

Geometry

MATH 245 Spring Term 2018
MWF 11:00-11:50 Hirt 213

Professor: Patrick M. Kelly

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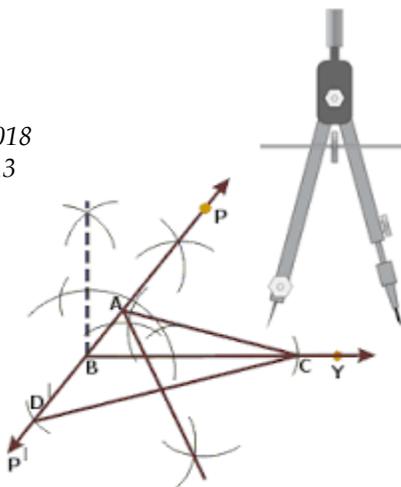
Office Hours: Mondays: 12:30-2:00

Tuesdays: 9:00-10:30

Wednesdays: 12:30-2:00

Fridays: 12:30-2:00

Meeting times by appointment may be arranged as well.



Other Information:

This course is registered on *Blackboard*, an academic software package set up on the Mercyhurst intranet. You may access information about the course via *Blackboard* at any time from any computer. You should get in the habit of doing so frequently.

Also, please check your information on *Blackboard*. Make sure the e-mail address listed for you is the account that you primarily use.

Textbook:

Modern Geometries (5th edition) by James R. Smart

Needs:

A compass and a straightedge

Course Description:

An objective of this course is to introduce the student to the rich variety of geometric topics, beyond those studied at the high school level. This should prove valuable to the mathematics student in broadening his/her horizons and specifically to the prospective high school teacher by increasing his/her knowledge in the area of geometry. Members of this class will study Euclidean geometry in much more detail than in a typical high school geometry course, and there will also be investigations into Non-Euclidean and finite geometries.

Another objective of the course is to help the student develop the skills of logical reasoning, specifically in the use of the axiomatic method and careful presentation of proof.

One or both of *Geometer's Sketchpad* and *Geogebra*, dynamic geometry software packages, will be used in the context of investigating and exploring (not proving!) geometric concepts discussed in the course.

Grading:

Your final course grade will be compiled from just a few factors. Assignments, a research paper, a midterm exam, and the final exam will be considered for the course-grade calculation.

The point distribution amongst these factors will be as follows:

| | |
|--|-------------------|
| Assignments, points per assignment will vary | 140 points |
| “Who’s the Man?” Paper, 20 points | 20 points |
| Three exams, 100 points each | 300 points |
| Final Exam, 140 points | <u>140 points</u> |
| | Total: 600 points |

Course grades will be determined using the following scale:

| | | | |
|---|-----------------------------|----|-----------------------------|
| A | 537-600 points (89.5-100%) | B+ | 519-536 points (86.5-89.3%) |
| B | 477-518 points (79.5-86.3%) | C+ | 459-476 points (76.5-79.3%) |
| C | 417-458 points (69.5-76.3%) | D | 357-416 points (59.5-69.3%) |
| F | 0-356 points (0-59.3%) | | |

Assignments:

Frequently throughout the term you will be given assignments to complete. Some of these assignments will involve the use of the computer, utilizing the *Geogebra* software. Some of these assignments may be given in class, to be completed during that class session, and may not be announced ahead of time.

“Who’s the Man?” Paper:

This paper will involve researching a geometer of your choosing and writing a little bit of a biography. As part of your report, you will present your findings to the rest of us. This will involve one or more 5-10 minute presentations in front of the class, in which you’ll summarize your paper. An added element to these presentations is that of a “Who’s the Man?” contest. At the end of each day of presentations, one or more of the mathematicians will be “voted off” by your peers. The one historical figure who remains at the end of the competition will be “The Man.” What’s more, the mathematician will get his/her picture immortalized on our campus, with your name on a plaque.

More details on the requirements for this paper will be provided later. You may wish to begin considering which mathematician you will write your paper on early in the term, though. Your choice will need to be cleared by me (so that there will be no duplicates).

Services:

In keeping with college policy, any student with a disability who needs academic accommodations must call Learning Differences at 824-3017 or stop by Old Main room 314, to arrange a confidential appointment with the Disability Services Director during the first week of classes.

(Tentative) Course Schedule:

| Day | Section | Material |
|-----------------|---------------------------------------|---|
| Monday, 1/15 | <i>MLK Day—no classes at our time</i> | |
| Wednesday, 1/17 | §1.3; §1.4 | Introduction to Finite Geometries; Four-Line and Four-Point Geometries |
| Friday, 1/19 | §1.5 | Finite Geometries of Fano and Young |
| Monday, 1/22 | | <i>Geogebra</i> |
| Wed., 1/24 | §1.6 | Finite Geometries of Pappus and Desargues |
| Friday, 1/26 | Chp. 1 | Sets of Axioms and Finite Geometries |
| Monday, 1/29 | §5.1 | The Philosophy of Constructions |
| Wednesday, 1/31 | §5.2 | Constructible Numbers |
| Friday, 2/2 | §5.2 | <i>Geogebra</i> |
| Monday, 2/5 | §4.1 | Fundamental Concepts and Theorems |
| Wednesday, 2/7 | §4.2 | Some Theorems Leading to Modern Synthetic Geometry |
| Friday, 2/9 | §4.2 | Some Theorems Leading to Modern Synthetic Geometry |
| Monday, 2/12 | §4.2 | <i>Geogebra</i> |
| Wednesday, 2/14 | §4.3 | The Nine-Point Circle and Early Nineteenth-Century Synthetic Geometry |
| Friday, 2/16 | §4.3 | The Nine-Point Circle and Early Nineteenth-Century Synthetic Geometry |
| Monday, 2/19 | §4.3 | <i>Geogebra</i> |
| Wed., 2/21 | §5.3 | Constructions in Advanced Euclidean Geometry |
| Friday, 2/23 | §5.3 | Constructions in Advanced Euclidean Geometry |
| Monday, 2/26 | §5.3 | <i>Geogebra</i> |
| Wednesday, 2/28 | §5.3 | <i>Geogebra</i> |
| Friday, 3/2 | §5.3 | <i>Geogebra</i> |
| Monday, 3/5 | <i>Mid-Semester Break—no classes!</i> | |
| Wednesday, 3/7 | | |
| Friday, 3/9 | | |
| Monday, 3/12 | §5.4 | Constructions and Impossibility Proofs |
| Wednesday, 3/14 | §4.4 | Isogonal Conjugates |
| Friday, 3/16 | §4.5 | Recent Synthetic Geometry of the Triangle |
| Mon., 3/19 | §4.6 | Golden Ratio, Tessellations, Packing Problems, and Pick's Theorem |
| Wednesday, 3/21 | §4.6 | Golden Ratio, Tessellations, Packing Problems, and Pick's Theorem |
| Friday, 3/23 | §4.6 | <i>Geogebra</i> |
| Monday, 3/26 | Chp. 2 | Geometric Transformations |
| Wednesday, 3/28 | Chp. 2 | Geometric Transformations |
| Friday, 3/30 | <i>Easter Break—no classes!</i> | |
| Monday, 4/2 | <i>Easter Break—no classes!</i> | |

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| Wednesday, 4/4 | Chp. 2 | Geometric Transformations |
| Friday, 4/6 | Chp. 7 | Projective Geometry |
| Monday, 4/9 | Chp. 7 | Projective Geometry |
| Wednesday, 4/11 | Chp. 7 | Projective Geometry |
| Friday, 4/13 | §9.1 | Foundations of Euclidean and Non-Euclidean Geometries |
| Monday, 4/16 | §9.2 | Introduction to Hyperbolic Geometry |
| Wednesday, 4/18 | §9.3 | Ideal Points and Omega Triangles |
| Friday, 4/20 | §9.3 | Ideal Points and Omega Triangles |
| Monday, 4/23 | §9.4 | Quadrilaterals and Triangles |
| Wednesday, 4/25 | §9.4 | Quadrilaterals and Triangles |
| Friday, 4/27 | §9.7 | Elliptic Geometry |
| Monday, 4/30 | §9.7 | Elliptic Geometry |
| Wednesday, 5/2 | §9.8 | Consistency; Other Modern Geometries |
| Friday, 5/4 | §9.8 | Consistency; Other Modern Geometries |
| Fri., 5/11 at 10:30 | <i>Final Exam</i> | |