

# Math 340: Higher Geometry

Fall 2005

## Geometry: A historical perspective

The series of parchments that comprise Euclid's *Elements* are often compared to the Bible in terms of worldwide recognition and influence. This compilation of mathematical definitions and propositions is both an amazingly well-organized and concise summation of the state of mathematics at the time of the ancient Greeks and a solid foundation for all mathematics over the course of 2000 years.

But there is far more to geometry than what can be found in Euclid's *Elements*. We will look at the progress of geometry from navigation, from mechanics and structure, from art and design, as well as the synthetic geometry codified by Euclid. In this class, we will see how these different strands of geometry have worked to advance our understanding of the world.

The material for this course is chosen keeping in mind the needs of those pursuing secondary education. However, this is a 300-level writing intensive course. Thus my interest in teaching the course is to help you explore the deeper questions of geometry: What is geometry? What role does classic geometry play in modern mathematics and in our understanding of the universe? What questions are still unanswered in the field of geometry?

## Course Info

**Time/Location:** MWF 12:50-2:00 p.m. in PPHAC 235

**Instructor:** Kevin Hartshorn

**Office:** PPHAC 215      **Phone:** x1374

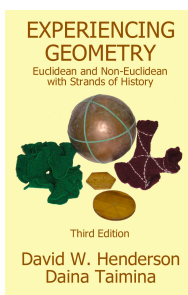
**e-mail:** [hartshorn@moravian.edu](mailto:hartshorn@moravian.edu)

**Office Hours:** Mon, Wed 9-10am; Wed, Thu 2-3pm;  
or by appointment

## Texts

Henderson, Taimina, *Experiencing Geometry: Euclidean and Non-Euclidean with History (3rd Edition)*

The computer program *Geometer's Sketchpad* will be used extensively in this course and I strongly recommend that you purchase your own copy from the bookstore.



## Other Resources

### On-line materials

Euclid's Elements

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

The Geometry Junkyard

<http://www.ics.uci.edu/~eppstein/junkyard/>

Geometry Topics at Mathworld

<http://mathworld.wolfram.com/topics/Geometry.html>

## Course Goals and Objectives

The goal of this course is to acquaint you with the breadth of the subject called "geometry" through the discovery and proof of many geometric properties and relationships of figures. Although most of the course will deal with Euclidean geometry in two and three dimensions, there will be an introduction to some non-Euclidean geometries.

### In this course we will

- develop an understanding of the central themes of geometry,
- enhance our capacity and recognize the importance of rigor in proofs and arguments,
- gain facility in the language and standard techniques of geometric research,
- develop an appreciation of the beauty and utility of geometry

## Why Writing Intensive?

Mathematics – and geometry in particular – has grown only because of extensive **writing**: letters between colleagues, journal articles, copious notes, books, etc.

You have been frequently told that the only way to learn math is to do it. Euclid established the tradition of carefully constructed proofs based on simple axioms and common notions. In this course, we shall continue that tradition, bringing the tools and techniques of writing into our study of mathematics.

Through writing, you will not only be able to express your solutions to problems, but develop a method to explore difficult problems in a careful and methodical manner.

## Assessment of progress

In assessing the work for this class, I plan to use journals, homework submissions, class presentations, exams, and a research project. These will be weighted as described in the table below. Be sure to review the Student Handbook (page 44) to get an idea of how grades will be determined.

Activity	Weight toward final grade
Homework and journaling	25%
Discussion and participation	15%
Midterm	15%
Research Project	25%
Final Exam	20%
<b>Total:</b>	<b>100%</b>

All grades will be based on the 4-point grading scale (page 46 of the course catalogue). For most assignments, you will either receive a number grade on the 4-point scale or a check-mark.

Roughly, check-marks translate as follows:

√+ is roughly equivalent to a 4.0

√ is roughly equivalent to a 3.0 (mid-B range)

√- is roughly equivalent to a 1.5 (low C or high D)

## Reading the Text

It is vital that you spend a significant amount of time at home reading the texts for yourself. I will not be lecturing on all of the material in the text. You will not be able to fully complete the homework, participate in discussions, or succeed in this class if you don't actively read the text.

Opportunity to reflect on the text and ask questions will be provided both in class discussion and in your journal writing.

## Homework write-ups

Some homework problems will be straightforward “prove this result” or “show that” problems. Others will require more involved reflection.

Some homework may be collected, graded and returned. Other homework may require several revision steps to help refine your thinking about the questions posed in this course. However, any homework problem that you do submit must be done neatly and completely. I expect you to use complete sentences for all problems that you submit. I will not accept work that is sloppy or fails to use complete sentences to explain your thinking.

Deeper “journaling” questions from the text will offer opportunities to work through particularly vexing problems, reflect and comment on readings, explore questions and ideas brought up in class, explore topics for writing assignments, or reflect on the progress of the course. Journal entries fall under the “homework” category, but will be graded less on absolute accuracy and more on evidence of progress and care.

If you wish, you may type homework submissions (using *Word* or *Geometer's Sketchpad*, for example). I will show you how to include sketches from *Geometer's Sketchpad* into your *Word* document.

I recommend everyone to keep a separate binder containing your work in this course. This should be a loose-leaf folder, as you will regularly add pages to entries you had made earlier or revise entries. This will help ensure that multiple drafts of a given assignment are kept together.

## Class Participation

Much of the time in class will be spent in small group discussions: working through proofs, grappling with questions raised in the text, reviewing one another's arguments. In addition, you will be occasionally asked to present homework problems to the class as part of your participation.

Your participation grade will be based on active attendance. Just showing up helps, but you will get full marks only by regularly engaging in the class activities.

## Exams

There will be a midterm exam and a final exam in this course. The midterm is tentatively scheduled to be an oral exam on Thursday, October 4. More information about these exams will be provided as the dates approach.

## Research Project

There will be one major project for this course. As you work through your project, you will have the opportunity to reflect, revise, and share your work with a wide variety of audiences. The grade for your research project will be based on your initial prospectus, reflective essays indicating progress, summary articles highlighting key ideas in your topic, an oral presentation, and the final paper. Later we will spend time discussing exactly how topics will be chosen and what I will expect from your projects.

## Re-Write Policy

Whenever I grade a submitted writing assignment (homework, project, exam question, etc.), you have the option of resubmitting your work for a new grade. Resubmitted work will be graded using the same criteria as the original assignment. In order to re-submit work, you must satisfy the following conditions:

- The original work must have been submitted on time. Late work may not be resubmitted.
- Your resubmission must be handed in within 7 days of receiving the graded work. It must include all prior drafts of the given assignment.

In grading a re-write, part of the grade will be based on how you address the questions/comments raised in the prior draft(s). Note that you may disagree with comments made in a draft. If so, you either need to defend your position more carefully in the rewrite, or speak to me personally if you feel that my comment was misplaced.

When I have graded your resubmitted work, I will compute your new grade for the assignment by averaging the old grade with the grade on the resubmission. That average will be entered in the grade book. You may resubmit work as often as you desire, provided you follow the two rules given above.

**Example:** Suppose you receive an 75% on an assignment. You decide to submit a rewrite, and I give the rewrite a score of 85%. I then change the recorded grade from 75% to 80% (the average of 75% and 85%). You decided that you are still not happy with the grade so you submit a second rewrite. This time you score a 90%, so I change the recorded grade from an 80% to an 85% (the average of 80% and 90%). This process may be repeated as often as you like.

## Academic Honesty

Except as specified below, the college's policy on academic honesty will be strictly enforced. I would suggest you reread that section of the Student Handbook (pages 52–53). Note the following:

- In all homework assignments to be graded, you may use your class notes and any books or library sources. *You are encouraged to work with your classmates in working through homework problems.* However, your homework submissions must be your own work in your own words. While you may work with others to solve a problem, the write up of that solution must be entirely your own work.
- All journal entries and reflective writing assignments should be entirely your own work. It is a waste of your time if you use outside resources for reflective and exploratory writing assignments. Note that your journal entries may reflect discussions that you have had with classmates or other people. The entries themselves should reflect your own thoughts.
- Some assignments will have special instructions. Be sure that you read and understand the instructions in all such assignments.

## Feedback

In any case, please feel free to drop by my office at any time to speak with me – if my door is open, I am available. You can also send e-mail or put a specific entry in your journal directed to me if you would like to contact me.

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## Disclaimers

All things in this course, including this syllabus are subject to change. For the most recent version of this syllabus, go to the class web page at <http://math.moravian.edu/hartshorn/math340>. If you want to stay on top of what changes in class, simply show up every day.

I have no obligation to accept late work for any reason.

You are responsible for the material from any class that you miss. I don't advise that you miss many classes.

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