Concordia Faculty of Arts and Science

Mathematics and Statistics

SFYX Math 205/53 - Winter 2022 - Course Outline

Instructor: Dr. Fred E Szabo, e-mail: fred.szabo@concordia.ca
Assistant: Serly Ishkhanian, e-mail: serly.ishkhanian@mail.concordia.ca
Office hours: By appointment, in-person or by ZOOM teleconferencing

Although Math SFYX-Math 205/53 is a sequel to SFYX-Math 203/53, the course can be taken independently. However, a successfully completed course on differential calculus, equivalent to Math 203, is appropriate for admission.

The course is taught interactively using Zoom and requires Mathematica for participation.

What is SFYX?

The Faculty of Arts and Science of the university puts it this way:

First-year students pursuing a Bachelor of Science at Concordia will have the unique opportunity to engage in interdisciplinary, research-based approaches to the foundational sciences (chemistry, biology, physics) and mathematics. You'll gain a well-rounded understanding of a variety of science disciplines, see how they're connected, and explore how they impact society.

Requirements

- LAPTOPS
  - Your need to have a laptop, both for the tutorials, lectures, and other course-related activities. Even in class, we will be using Zoom to exchange learning outcomes and explore Mathematica-based textbook material interactively in lectures and other activities.
- SOFTWARE
  - **Mathematica,** a free download from your MyConcordia portal is required. Once installed on your computer (Mac or PC), you need to activate Mathematica. **Your up-to-date *Concordia e-mail address* is your Activation Key.** No other activation method or other e-mail address will work.
- TEXTBOOK
  - Your **textbook** is the interactive electronic version of Calculus, Early Transcendentals, 3rd edition, by Briggs, Cochran, Gillett, and Schulz**,** published by Pearson**.** The textbook consists of a downloadable list of interactive Mathematica notebooks.

- All references to the topics listed in the **weekly lectures** refer to the Briggs et al. textbook.
- **(Optional reference)** Biocalculus (Calculus for the Life Sciences), by James Stewart and Troy Day, Cengage Learning, 2015.

- MYLAB/MATH
  - **Assignments and examinations** are randomized self-grading examinations posted in **MyLab/Math** and may include Mathematica-based questions drawn from integrated tutorials and notebooks.
- MOODLE (MATH 205 53 2204)
  - All required course material, including access to **MyLab/Math** (which includes the Mathematica version of the textbook)**,** as well as other relevant items such as the weekly lecture notes and tutorial recordings, will be made available in the **MATH 205 53 2204**.
  - The **MyLab/Math registration** for the course (including the **subscription** to the course textbook), are incorporated in **MATH 205 53 2204** and not managed by the Concordia Bookstore.
  - Students enrolled **SFYX Math 205/53** for the Winter 2022 term will be invited by e-mail to join **MATH 205 53 2204** in the first week of term. The e-mail addresses used for this purpose are the addresses on file in the Student Information System.

The Textbook

The textbook for the regular sections of Math 205 cannot be used in the SFYX section of Math 205. If you have bought the textbook for the regular sections of Math 205, please return it to the book-store for a refund.

Grading scheme

1. Assignments (Weeks, 2, 4, 6, 8, 10) - MyLab/Math assignments worth 20% of the final grade
2. Midterm 1 (Week 4) - A MyLab/Math examination worth 20% of the final grade
3. Midterm 2 (Week 8) - A MyLab/Math examination worth 20% of the final grade
4. Midterm 3 - (Week 10) A **proctored** MyLab/Math examination worth 20% of the final grade
5. Research Diary (Weeks 11, 12, 13) A critical summary of ideas, techniques, and applications worth 20% of the final grade.

Lectures

The lectures, both in-person and online, use Mathematica interactively and are recorded as Zoom meetings. They deal with problems in science and related fields solved with the differential calculus ideas and techniques studied in this course.

Tutorials

The SFYX Math 205 tutorials are Mathematica-based interactive Zoom meetings following the weekly lectures and are timed to ensure that most students are available for interactive participation. The tutorials are recorded and posted on Moodle.

Diaries

All students are required to keep a week-by-week diary using a Mathematica notebook or slideshow template. Each entry needs to consist of three parts: Presentation of one mathematical **idea** discussed in the lecture, illustration of one mathematical **technique** discussed in the lecture, and one step-by-step solution of an **application** of the mathematical ideas and techniques explored in the tutorial linked to the lecture.

Assignments and Examinations

The assignments and examinations use the MyLab/Math Learning System and cover a mix of problems discussed in the tutorials and lectures.The problems are drawn from relevant sections of the Briggs Calculus textbook used in the course.

Introductions to Mathematica

For students new to Mathematica and to the MyLab/Math learning system, the follow sources provide easy access to the computational fundamentals used in the course:

- What is Mathematica?
- Fast Introduction to Mathematica for Math Students

Week 1 - Lists and Limits

- Fast Introduction to Mathematica for Math Students
- Briggs, Chapter 2
  - Limits, Sections 2.7, Precise definitions of limits (116-128)
- Briggs, Chapter 3
  - Derivatives, Section 3.1, Introducing the derivative (131-148)

Week 2 - Derivatives and antiderivatives

- Briggs, Chapter 3
  - Section 3.3, Rules of differentiation (152-162)
  - Section 3.4, The product and quotient rules (163-170)
  - Section 3.5, Derivatives of trigonometric functions (171-177)
  - Section 3.7, The chain rule (178-200)
- Briggs, Chapter 4
  - Section 4.9, Antiderivatives (321-333)

Assignment 1 (Weeks 1 and 2)

Week 3 - The fundamental theorem of calculus

- Briggs, Chapter 5
  - Section 5.2, Definite integrals (353-366)
  - Section 5.3, Fundamental theorem of calculus (367-380)
  - Section 5.4, Working with integrals (381-387)
  - Section 5.5, Substitution rule (388-397)

Week 4 - Applications of integration

- Briggs, Chapter 6
  - Section 6.1, Velocity and net change (403-415)
  - Section 6.2, Regions between curves (416-424)
  - Section 6.3, Volume by slicing (425-438)
  - *Section 6.4, Volume by shells (Course Diary)*
  - Section 6.5, Length of curves (451-456)
  - *Section 6.6, Surface areas (Course diary)*
  - *Section 6.7, Physical applications (Course diary)*

Assignment 2 (Weeks 3 and 4)

Week 5 - Integration techniques

- Briggs, Chapter 8
  - Section 8.1, Basic approaches (520-524)
  - Section 8.2, Integration by parts (525-531)
  - Section 8.3, Trigonometric integrals (532-537)
  - *Section 8.4, Trigonometric substitutions (Course Diary)*
  - *Section 8.5, Partial fractions (Course Diary)*
  - *Section 8.6, Integration strategies (Course Diary)*

Midterm 1 (Weeks 3 and 4)

Week 6 - Numerical integration and Improper integrals

- Briggs, Chapter 8
  - Section 8.8, Numerical integration (567-581)
  - Section 8.9, Improper integrals (582-592)

Assignment 3 (Weeks 5 and 6)

Week 7 - Sequences and infinite series

- Briggs, Chapter 10
  - Section 10.1, An overview (639-649)
  - Section 10.2, Sequences (650-661)
  - Section 10.3, Infinite series (662-670)

Midterm 2 (Weeks 5 and 6)

Week 8 - Convergence tests

- Convergence tests
  - Section 10.4, The divergence and integral tests (671-682)
  - *Section 10.5, Comparison tests (Course Diary)*
  - Section 10.6, Alternating series (688-695)
  - *Section 10.7, The ratio and root tests (Course Diary)*
  - Section 10.8, Choosing a convergence test (700-703)

Assignment 4 (Weeks 7 and 8)

Week 9 - Power series

- Briggs, Chapter 11
  - Section 11.1, Approximating functions with polynomials (708-721)
  - Section 11.2, Properties of power series (722-730)
  - Section 11.3, Taylor series (731-741)
  - Section 11.4, Working with Taylor series (742-749)

Week 10 - Proctored Midterm 3

Midterm 3 (Weeks 7 and 8)

Assignment 5 (Week 9)

Week 11 - Diary Review 1 (Ideas and techniques)

Interactive discussion of the mathematical ideas and techniques chronicled in the student diaries.

Week 12 - Diary Review 2 (Applications)

Interactive discussion and review of a spectrum of mathematical applications included in the student diaries.

Week 13 - Review of integral calculus

From differential to integral calculus - a review of the Fundamental Theorem of Calculus.

Disclaimer

This outline is subject to change should unforeseen circumstances arise.