

# Math 340 – Higher Geometry

## Fall 2009 Syllabus

**Class Meetings:** Comenius 101, MWF 1:10-2:20pm

**Text:** *College Geometry Using the Geometer's Sketchpad*, by Fenton and Reynolds

**Software:** *Geometer's Sketchpad* and *Google Sketchup* (both are available on the campus network)

**Website:** <http://math.moravian.edu/hartshorn/math340>

**Instructor:** Kevin Hartshorn

**Office Hours:** PPHAC 215, Time Tu 1:30-3:00, WTh 3:00–4:00, *or by appointment*

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

## 1 Class Materials

- **Required text:** *College Geometry using Geometer's Sketchpad* by Reynolds and Fenton
- **Recommended software:** Both software packages are available on all campus computers. You may also acquire a version of the software for use on your personal computer.
  - *Geometer's Sketchpad:* You can purchase a copy through the bookstore or order a copy on-line.
  - *Google Sketchup:* You can download a free copy for your personal computer at <http://sketchup.google.com/download/>.

## 2 Goals and Objectives

The goals of this course focus on the ideas of experimentation, proof, and collaboration. You will have numerous opportunities to experiment with geometric ideas and develop your own conjectures about the patterns you find. Sharing your conjectures with your classmates, you will employ careful definitions, lemmas, theorems, and mathematical logic to prove or disprove your results. You will then practice disseminating your results to your peers.

This is the essence of mathematics, and will be the major theme throughout the course. This course will cover material often seen in high school geometry courses, including topics in Euclidean two- and three-dimensional geometry from classical (synthetic), analytic, and transformation points of view; transformations, including isometries, similarities, and inversions; and construction and properties of two- and three-dimensional geometric figures. But through collaborative work and investigative activities, we will visit these topics as living and evolving ideas, not merely facts and theorems to be memorized.

Throughout the course, we will work to develop the skills listed below.

- *Speaking and writing*

You will write about your geometric discoveries in papers aimed at several different audiences, demonstrating mastery of conventions in mathematical writing.

You will share your discoveries with your classmates through discussion. This will include written reports, informal conversations, and formal presentations. In all cases, you will show clarity of thought and precision of language.

- *Conjecture and experimentation*

You will demonstrate your ability to use *Geometer's Sketchpad* and *Google Sketchup* as tools for experimentation and conjecture in geometry. You will develop the capacity to recognize geometric patterns and express informed conjectures based on experimental evidence.

- *Theorems and proof*

You will demonstrate a mastery of the basic definitions and theorems used in this course. You will also demonstrate your ability to use those results to prove new theorems using clear logic and careful definitions.

We will assess your progress toward these goals through class discussion, oral presentations, regular homework assignments, in-class examinations, a research project, and a course portfolio.

### 3 Computing the course grade

Your course grade will be computed based on a raw percentage score, broken down as shown in the table below. Generally speaking, your final course grade translates to a letter grade loosely based on the standard 4-point system: generally 85% marks the difference between an “A” and a “B”, 70% marks the difference between a “B” and a “C”, 60% marks the difference between a “C” and a “D”, and any score below 50% is considered failing.

|             |   |
|-------------|---|
| 15%         | Writing & Course engagement             |
| 15%         | Homework                                |
| 20%         | Exams (September 30 and November 4)     |
| 20%         | Individual research project (see below) |
| 15%         | Portfolio (see below)                   |
| 15%         | Final Exam (December 14)                |
| <b>100%</b> | <b>Total</b>                            |

#### 3.1 Writing & Course engagement

Your active engagement with the progress of the class will be assessed by:

- Your work on “activities” in each chapter. Assessment on these problems is not based on a complete and correct solution, but rather on evidence of experimentation and careful thought on the problem. You are expected to bring questions and share results/ideas about the activity problems to class discussion.
- Your engagement in class discussion. Assessment is based on both your willingness to share thoughts, ideas, questions in class as well as your support of the effort of other students’ contributions to the class discussion. This includes your sharing ideas through short presentations of completed problems.

#### 3.2 Homework

Written homework will be assigned regularly. Please note the following for all assigned homework:

- Any submitted homework should be completed using complete sentences that clearly explains how you reached your solution or how the desired proof works.
- Mathematical notation should be used properly when needed to help with explanations.
- Unless otherwise stated, all homework assignments will be completed using *Sketchpad*, and may be submitted through the course webpage.
- All homework is due by 1:00pm on the date due. Homework submitted after that time is considered late, and may be penalized or given no credit.
- Missing class is not an excuse for not turning in homework. If you know you will miss a class, be sure that arrangements are made to have homework submitted in a timely manner.

### 3.3 Exams

There will be two in-class exams as well as a final exam for this course. The exams will be on **Wednesday, September 30** and **Wednesday, November 4**. The final exam will be on **Monday, December 14 at 1:30pm**.

Details on the format of the exams will be provided at a later date.

### 3.4 Individual Research project

Everyone in the class will have an opportunity to study one particular aspect of geometry and report on their findings to the rest of the class. Near the midterm, you will choose a topic for research. For your research project, you will be asked to provide a research prospectus, an annotated reference list, two short reports on the topic of your research, a full paper (with revisions) on the outcomes of your research, and a short oral presentation on your subject.

Details on the research project will be provided later in the semester.

### 3.5 Portfolios

At the midterm (Monday, October 5) and at the end of the course (Wednesday, December 9), you will submit a portfolio showing your progress towards meeting the course goals. The portfolios will include:

- A reflection on your progress or achievements in the course.
- Original and revised samples of your work on activities and homework problems, demonstrating your improvement on past work.
- Additional exercises showing your mastery of the topics in the course.

Details on the portfolios will be provided in a separate handout.

## 4 Course Format

### 4.1 Outline of course topics

Below is a preliminary plan for the course. Note that this is subject to change based on our progress through the semester:

| Topic  | Resource             | Duration |
|--|----------------------|----------|
| Introduction to <i>Sketchpad</i> and course format | Chapter 1            | 3 days   |
| Triangle geometry                                  | Chapter 2            | 4 days   |
| Geometry of the circle                             | Chapter 3            | 4 days   |
| First midterm: <i>Wednesday, September 30</i>      | Chapters 1–3         | In class |
| Trigonometry and analytic geometry                 | Appendix A/Chapter 4 | 4 days   |
| Non-euclidean geometries                           | Chapter 5            | 3 days   |
| Hyperbolic and spherical geometry                  | Chapter 9            | 5 days   |
| Second midterm: <i>Wednesday, November 4</i>       | Chapters 1–5, 9      | In class |
| Transformations of the plane                       | Chapter 6            | 3 days   |
| Symmetry and tilings                               | Chapter 8            | 4 days   |
| Solid geometry and <i>Sketchup</i>                 | Handouts             | 4 days   |
| Student presentations                              | Handouts             | 4 days   |

## 4.2 Chapter-by-chapter outline

For each chapter, our work will proceed roughly as follows:

1. At home, you will read the relevant section of the text while working on questions from the “Activities” section of the chapter. *This work is expected to be done on your own.*
2. In class, we will discuss the readings and share solutions to the activities. Work on the chapter will continue in small groups.
3. You will be given homework problems to complete at home. You may work with fellow students in completing homework problems, but *the final solution must be written in your own words.*

A weekly agenda will be provided outlining the relevant readings, exercises, and discussion material.

## 5 Attendance and other Issues

### 5.1 Attendance

There are 43 class meetings this semester. While I expect you to attend every session, unavoidable situations will arise during the semester. Thus I will allow each student up to 4 absences, excused or unexcused. Absences beyond this will incur a 10% penalty to your Class Engagement score (roughly 1.5% of your course average). This penalty will be applied regardless of the reason for missing class.

It is your responsibility to catch up on any material missed due to absence. If you know that you will miss class on any given day, it is your responsibility to make arrangements for any work that is due that day (homework submissions, rescheduling presentations, etc.).

### 5.2 Academic Honesty

Everyone is expected to adhere to Moravian College’s Academic Honesty policy, as described in pages 33–38 of the Student Handbook. Two issues of particular note for this course are:

- **Readings and *Sketchpad* activities:** The activities used for engaging with the reading are meant to be done on your own. Please wait until we get together in class before discussing the activity problems with your classmates.
- **Homework:** You are welcome and encouraged to work on homework problems with classmates. However, the final write-up for the homework problems should be your own, and you are expected to create your own *Sketchpad* document for each assignment.
- **Use of outside resources:** This is a course for discovering geometry, not chasing down geometric facts. Unless specifically told otherwise, you are not to use other textbooks or internet resources in completing your homework.

### 5.3 Final reminders and disclaimers

- If you have individual needs or concerns (e.g.: ADA requirements, special considerations for missing class or arriving late, etc.), please see me as soon as possible to inform me of those issues.
- While you are not required to purchase *Sketchpad*, please remember that it will be an integral part of both in-class work and homework. All on-campus computers should have *Sketchpad* installed.
- *Visit my office!* I would love to help address individual issues or answer questions you have about the course. I would love to hear feedback about which aspects of the course are or are not going well.

You can also communicate with me via e-mail (hartshorn@math.moravian.edu). Drop me a line and let me know how the course is going.

- This syllabus is subject to change through the semester. The most recent version of the syllabus can be found at <http://www.math.moravian.edu/hartshorn/math340/>.
- Final determination of your course grade is subject to my discretion as professor of the course.