Department of Mathematics & Statistics
Concordia University

MATH 479 (MAST 661/837), Sec. A

Convex and Non-Linear Analysis

Fall 2018

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Office hours: Tuesdays, 10:00-11:30 a.m.

References: The course will consist of a selection of topics listed below for which you may consult the following sources:

i. *Convexity* by Roger Webster, Oxford (1994).
ii. *Convexity* by H. G. Eggleston, Cambridge (2009).
iii. *Selected Topics in Convex Geometry* by Maria Moszynska, Birkhauser (2006) (**Electronic resource of Concordia's library).**
iv. http://www.stanford.edu/~boyd/cvxbook/bv_cvxbook.pdf with errata. http://www.stanford.edu/~boyd/cvxbook/cvxbook_errata.html
v. *Convex bodies: The Brunn-Minkowski Theory* by Rolf Schneider, Encyclopedia of Mathematics and its Applications, 2nd Edition (2013).

Topics: Did you hear about the isoperimetric inequality? It is perhaps the most famous geometric inequality already known in Ancient Greece, but proved rigorously only in the 19th century.

Starting with classical inequalities for convex sets and functions, the course aims to present famous geometric inequalities like the Brunn-Minkowski inequality and its related functional form, Prekopa-Leindler, the Blaschke-Santaló inequality, the Urysohn inequality, as well as more modern ones such as the reverse isoperimetric inequality, and the Brascamp-Lieb inequality and its reverse form. In the process, we will touch upon log-convex functions, duality for sets and functions and, generally, extremum problems.

A tentative week-by-week schedule is listed below. Please note that this schedule is subject to change during the term to reflect the mathematical interest and the mathematical background of the audience. Expect thus to actively participate in the lectures.

Week	Topics
1 - 3	Convex sets; separation theorems; polar sets; John's Theorem.
4 - 7	Convex functions; criteria of convexity for differentiable functions; inequalities for convex functions; conjugate functions.
7 - 8	Midterm and/or Brunn and Brunn-Minkowski Theorems.
9 - 10	Steiner symmetrization; other symmetrizations; applications such as Grünbaum's Theorem.
11 - 13	Minkowski's Existence Theorem and related problems; mixed volumes and applications such as Minkowski's first inequality.

Grading: Homework (20%), Midterm (30%) and Final Exam (50%).
Graduate students will be required to do extra work for these evaluations.

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

The homework will be assigned approximately every two weeks during class and posted on Moodle. In case of a student's absence or late arrival, it is the student's responsibility to find the assignment and submit it on time. **No late assignments will be accepted.**

A midterm exam will be scheduled in class during the 7th or 8th week of classes. The exact date will be announced at the beginning of the term. **Please be aware that a missed test cannot be made up.**

Have a good term!

Plagiarism: Cases of plagiarism (including the assignments, the midterm test and the final exam) will be treated according to the University policy:

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: concordia.ca/students/academic-integrity." *[Undergraduate Calendar, Sec 17.10.2]*