

# Math 103a Fall 2012: Modern Algebra I

MWF 10-10:50am, HSS 1128A

Professor D. Rogalski

## 1. CONTACT INFORMATION

**Prof. Rogalski's Office:** 5131 AP&M

**E-mail:** drogalsk@math.ucsd.edu

**Class web site:** [www.math.ucsd.edu/~drogalsk/103a.html](http://www.math.ucsd.edu/~drogalsk/103a.html). Check here for announcements, homework assignments, and the lecture and exam schedules. You can also find a link by following “resources” and then “course websites” from the math department homepage.

**Office hours:** M 11am-12pm, W 2-3pm

**Section Leader:** Zezhou (David) Zhang (6452 AP&M)

**E-mail:** z9zhang@ucsd.edu

**Meeting Times:** Tu 9-9:50am, AP&M B412

**Office hours:** Tu 10-11am, W 3-4pm.

## 2. BASIC COURSE INFORMATION

- **Course description and placement information** This is a first class in abstract algebra. The main topic will be the theory of groups. There is overlap between this course and Math 100a. Compared to Math 100a, Math 103a goes more slowly, covers less, and gives more applications. It suffices to introduce the basic ideas of the subject, which is enough for most students who plan to take their math major on to a career in industry or education. Students who are considering graduate study in pure mathematics, or who want to challenge themselves with a more rigorous course, should take Math 100a instead.

- **Prerequisites** The prerequisite is Math 109. Enrollment without Math 109 (or concurrent enrollment in Math 109) is usually not recommended. If you feel that this is the right course for you even though you have not yet passed Math 109, please come see me so we can discuss your particular case.

- **Textbook** The textbook is *Contemporary Abstract Algebra* by Gallian, 8th Edition. We will cover much of Chapters 0-11 of the book in this course. If you have an earlier edition of the book, it does not seem to have changed too much from each edition to the next the last few times (even the 5th edition looks similar to me), so you should be able to make do. I do recommend that you get some kind of access to a copy of the text, because I think you will find reading it a valuable addition to the lectures, in which I cannot cover everything.

I have requested a copy be put on reserve in the library; this copy will be the 7th edition.

• **Discussion section** This is your opportunity to get a review of some of the basic concepts, ask questions, and see worked examples. The section will meet for the first time on Tuesday October 2 (week 1).

• **Homework** Homework will be assigned weekly; the list of problems for the week will be posted on the class website. The problems will be a mix of problems from the text and problems I create. Because there may be some variation in the exercises in the text from one edition to the next, I will type out the full problem statements on the homework, so you do not need to worry about this if you have an earlier edition. Homework will be due on Fridays at 4pm in the homework box which your TA will set up in the basement of AP&M. (Notice this time has changed from the time of 5pm tentatively announced on the syllabus handed out at the first class). Late homework will not be accepted, but the lowest homework score will be dropped. I try to assign a mix of straightforward problems which help you to work through the definitions and concepts, together with more challenging problems.

You should expect to spend a lot of time thinking about some of these exercises, doing scratch work and playing with examples, until you start to get insight into the problem. This process does not have time to play itself out if you start the homework at the last minute. It is extremely important for this reason that you start the homework early. This will also allow you to take better advantage of the office hours of the instructor and TA, none of which will be scheduled close to the time the homework is due.

Finally, the write-up of the solutions you submit should be neat and well-organized. I usually recommend a first draft where you write out a solution which is as messy as you want, scratch things out if necessary, etc., and then a final draft in which you rewrite your solutions carefully. If your proof is not legible or we cannot follow it, then we can't give your credit. *See the section below on academic honesty for more rules/advice about homework.*

• **Exams** There will be 2 in-class midterms on Monday 10/22 (week 4) and Wednesday 11/14 (week 7), and a final exam on Friday 12/14 from 8am-11am. Bluebooks will not be needed; adequate room will be provided on the exam paper for your answers. No books, notes, or calculators are allowed during exams. The final exam will be cumulative.

• **Office Hours** Both I and your TA will have two office hours a week where we will be available for your questions. Please make an appointment (either ask in person or send an e-mail) with one of us if you cannot make the regularly scheduled office hours.

• **Grading** Your final average will be calculated as follows: Homework 20%, Midterms 30%, Final Exam 50%. Then your grade will be at least as good as the grade given by the following standard scale:

97	93	90	87	83	80	77	73	70	60
A+	A	A-	B+	B	B-	C+	C	C-	D

The final grading scale will almost surely be more lenient than this, depending on the class average.

### 3. ACADEMIC HONESTY

Academic honesty is important to me and I expect you to abide by the university's policies. Serious cases of dishonesty will be reported. You all know that during the exam, copying from or otherwise collaborating with a neighbor, or using unapproved notes, calculators, or other aids, is forbidden.

Here are my honesty rules on homework, which may be less obvious to you.

1. The homework you hand in should be your own written work, and your own only. It is not acceptable to copy word for word, or even paraphrase, the work of another student in the class, or a solution found (say) on the internet or in a solutions manual, and hand it in as your own work.

2. If you talk to others about the homework, be careful not to violate rule 1. You should not write up the homework as a group, because your written work should reflect your and only your own final understanding of the problems. Getting help/advice from the professor/TA/classmates on especially difficult problems that you have already thought hard about yourself and are stuck on is OK. But remember that the more time you put into thinking hard about the problems yourself, the more prepared you will be for exams.

### 4. TENTATIVE CALENDAR

The following outline of what we will cover when is subject to change, and updates to the schedule will be announced in class and posted on the website.

9/28 Chap 0: Division algorithm, GCD and LCM, induction.

10/1 Chap 0: Equivalence relations and modular arithmetic. Check digit schemes.

10/3 Chap 2: Definition of a group. Examples.

10/5 Chap 2: More examples of groups. Basic properties of groups.

10/8 Chap 1: Symmetry groups and Dihedral groups.

10/10 Chap 3: Subgroups. Examples.

10/12 Chap 3: Centers and centralizers.

10/15 Chap 4: Cyclic groups.

10/17 Chap 4: More on cyclic groups. Euler Phi function.

10/19 Chap 5: Permutation groups and  $S_n$ . Cycle notation and order of a permutation.

10/22 **EXAM I**

10/24 Chap 5: Decomposition into 2-cycles. The alternating group  $A_n$ .

10/26 Chap 5: Some applications of permutation groups.

10/29 Chap 6: Isomorphisms.

10/31 Chap 7: Cosets and Lagrange's Theorem.

11/2 Chap 7: Fermat's Little Theorem. Applications to primality tests.

11/5 Chap 7: The Orbit-Stabilizer Theorem and applications.

11/7 Chap 8: Direct Products

11/9 Chap 8: Decomposing  $Z_n$  and  $U(n)$ .

11/12 **Veteran's Day (NO CLASS)**

11/14 **EXAM II**

11/16 Chap 9: Normal subgroups and factor groups

11/19 Chap 9: More on factor groups and applications.

11/21 Catchup Day

11/23 **Thanksgiving Holiday (NO CLASS)**

11/26 Chap 10: Homomorphisms I.

11/28 Chap 10: More on Homomorphisms. First Isomorphism Theorem.

11/30 Chap 11: Fundamental Theorem of Abelian Groups

12/3 TBA

12/5 TBA

12/7 TBA

12/14 (Friday) Final exam, 8am-11am.