MATH 2023 - Topics from Advanced Calculus
Acadia University

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1 Summary

Vector functions and their derivatives. Line integrals, Infinite series. Differential equations: first and second-order linear equations and application; series solutions.

2 Prerequisite

Math 2013 is required.

3 Textbooks

Required:

- McCallum, Hughes-Hallett, and Gleason, *Multivariable Calculus*, Wiley, ISBN #0471311510.
- Bronson, *Schaum's Outline of Differential Equations*, Schaum, 1994, McGraw-Hill. ISBN #0070080194.

Suggested:

- Harry M. Schey, *Div, Grad, Curl, and all that*, W. W. Horton & Cie, August 1997. ISBN #0393969975.

Some free lecture notes will be made available to the students based on the following document:

- *Mathematics 2023 - Infinite Series I* © 1998 F. Chipman, Acadia University
  Revised 1999 T. Archibald, Acadia University.

4 Course outline

1. Vector Functions and Their Derivatives
    - Line integrals
    - Grad, Curl
    - Green's theorem, Stoke's theorem
2. Series
    - Convergence
    - Bounded series
    - Taylor series
    - Radius of convergence
3. Differential Equations
    - Linear Differential Equations
    - Second-Order Linear Differential Equations
    - The Method of Undetermined Coefficients
    - Variation of Parameters
    - Initial-Value Problems
    - Series Solutions
    - Eigenfunction Expansions

This course is a mix of three topics. We will first learn about *Grad, Curl and all that*, in other words, Vector calculus during the first weeks of the course. We will then learn more about series and their convergence. It should take us roughly to study week at which point we will be ready for the mid-term exam right after study week. The rest of the course will be on differential equations and we will use some of our knowledge of series to solve some of the more complicated differential equations. Correspondingly, you should expect 4 assignments, the first one on vector calculus, the second one on series and the last two assignments on differential equations. Maple might be used for this course.

5 Grading Scheme

There are two marking schemes. The second one is meant to help students who would do poorly on the Mid-Term and the assignments.

Best of two schemes	Scheme 1	Scheme 2
4 Assignments	20%	0%
Mid-Term Exam	20%	0%
Final Exam	60%	100%

6 Assignments

Assignments will be made of a large set of problems and students will have roughly two weeks to complete each set. Team work will be allowed but each student must write his own paper. These problems will be similar to what you can expect during the exams so students are encouraged to work the problems on their own whenever possible.