

# Math 400 Outline

## Section 201, Spring, 2021

**Instructor:** Brian Wetton, wetton@math.ubc.ca, www.math.ubc.ca/~wetton

**Focus:** This class concentrates on analytic methods to solve partial differential equations (PDE's) coming from physical applications.

**Topics:**

- Review: linearity, linear systems, eigen-analysis.
- 1D Boundary value problems: series solutions and Green's function solutions. Introduction to the concepts of well-posedness, weak solutions, and asymptotic methods.
- Modelling: scaling and non-dimensionalization.
- Parabolic equations (Heat Equation): maximum principle, integral transform methods.
- Linear and quasi-linear first order equations: characteristics, shock waves.
- Wave equation: D'Alembert's solution.
- Elliptic equations (Dirichlet and Poisson Problems).
- Classification of equations.
- Free boundary problems: Stefan Problem, Black-Scholes.

**Text:** No required text. Handwritten notes for the course will be posted online.

**Assignments:** Assignments in two parts, A & B, to be submitted separately in pdf format to the canvas course page. Part A will have four problems and part B will have one challenging problem. Late homework will not be accepted after solutions are posted (only part A solutions will be posted, shortly after class on the due date). Assignment schedule:

1. Assigned Thursday January 14, due Tuesday January 26.
2. Assigned Thursday January 21, due Tuesday February 2.

3. Assigned Thursday January 28, due Tuesday February 9.
4. Assigned Thursday February 11, due Tuesday March 2.
5. Assigned Thursday February 25, due Tuesday March 9.
6. Assigned Thursday March 4, due Tuesday March 16.
7. Assigned Thursday March 18, due Tuesday March 30.
8. Assigned Thursday March 25, due Tuesday April 6.
9. Assigned Thursday April 1, due Tuesday April 13.

**Midterms:** Two 24 hour take home midterms Wednesdays February 10 and March 17, submitted in pdf format.

**Marks:** Assignments and midterms are each worth 10%, with the lowest mark dropped. Two special rules are applied to grades in response to the unusual teaching environment this academic year:

- To encourage genuine, individual engagement with the material, a passing grade of 55% is guaranteed if a student attempts the majority of the material.
- To retain a mark of over 84%, students will be required to demonstrate mastery of the course material in an oral exam to be scheduled in the exam period. The resulting grade will be between 84% and the grade calculated from the term material.