

Geometry for teachers I
Course Outline
Course 7412074 Section 01, Spring 2021
Tuesdays 14:00 - 15:50, Wednesdays 14:00 - 14:50, Room: E1-2 #306
Chungbuk National University

Instructor: Dr. Byungdo Park

Email: byungdo@chungbuk.ac.kr

Office hours: By appointment.

Class webpage: Announcements, homework, exam schedules and other relevant information will be posted on the following webpage: https://byungdo.github.io/teaching/s2021_geom1.html which is also accessible via instructor's webpage: <https://byungdo.github.io/>

Textbook:

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

References:

- C. G. Gibson, *Elementary Euclidean Geometry: An Undergraduate Introduction* 1st Edition (2004), Cambridge University Press, ISBN-13: 9780521834483
- 이선흥, *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.
- Create an online learning contents such as YouTube videos for sharing knowledge with a broader audience.

- 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. He will also require you to participate in a Project-Based Learning to strengthen your competence as a teacher also in online, remote setup.

Grading policies: 60% from final exam, 17% from homework, 15% from PBL project, and 8% from attendance. Absolute evaluation [A: 100–90 points, B: 89.99–80 points, C: 79.99–70 points, D: 69.99–60 points, F: less than 60 points] with curving. Here the curving means a horizontal shift of the bell-shaped curve of %-score distribution in either directions using a rational constant which is determined at the discretion of the instructor. Grading policies in the academic integrity policies are applied in higher priority than the above grading policies.

Homework policies: A list of homework problems will be posted on the class webpage roughly in weekly basis. Late homework will NOT 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.

Assessment of Project-Based Learning (PBL): You must record a 20-minute long video lecture about one of the following:

- A sample lecture on any topic listed on the syllabus of this course.
- A sample lecture on a concept from secondary school geometry curricular.

You should submit the video in a form of a YouTube video link by choosing the sharing option “unlisted(일부공개).” Your video will be disclosed to your classmates in this course as a part of a YouTube playlist. Registering to this course would mean that you accept sharing your video lecture with your classmates via YouTube. You may turn your video into “private” or even delete the video after your letter grade for this course is assigned. The assessment will be done as follows: 3/3 all in all good work. 2/3 lacking important examples, theorem, proofs or there are significant mathematical errors. 1/3 overall poor contents of the material. 0/3 no hand-in.

Attendance policies: Attendance data will be collected in every class meeting and will be used for determining your final grade. You will get a grade F if you have missed more than 25% of class meeting hours. Up to 3 hour of absence there is no penalty on your score. After that, you lose 1% of total score for an absence to each 50-minute long class meeting, with a maximum total loss

8% 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 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. -- *Online lectures using recorded videos*

Week 2: Size of an angle, Projection theorem 1, curves and equations, coordinate transformations [Chapter 1] Sections 6, 7, 8, 9. -- *Online lectures using recorded videos*

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. -- *Online lectures using recorded videos*

Week 4: Equations of a straight line, first order equation, angles between two straight lines. [Chapter 2] Sections 15, 16, 17, 18 -- *Online lectures using recorded videos*

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 -- *Online lectures using recorded videos*

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. -- *Online lectures using recorded videos*

Week 7: An Equation of a circle, tangent lines, Power of a point to a circle, leeway for problem sessions, PBL presentations. [Chapter 3] Sections 28, 29, 30, 31 -- *Online lectures using recorded videos*

Week 8: 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. -- *Online lectures using recorded videos*

Week 9: Ellipses, hyperbolas, parabolas [Chapter 4] Sections 36, 37, 38 -- *Online lectures using recorded videos*

Week 10: The second definition of an ellipse and a hyperbola, parametric equations of conic sections [Chapter 4] Sections 39, 40. – *Online lectures using recorded videos*

Week 11: Polar equation of conic sections, tangent lines, intersection between a conic section and a straight line. [Chapter 4] Sections 41, 42, 43. – *Online lectures using recorded videos*

Week 12: Pole, polar, and focal radius theorem. [Chapter 4] Sections 44, 45. – *Online lectures using recorded videos*

Week 13: Center of quadrics, quadrics with a unique center, classification of quadrics [Chapter 5] Sections 51, 52, 53. – *Online lectures using recorded videos*

Week 14: PBL presentations. – *Online lectures using recorded videos*

Week 15: Leeway, final exam – *In-class final exam. Online lectures using recorded videos*

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 accommodate 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. 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. The grader will trust students and will not apply any prejudice. However, if the grader has found an evidence that you have violated those policies, the grader reserves the right to investigate by summoning you to come in to his office, reproduce and explain your own solutions in front of the chalkboard. If you cannot provide a coherent and consistent explanation to your own solution to a problem or do not show up to the investigation without a documented official cause and/or an emergency, the minimum punishment would be score zero to that problem and lowering your letter grades by 2 letters. (For example, if you were to receive A+, it will become C+.) In addition to that, your other homework solutions may possibly be a subject of investigation. The investigation session will be both video and audio recorded, and the result of the investigation (including video/audio recording of the investigation) can be reported to the department or the university center. You **MUST** drop this course if you cannot comply with this policy. There is a separate set of policies on the google form for attendance collection which you also have to comply.

Disclaimer: (1) All emails addressed to the instructor should have a title containing the course title, name, and a brief summary as well as a body starting with "Dear Professor Last name" and ending with "Sincerely, Your full name", which contains greetings, your name and department, a brief and clear purpose written politely. Any email deviating from this format will not be accepted and will be dismissed without any rejection reply. The corresponding disadvantages are solely and

entirely on the student.

(2) 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.

(3) This course has a deadline for attendance claims and homework assignments. Any attendance claim and assignments that are past due will not be accepted.

- Attendance: Every Saturday 23:59 of the week that the video belongs.
- Assignments: Follows the deadline posted on the course webpage for each assignment. (Only email submission will be accepted, and no hard copies will be accepted.)

사전고지: (1) 담당교수에게 보내지는 모든 이메일의 제목에는 과목명, 신원, 요지가 포함되어 있어야 하며, 본문은 반드시 “OOO교수님께”로 시작하여 인사, 신원, 용건을 간단 명료하고 예의바르게 기술한 후 “OOO올림” 또는 “OOO드림”으로 끝나야 합니다. 이 형식에 어긋난 이메일은 접수하지 않으며, 반려회신 없이 종결합니다. 이에 따른 불이익은 전적으로 학생의 단독 책임입니다.

(2) 본 강좌에서 강의는 한국어로 이루어집니다만, 글의 경우 대부분 영어가 사용될 것입니다. 수업 계획서, 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.

(3) 본 온라인강좌는 출석근거 및 과제물의 제출시한이 있습니다. 시한이 지난 출석인정신청 및 과제물은 접수하지 않습니다.

- 출석: 해당차시가 속한 주의 토요일 23:59.
- 과제물: 과제물별로 강좌 웹페이지에 게시된 제출시한 (이메일로만 과제물을 접수하며 학과 사무실 메일박스투입 등 불인정.)

General plans and outlook concerning the new Corona virus (SARS-CoV-2) outbreak: Following the guideline of the university center “학사지원과-266(2021.01.11.) 코로나19 대응 2021 학년도 제1학기 수업 운영 계획 안내” as well as the likelihood of COVID-19 infection persisting throughout the period of this course, the instructor has planned this course to run as an entirely

remote, online course. Following future guidelines from the university center, this course may be turned into an off-line, classroom lectures in which case the instructor may update the syllabus accordingly. Details of decisions made will be updated below in this document.

Remote classes using Youtube videos: We shall have remote classes using **video-recorded lectures** posted on Youtube. The **platform** will be CBNU e-Campus (Blackboard) wherein you will be able to find Youtube video links. By the class meeting time of each day, you will be provided video recordings of lectures for that day's class meeting. Your attendance will be collected by using the online system implemented on e-Campus, while you will be provided a google form (Link) to submit in case the e-Campus system does not recognize your watching activities correctly. The instructor recommends watching youtube videos while logged into your own google account so that youtube can record your history in your account.

How to hand-in your homework in remote class setup? You can hand-in your quiz via email to byungdo@cbnu.ac.kr by scanning it or using smart phone scanner apps. You have to hand-in your homework by the due date. A late submission will not be accepted for any reasons.