Course Information

- **Instructor:** Kelly McKinnie, Math 111, 243-5694, kelly.mckinnie@umontana.edu
- **Textbook:** No official textbook. This class will be taught as an Inquiry Based Learning Class. Students may wish to consult textbooks from time to time, including the one used in M431; Abstract Algebra, Theory and Applications by Thomas W. Judson. It is an open source book. Book usage will vary over the course of the semester.
- **Prerequisites:** M431, Abstract Algebra I
- **Software:** Some assignments will require the use of SAGE. Sage ([sagemath.org](http://sagemath.org)) is a free, opensource, software system for advanced mathematics, which is ideal for assisting with a study of abstract algebra. Sage can be used either on your own computer, a local server, or on CoCalc ([cocalc.com](http://cocalc.com)). Do not pay for this service! All exercises for this class can be done using the free account option.
- **Office Hours:** See [http://www.umt.edu/people/mckinnie](http://www.umt.edu/people/mckinnie)

Catalog Description

Offered spring. Continues the investigation of groups, rings, and fields begun in M 431. Further topics include vector spaces and field extensions. Level: Undergraduate-Graduate

Course Description

In this course we will further our study of groups, rings and fields. Topics will include normal groups, quotient groups, ideals, quotient rings, fields and field extensions and abstract vector spaces. Students will need to be highly motivated to learn the material both by reading and by independent problem solving. Very few lectures will be given.

Learning Outcomes:

Upon completion of this course, a student will be able to:

- Explain more about groups, rings, and fields;
- Explain the important definitions and to be able to use them correctly;
- Demonstrate improved proficiency in constructing proofs (in addition to correctness and clarity, focusing on concise, well-written proofs);
- Use proper English in written assignments.

Important dates:

<table>
<thead>
<tr>
<th>Dates</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Jan 22</td>
<td>Last day students can add a course on CyberBear</td>
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<tr>
<td>Feb 3</td>
<td>Last day students can drop a course on CyberBear or change grading option to audit</td>
</tr>
<tr>
<td>Mar 25</td>
<td>Last day to add/drop course w/o Dean’s approval.</td>
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<tr>
<td>May 1</td>
<td>Last class day, and last day to petition to drop/add and change to CR/NCR.</td>
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<tr>
<td>May 4</td>
<td><strong>Final exam</strong> Monday May 4, 10:10 – 12:10 pm in Math 305</td>
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Course Requirements & Grading (+/- grading will be used):

- **Class presentations/attendance:** 40%
  - This is a very small class. Mandatory attendance is the only way our class will work well. You should expect to present 3-5 problems a week on the board in front of the class. Presentations are graded according to the rubric given below.
Problem set journal checks: 10%
Midterm Exams 1,2: 30%. Tentative dates are Friday, Feb. 28 and Friday April 17. Makeups are given at instructor’s discretion and only in cases of emergency or other important circumstances. If you cannot make it to an exam, you must let me know BEFORE the exam is given.
Final Exam (comprehensive): 20%.

Course guidelines and policies:

Incompletes
Incompletes are given at the discretion of the instructor. They are only considered in cases where the student has been in attendance and doing passing work during the majority of the semester. The request must be made based on circumstances beyond the student’s control. Negligence and indifference are not acceptable reasons.

Classroom and Course-related Behavior
University policy requires that all of us in the classroom treat each other with respect, and refrain from behavior that will disrupt the educational process. Please refrain from using any electronics during class that are not directly related to what we are doing. If you would prefer to be called by a different name, or gender pronoun, then listed on the course roster, please let your instructor know.

Student Conduct Code
All students need to be familiar with the Student Conduct Code. You can find it at http://www.umt.edu/student-affairs/dean-of-students/default.php or by searching in the “A to Z Index” on the UM home page. In particular, discrimination and harassment are not tolerated at the University of Montana. If you feel that you have been subjected to discriminatory or harassing behavior, please contact the Office of Equal Opportunity and Affirmative Action at 243-5710 or http://www.umt.edu/policies/browse/personnel/discrimination-harassment-sexual-misconduct-stalking-and-retaliation for help in addressing the situation. You can also report the discrimination or harassment to me or to another faculty member you trust.

Academic Honesty
All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.

Disability modifications
The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

Homework journals: You will write up final, polished versions of the Theorems/HW problems presented in class and keep them in an “Algebra II journal”. This can be a notebook or a 3-ring binder with printed copies of tex-ed up solutions neatly arranged inside. These will be turned in on Mondays and returned on Wednesdays. They are checked for completion and spot checked for correct solutions.

You are allowed and even encouraged to work with others on the homework as long as the solutions you present are your own. Plagiarism will not be tolerated. This includes copying from another student, from a book or from internet sources. That being said, work together! Come
up with the ideas behind the solutions as a group, then write up your own solution. Avoid reading others solutions before writing up your own.

**Class Presentations:**
Each week I will give you a list of theorems and problems to work on. In class, I will ask you to present your work on this list. Working together on these problems is allowed, outside sources (eg. books or internet) should only be used for clarification or when directed by me. I expect you to be an active participant in the course, even when you are not presenting. Please speak up if you have questions, a criticism, or suggestions for your peers. Of paramount importance is that we maintain a polite and supportive environment. Participation is a critical part of this course and your attendance is required.

**Grade Scale**

<table>
<thead>
<tr>
<th>Cutoff Percentage:</th>
<th>93%</th>
<th>90%</th>
<th>87%</th>
<th>83%</th>
<th>80%</th>
<th>75%</th>
<th>70%</th>
<th>65%</th>
<th>62%</th>
<th>58%</th>
<th>55%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade:</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>B-</td>
<td>C+</td>
<td>C</td>
<td>C-</td>
<td>D+</td>
<td>D</td>
<td>D-</td>
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**Graduate Increment**
Students taking M431 with the graduate increment will take graduate versions of the Exams (I, II and final).

**Presenting Solutions**
We have a lot of work to accomplish this semester and your contributions in-class are crucial to the success of others. Student presentations of theorems and problems will be the centerpiece of the class. Here are some things to know about making presentations in abstract algebra II.

- The purpose of class presentations is not to prove to the instructor that you have done the problem. It is to make the ideas of the proof clear to the other students.
- You must use proper English and mathematical grammar during presentations.
- Presenters should explain their reasoning as they go along, not simply write everything down and then turn to explain.
- Fellow students are allowed to ask questions at any point and it is the responsibility of the person making the presentation to answer those questions to the best of his or her ability.
- Presentations are directed at students, so the presenter should look at students to be able to see how well they are following the presentation.

I will seek volunteers to present solutions in-class, but you should expect to present solutions to problems every day. The following scale will be used to grade your presentations.

<table>
<thead>
<tr>
<th>Mark</th>
<th>Criterion</th>
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<tbody>
<tr>
<td>4</td>
<td>Completely correct and clear proof or solution</td>
</tr>
<tr>
<td>3</td>
<td>Solution has minor technical flaws, unclear language, or lacking details. Essentially correct.</td>
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<tr>
<td>2</td>
<td>A partial explanation or proof is provided but a significant gap still exists</td>
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<tr>
<td>1</td>
<td>Minimal progress has been made, including relevant information and could lead to a proof</td>
</tr>
<tr>
<td>0</td>
<td>Completely unprepared</td>
</tr>
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