommodate your you.

Email Policy: I check my email twice per school day: once in the morning, where I'll deal with any emergencies, and once in the afternoon, when I'll respond to other emails (including any that have come in since the morning). If you require a more immediate response, you're welcome to come find me in my office.

Policy on Generative AI: Unless specifically permitted by Dr. Janssen in advance of student submission of work, any use of AI will be considered a breach of academic integrity. Suspected cases of misuse of AI tools will be treated as plagiarism and submitted to the Student Life Committee.

GRADING POLICY

Assuming you pass the portfolio, your final grade will generally be the **highest fully completed row** in Table 1. If you do not pass the portfolio, the highest grade you can earn will be a D. This will be awarded in the case that the grade calculated from Table 1 is not an F.

Final Grade	WW (M/E)	WW (E)	Exam and Project
A	17/18	13	87%
A–	16/18	11	84%
B+	15/18	9	80%
B	14/18	8	77%
B–	13/18	7	74%
C+	12/18	6	70%
C	11/18	4	67%
C–	10/18	2	64%
D	9/18	0	55%

Table 1: The Final Grade table.

TENTATIVE SCHEDULE

As the course will be driven by your work and interests, it is difficult to predict the amount of time that will be spent in each chapter. However, here is my best guess.

- Chapter 1: Divisibility (January 12–February 9)
- Chapter 2: Primes (February 12–March 25 (includes at least one project work day))
- Chapter 3: Congruences (March 27–April 12)

- Chapter 4: Fermat and Euler (April 15–May 3)

INSTITUTIONAL POLICIES

DORDT UNIVERSITY STUDENT'S RIGHT TO ACCOMODATIONS POLICY

Dordt University is committed to providing reasonable accommodations for students with documented qualifying disabilities in accordance with federal laws and university policy. Any student who needs access to accommodations based on the impact of a documented disability should contact the Coordinator for Service for Students with Disabilities: Sharon Rosenboom, Academic Enrichment Center, 712-722-6490, Email: Sharon.Rosenboom@dordt.edu.

DORDT UNIVERSITY ACADEMIC HONESTY POLICY

Dordt University is committed to developing a community of Christian scholars where all members accept the responsibility of practicing personal and academic integrity in obedience to biblical teaching. For students, this means not lying, cheating, or stealing others' work to gain academic advantage; it also means opposing academic dishonesty.

Students found to be academically dishonest will receive academic sanctions from their professor (from a failing grade on the particular academic task to a failing grade in the course) and will be reported to the Student Life Committee for possible institutional sanctions (from a warning to dismissal from the university). Appeals in such matters will be handled by the student disciplinary process. For more information, see the Student Handbook section concerning Academic Integrity.

DORDT UNIVERSITY ATTENDANCE POLICY

Class attendance policies and procedures as outlined in the Student Handbook are in place. To paraphrase the Student Handbook, Dordt University as an institution remains committed to in person instruction for face-to-face courses. As a result, you are expected to be present for every class period and laboratory period. Should you need to miss class for any reason, contact your instructor as soon as possible (either prior to the absence or immediately following). If the absence is the result of a documented disability, academic accommodations will be handled by the Coordinator for Service for Students with Disabilities. Absences for Dordt-sponsored curricular or co-curricular activities will be communicated by the activity sponsor and are considered excused. You are responsible to contact your instructor to make arrangements for missed work. Your instructor is not required to provide real time (synchronous) learning for you should you be absent for class for any reason (e.g., Zooming into your real time class). Your instructor is also not required to provide asynchronous virtual learning materials for you (e.g., recordings of missed classes, slide decks, other materials on Canvas). While some instructors might utilize some of the synchronous/asynchronous methods of making up work on occasion, you should not expect all instructors to provide these experiences automatically. Methods of making up missed work might include: contacting a fellow student to get notes from class, extensions on assignments or labs, or other methods as determined by your instructor. Making arrangements for missed class work is your responsibility! Please see your instructor's specific attendance policy.

I reserve the right to make changes to this document as the need arises.