

February 4, 2004

Mathematics 123, Spring 2004  
**Abstract Algebra II**

*COURSE INFORMATION*

Prerequisite: Mathematics 122.  
Catalog Number: 5613

• **Instructor:**

Alberto De Sole  
office: Science Center #331  
phone number: 617-496-5211  
email: desole@math.harvard.edu  
web page: [www.math.harvard.edu/~desole](http://www.math.harvard.edu/~desole)

• **Course Assistants:**

1. Jayce Getz  
email: [getz@fas.harvard.edu](mailto:getz@fas.harvard.edu)
2. Peter Andereg  
email: [pandereg@fas.harvard.edu](mailto:pandereg@fas.harvard.edu)

• **Textbook:**

Artin, *Algebra*, Prentice Hall

• **Meeting times:**

Lectures: M., W., F., 10–11 am, room 507

Problem sessions:

1. Jayce Getz: Tuesday, 3 pm, room 101b
2. Peter Andereg: Wednesday, either 3 or 4 PM (to be announced)

Instructor's office hours: M., W., 2–3, F. 1–2 (& by appointment)

CA's office hours: Thursday, 3 PM, 4th floor math lounge

- **Course Web Page:** <http://www.courses.fas.harvard.edu/math123/>

**Subjects to be covered**

Bilinear forms. Linear groups. Group representations. Rings. Modules. Fields and field extensions. Galois theory.

### Formal course requirements

**Problem sets** Weekly problem sets will be handed out. You are encouraged to work in groups on these problem sets. However, each of you must write up the solutions alone. Late problem sets will be penalized (by subtracting %10 of the grade for each day they are late) unless authorized by the instructor.

**Midterm Exams:** There will be two 1-hour midterm exams, during class hours, on the following days:

Friday March 5 , Friday, April 9

**Final Exam:** There will be a 3-hours final examination. It is tentatively scheduled by the Registrar for the following day:

Thursday May 27

**Grading policy:** Problem sets: 40%, mid-term exams: 30%, final exam: 30%

## *(TENTATIVE) SCHEDULE*

### Bilinear Forms

Wednesday, February 4

- Subject: *Bilinear forms*
- Sections: 7.1, 7.2

Friday, February 6

- Subject: *Symmetric forms*
- Sections: 7.3

Monday, February 9

- Subject: *Hermitian forms*
- Sections: 7.4

Wednesday, February 11

- Subject: *The spectral theorem*
- Sections: 7.5

Friday, February 13

- Subject: *Quadrics*

- Sections: 7.6
- **Problem Set #1 due**

Monday, February 16

*President's Day: no class*

### Linear Groups

Wednesday, February 18

- Subject: *The special unitary group  $SU_2$*
- Sections: 8.1, 8.2

Friday, February 20

- Subject: *The rotation group*
- Sections: 8.3
- **Problem Set #2 due**

Monday, February 23

- Subject: *The special linear group  $SL_2$*
- Sections: 8.4

Wednesday, February 25

- Subject: *One-parameter groups*
- Sections: 4.8, 8.5

Friday, February 27

- Subject: *The Lie algebra*
- Sections: 8.6
- **Problem Set #3 due**

Monday, March 1

- Subject: *Simple groups*
- Sections: 8.7

Wednesday, March 3

*Review session*

Friday, March 5

**Midterm Exam # 1**

Group Representations

Monday, March 8

- Subject: *Group representations, definitions*
- Sections: 9.1,9.4

Wednesday, March 10

- Subject: *Unitary representations*
- Sections: 9.2, 9.3, 9.4

Friday, March 12

- Subject: *Characters*
- Sections: 9.5
- **Problem Set #4 due**

Monday, March 15

- Subject: *Characters, cont.*
- Sections: 9.5

Wednesday, March 17

- Subject: *The regular representation*
- Sections: 9.6

Friday, March 19

- Subject: *Schur's Lemma*
- Sections: 9.9
- **Problem Set #5 due**

## Modules

Monday, March 22

- Subject: *Free modules*
- Sections: 12.1, 12.2

Wednesday, March 24

- Subject: *Integer matrices*
- Sections: 12.3, 12.4

Friday, March 26

- Subject: *Generators and relations*
- Sections: 12.5
- **Problem Set #6 due**

March 29 – April 2

*Spring Break: no classes*

Monday, April 5

- Subject: *Structure of abelian groups*
- Sections: 12.6

Wednesday, April 7

*Review session*

Friday, April 9

**Midterm Exam # 2**

## Fields and Field Extensions

Monday, April 12

- Subject: *algebraic elements*
- Sections: 13.1, 13.2

Wednesday, April 14

- Subject: *Degree of a field extension*

- Sections: 13.3

Friday, April 16

- Subject: *Ruler and compass*
- Sections: 13.4
- **Problem Set #7 due**

Monday, April 19

- Subject: *Symbolic adjunction of roots*
- Sections: 13.5

Wednesday, April 21

- Subject: *Finite fields*
- Sections: 13.6

## Galois Theory

Friday, April 23

- Subject: *The main theorem*
- Sections: 14.1
- **Problem Set #8 due**

Monday, April 26

- Subject: *Cubic equations*
- Sections: 14.2

Wednesday, April 28

- Subject: *Symmetric functions*
- Sections: 14.3

Friday, April 30

- Subject: *Primitive elements*
- Sections: 14.4, 14.5

- **Problem Set #9 due**

Monday, May 3

- Subject: *Quartic equations*
- Sections: 14.6

Wednesday, May 5

- Subject: *Quintic equations*
- Sections: 14.9
- **Problem Set #10 due**

Friday, May 7

*Review session*

May 10 – May 19

**Reading Period**

May 20 – May 28

**Final Examination Period**

The final exam is tentatively scheduled on: **Thursday May 27.**