

Math 463/563 Algebra II Fall 2012 11:00 MWF HB 423

Professor John Hempel

Office: 418 HB, hours 10-11 am MWF, or call ext 5126 (713 348 5126) or email hempel@rice.edu for other arrangements.

Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities should also contact Disability Support Services in Allen Center.

Text: *Algebra 2nd edition* by Michael Artin, Pearson (2010). The second edition is enough different from the first that I strongly recommend that you have access to it. In particular, homework problems, textual references, etc. will all be for the 2nd edition. It is available online through CourseSmart as well as in printed form through the book store. Depending on how you like to work, you may find the online version adequate— particularly if you already own a copy of the 1st edition

Topics: Basic Ring Theory: ideals, quotient rings, polynomial rings, factorization, UFDs, PIDs. Module Theory – including structure theorem for modules over a PID with applications to Advanced Linear Algebra (Jordan form, etc.). Quadratic and bilinear forms. Hom and dual spaces. Tensor and exterior algebras. Field Theory: algebraic and transcendental extensions, structure for finite fields, Galois Theory – including constructible numbers, solving equations by radicals, and Galois groups.

Grading:

- There will be a final exam and one or two mid-term exams – depending on class performance on the homework. The exams will be timed, pledged, take home exams.
- Homework will count for 50% of the grade. It will be broken into two categories: routine and challenging (marked with a "star", e.g 5*). For students taking Math 463 the routine problems will count for 4/5 of the 50% HW grade and the challenging problem the remaining 1/5. For students taking Math 563 the break down will be 3/5 routine and 2/5 challenging.
- Homework is not pledged, but I encourage you to put as much of your own effort into it as possible. In particular, the composition and write up

of homework must be your own work. Discussion of ideas, approaches, etc. in general (with fellow students, me, the grader, etc.) is encouraged and for particular problems is better than getting hopelessly stuck.

- Good mathematical exposition will be counted on both exams and homework.
- Homework is due at the beginning of class on the due date.
- Students enrolled in Math 563 must produce at least half of their homework assignments with \TeX . This is a necessary (but not sufficient) condition for a grade of at least "B"

Attendance will not be used in grade calculations, but students will be responsible for all material presented in class sessions.

Owl Space: This course has an Owl Space site with links to this page. I will use Owl Space primarily for emailing announcements, and, if interest exists, organizing chat rooms, forums, etc.. However, this web page will be the official source for all information about the course.

Grader: Ben Walters BW2@rice.edu

Homework Assignments:

HW #1. pg. 354: 1.1, 2*, 3, 8; 2.2*; 3.3, 4, 8, 10*, 11, 13*. Due Wed. 8/29.

HW #2. Pg. 355: 4.2 (you may assume $\mathbb{Z}[i]$ is a PID), 3 (a), (c), (e), 4*; 5.1, 5* (describe all such fields), 7*; 6.1, 2, 4. 8* (also show uniqueness mod $I \cap J$). Due Wed 9/5.

HW #3. Pg. 357: 7.3, 5; 8.1*, 2(a), (b), 4; 9.4, 7(b), (c), 8* (determine which are maximal), 12. Due Wed 9/12.

HW #4. Pg. 371: 1.2; 2.2, 6*, 10*; 3.2, 6; 4.5, 9, 12(a), 15*. Due Wed. 9/19.

HW #5. Pg. 381: 5.3, 5, 6; pg. 408: 1.3* (will need an extra assumption for one direction of (c)), 4; 2.2; 3.1, 2(a)(c); Extra 1*: Determine from their prime factorizations which integers are the sum of two squares of integers; Extra 2*:

Determine which integers $d < 0$ with $d \equiv 1 \pmod{4}$ have the ring of integers in $\mathbb{Q}[\sqrt{d}]$ Euclidean with respect to the size function $\sigma(z) = z\bar{z}$. Due Wed. 9/26.

HW #6. Pg. 409: 4.3; 5.1*, 2*; pg. 437: 1.4; 2,4; 4.2, 6, 7; 5.1*, 2. Due Wed. 10/3.

HW #7. Pg. 439: 6.1, 2; 7.4, 5, 7, 8, 9*; 8.2*, 3*. Due Wed. 10/10.

Take home Exam: Pick up in class Mon. 10/22. Return in class Wed. 10/24.

HW #8. Pg.472: 1.1, 2; 2.1; 3.1, 2, 4*, 8, 9: 4.2*. Due Wed 10/17.

HW #9. Pg. 473: 5.1, 2*, 4; 6.2, 3; 7.5, 7, 14*; 8.2*; pg. 505: 1.1(a)(b)(c). Due Wed. 10/31.

I recommend [the article by Rothman](#) for insights into Galois and his work.

HW #10. Pg. 506: 2.2, 3*; 3.1, 2, 3; 4.1,; 5.1(b)(c)(d)*; 6.1, 2. Due Wed. 11/7.

HW #11. Pg. 507: 6.3; 7.2, 5* 6, 7, 10; 8.1, 4*; Extra 1: Show that subgroups and quotient groups of solvable groups are solvable. Extra 2*: Show that a group G which contains a solvable normal subgroup N with G/N solvable is solvable.

HW #12. Pg. 508: 9.5*, 10; 10.2; pg.254: 3.3, 4; 4.10, 12; 5.3*, 4. Due Wed. 11/21.

HW #13. Pg 256: 6.1, 3, 11, 14, 19; 7.1; M.1*. Due Fri. 11/ 30.

Final Exam: Take home; same format as mid term. Should be ready for pickup in class 11/30. Will be due by 4:00 pm Wed. 12/12

This page is maintained by John Hempel (hempel@rice.edu or, [link to homepage](#)).
Last updated on 11/21/12.