SABANCI UNIVERSITY, Fall 2020 MATH 409/555 - Proofs from the Notebook

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Class Hours: M 14:40 – 15:30, R 8:40 – 10:30. Zoom links to lectures will be announced before each block of lectures.

Textbook: There is no textbook in this class. The lecture notes are the primary source of studying. Auxiliary reading is:

Tosun Terzioğlu, "Bir Analizcinin Defterinden Seçtikleri" (Nesin Yayınları, ikinci basım, 2014)

It is accessible as online resource through IC. However, the auxiliary reading is in Turkish. We will just follow the order of contents there.

Another source for auxiliary reading is:

Martin Aigner, Günter M. Ziegler, "Proofs from THE BOOK" (Springer, 2nd ed., 2013)

Learning outcomes: Upon completion of the course, student should be able to

- 1 Perceive relations between different branches of mathematics,
- 2 Understand advanced creative ideas involved in some of the fundamental results,
- 3 Develop proofs using ideas similar to those introduced in the course,
- 4 Have a sense of the history of mathematics,
- 5 Learn some of the major open problems in mathematics.

Topics: Although the topics seem to be diverse, the underlying theme will be "ingenious proofs". Some material will be familiar from your previous courses, such as MATH 102, but the main difference with MATH 102 will be that we will do proofs of all results we state. Knowledge of MATH 301 (Introduction to mathematical analysis) is essential.

1 - Pythegorean Theorem and Pythagorean triples,

2 - Prime numbers (we will just skim through this one, it is largely done in number theory),

- 3 Fermat's last theorem and Fermat's method of infinite descent,
- 4 Elementary Inequalities, infinite products and some applications,
- 5 Topology, Metric and Norm,
- 6 Power Series,
- 7 Stone-Weierstrass approximation theorem,
- 8 Banach fixed point theorem,

9 - Selected topics as time allows: fundamental theorem of algebra, the Riemann Zeta function, Brouwer fixed point theorem, geometry on the sphere.

Grading: Your grade exclusively depends on the below listed items. There will be no other extra-credit opportunities. There will be pre-class and post-class short assignments, as well as a midterm and a final.

I will also do one-on-one interviews with each of the students after the midterm, as a complement to the midterm.

Active participation in class will be expected and assessed, in the form of answering questions; or better, *asking* ingenious questions.

I may request one-on-one meetings to talk about your assignments, as well.

Midterm	20 %
Final	20 %
Pre-lecture homeworks	20 %
Post-lecture homeworks	20 %
Active participation in class	20 %

Exams: The date and time for the first midterm will be announced in due course.

The final may be given on any day between Jan 09-21, 2021. Student resources will determine the dates× for all final exams, and instructors cannot change it.

The exams will be online and proctored. You need a stable internet connection, a working camera and microphone.

Makeup Exams: Makeup exams will be planned for extraordinary circumstances. But, make every effort to the regular exams, and don't force your instructor to be creative.

Pre- and post-lecture homeworks: Pre-lecture assignments will be posted on SUCourse+ for the following week. They are due on Saturday of the week they are assigned, to be uploaded on SUCourse+. Late pre-lecture assignments will not be accepted.

Post-lecture homeworks will be assigned question by question in the lectures. They are due before the following Monday's class, to be uploaded onSUCourse+. Late post-lecture assignments may be accepted with a penalty, or may not be accepted at all.

Once again, the students are responsible to follow the assignments and announcements both in class, and on SUCourse+.

Two lowest scores in each bundle will be dropped.

Academic Integrity: All university policies on academic integrity apply to our course (more information on <u>https://www.sabanciuniv.edu/en/academic-integrity-statement</u>), and they will be enforced.

In particular, no form of cheating is welcome on the homeworks such as copying whole or part of each other's answers, submitting answers that are available online etc. Such behavior will be punished.

Extra Help: You are more than welcome to utilize the office hours. If you wish to read other textbooks, you had better ask your instructor or another mathematician first.