

Course Syllabus




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TMATH 402 Autumn 2020

This is a proof based course on group theory with an introduction to rings and fields. Topics include: cosets, Lagrange's theorem, homomorphisms, normal subgroups, quotient groups, the first isomorphism theorem, cyclic and symmetric groups, Cauchy's theorem, automorphisms, and elementary properties of rings and fields. Prerequisites: 2.0 in TMATH 300.

Contact Information:

- Instructor: Ruth Vanderpool
- email: rvanderp@uw.edu
- Social Hours: in the Teaching & Learning Quantitative space (SNO 2nd floor) or zoom (if requested) <https://washington.zoom.us/my/rvanderp> 
[\(https://washington.zoom.us/my/rvanderp\)](https://washington.zoom.us/my/rvanderp)
 - Mondays 11:00-11:30am, Tuesdays 9:30-10:00am, Thursdays 9:30-10:00am, & Friday 11:00-11:30am
- website: <http://faculty.washington.edu/rvanderp/> 
[\(http://faculty.washington.edu/rvanderp/\)](http://faculty.washington.edu/rvanderp/)
-  [_ \(https://washington.zoom.us/my/rvanderp\)](https://washington.zoom.us/my/rvanderp) Office: MDS 303C (do not expect me there!!)

Class Time: Tuesdays & Thursdays 10:10am to 12:10pm

For class structure or content questions I have created the "Technical or Course Related Discussion Board" which I would encourage you to use instead of emailing me. Generally I'll check and post answers there more quickly than through email and would encourage others in the class to answer questions posted there as well.

Course Objectives:

By the end of the course students should be able to:

- define and identify groups, rings, and fields, both abstractly and in applications,
- derive and prove elementary results about groups
- identify and arrange all subgroups of basic groups into a lattice ordered by containment,
- build a well-defined homomorphism and identify its kernel,
- use the Isomorphism Theorems to prove results about groups,
- apply abstract algebra to a science, educational, or engineering project of their choosing.

The course supports the following Mathematics Program Student Learning Objectives

- comprehend, discover, and communicate common principles from algebra, geometry, and analysis
- recognize, understand and also make his/her/their own mathematically rigorous arguments
- interpret and present results to a technical audience both in writing and verbally, and
- apply quantitative theory, modeling, or mathematical principals to other disciplines to solve problems.

These objective relate to the UW Tacoma-wide objective: Student will acquire skills and familiarity with modes of inquiry and examination from diverse disciplinary perspectives, enabling them to access interpret, analyze, quantitatively reason, and synthesize information critically.

Rights of the Learner

As a student in this class, you have the right:

- to be confused,
- to make a mistake and to revise your thinking,
- to speak, listen, and be heard, and
- to enjoy doing mathematics.

Opportunities for Mastery:

- Daily Homework that provides feedback and support in a low stakes manner.
- Up to four missing Daily Homework assignments excused from course percentages.
- Existing tokens that allow for either a late Written Homework submission or regrade.
- Proof Portfolio marks used to replace lowest WrittenHW marks.
- Additional collaborative time provided each day to revisit presentation material and improve presentation marks.
- Opportunities for additional presentations beyond those required so as to replace lowest presentation marks.

Required Items:

- Textbook (freely available & open-source): Thomas Judson, *Abstract Algebra: Theory and Applications*
July 2022 edition from <http://abstract.ups.edu/download.html>
(<http://abstract.ups.edu/download.html>)
- Optional supplement material (freely available): [Matt Macauley's Abstract Algebra class](http://www.math.clemson.edu/~macaule/classes/f22_math4120/) [↗] (http://www.math.clemson.edu/~macaule/classes/f22_math4120/)
- Optional supplement textbook (freely available & open-source): [Dana Ernst, An Inquiry Based Learning approach to Abstract Algebra](http://danaernst.com/teaching/mat411f19/) 2019 edition from <http://danaernst.com/teaching/mat411f19/> [↗]
(<http://danaernst.com/teaching/mat411f19/>)
- Calculators: Either scientific or graphing are welcome. Although no internet tools are allowed during exams, you are welcome to use Desmos Test Mode on a smart device if you have one.

Grades:

The following weights are used to determine your total score in the course:

Daily Homework Assignments 20%

In Class Presentations	15%
Written Homework Assignments Including a final portfolio	20%
Midterm	20%
Final	25%
Total	100%

Your final percentage, x will then be converted to the UW 4.0 scale by the piece-wise defined function

$$f(x)=4.0 \text{ if } 90 < x,$$

$$f(x)=.1x-5 \text{ if } 57 \leq x \leq 90, \text{ or}$$

$$f(x)=0 \text{ if } x < 57.$$

Typical Day:

10-15 min: Announcements & observations about materials collected and reviewed.

15 min: Presentation Prep-meet with your group members to go over problems responsible to present, compare work, hammer out understanding.

15 to 60 min: Presentations & Class discussions. The class comes together and groups take turns facilitating presenting their work & answering questions on their assigned problems. Each group will have one student called on, randomly by the instructor to present. Make sure everyone is comfortable enough with the material to lead the class!

10 min: Extra Presentation Prep time: If the presentation or questions were not satisfactory more time is given to groups to focus on the particular problem.

15 to 45 min: Remaining Presentations

10 min: Identify materials to be read & presented for next class.

Homework:

There are two kinds of homework:

Daily Homework:

The Daily Homework will have approximately 7 –10 new statements to parse, justify or contradict, and write up. This work will be collected from each student at the end of each class meeting and will be evaluated for evidence of productive struggle, NOT correctness. Daily Homework will be graded using a \checkmark -system (consider reviewing the rubric for the Daily Homework).

On the day that a Daily Homework is due, the majority of the class period will be devoted to students presenting some subset (maybe all) of the proofs/solutions that are due that day. At the end of each class session, students will submit their work for all of the proofs that were due that day. Students are allowed (in fact, required!) to modify their written proofs in light of presentations made in class; however, you must do so in a different color. This will allow me to differentiate the work done in class versus the work you completed before class. Note that in order to earn complete marks all problems must have been attempted before class, participation in the class conversation or edit marks should be present, and a self evaluation mark (1,2,3 or 4) should be at the top of the page.

You can miss up to 4 Daily Homework assignments without impacting your score but I would advise you minimize this as it adversely effects both your and your presentation group's learning!

Written Homework:

Due most every Wednesday by 8 pm will be 1-3 formally written proofs. Typically, these problems will come directly from the Daily Homework assigned the previous week. You are encouraged to work with others in the class but please indicate at the start of the problem who your teammates were (always give credit where credit

is due!). Your answer should, however, be *your own* work. Yes, you can have your peers read and provide feedback and edits on your answers, but your answer should look different than theirs if you write them up on your own! Similarly, if you use other resources to help you with a problem, you are expected to cite where you received help at the start of the problem. Again note, if you are writing up your own answer with your own words, your answer should still differ significantly from a source that you use.

You are encouraged to type your submission (I recommend using (Overleaf) LaTeX; MSWord is OK) but it is not required. If done early you may submit your write-ups in class on Tuesdays, otherwise turn in your physical copy to my office. If you need remote accommodations, reach out to me ASAP so arrangements can be made.

Each problem on the Writing Homework assignments is subject to the following rubric:

Grade Criteria

4 This is correct and well-written mathematics! Solutions are typed.

3 This is a good piece of work, yet there are some mathematical errors or writing improvements that need addressing.

2 There is some good intuition here, but there is at least one serious flaw.

1 I don't understand this, but I see that you have worked on it; come see me!

0 I believe that you have not worked on this problem enough or you didn't submit any work.

Tokens:

You start the quarter with **2 tokens**.

- You may exchange one token for the opportunity to *rework and resubmit a written homework*. The new work will replace the original score only if the new score is higher.
- You may exchange one token to submit a late written homework without penalty.

Late written homework without tokens will be penalized 50%, if marked at all.

In Class Presentations:

Though the atmosphere in this class should be informal and friendly, what we do in the class is serious business. In particular, the presentations made by students are to be taken seriously since they spearhead the work of the class.

Each class day your group will present 1 to 3 problems (from the Daily Homework) with the presenter randomly selected by the instructor. Since groups are 2-3 people, you should expect to present *7 problems during the quarter*. The group will share the score earned by the presenters and if multiple group presentations are made in one day the average will be recorded.

Here are some of my expectations:

- The purpose of class presentations is not to prove to me that the presenter has done the problem. It is to make the ideas of the solution clear to the other students.
- Presenters should explain their reasoning as they go along and call out any struggles, 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.
- Since the presentation is directed at the students, the presenter should frequently pause to connect with the students in class and provide time for questions to arise.

Presentations will be graded using the rubric below.

Grade Criteria

- | | |
|---|---|
| 4 | Well paced class discussion wherein the proof is explained and annotated with reasons behind the steps that were taken and well paced. Or approach is explained with illuminating examples. |
| 3 | Solution/proof has minor technical flaws, some unclear language, or lacking some details. Essentially correct. |
| 2 | A partial explanation or solution is provided but a significant gap still exists. |
| 1 | Minimal progress has been made that includes relevant information & could lead to a solution/proof. |
| 0 | You were completely unprepared. |

However, you should not let the rubric deter you from presenting if you have an idea about a solution/proof that you'd like to present, but you are worried that your solution/proof is incomplete or you are not confident your solution/proof is correct. You will be rewarded for being courageous and sharing your creative ideas! Yet,

you should not come to the board to present unless you have spent time thinking about the problem and have something meaningful to contribute.

Exams

- **Tuesday, Nov. 1st:** Midterm exam.
- **Thursday, Dec 15th:** Final comprehensive exam.

The exams are to be done individually within the assigned two hour class time while proctored. Both exams may have a take-home portion that will be distributed the class day before and collected at the beginning of the exam times. One one-sided page of 8.5 by 11 inch paper of notes is allowed for each exam with what ever you would like written/typed/photo copied/etc on it.

Make-up tests will only be given for absences deemed justifiable by the instructor (e.g., illness, family emergency), and may be considerably more difficult than the original test. If you must be absent for an exam, I will only give a make-up exam if notified in advance.

Getting Help:

<https://www.google.com/url?q=https://docs.google.com/document/d/1h-9ks1Rj1AswJswN4qgjn-veRxVH9WkAfS6Cu89JCHY/edit&sa=D&ust=1585007673675000>) Many resources exist, are available, and are intended to help you with math, technology, and personal issues and questions. A few of the most helpful are listed [here](https://www.google.com/url?q=https://docs.google.com/document/d/1h-9ks1Rj1AswJswN4qgjn-veRxVH9WkAfS6Cu89JCHY/edit&sa=D&ust=1585007673676000) <https://www.google.com/url?q=https://docs.google.com/document/d/1h-9ks1Rj1AswJswN4qgjn-veRxVH9WkAfS6Cu89JCHY/edit&sa=D&ust=1585007673676000>).

General Policies:

Campus-wide and class policies regarding inclement weather and emergency procedures are posted [here](https://www.tacoma.uw.edu/teaching-learning-) <https://www.tacoma.uw.edu/teaching-learning->