**UWL Fall 2018 MTH 411 Precalculus – Dr. Das** **Dated: 09/04/2018**

---


INSTRUCTOR

Dr. Tushar Das
1016 Cowley Hall
*Email:* tdas@uwlax.edu
*Phone:* (608) 785-8392
*UWL profile page:* `https://www.uwlax.edu/profile/tdas/`
*Website:* `https://sites.google.com/a/uwlax.edu/tdas/`


COORDINATES

| Section | Lecture |
|---|---|
| 411-**01** | TuTh @ 02:15pm-03:40pm, Cowley 111 |

OHOURS/HW LAB

Learning math actively in a one-to-one / small-group setting occurs during office hours, and is especially conducive to effective learning and deep comprehension of the material. Naturally, I hope to meet with every single one of you during my office hours!

| Day of week | Time | Location |
|---|---|---|
| Mondays | 02:00pm–04:00pm | Office (1016 Cowley Hall) |
| Tuesdays | 04:00pm–05:00pm | Office (1016 Cowley Hall) |
| Wednesdays | 02:00pm–04:00pm | Office (1016 Cowley Hall) |
| Thursdays | 04:00pm–05:00pm | Office (1016 Cowley Hall) |
| Fridays | 09:00am–10:30am | Murphy Learning Center Studio (273 Murphy Lib.) |

At any stage if there are more students than can reasonably fit in my office, we will move to the Murphy Learning Center Studio (273 Murphy Library), or to a free classroom in Cowley. In such cases, look for a sign on my door directing you to where we've moved.

COURSE INFORMATION

A rigorous approach to algebraic systems including the study of groups, rings, integral domains and fields with application to polynomials. Prerequisite: grade of "C" or better in MTH 225 or CS 225; grade of "C" or better in MTH 309. Offered Fall and Spring.

TEXTBOOKS

Fraleigh, *A First Course in Abstract Algebra*. 7th Edition. Addison-Wesley.

Gallian, *Contemporary Abstract Algebra*. 9th Edition. Cengage.

Course materials and information will be emailed to students and/or posted on D2L, as appropriate. It is your responsibility to check both regularly.

LEARNING OUTCOMES

By the end of this course, the student will be able to:

- Explain the fundamental concepts of group theory and ring theory.
- Use results from elementary group theory to solve contemporary problems.
- Describe and generate groups, rings, and fields.
- Relate abstract algebraic constructs to more familiar number sets and operations and see from where the constructs derive.
- Explain the significance of the notion of a normal subgroup, and of a simple group.
- Articulate the role and purpose of homomorphisms and isomorphisms in describing algebraic structures.
- Prove basic results about groups, rings, domains, and fields.
- Present complete proofs acceptable in modern mathematics in both handwritten, typeset, and oral presentation formats.

There are three broader implicit learning goals for this course. These are 1) to make you *independent learners* of mathematics, 2) to develop your *visual thinking* skills, and 3) to develop your *mathematical communication* skills.

By the end of the course, you should be able to:
– develop a facility with new mathematical concepts and notation
– master standard proof techniques
– prove results using a systematic formal approach
– expose results using effective communication, both in writing and in speaking
– attempt to generalize results via searching for analogies/patterns
– generate and test your own conjectures (proof or counterexample)
– make connections between mathematics courses
– reflect on, classify and structure the course material you are learning
– take ownership of your own learning, and persevere in the face of frustration

D2L/EMAIL

Course materials and information will be **emailed to students and/or posted on D2L**, as appropriate. Check both regularly. We will *not* use Canvas for this class.

COURSE GRADES

Your grade for this course will be based on scores earned from participation, homework notebooks, quizzes, two cumulative in-class exams, and a comprehensive final exam.

There will be no curve at any point. Each portion of your grade is worth the following points out of a possible 1000 points:

| | |
|---|---|
| Final Exam | 200pts |
| In-Class Exams (150pts $\times$ 2) | 300pts |
| Participation (2pts $\times$ 25) | 50pts |
| Short Quizzes (6pts $\times$ best 10) | 60pts |
| Long Quizzes (12pts $\times$ best 10) | 120pts |
| Written HW (15pts $\times$ best 10) | 150pts |
| Presentations | 120pts |
| **Total** | **1000pts** |

The grading for this course will follow the following scale:
F: [0,60), D: [60,70), C: [70,78), BC: [78,82), B: [82,88), AB: [88,91), A: [91,100].

EXAMS & FINAL

Below is the tentative schedule for the 2 in-class Exams and the Final Exam. If there are any changes to this schedule, I will announce them in advance.

Exact material to be covered will be determined before the exam. The material covered will always start from September $4^{\text{th}}$ up to a certain point, usually two lectures before the particular exam. For example, the exam on Oct 12 will be up to material covered on Oct 5. **The exams are all comprehensive**, and the material covered grows in size as the semester progresses. *Nevertheless, the exams will generally emphasize later material*. This strategy will help prepare you to succeed in the **Final Exam (worth** $200$ **points) which is also comprehensive and with uniform emphasis spread across all the material**.

**Exam 1** Thursday October $11^{\text{th}}$ in class.
**Exam 2** Thursday November $29^{\text{th}}$ in class.
**Final Exam** Monday December $17^{\text{th}}$, 07:45am – 09:45am, Room TBD.

The **Final Exam** is from 07:45am – 09:45am on **Monday, Dec 17.** Room TBD.

QUIZZES

Quizzes will take place most Tuesdays and Thursdays.

**Tuesdays** will have short quizzes (5 mins / 6 pts), which will consist of asking you for one or more definitions. A quiz on Tuesday may include definitions from the beginning of the semester up through the previous class.

**Thursdays** will have longer quizzes (10-15 mins / 12 pts), which will usually involve a short proof (that cannot be completed without knowing the definitions). A quiz on Thursday may include proof ideas from the beginning of the semester up through the previous class. These longer quizzes will be graded using the one-category proof rubric below.

*One-category Proof Rubric*: When graded out of 12 points, a proof will earn:

- **12 points**. Proof is mathematically correct. Proof reads well and logically flows from one paragraph or equation to the next. Proof is clearly and fully explained with no missing steps, gaps in reasoning, or extraneous details. Proof is concise and not overly wordy.
- **10 points**. Proof is mathematically correct. Proof has some minor writing issues, but still mostly satisfies the criterion for getting a 12. An extremely well-written proof with minor mathematical errors may still receive a 10.
- **8 points**. Proof is mathematically correct, but has more serious gaps, jumps, or "fuzziness" in the reasoning; or the proof has more serious mathematical flaws, but is generally well-written.
- **6 points**. Proof is poorly-written, has serious mathematical errors, or is missing justification for key steps.
- **4 point**. Proof has serious writing or mathematical errors, is missing parts or key steps.
- **2 points**. Proof is extremely seriously flawed, has almost all parts and key steps wrong.
- **0 points**. Proof is not turned in, or is plagiarized. (Plagiarism may result in additional penalties, up to and including a failing grade for the course and documentation of academic dishonesty with the Office of Student Life.)

HW NOTEBOOKS

A new homework set will be released almost every week, and which will be due the following week (you will have a minimum of 7 days per assignment). Your HW solutions must include **writing out each problem** and **working out solutions in full detail** (as if on an exam). Homework must be typeset using LaTeX. Both the LaTeX and the PDF output should be submitted in the D2L Dropbox by 11:59pm on the appropriate date. (If submitting multiple times, I will assume you want the latest submission graded: otherwise, you can explain the situation in an e-mail). A subset of problems (or clearly-identified subparts) will be graded using the one-category proof rubric above. You should follow standard rules for written homework: e.g., use complete sentences, and do not begin sentences with mathematical notation[1]. I will share further expectations with you as the course progresses.

To download and setup LaTeX on your computer visit Getting Started on `http://tug.org`, or use a web-based LaTeX compiler like `https://www.sharelatex.com`.

[1]Instead of saying "$f$ is surjective", saying "The function $f$ is surjective" helps the reader and forces YOU, the proof writer, to think about what each object is.

PARTICIPATION

There will be plenty of opportunities for you to answer questions posed by me during lectures. At the end of a lecture in which you have answered one or more such questions, you may see me to get a participation star (max of one per lecture) on my roster. Each student can earn at most $25$ such participation stars (worth $2$ points each), for a total of $50$ points. Do not be afraid to answer incorrectly, as there are greater learning gains to be obtained in the process! *Many students unwittingly undermine the value of making mistakes in the learning process. This classroom is a safe environment where risk taking is encouraged and productive failure is valued.*

PRESENTATIONS

There are two due dates: Oct 20, and Dec 8. By each of these dates, you should have orally presented a set of 3 proofs in my office with an individual appointment.

- **When to present:** If you want to present during an office hour spontaneously, that is fine if nobody else is in my office hour. In general, it will be better to send an e-mail scheduling an appointment in advance.
- **What to present:** Discuss which problems you would like to present with me. You may pick from the exercises in the text which (1) have giving a **proof** as the task, and (2) have not otherwise been assigned for written homework. If I believe that a certain problem is under par, I will suggest alternates.
- **Format:** You can have up to 1 sheet of standard-sized paper (single side) as your notes. One such sheet per problem presented. You can present up to 1 problem before letting someone go. I may ask (either after, or if really needed, during your presentation) any clarification and follow-up questions that are relevant.

  I am paying attention to (1) the correctness of your proof, (2) your notation on the board, (3) the grammar of your spoken explanation, and (4) the overall clarity of what you say and present.
- **Grade:** These grades will be based on a mastery paradigm. For each proof you present, you will be given either a "pass" or "try again", along with a reason if it's "try again". You have an unlimited number of attempts (within reason, though: please don't waste your time or my time by too much!) to do a redo presentation, though you may be required to select a new problem. If you get three passes by Oct 20, and three more by Dec 8, you earn the full grade for this category.

TOPICS

We will start with a quick review of some of your prerequisites from MTH/CS 225 (Section 0) and MTH 309, and then cover the following 24 sections from Fraleigh:

- Sections 1-7 (Groups and Subgroups)
- Sections 8-11 (Permutations, Cosets, and Direct Products)
- Sections 13-15 (Homomorphisms and Factor Groups)
- Sections 18-23 (Rings and Fields)
- Sections 26-27 (Ideals and Factor Rings)
- Sections 29-30 (Extension Fields) *time permitting*

ATTENDANCE POLICY

It is extremely important that you attend class. Your attendance and class participation will be used as a guide to make grade decisions in borderline cases. I will remove students from the class if they have irregular attendance within the first few weeks of class without prior approval.

Attendance for the full class period is expected. You should be prepared to ask and answer questions, take notes, and look alive in class (see PARTICIPATION). **Remove headphones and turn off all electronic devices such as cell phones, MP3 players, laptops, etc.** If you are absent, it is your responsibility to obtain all assignments / handouts / announcements / info / lecture notes from a classmate.

CELLPHONES ETC.

I dislike when electronic devices make noise in class, as do many students who find this disruptive. **Please turn off all electronic devices, when you are in my classroom**. If your device *does* make an audible noise during class you must bring **cookies** to share with the class the next time we meet, or forfeit 5 points from your next exam.

EXAM POLICY

Please ensure that the exam dates and times fit your schedule. There are **no make-up exams** for the in-class exams, except under extreme circumstances (determined by instructor). In case of such an extreme circumstance, I may allow your final (appropriately rescaled) to replace one missed exam.

HONOR CODE

I expect everyone to do their own work in the class. I do not tolerate cheating of any kind. I am always available to help you, so there should be no need for you to feel like you have to cheat on anything for this class. If you are uncertain at any time, contact me for clarification.

DISABILITIES

Any student with a documented disability (e.g. ADHD, Autism Spectrum Disorder, Acquired Brain Injury, PTSD, Physical, Sensory, Psychological, or Learning Disability) who needs to arrange academic accommodations must contact The ACCESS Center (165 Murphy Library, 608.785.6900, ACCESSCenter@uwlax.edu) and meet with an advisor to register and develop an accommodation plan. In addition to registering with The ACCESS Center, it is the student's responsibility to discuss their academic needs with their instructors. Please get this taken care of by the end of the second week of classes.

You can find out more about services available to students with disabilities at
**The ACCESS Center website**: `https://www.uwlax.edu/access-center/`.

INCLUSIVE EXCELLENCE

UWL's core values include "**Diversity, equity, and the inclusion and engagement of all people in a safe campus climate that embraces and respects the innumerable different perspectives found within an increasingly integrated and culturally diverse global community**". If you are not experiencing my class in this manner, please come talk to me about your experiences and I will try my best to adjust the course.

LEGAL STATEMENTS

`https://www.uwlax.edu/info/syllabus/` The link takes you to a UWL webpage that includes statements that reflect UWL's legal obligations to students. There are sections on **Sexual misconduct**, **Religious accommodations**, **Students with disabilities**, **Veterans and active military personnel**. There is also a link to **Student Success Tips**: `https://www.uwlax.edu/info/student-success/`

EMAIL

Email is the best way of communicating with me, other than coming by my office and meeting with me in person. When you email me, please have a *subject* and remember to *identify your class and section* below your signature. Visit `http://web.wellesley.edu/SocialComputing/Netiquette/netiquetteprofessor.html` for a guide to e-etiquette.

I will send emails to the entire class, please check your email regularly.

I recommend saving my emails in an appropriately titled folder, say **18F MTH411**.

STUDY GUIDE

Success requires a serious commitment on your part, strive to engage with the material so that it becomes part of your every day. Therefore (1) active reading of lecture notes and the textbook with a view to writing your own (improved) notes, (2) working out plenty of problems under timed constraints, and (3) generating your own questions, are all pivotal components of success in this course. **For each hour in lectures, plan to spend a minimum of 3-4 hours outside of class studying the material.** This is the minimum required to stay afloat. If you have a weak background in proof-based mathematics or have had difficulties in succeeding in your previous mathematics classes (especially MTH 255 and 309), you must dedicate significantly more effort than before in order to comprehend the course material. That said, most learning takes place on your time, outside of class. It helps to work in groups and make sure to talk to each other and me – discuss your progress and struggles on a weekly basis. I am here to help you succeed, don't waste that opportunity.

- **Budget your time:** Don't put off assignments until the last minute, *start work on them as soon as we start a section*. Master and understand the concepts which the exercises are training you for. Approach the class knowing that mathematics is inherently cumulative. By the end of the 2nd week of classes, you should have made and started to follow a *schedule that includes a regular study time* for this class. Remember that you need *at least* $12^+$ *hours of study time per week, outside of lectures*.
- **Read the book:** The textbook is well-written and is designed to be read by students. Each chapter has a lesson section and a section with exercises. Do not skip the lesson section, and only use it as a model for when you're stuck. My lectures will complement the book. Read the relevant lesson/section in your textbook before class. If it doesn't make much sense, that's okay! Then, read it again *after* the relevant class. Then, and only then, should you attempt the exercises in self-timed batches.
- **Study first, then try the exercises in self-timed small batches**: This is probably the most counter-intuitive piece of advice so far. Do not attempt the HW problems until you have first carefully worked through the chapter and my notes. Thus prepared, you are now ready to test yourself by making yourself a quiz – pick $4$ problems with $4$ minutes for each. Now time yourself and take this quiz as if you were in class. Reflect on your performance and work to improve your content-knowledge and your time.
- **Don't just look at solutions:** You will **not** learn simply by looking at someone else's solution to a problem and thinking, "Yeah, okay. I think I could have come up with that by myself." No! You should try a problem on your own, and only AFTER you believe you have a complete answer, compare it!
- **Present your solution well:** It is not enough to simply know **how** to do the problems. You must ensure that you have addressed every important mathematical detail. You must also be able to explain your answer clearly and precisely. Unclear answers will receive less than full credit. In this class, in addition to learning mathematics, you will be trained in how to present clear explanations, an important life skill for future classes and beyond!
- **Try and do all the exercises:** Even if you are unable to due to time constraints, it will help you (1) learn more results about the concepts you are studying in the section, and (2) understand how to *generate your own questions*.

- **Generate your own questions:** In this class, asking questions is valued at least as much answering them. Keep track of questions that you have while you are in lecture and while you read the textbook. You could write them in the margins of your lecture notes, or have a small notepad for questions from all your classes. Make sure go back to your list at the end of each week, and try to have them all checked off!

FRALEIGH'S ADVICE TO STUDENTS

"This course may well require a different approach than those you used in previous mathematics courses. You may have become accustomed to working a homework problem by turning back in the text to find a similar problem, and then just changing some numbers. That may work with a few problems in this text, but it will not work for most of them. This is a subject in which understanding becomes all important, and where problems should not be tackled without first studying the text.

Let me make some suggestions on studying the text. Notice that the text bristles with definitions, theorems, corollaries, and examples. The definitions are crucial. We must agree on terminology to make any progress. Sometimes a definition is followed by an example that illustrates the concept. Examples are probably the most important aids in studying the text. *Pay attention to the examples*. I suggest you skip the proofs of the theorems on your first reading of a section, unless you are really "gung-ho" on proofs. You should read the statement of the theorem and try to understand just what it means. Often, a theorem is followed by an example that illustrates it, a great aid in really understanding what the theorem says.

In summary, on your first reading of a section, I suggest you concentrate on what information the section gives, and on gaining a real understanding of it. If you do not understand what the statement of a theorem means, it will probably be meaningless for you to read the proof.

Proofs are very basic to mathematics. After you feel you understand the information given in a section, you should read and try to understand at least some of the proofs. Proofs of corollaries are usually the easiest ones, for they often follow very directly from the theorem. Quite a lot of the exercises under the "Theory" heading ask for a proof. Try not to be discouraged at the outset. It takes a bit of practice and experience. Proofs in algebra can be more difficult than proofs in geometry and calculus, for there are usually no suggestive pictures that you can draw. Often, a proof falls out easily if you happen to look at just the right expression. Of course, it is hopeless to devise a proof if you do not really understand what it is that you are trying to prove. For example, if an exercise asks you to show that given thing is a member of a certain set, you must *know* the defining criterion to be a member of that set, and then show that your given thing satisfies that criterion.

There are several aids for your study at the back of the text. Of course, you will discover the answers to odd-numbered problems not requesting a proof. If you run into a notation such as $\mathbb{Z}_n$ that you do not understand, look in the list of notations that appears after the bibliography. If you run into terminology like *inner automorphism* that you do not understand, look in the Index for the first page where the term occurs.

In summary, although an understanding of the subject is important in every mathematics course, it is really crucial to your performance in this course. May you find it a rewarding experience." – John B. Fraleigh

CLASS CALENDAR

| TUESDAY | | THURSDAY | |
|---|---|---|---|
| Sep 4th | **1** | 6th | **2** |
| 11th | **3** | 13th | **4** |
| 18th | **5** | 20th | **6** |
| 25th | **7** | 27th | **8** |
| Oct 2nd | **9** | 4th | **10** |
| 9th | **11** | 11th<br>**EXAM 1** | |
| 16th | **12** | 18th | **13** |
| 23rd | **14** | 25th | **15** |
| 30th | **16** | Nov 1st | **17** |
| 6th | **18** | 8th | **19** |
| 13th | **20** | 15th | **21** |
| 20th | **22** | 22nd<br>**Thanksgiving** | |
| 27th | **23** | 29th<br>**EXAM 2** | |
| Dec 4th | **24** | 6th | **25** |
| 11th | **26** | 13th | **27** |

Note what section we are working on in lectures in the calendar above. Also, this alerts you to the relevant section you should be working on in your HW notebooks.

It is in your best interest to come prepared for lectures by actively reading over the appropriate section in the book before lectures. Even skimming a part of this material will help you gain understanding and allow you to better engage with the lectures.

IMPORTANT DATES Visit `http://www.uwlax.edu/records/dates-and-deadlines/`

FINAL EXAMS `http://www.uwlax.edu/Records/Final-Exam-Schedule/`

DISCLAIMER The information in this syllabus is subject to change at the discretion of the instructor. Changes will be announced in class and updates will be emailed to students.