

This course covers differential calculus and the beginning of integral calculus. Students will study limits, continuity, differentiation, and integration, with a focus on theory, applications, and problem solving. A detailed outline of course topics is provided below.

- **Functions** (definition, domain and range, representation of functions, piecewise functions, catalog of essential functions, symmetry, new functions from old ones, combining functions, composition of functions)
- **Limits** (intuitive definition, one-sided limits, infinite limits, limits laws, trigonometric limits, vertical and horizontal asymptotes, squeeze theorem, precise definition)
- **Continuity** (definition, types of continuous functions, types of discontinuities, intermediate value theorem)
- **Derivatives** (geometric and algebraic interpretation, differentiability and continuity, power rule, product rule, quotient rule, chain rule, implicit differentiation, higher derivatives, derivative formulas)
- **Applications of Derivatives** (extreme value theorem, mean value theorem, monotonicity and concavity, extrema, inflection points, first derivative test, second derivative test, optimization problems, rate of change, related rates, curve sketching)
- **Integrals** (definite integral, The Fundamental Theorem of Calculus, indefinite integrals, u-substitution)
- Extra topics may be added, if time permits.

Learner Outcomes

By the end of this course, students will be able to:

- Analyze and describe functions (including piecewise functions); identify symmetries; and create new functions through transformations, algebraic operations and composition.
- Prove limits of functions using the epsilon-delta definition and calculate limits graphically, numerically, and algebraically, applying limit laws, the squeeze theorem, and trigonometric limits.
- Identify and classify asymptotes and discontinuities of functions, and apply the Intermediate Value Theorem to solve problems involving continuous functions.

- Interpret and compute the derivative of functions using the limit definition, understanding its meaning as slope of the tangent line and instantaneous rate of change.
- Differentiate functions using power, product, quotient, and chain rules; apply implicit differentiation; compute higher-order derivatives;
- Apply the Extreme Value Theorem and Mean Value Theorem to analyze function behavior, identify extrema, and solve optimization problems.
- Solve optimization and related rates problems by applying derivative concepts to real-world contexts.
- Analyze and sketch graphs of functions by determining intervals of increase/decrease, concavity, local extrema, and inflection points using the first and second derivative.
- Define definite integrals via Riemann sums, compute indefinite integrals using u-substitution, apply the Fundamental Theorem of Calculus, and interpret integrals in practical contexts.

Course Site

This course has an online D2L site, which you access through *mycourselink* via myInfo or directly using the link

<https://mycourselink.lakeheadu.ca>.

This course has an online D2L site, which you access through MyInfo, via *mycourselink*. All information with regards to this course can be found on D2L and should be checked regularly. Class notes, lecture videos and other information will be posted on D2L regularly. It is beneficial to watch the lecture videos as we will work on problems related to the topics in the videos in order to reinforce understanding.

Textbook

This class will not have a textbook required to purchase. There is a wealth of textbooks and calculus resources available to you and many can be found in the LU library. Here are some suggested references:

Comprehensive Textbooks:

- *Calculus* by Stewart
- *Calculus* by Salas, Hille, Etgen
- *Calculus* by Thomas, Weir, Hass

Free online textbooks that can serve as a supplement to the class notes:

- Calculus Volume 1 by Edwin Herman, Gilbert Strang
<https://openstax.org/details/books/calculus-volume-1>
- Apex Calculus, Version 4 by Gregory Hartman
<http://www.apexcalculus.com/downloads/>

WeBWork

WeBWork is a free online homework system that will be required to complete the assignments. The link to access WeBWork as well as login information will be provided to you on D2L.

Labs

The lab will also be used to facilitate your understanding of the material and it will be beneficial to attend. Concepts will be reinforced through explanations and examples. You will also have time to work through questions yourself so that you can test your understanding.

Class Policies

It is strongly recommended that you attend class. If you come to class, I would appreciate that you show up on time. Please turn off your phone on silent while in class. Midterms and exams must be taken on the date assigned. There will be no books, calculators, cell phones, or other aids allowed during the exams. Cell phones or other electronic devices are not allowed to be on your person during midterms and exams, per university policy.

Accommodations

Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please visit: <http://studentaccessibility.lakeheadu.ca>

Evaluation

A. Online Assignments (10 %)

There will be weekly assignments posted on WeBWorK. ***Late assignments will not be accepted.***

C. Test I (25%)

Test I is tentatively scheduled on **Monday, February 23**, during the class time.

D. Test II (25%)

Test II is tentatively scheduled on **Friday, March 20**, during the lab time.

E. Final Exam (40%)

The final exam will be a three hour cumulative exam. The date of the exam will be provided as soon as the university schedules it.