Geometry for teachers I
Course Outline
Course 7412074 Section 01, Spring 2020
Mondays 15:00 - 16:50, Thursdays 15:00 - 15:50, Room: E1-2 #306
Chungbuk National University

Instructor: Dr. Byungdo Park

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Office hours: Tuesdays 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: https://byungdo.github.io/teaching/s2020_geom1.html which is also accessible via instructor's webpage: https://byungdo.github.io/

Textbook:

- 이성헌, *해석기하학*, 1963, 진명문화사, ISBN-13: 9788973390151.

References:

- 이선홍, *해석기하학*, 초판(2019), 교우사, ISBN-13: 9791125103035
- George A. Jennings, *Modern Geometry with Applications* (Universitext), 2nd Edition (1997), Springer-Verlag Berlin, ISBN-13: 9780387942223

Prerequisites: None. If you have learned "Geometry and Vectors" subject in high school, that will help.

Course description: Among many ways to study Euclidean geometry, there are synthetic method and algebraic method. The latter is analytic geometry wherein we study properties of geometric figures by using coordinate systems to represent them in equations. This course is a theoretical underpinning of geometry in secondary school mathematics curricula concerning coordinate systems, coordinate transformations, lines, angles, proportions, circles, conic sections, quadrics and their properties.

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

- Express various geometric figures treated in Euclidean geometry in coordinates and equations.
- Study various properties of planar and spatial geometric figures using coordinates.
- Shape sophisticated knowledge in analytic geometry to teach it as a secondary school mathematics teacher.

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.

Grading policies: 35% from midterm exam, 35% from final exam, 15% from homework, 5% 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. In a class meeting consisting of two-consecutive class hours, there will be only one attendance call, but if you miss it, it will be recorded as a 2-hour absence. You will get a grade F if you have missed more than 25% of class meeting hours. Up to 5 hours 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 maximum total loss 10% from your total score. If you have permissible reasons for your absence in accordance with the Regulation on Academic Management of the CBNU Article 52(1) (충북대학교 학사운영규정 제52조(공결승인) 제1항), you will need to contact the Department Assistant to follow the procedure for getting an approval on your absence bringing proper documentation as proof. That said, you have to fill out a form and submit it along with appropriate proofs before the absence or after seven days of the date of absence.

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 1% of the total score subject to the same maximum. For example, if a group of student has obtained 4 out of 5% from the group presentation, the speaker will get full 5%.

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: Length of a line segment, coordinates on a line, orthogonal coordinates, distance between two points, division points of a line segment [Chapter 1] Sections 1, 2, 3, 4, 5.

Week 2: Size of an angle, Projection theorem 1, curves and equations, coordinate transformations [Chapter 1] Sections 6, 7, 8, 9.

Week 3: Curves in symmetry, polar coordinates, relationships between the orthogonal and polar coordinate systems, curves and polar equations. [Chapter 1] Sections 10, 11, 12, 13.

Week 4: Equations of a straight line, first order equation, angles between two straight lines. [Chapter 2] Sections 15, 16, 17, 18

Week 5: Intersection of two straight lines, parametric representation of a straight line, positive and negative regions of ax+by+c [Chapter 2] Sections 19, 20, 21, 22

Week 6: The distance from a point to a straight line, polar equation of a straight line, second-order homogeneous equations, Oblique axes formula [Chapter 2] Sections 23, 24, 25, 26.

Week 7: An Equation of a circle, tangent lines, Power of a point to a circle, leeway for problem sessions, team project presentations. [Chapter 3] Sections 28, 29, 30, 31

Week 8: Midterm exam

Week 9: A circle passing intersections of two circles, pole and polar, parametric equations of circles, polar equation of a circle [Chapter 3] Sections 32, 33, 34, 35.

Week 10: Ellipses, hyperbolas, parabolas [Chapter 4] Sections 36, 37, 38

Week 11: The second definition of an ellipse and a hyperbola, parametric equations of conic sections [Chapter 4] Sections 39, 40.

Week 12: Polar equation of conic sections, tangent lines, intersection between a conic section and a straight line. [Chapter 4] Sections 41, 42, 43.

Week 13: Pole, polar, and focal radius theorem. [Chapter 4] Sections 44, 45.

Week 14: Center of quadrics, quadrics with a unique center, classification of quadrics [Chapter 5] Sections 51, 52, 53.

Week 15: Leeway for problem sessions, team project presentations, 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.

Disclaimer: Lectures in this course will be given in Korean, but most of written materials will be in English. For example, the course syllabus, most of boardwork, exam problems, homework, solutions to exams, course webpage, announcements, but not limited to those. English sentences to be used in this course should be understandable enough based on the regular Korean public high school curriculum. Nonetheless if your English skill is not competent enough to follow this course or understanding announcements, it is your responsibility to ask the instructor to also provide an explanation in Korean. The instructor will take those questions under an attitude of helping students' understanding, but taking into account the contents of each question, he may reject the question or advise the questioner to visit him during his office hour to ask the question about Korean translation.

사전고지: 본 강좌에서 강의는 한국어로 이루어집니다만, 글의 경우 대부분 영어가 사용될 것입니다. 수업계획서, 칠판 판서의 대부분, 시험문제, 숙제, 시험문제에 대한 풀이, 강좌의 웹페이지, 공지사항 등이 예가 될 수 있으며, 이상 열거한 것들로 한정되지 않습니다. 본 강좌에서 사용될 영어 문장들은 한국의 공립 고등학교 정규 교과과정을 기초로 할 때 충분히 이해될 수 있어야 합니다만, 만약 수강생 본인의 영어실력이 본 강좌를 따라오거나 공지사항을 이해하기에 충분치 못하다면, 담당교수에게 한국어로 추가 설명을 요청하는 것은 학생 본인의 몫입니다. 담당 교수는 학생들의 이해를 도우려는 자세로 질문을 받을 것이지만, 질문의 내용에 따라 답을 하지 아니할 수도 있고, 면담시간에 개별 방문하여 질문하도록 안내할 수도 있습니다.

Updates regarding the new Corona Virus (COVID-19) outbreak: Following the decision of the university center (교무과-2459, 2020.02.12.), the first day of class has been deferred to March 16th. Also following another decision of the university (학사지원과-2288, 2020.03.05.), we shall not meet during the period March 16th to 28th and make-up those 6-contact hours by an "Assignment-based Class (과제물 활용수업)." Details below. Please stay tuned for any further updates which will be posted on the course webpage.

Plan for Assignment-based Class (과제물 활용수업): Here is how it works.

- Our **platform** will be the class webpage
  `https://byungdo.github.io/teaching/s2020_geom1.html`
  and you must visit this online platform (webpage) to regularly check any update.
- On the platform, there will be a section "Assignment-based Class" wherein you will be able to find weekly **assignment**. It will be of the form of downloading reading materials (if you

do not have a textbook yet) from CBNU e-Campus (blackboard), learn the material while getting necessary help from the lecture note (will be available on the platform) and completing assigned homework problems in the "Homework" section on the platform.

- You must **submit** your work on each weekly assignment by (1) making it into a PDF and attaching to an email to `byungdo@g.cbnu.ac.kr` (2) dropping it off to the instructor's mailbox, or (3) bringing it in-person when we meet at the classroom.
- You will receive **feedback** on your submitted assignment.
- **Important:** Your attendance will be counted based on your submitted assignment. Not handing-in an assignment will not only affect your homework score but also your attendance record.
- If you completed the assignment but do not want to submit your homework for any reason, you must still submit an assignment on a sheet with your name and CBNU ID written on it for each class hour. For example, if you do not want to submit your homework for first two weeks, you must still submit six sheets of papers each of which contains your name, CBNU ID, and a claim of your attendance to a class hour.