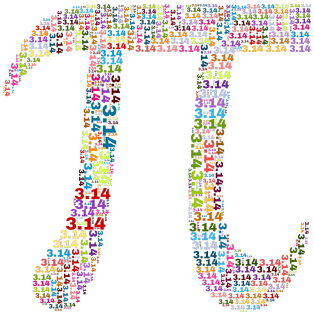
Faculty of Science Course Syllabus (Section A)
Department of Mathematics and Statistics, Dalhousie University
Winter 2024

MATH 1215 - Calculus for the Life & Social Sciences

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship



Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years

1 Instructors & course delivery details

Lec	Days/Time	Location	Instructor	email
1	MWF 08:35-09:25	HENRY HICKS 212	Scott Wesley (he/him)	scott.wesley@dal.ca
2	MWF 12:35-13:25	CHEMISTRY 226	Dr. Sarah Chisholm (she/her/hers)	sachisho@dal.ca
3	MWR 17:35-18:25	LSC COMMON C240	Daniel Teixeira (he/him)	daniel.teixeira@dal.ca

The MATH 1215 lecture classes will be held in-person. Please see the academic timetable for the day, time, and location of your tutorial class.

2 Student Support

There are many ways to seek help in this course. There are **office hours** with instructors (see the course Brightspace homepage page for details about days/times for office hours), our class discussion board on **Piazza** (see more details below), support from Teaching Assistants in the **MATH/STAT Learning Centre**, and other **classmates**.

Contacting us with your questions: We will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, and the Instructional Team.

Rather than emailing questions to the teaching staff, we request you post questions on Piazza.

If you have any problems or feedback for the developers, email team@piazza.com.

Find our class signup link at: `https://piazza.com/dal.ca/winter2024/math1215`

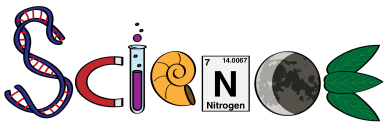
The **MATH/STAT Learning Centre** is located in Chase 119 and will be operating in-person and remotely. It opens on Jan. 8 and support is available Monday through Friday from 11:30am - 4:30pm and Monday through Friday evenings from 6:30-7:30pm, until Apr. 23. Register for the Brightspace "course" at `https://www.dal.ca/faculty/science/math-stats/about/learning-centre.html` to access the online support and see the latest schedule.

3 General Information

Course Description: Rates of change are at the heart of Calculus. By examining how a quantity changes instantaneously, we can model, say, the amount of medicine in the body over time, or the spread of misinformation.

Prerequisites: Nova Scotia Mathematics 11 and 12 or pre-calculus is highly recommended.

Exclusions: MATH 1000 and MATH 1280.



MATH 1215 is designed to provide some foundational mathematical tools required for the life and social sciences. The main topics from differential and integral Calculus will be covered (including rates of change, differentiation, Taylor polynomials, the Fundamental Theorem of Calculus, integration, and basic ordinary differential equations) and have an emphasis on modelling systems from the life and social sciences.

Class structure: The course material is taught in both the lecture and tutorial class components. Although called a "tutorial", it is class time with initially some review of background material, and after a couple weeks will cover Calculus content.

Textbook: Calculus for the Life Sciences: Modelling the dynamics of life, 2nd Cnd. ed. by F. Adler and M. Lorvić.

Calculators: Calculators are not permitted during the midterm and final exam. Answers may be left unsimplified.

4 Student Accommodations

If there are aspects of the design, instruction, and/or experiences within this course that result in barriers to your inclusion please contact the Student Accessibility Centre `dal.ca/access`.
Please note that your classroom may contain accessible furniture and equipment. It is important that these items remain in the classroom, undisturbed, so that students who require their use will be able to fully participate.
A note taker is required to assist one of your peers. If you are interested, please contact the Student Accessibility Centre, notetaking@dal.ca.

5 Course Assessment

Homework: Homework assignments typically follow each class (lectures and tutorials) and are found on the course Brightspace page via the online platform **WeBWorK**. The problems extend class content and suggested textbook problems. This is an opportunity to think about problems more deeply, beyond our first inspection in class, as you invesitgate more challenging problems.
There is an opportunity to highlight the mathematical contributions made by people from Black, Indigenous, and People of Color (BIPOC) communitites in this class. By writing a short biography about a mathematician of your choosing to post on the course Brightspace page (300 word limit), you can drop 3 low homework scores.

Group Projects: There are two projects that provide the opportunity to work through an application of the theory in this course to a real-life situation, with other students. Group sizes are 2 or 3 people and all group members should contribute equally.

Midterm Test: The midterm test is on Friday, March 1, from 6:30-8:30pm. Location TBA.
Final Exam: The date and time for the final exam is set by the registrar during the official Dalhousie exam period from Apr. 11 until Apr. 23, 2024. If you plan to depart from campus at the end of the semester, please make your plans after the registrar has announced the exam schedule, or plan to leave after Apr. 23. Unfortunately, there are no opportunities to write the exam early or remotely.

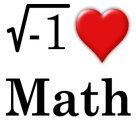
Course score: We use the maximum of the following possible combinations for you –
Homework 15% + Projects 20% + Midterm Test 25% + Final Exam 40%
Homework 10% + Projects 20% + Midterm Test 25% + Final Exam 45%
Homework 15% + Projects 15% + Midterm Test 25% + Final Exam 45%
Homework 15% + Projects 20% + Midterm Test 20% + Final Exam 45%

The grading scheme for this course will follow the standard scale set by Dalhousie University.
`https://www.dal.ca/campus_life/academic-support/grades-and-student-records/grade-scale-and-definitions.html`

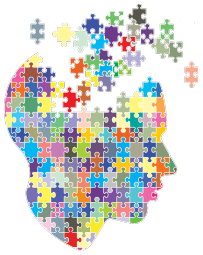
6 Important Dates

January 22 Project 1 is available
February 5 Project 1 is due
March 1 Midterm Test

March 13 Project 2 is available
March 27 Project 2 is due
April 11 - 23 Exam period



7 Growth mindset vs. fixed mindset



There is evidence[a] that shows that your frame of mind can greatly affect your success. In particular, if you have a growth mindset (you believe that with practice your abilities can improve) you are often more successful than if you have a fixed mindset (you believe that your abilities are fixed and cannot be improved). We invite you to take a growth mindset to mathematics: with regular practice, you will improve your skills.

[a] Dweck, Carol S. (2006). Mindset: The new psychology of success. Random House.

8 Course topics and approximate schedule

week 1 Discrete dynamical systems - §3.1-3.4
week 2 Rates of change, Limits, Trig. Functions - §4.1-4.3, 2.3
week 3 Continuity, Differentiation, Exponential Functions - §4.4-4.5, 5.1, 2.2
week 4 More derivatives, Implicit derivatives, Logarithmic Functions - §5.2-5.3, 5.5, 2.2
week 5 Trig. derivatives, Related Rates, Second derivatives, Linear Approximation - §5.4, 5.5, 5.6, 5.7
week 6 Max/Min, Midterm Exam Review, Graphing - §6.1, 6.5
week 7 l'Hôpital's rule, Taylor Polynomials - §6.4, 5.7
week 8 Equilibria & derivatives, Logistic Equation, Differential equations - §6.7, 6.8, 7.1
week 9 Euler's Method, Antiderivatives, Definite Integrals, Riemann Sums - §7.1-7.4
week 10 FTOC, Substitution, Autonomous Differential Equations - §7.3-7.5, 8.1-8.3
week 11 Integration by Parts, Separable Differential Eqns., Systems of Differential Eqns. - §7.5, 8.4, 8.5
week 12 Integration by Taylor Polynomials, Final Exam Review - §7.5, 8.4

9 Course Policies related to Academic Integrity

Submitting your WeBWorK homework: You are strongly encouraged to collaborate with other students when working on homework and studying for your exams. When you submit your homework online, this is done independently so that you assess your own learning.

10 Learning Objectives

- To encourage you to regularly ask "why, why, why?"
- To enhance your mathematical tool kit to help model problems in the world around you.
- To develop an understanding of applications of dynamical systems, equilibria, and stability in science.

- To enhance your mathematical intuition and develop your curiosity.
- To build upon your logical reasoning, and both critical and analytical thinking.
- To grow your fluency in mathematics so that you can identify injustices in the world and move towards change.

11 Course Policies on missed or late academic requirements

In the event that you are absent for three days or fewer resulting in missed or late academic requirements, you will be required to submit a Student Declaration of Absence Form to your instructor, see:
`https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence.html`

We understand that circumstances can arise that can interfere with completing your work. We will drop your two lowest homework scores to function as a buffer for all. This is in addition to the BIPOC extra credit homework assignment (which would bring you to a total of 5 drops).

Midterm and Final exams: In the event that you are unable to attend our midterm or final exam due to exceptional circumstances, please notify your instructor via email in advance to determine what alternatives may be possible.

12 Homework Schedule

There are a total of **28 homework assignments** (roughly 3 per week). Each homework topic is assigned on the day the topic is covered in class and you will have about 4 days to complete the homework. (Some tutorial classes will be a bit ahead, due to when the tutorial class is held during the week, and so some homework topics may open up just before you learn them in your section.)

The "Opens on" date begins at 9am of that day and the "Due date" is by 11:59pm on that day.

Homework #	Topic	Opens on	Due date
1	Review	Jan. 8	Jan. 12
2	Equilibria	Jan. 10	Jan. 17
3	Rates of Change	Jan. 15	Jan. 19
4	Limits	Jan. 17	Jan. 22
5	Infinite Limits	Jan. 19	Jan. 24
6	Continuity	Jan. 22	Jan. 26
7	Definition of the Derivative	Jan. 24	Jan. 29
8	Derivative Rules	Jan. 26	Jan. 31
9	Product & Quotient Rules	Jan. 29	Feb. 5
10	Chain Rule	Jan. 31	Feb. 7

*Note that the homework sets are arranged in order by deadline (not by homework number, for example, or by the opening date). Some of the deadlines get whacky from here on in, now that you have homework that follows tutorial classes (which fall on different days of the week, depending on which tutorial classs you are in), i.e. homework 11 is due after 12 & 13. This table is intentionally broken into two pieces so that you are aware of this!

Homework #	Topic	Opens on	Due date
12	Implicit Differentiation	Feb. 5	Feb. 9
13	Related Rates	Feb. 7	Feb. 12
11*	Trig. Derivative Rules*	Feb. 6	Feb. 14
14	Second Derivative	Feb. 9	Feb. 16
15	Linear Approximation	Feb. 12	Feb. 26
16	Extreme Values	Feb. 14	Feb. 28
17	Graphing	Feb. 26	Mar. 6
18	l'Hôpital's Rule	Mar. 1	Mar. 8
19	Differential Equations	Mar. 5	Mar. 13
20	Taylor Polynomials	Mar. 6	Mar. 15
21	Antiderivatives	Mar. 12	Mar. 20
22	Euler's Method	Mar. 13	Mar. 22
23	Substitution	Mar. 19	Mar. 28
24	Riemann Sums	Mar. 18	Apr. 1
25	Fundamental Theorem of Calculus	Mar. 20	Apr. 3
26	Integration by Parts	Mar. 26	Apr. 5
27	Autonomous Differential Equations	Mar. 27	Apr. 8
28	Separable Differential Equations	Apr. 1	Apr. 9