

Math 103A Fall 2007: Applied Modern Algebra

MWF 3-3:50pm, Solis Hall 110

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/math103a.html. Check here for announcements, homework assignments, and the lecture and exam schedules.

Office hours: M 4-5pm, W 11am-12pm

Section Leader: Michele D'Adderio (5412 AP&M)

E-mail: mdadderio@math.ucsd.edu

Meeting Times: Thu 9-9:50am, York 4080A

Office hours: T 9-10am, T 11am-12pm

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. Compared to Math 100A, this course goes more slowly, is somewhat less proof-oriented, and spends more time on applications of the theory. For most variations of the math major which require a course in algebra, 103A suffices. If you are considering graduate study in mathematics, however, you should take Math 100A instead.

- **Prerequisites** The prerequisite is Math 109. Concurrent enrollment in Math 109 is usually not recommended; please come talk to me if you want to take this course and have not yet passed Math 109.

- **Textbook** The textbook is *Contemporary Abstract Algebra* by Gallian, 6th Edition. It is well written and is aimed at the right level for Math 103a, and I think you will find reading it a valuable companion to the lectures. We will cover approximately Chapters 0-11 of the book (plus hopefully some of Chapter 29) in this course, although not everything in those chapters. I will tell you what you can skip. If you have the 5th edition of the book, that should be OK but you need to check with a friend who has the 6th edition to make sure you do the right homework exercises—problem numbers always refer to the 6th Edition.

One copy of the textbook will be placed on reserve in the Science and Engineering Library; however, it will be the 5th Edition (the most recent the library owns.)

- **Homework** Homework will be assigned weekly; the list of problems for the week will be posted on the class website. Homework will be due Friday in class. Late homework will not be accepted, but the lowest

homework score will be dropped. I will 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 before the solution is clear to you (start the homework early!), and the write-ups you submit should be clear, neat, and well-organized (not rough drafts). A thorough working-through of the homework exercises is the key to success in the class. *You are welcome to discuss the homework problems with other students, but the write-up you hand in should be your work only. See also the section below about academic honesty.*

- **Exams** There will be 2 in-class midterms on Wednesday 10/24 and Wednesday 11/14, and a final exam on Friday 12/14 from 3pm-6pm. 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 and roughly the length of two midterms.

- **Office Hours** Both I and your TA will have several 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 25%, Midterms 25%, 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 likely be more lenient (“curved”) 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 may be reported to the appropriate university committee. The most straightforward kind of cheating which is obviously disallowed is copying from a neighbor’s exam, or consulting notes or the book during an exam.

The honesty rules for homework are sometimes less obvious. So there is no confusion, here are my particular rules.

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 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. You may work with others in the class (I am all for this), but be careful not to violate rule 1 above. Certainly you can freely discuss definitions, examples in the text, etc. with others to help you understand them. For the homework problems, it is best to start by thinking about the problems yourself, hard. You

may see how to do some of them, but be stuck on others. Wait a while, you will probably have additional insights the next day (this is one reason it is important to start the homework early). You can ask us or a friend for hints. Hopefully after more thought you will see how to solve the ones you were stuck on. If not, and here and there a friend tells you how to do a problem you were completely stuck on, and then you write it up yourself using only your own understanding, that's OK. But this should only be a problem here or there, not a significant fraction of them, or else you won't learn how to work through these problems independently.

3. Just to clarify further, reading through a friend's entire solution to a problem *which you did not think about yourself* and then immediately writing your own solution is not allowed. You are likely to end up writing a paraphrase of the other solution and not really understand the proof, and you won't gain the benefit that comes from thinking long and hard about the problems.

4. TENTATIVE SYLLABUS

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. Review of functions.

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 Chap 5: Decomposition into 2-cycles. The alternating group A_n .

10/24 **EXAM I**

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 Chapter 29: Burnside's Theorem and group actions.

12/5 Chapter 29: Applications of Burnside's Theorem.

12/7 Review Day

12/14 (Friday) Final exam, 3-6pm.