THE UNIVERSITY OF BRITISH COLUMBIA

Land Acknowledgement

We respectfully acknowledge the Syilx Okanagan Nation and their peoples, in whose traditional, ancestral, unceded territory UBC Okanagan is situated.

MATH 116: Calculus I for Management and Economics

Faculty: Irving K. Barber Faculty of Science

Department: Computer Science, Mathematics, Physics, and Statistics

Instructor(s): Paul Tsopméné

Instructor(s) Email: paul.tsopmene@ubc.ca

Instructor(s) Office: SCI 259

Duration: Term 2 Winter 2022 (Jan – Apr 2023)

Delivery Modality: In-Person

Course Location: LIB 305

Course Days: Mon/Wed/Fri

Class Hours: 1:00 PM - 2:00 PM

Office Hours: Monday and Wednesday: 5:00 pm – 6:30 pm. I am also available by email or appointment if these times do not work for you.

Other Instructional Staff

1	Course Support/Marking, Amirhossein Salamirad, Email: ahsalami@mail.ubc.ca
2	Tutorial Instructor, Amirhossein Salamirad, Section: T2D, Wed, 9:00 AM - 10:00 AM, Email: ahsalami@mail.ubc.ca
3	Course Support/Marking, Wanye Gao, Email: wanyegao@mail.ubc.ca
4	Course Support/Marking, Puneet Kaur Aulakh, Email: puneetk1@mail.ubc.ca

5	Tutorial Instructor, Puneet Kaur Aulakh, Section: T2C, Mon, 3:00 PM - 4:00 PM, Email: puneetk1@mail.ubc.ca
6	Course Support/Marking, Insha Hooda, Email: insha25@student.ubc.ca
7	Tutorial Instructor, Insha Hooda, Sections: T2A (Fri, 2-3 PM), T2B (Wed, 4-5 PM), T2E (Mon, 11 AM-12 PM), T2F (Mon, 4-5 PM), Email: insha25@student.ubc.ca

Course Description

The derivative; limits; rate of change; derivatives of algebraic, logarithmic, trigonometric and exponential functions; applications to marginal analysis; elasticity of demand; optimization and curve-sketching, Newtons Method and Taylor polynomials. Credit will be granted for only one of MATH 116 or MATH 100. [3-0-1]
Prerequisite: Either (a) a score of 67% or higher in one of MATH 12, PREC 12 or (b) a score of 60% or higher in one of MATH 125, MATH 126.
Equivalency: MATH 100.

Course Format

Lectures and tutorials.

Lecture Format: Each week (except holidays), three lectures will be delivered in person. During a typical lecture, the instructor will present one or more concepts, cover examples, and answer questions. The focus will be on applications of the concepts rather than proofs.

Tutorial Format: Most weeks, students will meet with their tutorial section in person. And the Teaching Assistant will answer their questions and/or review and practice course material. **Tutorial sessions start on Monday, January 16**. Attendance is not mandatory. But every student must be registered in one of the tutorial sections.

Course Overview, Content and Objectives

Course Overview: This course will focus on single-variable differential calculus and its applications. While the list of topics aligns well with a general calculus course, most of the concepts will be presented through applications in Management and Economics. The course will start off with linear functions. In this chapter, we will learn how to find the slope between two points and the equation of a line. We will also learn how to find the equilibrium quantity, the equilibrium price, and the break-even quantity. In the second chapter, we will learn how to sketch the graph of a quadratic function and find the maximum profit/revenue, solve exponential and logarithmic equations, and solve (continuous) compound

amount/interest problems. Calculus really starts in the third chapter with the concept of limits. We will learn how to find limits using rules and show that a function is continuous/discontinuous using limits. Then we will define the core concept of this course: the derivative. And we will learn how to find it using the limit definition, interpret the derivative geometrically (as the slope of the tangent line), interpret the derivative as the instantaneous rate of change, and sketch the graph of the derivative of a function defined by a graph. In the fourth chapter, we will learn how to find derivatives using rules (constant rule, power rule, constant multiple rule, sum/difference rule, product rule, quotient rule, and chain rule). We will also learn how to find and interpret the marginal cost, revenue, profit, average cost, average revenue, and average profit by using the concept of derivatives. In the fifth chapter, we will cover some applications of the derivative. We will learn how to find the intervals where a function is increasing/decreasing, find the relative extrema, find the intervals where a function is concave upward/downward, find the point of diminishing returns, and sketch the graph of a function. We will also learn how to maximize the profit/revenue function and minimize the cost function. The last chapter will cover more applications of the derivative. We will learn how to find the absolute maximum and minimum of a function on a closed interval, solve optimization problems, use implicit differentiation to solve related rate problems, find and interpret the elasticity of demand, use differentials to approximate the change in cost, revenue, and profit, and use Newton's method to approximate solutions of algebraic equations.

Content: Topics include
→ Linear Functions: Slopes, Equations of Lines and Applications.
→ Nonlinear Functions: Quadratic, Exponential and Logarithmic Functions.
→ The Derivative: Limits, Continuity, Rates of Change, Definition of the Derivative, and Graphical Differentiation.
→ Calculating the Derivative: Techniques for Finding Derivatives, Product, Quotient, and Chain Rules Derivatives of Exponential and Logarithmic Functions.
→ Graphs and the Derivative: Increasing and Decreasing Functions, Relative Extrema, Concavity, the Second Derivative Test, and Curve Sketching.
→ Applications of the Derivative: Absolute Extrema, Optimization, Implicit Differentiation, Related Rates, Elasticity of Demand, Differentials, and Newton's Method.

Objectives: To enable the student to:
→ Understand the fundamental concepts of differential calculus and applications to marginal analysis and elasticity of demand.
→ Learn the most important techniques for calculating derivatives.
→ Practice how to apply these techniques to model and solve various problems.

Learning Outcomes

Upon successful completion of this course, students will be able to…

→ Understand the basic idea of differential calculus: finding the slope of a tangent line to a curve.
→ Evaluate limits both algebraically and geometrically. In particular, students should be able to find "limits of the form 0/0" and limits at infinity.
→ Determine whether a function is continuous or not. And find the points of discontinuity (if any).

→ Find derivatives by using the limit definition.
→ Find derivatives graphically.
→ Find derivatives by using rules (constant rule, power rule, constant multiple rule, sum/difference rule, product rule, quotient rule, chain rule).
→ Find the slope of a tangent line to a curve.
→ Find the equation of the tangent line to a curve at a given point.
→ Find the (instantaneous) rate of change of a quantity.
→ Find and interpret the marginal X, where X could be the cost, revenue, profit, average cost, average revenue, or average profit.
→ Find the intervals where a function is increasing and where it is decreasing.
→ Find the local or relative extrema.
→ Find the maximum profit/revenue and the minimum cost.
→ Find the intervals where a function us concave upward and where it is concave downward.
→ Find the point of diminishing returns.
→ Sketch the graph of a function.
→ Find the absolute maximum and minimum of a function on a closed interval.
→ Solve optimization problems, that is, problems where it is asked to maximize or minimize a quantity.
→ Find the derivative of implicit functions by using the implicit differentiation method.
→ Solve related rates problems. That is, problems where there two quantities are involved, and the rate of change of one quantity is given, and it is asked to find the rate of change of the other quantity.
→ Calculate and interpret the elasticity of demand.

Assessments of Learning

Assignments	20%		
Midterm 1	17.5%	Feb 17, 1:00 PM-1:50 PM	in LIB 305
Midterm 2	17.5%	Mar 24, 1:00 PM-1:50 PM	in LIB 305
Final Exam	45%	TBA	

Assignments: There will be six assignments throughout the semester. These will be posted on Canvas on Fridays, and the due date will be next Friday at 11:59 PM. (Assignments will be released on the dates in the table below titled "course schedule".) To submit your assignment, you will have to upload the assignment as a single .pdf file on Canvas. Once you submit your work on Canvas, make sure to go back to the submission box on Canvas and check that your submission is uploaded correctly, and confirm that there are no missing pages. The lowest assignment grade will be dropped.

Midterms: There will be two midterms that will be held on the dates mentioned above. I will post the midterm topics on Canvas about a week before the date of each midterm.

Final Exam: There is a 2.5-hours comprehensive final exam during the final examination period of April 17 – 28. Date: To Be Announced. This is a cumulative final exam.

Learning Activities

Course schedule

Tentative course schedule: The following course schedule is subject to change.

Lecture Week	Topics, Assignments, and Midterms
Jan 9 – 13	Introduction to Calculus, Slopes, Equations of Lines, Linear Functions, Applications
Jan 16 – 20	Quadratic Functions, Exponential Functions January 20: **Assignment 1** will be released
Jan 23 – 27	Logarithmic Functions, Limits (tables and graphics) January 27: **Assignment 2** will be released
Jan 30 – Feb 3	Limits (indeterminate form k/0), Limits (at infinity), Continuity Feb 3: **Assignment 3** will be released
Feb 6 – 10	Continuity and Rates of Change, Definition of the Derivative
Feb 13 – 17	Graphical Differentiation, Techniques for Finding Derivatives **Midterm 1** – Friday, Feb 17 (1:00 pm-1:50 pm, in LIB 305)
Feb 20 – 24	Midterm Break (no classes)
Feb 27 – Mar 3	Product and Quotient Rules, Chain Rule, Chain Rule (continued) March 3: **Assignment 4** will be released
Mar 6 – 10	Derivatives of Exponential Functions, Derivatives of Logarithmic Functions, Marginal Analysis March 10: **Assignment 5** will be released
Mar 13 – 17	Increasing and Decreasing Functions, Relative Extrema, Concavity and the Second Derivative Test
Mar 20 – 24	Curve Sketching, Absolute Extrema

	Midterm 2 – Friday, March 24 (1:00 pm-1:50 pm, in LIB 305)
Mar 27 – 31	Optimization, Optimization (continued), Implicit Differentiation March 31: **Assignment 6** will be released
Apr 3 – 7	Related Rates, Elasticity of Demand Friday, April 7: Holiday (Good Friday) – no classes
Apr 10 – 14	Differentials, Newton's Method

Late policy

Assignments: Late submissions won't be considered. No extensions or make-up assignments. If an assignment is missed for a valid reason (e.g., religious, medical or compassionate reasons, with documentation), the final exam will be weighted more heavily to compensate.

Missed exam policy

Midterms: No make-up midterms will be given. If a midterm is missed for a valid reason (e.g., religious, medical or compassionate reasons, with documentation), the other midterm and/or final exam will be weighted more heavily to compensate.

Missed Activity Policy:

N/A

Passing/Grading Criteria

In order to pass the course, you MUST attain a grade of at least 40% on the final exam AND your overall final grade has to be greater than or equal to 50%.
Note: In the event you do not get at least 40% on the final exam AND your final grade is less than 50%, your final grade will be recorded. In the event you do not attain at least 40% on the final exam AND your final grade is greater than or equal to 50%, a maximum grade of 47% will be recorded.

Learning Materials

Textbook (optional): Calculus with Applications, by Margaret L. Lial, Raymond N. Greenwell, and Nathan P. Ritchey, 12th edition, Pearson. It is available in the bookstore.

Exercise Book: Calculus I for Management and Economics, by Paul Tsopméné. This is free and contains problems with very detailed solutions. Summaries of concepts are included, making the book self-contained. It is available at http://hdl.handle.net/2429/83411

Calculators: The use of a scientific calculator (non-graphing, non-programmable) is permitted.

Course Website: Course materials are available at https://canvas.ubc.ca. My primary method of communication is through Canvas messages/emails. Make sure you check this website regularly.

Learning Resources

N/A

Other Course Policies

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 usually result in a failing grade or mark of zero on the assignment or in the course.** Careful records are kept to monitor and prevent recidivism.

The use of artificial intelligence (AI) assistance for any assessed portions of this course is not permitted.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at:
http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,54,111,0

Final Examinations

You can find the Senate-approved term and examination dates here. Except in the case of examination clashes and hardships (three or more formal examinations scheduled within a 27-hour period) or unforeseen events, students will be permitted to apply for out-of-time final examinations only if they are representing the University, the province, or the country in a competition or performance; serving in the Canadian military; observing a religious rite; working to support themselves or their family; or caring for a family member. Unforeseen events include (but may not be limited to) the following: ill health or other personal challenges that arise during a term and changes in the requirements of an ongoing job.

Further information on Academic Concession can be found under Policies and Regulation in the Okanagan Academic Calendar http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,48,0,0

Grading Practices

Faculties, departments, and schools reserve the right to scale grades in order to maintain equity among sections and conformity to University, faculty, department, or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department, or school. Grades are not official until they appear on a student's academic record.

http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,41,90,1014

Resources to Support Student Success:

UBC Okanagan Disability Resource Centre

The DRC facilitates disability-related accommodations and programming initiatives to remove barriers for students with disabilities and ongoing medical conditions. If you require academic accommodations to achieve the objectives of a course please contact the DRC at:

UNC 215   250.807.8053
Email: drc.questions@ubc.ca

Web: www.students.ok.ubc.ca/drc

UBC Okanagan Equity and Inclusion Office

Through leadership, vision, and collaborative action, the Equity & Inclusion Office (EIO) develops action strategies in support of efforts to embed equity and inclusion in the daily operations across the campus. The EIO provides education and training from cultivating respectful, inclusive spaces and communities to understanding unconscious/implicit bias and its operation within in campus environments. UBC Policy 3 prohibits discrimination and harassment on the basis of BC's Human Rights Code. If you require assistance related to an issue of equity, educational programs, discrimination or harassment please contact the EIO.

UNC 325H   250.807.9291
Email: equity.ubco@ubc.ca

Web: www.equity.ok.ubc.ca

Student Wellness

At UBC Okanagan health services to students are provided by Student Wellness. Nurses, physicians and counsellors provide health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. As well, health promotion, education and research activities are provided to the campus community. If you require assistance with your health, please contact Student Wellness for more information or to book an appointment.

UNC 337   250.807.9270
Email: healthwellness.okanagan@ubc.ca

Web: www.students.ok.ubc.ca/health-wellness

Office of the Ombudperson

The Office of the Ombudsperson for Students is an independent, confidential and impartial resource to ensure students are treated fairly. The Ombuds Office helps students navigate campus-related fairness concerns. They work with UBC community members individually and at the systemic level to ensure students are treated fairly and can learn, work and live in a fair, equitable and respectful environment. Ombuds helps students gain clarity on UBC policies and procedures, explore options, identify next steps, recommend resources, plan strategies and receive objective feedback to promote constructive problem solving. If you require assistance, please feel free to reach out for more information or to arrange an appointment.

UNC 328   250.807.9818
Email: ombuds.office.ok@ubc.ca

Web: www.ombudsoffice.ubc.ca

Student Learning Hub

The Student Learning Hub is your go-to resource for free math, science, writing, and language learning support. The Hub welcomes undergraduate students from all disciplines and year levels to access a range of supports that include **tutoring in math, sciences, languages, and writing, as well as help with study skills and learning strategies**. Students are encouraged to visit often and early to build the skills, strategies and behaviors that are essential to being a confident and independent learner. For more information, please visit the Hub's website.

LIB 237   250.807.8491
Email: learning.hub@ubc.ca

Web: www.students.ok.ubc.ca/slh

The Global Engagement Office

The Global Engagement Office provides advising and resources to assist International students in navigating immigration, health insurance, and settlement matters, as well as opportunities for intercultural learning, and resources for Go Global experiences available to all UBC Okanagan students, and more.

Come and see us – we are here to help! You may also contact geo.ubco@ubc.ca

Safewalk

Don't want to walk alone at night? Not too sure how to get somewhere on campus? Call Safewalk at
250-807-8076.

For more information, see: www.security.ok.ubc.ca