



MTH 301 - Fall 2021

Introduction to Number Theory

Course Syllabus

Course information

Room: BH 306A

Time: MWF 9:10 - 10:00 am

Credits: 3.0

Prerequisites: A grade of C or better in MTH 220, or permission of the instructor.

Description: This course is an introduction to elementary number theory. One of the main driving questions for this course is: how can we find integer solutions of an algebraic equation with integer coefficients? This will motivate the study of several topics including: properties of integers (e.g. divisibility, greatest common divisors, primes, factorizations), modular arithmetic (e.g. linear congruences, Chinese remainder theorem), and quadratic equations (e.g. Legendre symbols, quadratic reciprocity).

Learning outcomes: Successful MTH 301 students will be able to:

- define and recognize properties of integers and modular integers, and correctly compute with them;
- solve linear Diophantine equations, and linear and quadratic congruences;
- state and prove foundational results of elementary number theory.

Online resources: Visit Blackboard for up-to-date information about this course.

Instructor

Name: Federico Galetto (he/him/his; I/me/the instructor, in this document)

E-mail: f.galetto@csuohio.edu

Office: Rhodes Tower 1528

Virtual office hours: Schedule an appointment at <https://math.galetto.org/appt>

In-person office hours: Request an appointment via email

Materials

Notes and other materials will be distributed on Blackboard. All course materials are copyrighted and cannot be distributed without the permission of the authors.

The following textbooks will be used, the first one is required.

Required textbook:

- Martin H. Weissman, *An Illustrated Theory of Numbers*, AMS, 978-1-4704-3493-9

Secondary textbook:

- Karl-Dieter Crisman, *Number Theory: In Context and Interactive*, Available at <http://math.gordon.edu/ntic>.

Grading

Standards based grading: In order to succeed in this course, you will need to demonstrate competency in several standards. You will be provided with a separate document containing a list of standards and a detailed rubric. Each attempt at showing competency in a certain standard will receive one of the following evaluations, listed from highest to lowest: Exceeds expectations (E), Meets expectations (M), Some progress (S), or Little progress (L).

At the end of the course, your letter grade will be:

- A** if you exceed expectations on at least 80% of the standards, and meet expectations on the rest;
- A-** if you exceed expectations on at least 40% of the standards, and meet expectations on the rest;
- B+** if you meet expectations on 100% of the standards;
- B** if you meet expectations on at least 66% of the standards, and show some progress on the rest;
- B-** if you meet expectations on at least 33% of the standards, and show some progress on the rest;
- C+** if you show some progress on 100% of the standards;
- C** if you show some progress on at least 75% of the standards, and little progress on the rest;
- D** if you show some progress on at least 50% of the standards, and little progress on the rest;
- F** if you show some progress on less than 50% of the standards, and little progress on the rest.

Please note that you will need to attempt all standards. The instructor reserves the ability to revise this grading scheme but never in a way that would lower your grade.

Homework: Homework assignments and due dates will be posted on Blackboard. Assignments are part of the standards grading and are evaluated as above (E, M, S, L).

Testing: Each Friday starting the second week of the semester, the second half of class will be reserved for standards testing. You may attempt any standard that has been covered in class or assigned up to that point in the semester. You may request additional opportunities for standards testing during office hours or by appointment. There are no formal quizzes, tests, or midterm exams in this course.

Exams: There is no final exam in this course. The time designated by the registrar's office for the final exam:

- Friday, December 10, 2021, 8:00 - 10:00 am,

will be used for further standards testing.

Participation: Active participation is encouraged and can contribute positively to your grade. Such participation includes asking good questions during class, answering questions in class, contributing to class discussions and activities, etc.

Feedback: Feedback on your work will be provided using the comments and feedback tools on Blackboard. Turnaround time for grading will be communicated in class.

Grade appeal: You are responsible for checking feedback on your work, and for ensuring evaluations are reported correctly on Blackboard. Any appeal request must be submitted within one week after a score is posted.

Policies

COVID-19 measures: The COVID-19 pandemic is still present and serious, especially with the Delta variant. While you are in class on campus, you are required to have a properly worn mask regardless of vaccination status, always cough or sneeze into your elbow or tissue, and adhere to other public safety protocols and directives for your specific classroom/lab/studio. Students who do not follow these health and safety requirements will be instructed to leave class immediately. If you violate this protocol, you will need to leave the classroom and may be marked absent. Repeated violations of these health-saving protocols may lead to sanctions under the Student Code of Conduct (3344-83-04 [E] and [Z]) up to and including suspension or expulsion. Students with medical conditions that prevent them from wearing a mask should register with

the Office of Disability Services to explore reasonable accommodation options as soon as possible. To register with the office, please visit their webpage at: <https://www.csuohio.edu/disability/register>. The CSU community thanks you for your cooperation!

Communication: All communication, outside of class meetings, will be conducted via email. You can reach me at f.galetto@csuohio.edu. I strongly recommend using your CSU email account, as email from other accounts is often marked as spam. You can usually expect to receive an answer from me within 24 hours Monday through Friday, or within 48 hours during the weekends.

Attendance: You are expected to attend all classes. If you are unable to attend a class, it is your responsibility to notify your instructor in advance and to inquire about any topics covered and announcements made during that class.

Electronic devices: The use of electronic devices such as (but not limited to) phones, smartwatches, computers, tablets, and headphones is prohibited during class, unless otherwise required (e.g. to connect to a Zoom meeting) or indicated by the instructor.

Excused absences: You may only be excused from class and class related activities in case of university sanctioned activities (such as conferences, competitions, etc.) or in case of medical conditions. With the exception of unforeseen medical emergencies, you must notify your instructor of your absence and present sufficient documentation in advance. Sufficient documentation includes an invitation to attend an event or a doctor's note indicating you cannot attend on the scheduled date.

Extra credit and makeups: There is no extra credit in this class. There are no makeups in this class other than for excused absences. Insofar as circumstances allow, all makeups have to be arranged in advance.

Academic integrity: Cheating and/or plagiarism will not be tolerated. Cheating includes copying or receiving help from another student on quizzes, tests or exams, as well as allowing another student to copy from your work. Receiving help from someone else by using an electronic device such as a mobile phone or a smartwatch constitutes cheating. Copying another student's homework, or allowing someone else to do your homework for you, is also considered cheating. If cheating occurs in a quiz or test, the student will receive a grade of 0 for that component of the course. If a student cheats a second time during the course, the student will receive an F for the course. If cheating occurs on the final exam, the student will receive a grade of F in the course. Any cheating activity may be reported for further action. Information regarding the official CSU Policy on Academic Misconduct can be found at https://www.csuohio.edu/sites/default/files/3344-21-02_0.pdf.

Safe space: I am committed to making our encounters (in class, during office hours, in person, and online) feel safe for everyone involved. All participants are expected to conduct themselves in a respectful manner towards other participants and their ideas. Behaviors that are disrespectful or discriminatory towards other individuals or groups of individuals will not be tolerated.

Accommodations: Educational access is the provision of classroom accommodations, auxiliary aids and services to ensure equal educational opportunities for all students regardless of their disability. Students who feel they may need an accommodation based on the impact of a disability should contact the Office of Disability Services at 216-687-2015. The Office is located in BH 147. Accommodations need to be requested in advance and will not be granted retroactively.

Withdrawals: The last day to withdraw is Friday, October 29, 2021. Withdrawing from the course may put a student in violation of the federally mandated standards for academic progress (SAP) that a student must maintain to be eligible for financial aid. Please visit <https://www.csuohio.edu/financial-aid/standards-academic-progress-sap> for more information.

Course modifications: The instructor retains the right to modify the contents of the course, including grading criteria and course policies. Reasonable notice will be given for all time sensitive matters. Course changes will be communicated in class and on Blackboard.

Calendar

Here is a rough calendar for the course. Please note this is tentative and subject to change. References are from Martin H. Weissman, *An Illustrated Theory of Numbers*, AMS, 978-1-4704-3493-9.

Weeks	Topics	Reference
1	Division with remainder, divisibility	Chapter 0, pages 12-17
2-3	GCD, Euclidean Algorithm, LCM, linear Diophantine equations	Chapter 1
4-5	Prime numbers and factorizations	Chapter 2, pages 47-50, 56-59, 61
6-7	Modular arithmetic and congruences	Chapter 5, 127-139
8-9	Totient, Euler's Theorem and Fermat's Little Theorem, modular dynamics	Chapter 6, pages 153-159, 161
10-11	Chinese Remainder Theorem, RSA cryptosystem	Chapter 7, pages 173-181, 186-187
12-14	Legendre symbol, Quadratic reciprocity	Chapter 8, pages 194-199, 202-203
15	Catch-up and/or applications	