MATH 360

Introduction to Mathematical Modelling — Course Outline 2025W1

Construction and evaluation of deterministic, stochastic, and data-driven models. Software-assisted simulations and numerical solutions involving ordinary differential equations, stochastic processes, and basic machine learning algorithms. Examples from science, engineering, and economics.

Learning Goals

- Classify and contrast different types of mathematical models.
- Construct a mathematical model by applying the modelling process.
- Simulate a mathematical model using mathematical software.
- Evaluate the effectiveness and accuracy of a mathematical model and its computed solution.
- Describe quantitative/qualitative properties of a system by interpreting a mathematical model.
- Demonstrate effective mathematical communication by clearly and concisely articulating mathematical concepts.

Instructors

Name	*Role*	*Office*	*Email*
Lindsey Daniels	Instructor	MATH 211	ldaniels@math.ubc.ca
Fatemeh Saghafifar	Teaching Assistant	–	fsaghafi@math.ubc.ca

Lectures

Days	*Time*	*Location*
Tuesday and Thursday	11am-12:30pm	HEBB 114

Textbooks

MATH 360 Course Notes	Mathematical Python

Important Dates

Tuesday, September 2	Imagine UBC (no lecture)
Thursday, September 4	First Lecture
November 10–12	Midterm Break (no lectures)
Thursday, December 4	Final Lecture

- See the UBC Academic Calendar

Schedule

Hours	*Topics*
4.5	**Modelling Process.** Variables, parameters, assumptions, constraints. Classification of mathematical models: deterministic, stochastic and data-driven. Mathematical communication.
10.5	**Deterministic Models.** Differential equations, nondimensionalization, and numerical methods. Newton's laws of motion and gravity, conservation of mass and energy. Applications: mechanics, mass balance, heat transfer, climate models.
10.5	**Stochastic Models.** Random variables and probability distributions. Monte Carlo simulation, kernel density estimation, and uncertainty analysis.
10.5	**Data-Driven Models.** Linear regression, logistic regression, gradient descent.
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Assessments

Modelling Assignments	$3 \times 20\%$ each $= 60\%$
Computational Assignments	$4 \times 1\%$ each $= 4\%$
Mathematical Communication Assignment	$1 \times 1\%$ each $= 1\%$
Participation	3%
Final Exam	32%

Prerequisites

Programming	One of MATH 210, CPSC 203, CPSC 210
Linear Algebra	One of MATH 152, MATH 221, MATH 223
Multivariable Calculus	One of MATH 200, MATH 217, MATH 226, MATH 253, MATH 254
Differential Equations	One of MATH 215, MATH 255, MATH 256, MATH 258

- See the UBC Course Schedule

Canvas

Announcements, assignments, grades, lecture notes, and all other course information will be posted on Canvas. Please check it often!

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.