MATH 361 | ALGEBRAIC STRUCTURES II | Spring 2011
MW 10:20 - 11:35

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Required Text:	*NONE* See the NO TEXTBOOK RULE below.

GOALS FOR COURSE:

MATH 361 students will:

- ... improve their ability to think abstractly and critically;
- ... improve their ability to construct mathematical proof;
- ... improve their confidence in their ability to construct mathematical proof;
- ... improve their ability to thoughtfully analyze the mathematical work of others;
- ... be able to communicate in precise written mathematical language, using correct logic and notation;
- ... be able to identify groups with certain properties, and provide concrete examples;
- ... have a firm grasp on the basic concepts of group theory, and the facility to apply them to particular groups;
- ... actively participate in the classroom dialogue, both as an individual and as a member of a small group, and be an active partner during in-class exercises.

COURSE CONTENT:

In this course, we will continue our study of advanced algebra, focusing on the study of group theory. We will consider the connections between group theory and transformational geometry, with particular attention to concepts that appear in the high school curriculum. Abstract algebra is a dynamic, active field – many of my mathematical colleagues are engaged in research in the areas of group theory, ring theory, and matroid theory. Concepts and methodologies from algebra are used in diverse fields such as computer science, physics, and chemistry, as well as mathematics.

There are two types of problems in this course: computational problems (which may still be fairly abstract), and proofs; as stated in the course goals, we will continue to develop proof-writing ability. In this course, however, proofs can be tricky since there is rarely a picture you can draw to get yourself started. We will see that many of the methods and topics studied in Math 260 are used in extensively in this course.

PROBABLE COURSE TOPICS:

- ▷ Groups and Subgroups: general groups, cyclic groups, generating sets
- ▷ Permutation Groups
- ▷ Isomorphism & Homomorphism
- ▷ Direct Products & Classification of Finite Abelian Groups
- ▷ Symmetry Groups

Course Philosophy & Methodology:

This is not a traditional lecture course. Just as you cannot learn to play violin by watching a recital, you cannot learn to do mathematics by watching me do mathematics. In this course, you will learn mathematics through discussion, presentation, and critical analysis, using pedagogical methods often labeled as 'Inquiry-Based Learning' (IBL).

Each class session (after the first) will begin with student presentations. Roughly 30 - 45 minutes of class time will be devoted to analysis of student work at the board. Students will volunteer to present their work, but I reserve the right to call any student to the board at any time. After student presentations have concluded, we will spend the remainder of the class period working through exercises that introduce the concepts in the upcoming section of material.

I will lecture only rarely, and we all need to be aware of the expectations placed upon us in this non-traditional model of learning.

What is Inquiry-based learning (IBL)? Inquiry-based learning is a set of pedagogical techniques that place student contributions at the center of the classroom interactions. There are many different ways to implement inquiry-based learning in the classroom. From my perspective, a successful IBL classroom is one in which the students are actively responsible for their own learning, under the guidance and mentorship of an expert.

What are the guiding principles of IBL?

1. Every student can and will do significant mathematics.
2. Students should be elevated from recipients of mathematical knowledge to creators of mathematical knowledge
3. The mathematics classroom should be a shared learning community in which the students are actively engaged in discussion and development of course material.
4. The course material should include a significant body of mathematical knowledge, at varying levels of difficulty.

What is the role of the professor in this IBL course? The professor will:

1. ... facilitate and encourage classroom discussion;
2. ... clarify points or questions raised by students during presentations;
3. ... not speak significantly more than other members of the class;
4. ... be available for outside help during office hours or via email.

What is the role of the student in this IBL course? Students are expected to:

1. ... honestly attempt to solve every problem assigned;
2. ... revisit problems for which no solution was obtained on the first try;
3. ... persevere and seek help when stuck on a solution;
4. ... participate actively in classroom discussions;
5. ... develop a critical eye when examining solutions of others;
6. ... ask questions when they arise, both of the professor and the other students;
7. ... be respectful both when critiquing the work of others and when having their own work critiqued;
8. ... have at least one problem ready to present each day of class.

No Textbook Rule:

You are not allowed to use outside resources for this course. You are only allowed to talk to students currently enrolled in the course and to the professor. **All other resources, including texts and the internet, are strictly forbidden.** In this course, you are doing research at your level, just like mathematicians do research. The only difference is that you are doing research where the answers are already known to experts. Looking for answers to these questions circumvents the learning process, and counts as academic dishonesty. Help will always be available to those who ask.

Homework:

Your standing assignment is to write up solutions to all of the problems given in the packets. You are expected to be ready to present at least one solution each day of class. Ideally, you will have solutions to every problem before arriving in class. You will submit four problems to me each week to be graded: at least one that you presented to the class and the remaining problems of your choosing. This extra problems should be ones that you are proud to have solved, and must be submitted before presentations begin for that day.

Homework problems may be rewritten **one time** if resubmitted within one week of being returned to you.

Portfolio:

The portfolio is worth 100 points, due on the day of the final exam. The portfolio is a well-organized and neatly-written (or typed) 3-ring binder containing 4 sections as outlined below. Portfolios will be checked on the day of each in-class exam. As there is no text, this portfolio will be your only record of this class.

Section 1: The Problem Packets. Include the problem packets with definitions, exercises, and the problem statements.

Section 2: Proofs. Rewrite all proofs presented in class or turned in as homework. These must be typed or nicely handwritten with one problem per page. Include the problem number (such as 'P4.3') and the statement of the problem at the top of the page.

Section 3: Expanded Explanations. Choose one significant theorem from each section (for computational sections, choose one method) and address the following questions:

1. What is the importance of the theorem (or method) to the theory of the course?
2. What are the key steps in the proof (or the method)?
3. What did you learn from the proof (or from application of the method)?

Section 4: Summary. Address the following topics:

1. Review the material in the course and explain why we study groups.
2. Discuss why the material in this course is important to you as a future secondary mathematics teacher.

Presentation & Participation:

You will earn between 0 - 4 points for each presentation at the board, according to the following scale:

0 – You really have no idea; you're just winging it.

1 – You have major errors in your logic.

2 - 3 You have some minor errors, your solution is not quite complete, or your presentation is not clear.

4 – You present a clear, correct and complete solution.

An unsuccessful first attempt with a score above 0 may be redeemed at a subsequent meeting. Additionally, you may earn additional points by contributing to someone else's solution – ONLY if the help is welcome. Never blurt out a comment or part of a solution – the person at the board may ask for help at her/his own discretion.

Citizenship:

Citizenship addresses your behavior and comportment with class members and the professor. We each need to be respectful of other students, other cultures, and differing ideas within our learning community, and treat each other as professionals, particularly when we are critiquing the work of others.

Grading:

Homework:	200 - 250 points
In-Class Exams:	200 points (2 @ 100 pts each)
Final Exam:	100 points
Portfolio:	100 points
Presentation & Participation :	50 points
Citizenship:	10 points

Honor and Respect:

Each of us should consider our placement at this institution to be a privilege. We need to have respect for one another, and for ourselves. In light of these facts, cheating in any form will not be tolerated. You are encouraged to work together on homework problems, however anything you turn in with your name on it should have been written by you alone. In a course where much of your grade is determined by your proof writing and collaboration is encouraged, plagiarism is a concern. The word "plagiarize" is defined by Merriam-Webster as "to steal and pass off (the ideas or words of another) as one's own: use (another's production) without crediting the source." This is a very serious offense.

Disability Services:

Students with disabilities may arrange for academic adjustments by providing the instructor with a copy of the "Confirmation of Eligibility for Academic Adjustments" from the Disability Support Services Office. To obtain this form contact Bree Callahan, the coordinator of Disability Support Services for the westside centers, at bcallaha@cwu.edu or 206-439-3800 ext 3866.