



MATH 479 (MAST 661/MAST 837), Sec. A (Fall 2026)
Convex and Non-Linear Analysis

Instructor:	Dr. A. Stancu
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Office Hours:	_____
Important:	Students should get the above information from their instructor and from the course Moodle site. The instructor is the person to contact should there be any questions about the course.
Class Schedule:	Mondays and Wednesdays, 10:15-11:30.

Reading Week

Begins on Saturday, October 10 and ends on Friday, October 16, 2026. No classes that week.

References

The course will consist of a selection of topics listed on the next page for which you may consult the following sources (all e-books):

1. *Convex functions and their applications: a contemporary approach* by C. P. Niculescu and L.-E. Persson, Springer (2018) **E-link at Concordia's library.**
2. *Convex Optimization* by Boyd and Vanderberghe, Cambridge University Press (2004), available on Dr. Boyd's web page at Stanford University (check also the book's errata on the same web page for possible typos).
3. *Lectures in Convex Geometry* by D. Hug and W. Weil, Springer (2020) **E-link at Concordia's library.**
4. *Convex and discrete geometry* by Peter M. Gruber, Springer (2007) **E-link at Concordia's library.**

Summary

Starting with classical properties of convex sets and functions, the course aims to present several classical inequalities like the Brunn-Minkowski inequality and its related functional form, Prekopa-Leindler, the Blaschke-Santaló inequality, the Urysohn inequality, as well as more recent results 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. Finally, the course will cover some advanced topics (time permitting) and applications of convexity.

A tentative schedule is listed below. The schedule is subject to change during the term to adjust to the mathematical interest and background of the audience.

Week	Topics
1 - 3	Convex sets; separation theorems; polar sets; ellipsoids, John's Theorem.
3 - 5	Convex functions; criteria of convexity for differentiable functions; inequalities for convex functions; conjugate functions; the Brunn-Minkowski theorems.
-	Reading week
6 - 7	Polarity, duality and applications; symmetrizations and rearrangements of convex sets.
8	Discussions, problem solving, Q&A and Midterm
9 - 10	Loomis-Whitney, projections, and sections, center of mass, applications.
11 - 12	Selected topics in advanced convexity – final project launch

Grading

Homework (20%), Quizzes (10%), Midterm (40%), and Final project (30%).

The evaluations of undergraduate students will be different in content than the evaluations of graduate students.

The **homework** will be assigned approximately every two weeks during class and posted on Moodle. It is the student's responsibility to upload the assignment on Moodle on time. **No late assignments will be accepted. No submissions by email will be accepted either.**

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.

There will be three 10-minute **quizzes** during the term, and the two highest quiz scores will count toward the final grade.

A closed-book midterm exam will be held in class on Wednesday, November 4, 2026. Students who miss the midterm due to illness or another documented emergency will be required to

complete a make-up midterm outside of class within one week. **Valid documentation (e.g., a medical note) will be required to be eligible for the make-up midterm.**

Final Project: Students will be required to complete an independent study project on a topic of their choice as approved by the instructor, related to the course material, and submit it as a written report or in the form of an oral presentation. Specific steps, deadlines and instructions will be given during the semester.

Final Note

Active participation in class and continuous work on the course material throughout the term is important for success in this course. Read the course material and do the assignments on your own. By assuming a responsible behavior (see also the **Academic Integrity and the Academic Code of Conduct** below), you will also achieve a better understanding of the material.

Student Services

You may wish to access the many services available to you as a Concordia student. An overview of these resources can be found here: <https://www.concordia.ca/students/services.html>

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: <https://www.concordia.ca/conduct/academic-integrity.html>" [*Undergraduate Calendar, Sec 17.10.2*]

AI

The use of AI tools is not forbidden in this course. However, students are responsible for understanding the material and for being able to explain and justify their work independently. Whether in exams, homework assignments, projects, or any other course activity, students should be prepared to demonstrate their own understanding of the concepts and methods used.

Behaviour

All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the [Code of Rights and Responsibilities](#) which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in university activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

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Use of Concordia email

Your [Concordia email](#) is the official channel for all university communications, as required by the university's [Policy on Concordia email accounts for students and employees](#). Please use your Concordia email for all communication related to this course and check it regularly so you don't miss important information. [Learn more about how to access your Concordia email.](#)

As a student, you are expected to follow the email policy and to use your Concordia email in a respectful and responsible manner. The policy helps ensure that communication across the university is secure, reliable, and consistent.

Extraordinary circumstances

In the event of extraordinary circumstances and pursuant to the [Academic Regulations](#) the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.