MATH_V 516 101 2026W1 Partial Differential Equations I

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MATH_V 516 101 2026W1 Partial Differential Equations I

Term 1 (Classes: Sep 8 (Tue), 2026 to Dec 7 (Mon), 2026)

I**nstructor:** Young-Heon Kim

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Class: Mon Wed Fri | 2:00 p.m. - 3:00 p.m.

Classroom: Mathematics Building (MATH) | Floor: 2 | Room: 204

Office hours: TBA

Brief Description:

This course is an introduction to the qualitative theory of partial differential equations, focusing on elliptic and parabolic problems. Our main goal is to understand basic concepts of weak solutions in appropriate function spaces such as Sobolev spaces. This course should be useful to students with interests in applied mathematics, differential geometry, mathematical physics, probability, harmonic analysis, dynamical systems, and other areas, as well as to PDE-focused students.

Learning objectives:

- Students will be familiar with basic questions on partial differential equations and related theories.
- Students will be able to solve problems concerning basic properties of the Sobolev spaces.
- Students will be able to solve problems on qualitative behaviour of solutions to partial differential equations.

Learning outcomes:

By the end of this course, students will be able to read research papers on qualitative theory of partial differential equations, especially those that use Sobolev spaces.

Main textbook (optional): Partial Differential Equations 2/E. L. C. Evans. AMS

Pre/co-requisites

Basic measure theory, such as Math 420 (or equivalently Math 507) is necessary. Some functional analysis, such as Math 421 (or equivalent Math 510) would be helpful, as would some previous exposure to PDE.

Evaluation:

- **Two in-class written Midterm exams** (each 10%): 20%
  - **Midterm 1: October 21 (Wednesday)**
  - **Midterm 2: November 18 (Wednesday)**
- **Class participation:** 30%
  - If you *regularly* attend classes and actively participate in, then you will get the full participation mark.
- **Final exam:** 50% (in person written exam)

All grades are subject to scaling.

Topics (subject to changes):

- Laplace / heat / wave equations (2 - 3 weeks)
  - Fundamental solutions, mean value properties, regularity, maximum principles, uniqueness for boundary (and initial) value problems.
- Sobolev Spaces (4 weeks)
- Linear Elliptic Equations (3 - 4 weeks)
  - Existence of weak solutions, regularity, maximum principles, eigenvalues / eigenfunctions
- Linear Parabolic equations (1 + 1/2 weeks)
  - Existence of weak solutions, regularity, maximum principles
- Supplementary topics (only if time permits): De Giorgi-Nash-Moser theory.

Copyright:

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Important days:

- **Wednesday, September 30, 2026. National Day for Truth and Reconciliation. University closed.**
- **Monday, October 12, 2026 – Thanksgiving Day. Lectures and laboratories cancelled.**
- **Wednesday, November 11, 2026 – Remembrance Day. University Closed**.
- **Monday, November 9 to Wednesday, November 11, 2026 – midterm break. Lectures and laboratories cancelled.**

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at

http://calendar.ubc.ca/vancouver/index.cfm?tree=3,54,111,0 (http://calendar.ubc.ca/vancouver/index.cfm?tree=3,54,111,0) .

Generative artificial intelligence (GenAI) usage in student-submitted work:

Use of GenAI will not be allowed in any submitted work. It is important for students' career that they try to maximize their independent intellectual ability; consequently, I strongly urge students to minimize their reliance on AI, when they attempt to tackle questions/exercises. AI, on the other hand, can give an interactive learning tool.

Course Summary:

Date	Details	Due
	Midterm 1 (https://canvas.ubc.ca/courses/194098/assignments/2528265)	
	Midterm 2 (https://canvas.ubc.ca/courses/194098/assignments/2528266)	