

LECTURE: MWF 9:00 – 9:50 a.m. in GAB 317

INSTRUCTOR: William Cherry

OFFICE: GAB 405

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WEB PAGE: <http://wcherry.math.unt.edu/math4060>

OFFICE HOURS: Mondays & Wednesdays 10–Noon and by appointment

Students unable to attend the above scheduled office hours or needing extra help are welcome to make an appointment with me at other times, including evenings and weekends.

PREREQUISITE(S): Math 3000. Prior to taking this course, students are expected to have had a course in proof writing, proof technique, and proof strategy. No particular knowledge of real analysis, other than proof writing, will be assumed. Concurrent or previous enrollment in Math 3510 or Math 3610 is *strongly* recommended.

TEXTS: *Euclid's Elements*, The Thomas L. Heath translation edited by Dana Densmore, Green Lion Press, 2002, and Robin Hartshorne, *Geometry: Euclid and Beyond*, Springer Verlag, 2000

NOTE: A version of *Euclid's Elements* is also available online at:

<http://aleph0.clarku.edu/~djoyce/java/elements/elements.html>

GRADES: There will be five components to your final grade, weighted as follows:

Homework: 30%

Daily Quizzes: 5%

Geometry Art Project: 10%

Midterm Exams: 28%

Final Exam: 27%

Students are expected to complete the SPOT evaluation between April 17 and May 4.

IMPORTANT DATES:

MIDTERM EXAMS: Monday, March 6 and Monday, April 10.

ART PROJECTS DUE: Monday, May 1.

FINAL EXAM: Wednesday, May 10, 8:00 – 10:00 a.m.

ATTENDANCE: Class attendance will be taken by the daily quizzes. **Students who miss more than 15 of the daily quizzes will have their overall course grade lowered by a full letter grade. No late homework** will be accepted, and homework assigned for in class presentation must be presented as scheduled. **Students must plan to attend the midterm and final exams.** Makeup exams will be given only in extremely exceptional circumstances, such as serious illness, and must be arranged in advance.

ACADEMIC DISHONESTY: Cheating on exams is a serious breach of academic standards and will be punished severely. UNT's full policy on academic integrity can be found at:

<http://vpaa.unt.edu/academic-integrity.htm>.

*Note: It is the responsibility of students with certified disabilities to provide the instructor with appropriate documentation from the Dean of Students Office*

## Student Perceptions of Teaching (SPOT)

The SPOT evaluation is a requirement for all organized classes at UNT. This survey will be made available to you at toward end of the semester, providing you a chance to comment on how this class is taught. Please be sure to complete this important survey for all of your classes between April 17 and May 4.

### Useful Computer Software

**Geometer's Sketchpad:** Should be available in the CAS labs (GAB, Wooten, Terrill)

**Geogebra:** Free software: [www.geogebra.org](http://www.geogebra.org)

### Learning Objectives

Math 4060 contributes to the following mathematics undergraduate program objectives:

#### Mathematical Reasoning

- MR 1. Read, understand, formulate, explain, and apply mathematical statements.
- MR 2. Formulate conjectures by considering examples that move from the specific to the general.
- MR 3. Distinguish between valid and fallacious arguments.
- MR 4. State and apply important results in key mathematical areas, with the ability to provide proof-based arguments of these and related results.
- MR 5. Use a variety of techniques – such as, mathematical induction, proof by contradiction, or direct application of axioms and previously proven theorems – to prove propositions.

#### General skills

- GS 1. Solve mathematical problems individually and cooperatively.
- GS 2. Formulate strategies for solving novel analytical – both theoretical and applied – problems.
- GS 3. Communicate, both verbally and in writing, mathematical ideas at a variety of levels from technical to intuitive.

### Where to get help

Math 4060 is NOT one of the courses eligible for math lab tutoring. If you are having trouble, please make full use of your instructor's office hours. If the scheduled office hours are not convenient for you, make an appointment for another time. Working together with other students is also a good way to get help, but just be sure you are also able to work alone when it comes time to take the tests.

## Tentative Course Outline

### Weeks 1–5 Euclid’s *Elements*

Reading: Euclid books I–IV and Hartshorne Chapter 1.

Abraham Lincoln wrote in his autobiography that: *He studied and nearly mastered the six books of Euclid since he was a member of Congress. He began a course of rigid mental discipline with the intent to improve his faculties, especially his powers of logic and language. Hence his fondness for Euclid, which he carried with him on the circuit till he could demonstrate with ease all the propositions in the six books; often studying far into the night, with a candle near his pillow, while his fellow-lawyers, half a dozen in a room, filled the air with interminable snoring.* Euclid’s *Elements* is the most widely read textbook of all time, and along with the *Bible* and the writings of Confucius, is one of the most read books ever. This course will begin with a guided reading to parts of Euclid and a study of what Euclid was trying to accomplish. This will be used to help us understand the value of proof and to improve our proof writing abilities.

Monday	Wednesday	Friday
	1/18: Introduction & Euclid Book I	1/20: Euclid Book I Presentations
1/23: Euclid Book I Presentations	1/25: Euclid Book I Presentations	1/27: Euclid Book III Presentations
1/30: Euclid Book II	2/1: Euclid Book III	2/3: Hartshorne §2
2/6: Hartshorne §2	2/8: Hartshorne §3	2/10: Hartshorne §3
2/13: Hartshorne §4	2/15: Hartshorne §4–5	2/17: Hartshorne §5

**Midterm I.** The first midterm will cover Euclid and Chapter 1 of Hartshorne.

### Weeks 6–9 Hilbert’s Modern Foundations for Euclidean Geometry.

Reading: Hartshorne Chapter 2

After examining Euclid, we will turn to 19th and 20th century critiques of Euclid and discuss the modern foundations for Euclid’s theory set out by Hilbert, one of the most influential mathematicians of the late 19th and early 20th centuries.

Monday	Wednesday	Friday
2/20: Hartshorne §6	2/22: Hartshorne §6	2/24: Hartshorne §6–7
2/27: Hartshorne §7	3/1: Hartshorne §7	3/3: Hartshorne §7–8
3/6: <b>Midterm</b>	3/8: Hartshorne §8	3/10: Hartshorne §9
Spring Break		
3/20: Hartshorne §9	3/22: Hartshorne §9-10	3/24: Hartshorne §11-12

**Midterm II.** The second midterm will cover Hartshorne Chapter 2, emphasizing sections 6–8.

**Weeks 10–13** Non-Euclidean Geometry.

Reading: Hartshorne Chapter 7

During the second half of the course we will discuss the history of Euclid’s famous “parallel postulate” and examine alternative geometries where the parallel postulate is no longer true.

<b>Monday</b>	<b>Wednesday</b>	<b>Friday</b>
3/27: Hartshorne Chapter 7	3/29: Hartshorne Chapter 7	3/31: Hartshorne Chapter 7
4/3: Hartshorne Chapter 7	4/5: Hartshorne Chapter 7	4/7: Hartshorne Chapter 7
4/10: <b>Midterm</b>	4/12: Hartshorne Chapter 7	4/14: Hartshorne Chapter 7
4/17: Hartshorne Chapter 7	4/19: Hartshorne Chapter 7	4/21: Hartshorne Chapter 7

**Weeks 14–15** Hyperbolic Trigonometry, applications of finite geometries, three dimensional geometry, or connections between Geometry and Algebra

Reading: Various sections of Hartshorne

At the end of the course, time permitting and depending on the interest of the students, we will discuss hyperbolic trigonometry, some three dimensional geometry, computer applications of finite geometries, or connections between geometry and algebra.

<b>Monday</b>	<b>Wednesday</b>	<b>Friday</b>
4/24: To be announced	4/26: To be announced	4/28: To be announced
5/1: Art Project Show&Tell Art Projects Due	5/3: Final Exam Review	5/5: <b>Reading Day</b> No Class

**Final Exam.** The final will cover non-Euclidean geometry, mostly the material in Chapter 7 of Hartshorne.