Exam 2 # TMath 344 Winter 2025

Use any resources available to prepare, including your classmates, the TLC, internet, or me. You should plan, discuss, and debate answers with anyone that is willing to engage. **You are required to cite your sources and collaborators.**

- Sign up for a 25 minute interview slot at: `https://calendly.com/r-e-vanderpool/30min`
- The assessment is closed book but you make use a two-sided 8.5" by 11" sheet of notes with definitions and theorems. No prepared solutions.
- Location: I am looking to book private space in the TLC. Details will come!
- In Person:
  - Please arrive 5 minutes early and get your materials prepared so that we can start promptly. You will have a maximum of 25 minutes to present your solutions.
- Remote
  - For your interview, please sign into the zoom room at least 5 minutes before your selected time. Have your working surface clear of clutter with only the allowed materials, blank paper, computer/tablet/phone.
  - You need a working camera to give a tour of your space. I would appreciate being able to see your face during the interview, but that is not required.
  - You will have a maximum of 25 minutes to include a brief tour of your space and discussion/solutions to three questions
  - You are required to share your screen when asked. Failure to comply will result in 0.

Grading Rubric

The exam consists of two questions (worth 20 points each) from the next page and one ???? (worth 10 points). Questions will be graded according to the following rubric:

95%	Well-executed. Thorough discussion. All points are well supported. Two or fewer minor errors. No nontrivial errors.
85%	Generally well-executed. Several minor errors; or a nontrivial mathematical error that gets corrected when identified.
75%	Uncorrected nontrivial error; or several nontrivial errors that get corrected when identified; or error in fundamental understanding that gets corrected when identified.
60%	Error in understanding of fundamental concept that does not get corrected.
0	No evidence of preparation or understanding.

- (20 pts) The first question will be **your choice**.
- (20 pts) I choose the second question from the ones remaining.
  - You may pass on my choice once for a 4 point penalty. If the pass is used, I select another problem.
- (10 pts) Last problem that has an element of chance in it.

Exam 2 Questions:

1. Write 4 true/false questions to assess four *different* concepts from 4.5, 4.6, 5.1, and 6.1 that you might put on an exam if you were teaching the class. Then explain the answers, explain why you chose those particular questions and what concepts they are testing. *You are allowed to prepare a separate document containing your typed questions (only the questions) and bring them to the interview.*

2. State the two-dimensional postulates in your own words (we have come across 7 of them). Identify any redundancies (one postulate comes from another, etc), provide examples where each postulates is "self evident" and examples where they are not. Make sure that Euclidean geometry is one of your examples.

3. Grade the following proof on clarity and accuracy/correctness (scale between 0 and 4 in alignment with the rubric posted on Syllabus for Proofs). Fully justify your scores.

   Theorem 4.28. *The ϕ be a fold that A and B be points so that $\phi(A) = B$. Then $\phi(B) = A$*

   Proof. Since A and B are distinct points we can use Theorem 4.27 that states there is a unique fold taking A to B. Specifically, the fold that has the perpendicular bisector of AB as the crease. Thus ϕ is the fold with the crease that is the perpendicular bisector of AB.

   Note that AB is the same set as BA. Thus, the perpendicular bisector of AB is the same line as the perpendicular bisector of BA. Theorem 4.26 states that the fold with a crease on the perpendicular bisector of BA sends B to A. Thus $\phi(B) = A$ which is what we wanted to show. □

4. Fold an origami instruction from one listed below. Examine the crease pattern and justify the claim made by each pattern.

   (a) Paper cup at `http://origamiusa.org/files/atsushi-cup.pdf`: the rim and bottom of the cup are parallel.

   (b) "Snow flake" pattern from Exercise 5.6: there is a 5 symmetry pattern

The last question everyone will do. Roll a die to choose which of the geometries you will work with:

1. "Points" will be lines in $\mathbb{R}^3$ thru the origin.

2. Points will be points on S^2 defined as $\{(x, y, z) \in \mathbb{R}^3 | x^2 + y^2 + z^2 = 1\}$

Now answer questions about that geometry. These questions will be largely impromptu, but below are some questions to give you an idea of what might be asked:

1. Identify what lines should look like in your geometry. Be prepared to provide examples when 2 points are given to you.

2. Do your lines satisfy 2-dimensional postulates 1, 2, or 3?

3. Identify what angles should look like in your geometry. Be prepared to provide examples when 2 lines are given to you.

4. Do your angles satisfy 2-dimensional postulates 4 or 5?

5. Does the geometry satisfy the parallel postulate (postulate 7)? Why or why not?