MATH 461
Projects in Mathematical Modelling

Course Outline 2025W2

Computational methods for mathematical modelling. Numerical methods for partial differential equations, stochastic processes, and data-driven models. Includes student-directed projects on current research and applications.

Learning Goals

- Construct a mathematical model by applying the modelling process
- Approximate solutions, simulate processes and visualize data generated by a model
- Analyze a mathematical model to derive meaning and make predictions about a system
- Evaluate the validity of a mathematical model and its solutions
- Communicate analysis and results to a mathematical audience

Instructors

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Lectures

Day	*Time*	*Location*
Tuesday/Thursday	11am–12:30pm	LSK 121

- Many lectures are reserved for student work on modelling projects and instructor feedback

Important Dates

January 6	First class
February 16–20	Reading break (no classes)
April 9	Last class

- See the UBC Academic Calendar 2025/2026

Prerequisites

Either (a) MATH 360 or (b) one of MATH 210, CPSC 203, CPSC 210 and one of MATH 345, MATH 361. See the UBC Course Calendar.

Resources

- Math 360 notes
- Mathematical Python, by Patrick Walls
- SIAM Math modelling handbook

Assessments

Unit 0: Journal Article Summary	10%
Unit 1 Project	30%
Unit 2 Project	30%
Unit 3 Project	30%

Units

Topics

- *Journal article summary* [1 week]
- *Unit 1:* Ordinary differential equations [4 weeks]
- *Unit 2:* Probability and Stochastic differential equations [4 weeks]
- *Unit 3:* Partial differential equations *(tentative)* [4 weeks]

Project units

- Each unit will have 3 lectures, followed by 5 classes
- Students formulate modelling problems, construct and analyze mathematical models, and present results in a technical document written in LaTeX, similar to an article published in a peer-reviewed journal in applied mathematics.

Groupwork

- Journal Article Summary is completed independently
- Projects are completed in groups of 2 or 3 students
- Some units you have the option to choose your group, some you will be required to work with different people. You always have the option of being assigned to a group. (This has the advantage of letting you work with different people.)

Feedback and grading

For Units 1&2, we will implement a 2-round grading process for projects:

- Students/groups submit documents by due date
- Instructors review documents and provide written feedback but no grades
- Students/groups meet with instructors to present their findings and discuss feedback
- Students/groups review feedback and, if they choose, revise and resubmit their work

- Grades are assigned at the discretion of instructors

What's the point?! The focus is on *your learning* and not the "right answers". One of the best ways to learn is to respond to feedback from others. The goal is to have you step back and think reflectively about your work, and to try to see it through the eyes of other people. Most "real-word" projects go through several rounds of feedback, and this process is intended to help you think about how other people view your work, and to move away from making it something you are "done" with, to thinking about projects and learning as an ongoing process where you are continually learning and improving it. Ultimately, we hope you can learn to carry out high-quality projects that demonstrates your mastery of mathematical thinking and that you will be proud of in the future.

Some additional information:

- We may also implement a round of peer feedback, in Units 2&3.
- Finally, we plan to host a gallery on Canvas to showcase projects – this is opt-out in the sense that you must tell the instructors directly if you do not wish the final version of your project to be posted here.

GenAI Policy

Generative artificial intelligence (GenAI) includes tools such as ChatGPT, Gemini, Copilot, Claude, etc. Students may use GenAI as a study aid and search tool however:

- Students must submit their own work. Do not submit any text, code or images created by GenAI. Do not submit any work that is paraphrasing output created by GenAI.
- Do not cite GenAI or its output as a source. Find primary sources such as published books and peer-reviewed research articles and cite those sources properly.

Violating the GenAI policy is academic misconduct. See UBC Academic Integrity and UBC Academic Misconduct for more information.

See UBC Guidance on Learning with GenAI for more information, and ask your instructors if you have further questions.

Participation

Instructors will record attendance every class. Class attendance is strongly encouraged. Mathematics is best learned in conversation with others. Many activities will be conducted in class that require participation. Instructors will provide reference letters only for students who regularly participate in class.

Student Resources

Science Advising	Health and Wellbeing	Centre for Accessibility
Academic Concession	Academic Integrity	Counselling Services

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the UBC Senate website.