Geometry for teachers 2
Course Outline (updated)
Course 7412075 Section 01, Fall 2019
Mondays 10:00 - 11:50, Tuesdays 10:00 - 10:50, Room: E1-1 #140
Chungbuk National University

Instructor: Dr. Byungdo Park

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Office hours: Mondays 16:00–17:00 at E1-1 #110 or by appointment.

Class webpage: Announcements, homework, exam schedules and other relevant information will be posted on the following webpage: http://newton.kias.re.kr/~byungdo/teaching/f2019_geom2.html which is also accessible via instructor's webpage: http://newton.kias.re.kr/~byungdo/

Textbook:

- Claire F. Adler, *Modern Geometry : an integrated first course*, 2nd Edition (1967), McGraw-Hill, ISBN-13: 9780070004214

References:

- Marvin J. Greenberg, *Euclidean and Non-Euclidean Geometries: Development and History*, 4th st Edition (2007), W. H. Freeman, ISBN-13: 9780716799481
- Robin Hartshone, *Geometry: Euclid and Beyond* (Undergraduate Texts in Mathematics), 1st Edition (2005), Springer New York, ISBN-13: 9780387986500
- Shoshichi Kobayashi, *From Euclid geometry to modern geometry*, translated in Korean by D. Won (1999), Cheongmoongak, ISBN-10: 8970881816

Course description: Geometry for teachers 2 treats classical topics in Euclidean, non-Euclidean, and projective geometry by tracing through the history of development of geometry. The subject is also called "modern geometry" because the subject was in its peak during the modern literary era. We shall begin with basics from set theory and logic, followed by axiomatic systems in geometry, naturally leading to the development of non-Euclidean geometry. After that, we change the gear toward projective geometry and study its axiomatic system and basic theorems. This course will provide necessary theoretical backgrounds for mathematics teachers in secondary education for teaching geometry, and connections to secondary school curricula will be empasized.

Course objectives: At the end of the course students should be able to:

- Understand Euclidean axioms and prove basic theorems in Euclidean geometry
- Understand logical defects of Euclidean axiomatic system and explain why Hilbert's axiomatic system has emerged.

- Understand models for hyperbolic geometry
- Explain how hyperbolic and elliptic geometries are different from Euclidean geometry.
- Understand axioms of projective geometry and prove basic theorems in projective geometry
- Have a firm grasp of underpinning knowledge from Euclidean, non-Euclidean, and projective geometry in connection to the curricula in secondary mathematics education.

Details on problem solving: Problems arising in this course will be requiring proofs and calculations based on the mathematical discourse in class. Through dialogues and discussions during each lecture as well as the instructor's office hours, the instructor will guide students approaching to problems that they will have to address.

Details on class proceeding: The instructor will give lectures on the material following the weekly lesson plan and assign weekly homework problems. Some of problems will be assigned as a team project, for which each student has to be belong to one of groups and collaboratively discuss and work on those problems. Each group has to give an in-class presentation on team project problems at least once. We shall also watch several videos overarching the subject we study.

Grading policies: 35% from midterm exam, 35% from final exam, 10% from homework, 10% from group presentation, and 10% from attendance.

Homework policies: A list of homework problems will be posted on the class webpage roughly in weekly basis. Late homework will be accepted. The instructor will assign as many homework problems as it is needed to master the subject. The instructor will scan through each submitted homework and assign a score 2, 1, or 0 depending on quality of work. The homework score for the total grade will be calculated based on the following formula: $(\sum_{i=1}^{h} h_i \cdot n_i)/(\sum_{i=1}^{h} 2 \cdot n_i)$, where h is total number of homework assignment, h_i is the score for the i^{th} homework score, n_i is the number of problems in the i^{th} homework.

Attendance policies: Attendance data will be collected in every class meeting and will be used for determining your final grade. Up to 3 total number of absence there is no penalty. After that, you lose 1% of total score for an absence to each 50-minute long class meeting with a doubled loss on each of the seventh to the ninth absence, with a maximum total loss 10% from your total score. If you have permissible reasons for your absence (for example illness), you won't get any penalty as long as you can justify by documenting (for example, a photo of your doctor's prescription of medicines or a detailed hospital receipt suffices for an illness cause).

Assessment of group presentation: All group members in each group will receive the same score, with an exception that the student who gave the presentation will receive an additional 2% of the total score subject to the same maximum. For example, if a group of student has obtained 9 out of 10% from the group presentation, the speaker will get full 10%.

Assessment of learning: The assessment will be primarily done by the abovementioned grading policy. Nonetheless, the instructor will also take into account students' devotions and efforts for

this course as well as their enthusiasm as a future educator so that those qualitative elements are not going to be neglected.

Weekly lesson plan:

Week 1: 1. Symbolic logic and set theory preliminaries

Week 2: 1. Symbolic logic and set theory preliminaries

Week 3: 2. Axiomatic systems

Week 4: 2. Axiomatic systems

Week 5: 3. Non-Euclidean geometry

Week 6: 3. Non-Euclidean geometry

Week 7: 4. Euclidean forerunners of projective geometry

Week 8: Team project presentation and midterm exam

Week 9: 4. Euclidean forerunners of projective geometry

Week 10: 5. The formal approach to projective geometry

Week 11: 5. The formal approach to projective geometry

Week 12: 6. Projective theory of harmonic elements. Additional axioms.

Week 13: 7. Perspectivities, projectivities, and the projective theory of conics

Week 14: 7. Perspectivities, projectivities, and the projective theory of conics

Week 15: Make-up classes if nessary, team project presentation, and final exam.

Week 16: Make-up classes if nessary, team project presentation, and final exam.

Accommodating disabilities in learning and assessment: The instructor is committed to providing access to all students. If you need accommodation in classroom or in assessment, you are encouraged to set up an appointment with the instructor at your soonest availability so that we can figure out the best way to acoommodate you. Possible accommodations include, but not limited to, provision of materials from lectures, permission to hire an assistant for taking notes, audio-recording lectures, and aid/assistant devices, extension of due dates for assignments, alternative assessment for in-class presentations, extension of exam hours, and provision of an accommodating exam locations and exam sheets.

Academic integrity: It is expected that you will complete all exams without giving or receiving help from anyone. The minimum penalty for giving or receiving help on an exam is a grade of 0 on that test. Electronic devices are not allowed in any in-class exam. You may talk to other students about the homework but you must then complete the homework yourself. If your homework is

identical to someone else's in the class, you will be summoned to explain your solution in front of the instructor. A failure in justifying your solution would lead score 0 to that homework. The abovementioned violation of academic integrity can be a subject of filing a report in accordance with the university policy.