

# Math 566 - Abstract Algebra I

## Fall 2021

### Basic Information

**Instructor:** Maria Gillespie, Maria.Gillespie@colostate.edu

**Office:** Weber 125

**Course web page:** <http://mathematicalgemstones.com/maria/Math566Fall21.php>

See also the Canvas course page.

**Class time and location:** MWF 11:00 am, Weber 15 (in the basement)

**Office hours:** MW 12-1 pm, Th 8 pm on zoom (ID: 873 0031 2375, Passcode: Symmetry), by appointment, or by knock

**Final Exam:** Qualifier (Date TBD)

**Textbook:** *Algebra* by Michael Artin, 2nd ed.

### Grades and Policies

The following table summarizes how the course will be graded.

Activity	Percent of Grade	Date
Homework	70%	Due Fridays in class
Presentation	10%	One per student
Final exam	20%	TBD

**Homework:** will be posted each Friday and will be due the following Friday in class. Please either (a) write your homework on paper to hand it in, (b) type it in LaTeX and print it, or (c) type it in LaTeX and email it to me. If emailing it, the timestamp on the email should be before 11:10 am on Friday, or else it is counted as one day late (see Late Policy below).

Collaboration is permitted, but as in research, you must list all coauthors on a problem's solution at the top of the page. In addition, your writing must be your own; copying is not permitted and clearly-copied solutions (either from a fellow student or from an online resource) will result in an automatic zero on the assignment.

**Late policy:** You may hand in homework late, but one point will be deducted for each day it is late. In particular, if it is handed in between 11:10 am on the Friday it is due and 11:09:59 am on Saturday, it is counted as one day late. If it is handed in between 11:10 on Saturday and 11:09:59 am on Sunday, it is counted as two days late, and so on.

Note that these deductions will continue past 10 days; if you hand it in 11 days late, you can get a maximum score of -1 on that homework. If the homework is not handed in at all, it will be scored -10.

The lowest homework score will be dropped from your overall homework average.

**Presentations:** Each student will give one of the lectures in the course, most likely presenting the proof of one of the Sylow theorems or a similarly important result. This will likely take place in mid-October, and more details will be given in early October.

**Final Exam:** The final exam also counts as the qualifying exam for this course. It will be on material from all topics covered in the course.

**Covid policies:** We will be wearing masks during class. We may move class outdoors when it's nice out in order to have a masks-optional day of class now and then.

If any of us needs to quarantine for any amount of time, we will move class onto Zoom during the quarantine period; it is a small enough class that hopefully this will not happen with too much frequency.

In general, if you have any needs or concerns related to the ongoing COVID-19 pandemic at any time, please do not hesitate to reach out by email or come see me in my office.

**Attendance:** Attendance in class is important. The class will not follow the textbook closely; the textbook will more be used as a guide and as a reference for important proofs and exercises.

## Goals and Topics

The goal of this class is to introduce the basic algebraic structures of groups and rings and discuss their uses and applications. A tentative schedule of topics is listed below.

## Tentative Schedule

- Week 1: (Aug 23, 25, 27) Matrices and permutations
- Week 2: (Aug 30, Sep 1, 3) Groups and first examples
- Week 3: (Sep 8, 10) Homomorphisms and isomorphisms
- Week 4: (Sep 13, 15, 17) Cosets, products, quotients, semidirect products
- Week 5: (Sep 20, 22, 24) Vector spaces and transformations
- Week 6: (Sep 27, 29, Oct 1) Direct sums, tensor products, and representations
- Week 7: (Oct 4, 6, 8) Symmetry, group actions
- Week 8: (Oct 11, 13, 15) Cayley's theorem, normalizers, centralizers
- Week 9: (Oct 18, 20, 22) Sylow theorems (student presentations)
- Week 10: (Oct 25, 27, 29) Generators and relations, Coxeter groups
- Week 11: (Nov 1, 3, 5) Rings: first examples, definitions
- Week 12: (Nov 8, 10, 12) Rings: Quotients, fractions, prime and maximal ideals
- Week 13: (Nov 15, 17, 19) Rings: Preview of algebraic geometry
- (Thanksgiving break)
- Week 14: (Nov 29, Dec 1, 3) Rings: Factoring in domains
- Week 15: (Dec 6, 8, 10) Bonus topics: Hopf algebras, symmetric functions