

Math 1290

Topics in Geometry

SPRING 2016

Syllabus

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About the course

This is an undergraduate course in Geometry. Its main focus is on the classical Euclidean plane geometry and solid geometry, including ruler and compass constructions, geometry of triangles and circles, relative positions of bodies, symmetries and homotheties. It will also include some discussion of spherical geometry, non-Euclidean geometry, projective geometry and other related topics. A number of exercises of different level of difficulty will strengthen your problem-solving abilities and geometrical intuition.

Prerequisites

Introduction to Theoretical Math (Math 0413).

Text

You will not need to purchase any textbooks. During the semester we will be using several free on-line textbooks and other resources. The links will be posted by the instructor throughout the semester, as appropriate.

Instruments

You must bring a **ruler** and **compass** to every class.

Schedule

The precise schedule and the list of problems will be announced in class and posted on the web. **Quizzes** will be given during the lecture time; the dates of the upcoming quizzes will be announced in class in advance. One **Midterm Exam** will be given during the lecture time; the date will be announced in class in advance and posted on the web. As a **Final Project**, at the end of the semester each student will make a presentation on a topic related to the course. The topic will be chosen in consultation with the instructor.

Grades

Your course grade will be determined as follows:

- Midterm exam 30%
- Final project 30%
- Quizzes, class participation, collaboration problems and written assignments 40%

Disability Resource Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services, 140 William Pitt Union (412) 624-7890 as early as possible in the term. See <http://www.studentaffairs.pitt.edu/drsabout>

Academic Integrity

Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity will incur a minimum sanction of a zero score for the quiz, exam or paper in question. Additional sanctions may be imposed, depending on the severity of the infraction.

On homework, you may work with other students or use library resources, but each student must write up his or her solutions independently. Copying solutions from other students will be considered cheating, and handled accordingly.

Math 1290 Spring 2016 Topics

General Plane Geometry

1. Discussion of axioms
2. Angles and distances. Construction with ruler and compass.
3. Parallel lines. Thales' Intercept theorem
4. Congruent and similar triangles
5. Pythagorean Theorem and scalar product.
6. Ceva Theorem.
7. Projections. Menelaus Theorem
8. Some linear transformations of the plane: symmetries and homotheties

Geometry of Triangles and Circles

9. Inscribed Angle Theorem, its generalizations
10. Power of a Point theorem
11. Four centers of a triangle. Inscribed and circumscribed circles.
12. Characterization of Isosceles triangles.
13. Euler's theorem.
14. The Nine-Point Circle.
15. Laws of Sine and Cosine.
16. Different formulas for the area of a triangle.
17. Trapezoids and other geometric figures.

Space Geometry

18. Lines and planes.
19. Pyramids and cones.
20. Spheres, their intersections.
21. Tetrahedra. Barycentric coordinates.
22. Convex polyhedra and other convex bodies. Convex closure.

Other Geometries and Miscellaneous Related Topics

23. Projective geometry: line, plane and space; higher dimensions.
24. Spherical Geometry and non-Euclidean Geometry.
25. Minkowski Lemma.*
26. Finite Projective Planes.*
27. Manifolds, metric spaces, topological spaces.*
28. Impossibility of classical compass-ruler constructions.*
29. Any two polygons with equal areas can be cut into congruent pieces.*