Math 151 Calculus I

Semester: Fall**, Year:** 2023

Instructor information

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Course Description

● A study of limits and continuity of functions, derivatives, rules and applications of differentiation, inverse trigonometric functions, rates of change, single-variable optimization, Newton's method, and indefinite integrals. A wide variety of applications from the physical, natural, and social sciences are explored. **Prerequisite: MATH130 or equivalent.**

Learning Resources

● Online Text: Herman, E. & Strang, G. (2016). *Calculus Volume 1.* Houston, TX: OpenStax CNX.
ISBN-13: 978-1-947172-13-5
https://openstax.org/details/books/calculus-volume-1
● Access to XYZ Homework https://www.xyzhomework.com/
Discount Code: XYZF23
Course ID: 38932
● Suggested Calculators: TI-83, TI-83+, TI-84, TI-84+, or TI-89 graphing calculator.

Institutional Objectives

By graduation, a Bethany Lutheran College student will:
● Recognize that the historic Christian faith professes that God the Holy Trinity is the source of all knowledge and truth, and that His wisdom is most clearly revealed in the life, death, and resurrection of Jesus Christ.
● Demonstrate intellectual, creative, and problem, solving skills.
● Demonstrate an understanding of personal and public responsibility.
● Develop habits of thinking that apply to a fulfilling life of learning.

Program Objectives

The Student will be able to:
- Construct, modify, and analyze mathematical models, assess the accuracy of the models, and draw contextual conclusions by leveraging sophisticated mathematical theory.
- Make rigorous mathematical arguments and apply precision of thought in the development and critique of mathematical proofs.
- Communicate mathematical ideas, orally and in writing, with clarity and coherence while using carefully reasoned, sound, and logical arguments.
- Demonstrate insight into the detailed structure, beauty, and creativity of mathematics along with an appreciation of the power of its applications across disciplines.

Course Objectives

- Estimate limits from graphs or tables of data and identify situations where limits fail to exist.
- Define the concept of continuity in terms of limits.
- Calculate limits algebraically, applying L′Hopital's rule to limits with indeterminate forms.
- Explain why limits are fundamental in the development of differentiation and use the limit definition of the derivative.
- Define the derivative as the instantaneous rate of change and the slope of the tangent line at a single point.
- Compute basic derivatives, including applying the power rule, the product rule, the quotient rule, and the chain rule, by hand.
- Use technology appropriately to assist in advanced derivatives, particularly in applications.
- Classify maxima and minima of a function using derivatives and critical points.
- Determine the intervals where a function is increasing and decreasing.
- Explain the implications of concavity on the shape of a function and its behavior.
- Calculate inflection points, knowing their implications on concavity.
- Solve applications that employ the derivative, such as optimization problems and related rate problems for a wide variety of disciplines.
- Estimate the area under the curve via finite and infinite summations.
- Define the definite integral of a function.
- Interpret the properties of definite integrals as properties of areas and solve problems of area, distance, and accumulation.
- Discover, understand, and implement the Fundamental Theorem of Calculus.

Evaluation

The final course grade will be calculated using the following categories:

Assessment	Percentage of Final Grade
Exams	40%
Activities	20%
Homework	20%
Final Exam	20%

Exams: There will be three Unit Exams and a 2 hour comprehensive Final Exam, designed to evaluate your understanding of the material covered in each unit and throughout the course. The dates of these exams will be announced at least one week prior to taking the exam.

If you have a conflict with an exam date, you must notify your instructor prior to the scheduled exam time to be considered for a make-up exam. Make-up exams are offered at the instructor's discretion.

Activities: Your instructor will use a variety of in-class and out-of-class activities to help teach or enhance several of the topics covered in this course. These activities may include (but are not limited to) worksheets, group practice, presentations, papers, essays, quizzes, etc.

Homework: Homework will be completed online. XYZ Homework provides immediate feedback so that you know the areas in which you need more help and practice. You will need the course ID when registering online. **Our course ID is 38932**. You will be allowed to re-attempt each question to improve your score. The first four attempts all receive full credit. You may use open book and open notes to complete your homework. You may also ask questions on the homework forum and are encouraged to seek assistance from fellow students, tutors, and the instructor as needed. There are five late passes that allow you to complete an assignment up to two weeks after the due date. If you are experiencing any difficulty at all with the homework system, please do not hesitate to contact me as I can either fix or address virtually any issue – all you have to do is ask!

Final Exam: There will be a 2 hour comprehensive Final Exam, designed to evaluate your understanding of the material covered in each unit and throughout the course.

Students will be assigned the following final letter grades, based on calculations coming from the course assessment section.

Grade	Percentage Interval
A	93-100%
A-	90-93%
B+	87-90%
B	83-87%
B-	80-83%
C+	77-80%
C	70-77%
D	60-70%
F	<60%

Grading Policies

- **Late-work policy**: There are five late passes that allow you to complete a homework assignment up to two weeks after the due date. Late homework will not be accepted after the late passes are used up. Activities, will be accepted up to a week late. If activities are late, there will be a 25% reduction in the grade for that assignment. After a week, activities will not be accepted.
- **Make-up work policy**: If you have a conflict with an exam or quiz date, you must notify your instructor prior to the scheduled exam time to be considered for a make-up exam. Make-up exams are offered at the instructor's discretion.
- **Attendance policy**: Attendance will not be a part of your final grade but is essential to success in this course.

Recording and Privacy

- In this class, software will be used to record live class sessions. As a student in this class, your participation may be recorded. These recordings will be made available only to students enrolled in the class. The intent of the recordings is to assist those who cannot attend the live session or to serve as a resource for those who would like to review content presented during the current semester in which the recording is made. You may not download, share, replicate, or publish the recording, in whole or in part, or use the recording for any other purpose without the written approval of the instructor. Recordings are for personal academic use only, where personal academic use is restricted to the personal study use of the individual. Any violations to this policy must be reported to the Vice President of Academic Affairs and may result in disciplinary action, including expulsion from the college. All recordings will become unavailable to students in the class shortly after the course ends.
- If you have any concerns about being recorded during class, please discuss your options with your instructor or express your concerns to the Dean of Faculty.

Course Policies

- **Academic Integrity & Collaboration**: Bethany Lutheran College expects you to follow high ethical standards. Although you should explore the many resources available for learning, all work you submit for this class must be your own. Standards for academic integrity and consequences will be strictly enforced following policies in the current student handbook and college catalog. Consider the institutional policy on the website https://blc.edu/academics/registrar/honor-code/ or to the more detailed document: https://blc.edu/wp-content/uploads/2018/08/Academic-Honor-System.pdf
- **Accommodations for students with disabilities**: If you have a disability and require accommodations, please contact Kristi Ringen, Coordinator of the Academic Resource Center, 507-344-7730, kringen@blc.edu. If you have an accommodations letter from the Academic Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate.
- **Mobile Devices**: No cell phone use in class.

MATH 151 (Calculus I)

Substandard	Text	Assessment
8710.4600 (Mathematics)		
Sub. 3.A. A teacher of mathematics understands patterns, relations, functions, algebra, and basic concepts underlying calculus from both concrete and abstract perspectives and is able to apply this understanding to represent and solve real world problems. The teacher of mathematics must demonstrate knowledge of the following mathematical concepts and procedures and the connections among them:		
Sub. 3.A. 1	recognize, describe, and generalize patterns and build mathematical models to describe situations, solve problems, and make predictions;	Students will solve optimization problems, where they use the given information to build an appropriate model. (Chapter 4 exam, homework, and activity)
Sub. 3.A. 2	analyze the interaction between quantities and variables to model patterns of change and use appropriate representations including tables, graphs, matrices, words, ordered pairs, algebraic expressions, algebraic equations, and verbal descriptions;	Students will analyze related rates problems with set quantities and variables. (Chapter 4 homework and exam)
Sub. 3.A. 3	represent and solve problem situations that involve variable quantities and use appropriate technology;	Students will investigate and solve limit problems using graphs, tables, and functions and appropriate graphical and tabular technology. (Chapter 2 exam and activity)
Sub. 3.A. 6	apply concepts of derivatives to investigate problems involving rates of change;	Students apply differentiation to the concepts of position, velocity, and acceleration. (Chapter 3 exam and activity)
Sub. 3.C A teacher of mathematics understands that number sense is the underlying structure that ties mathematics into a coherent field of study, rather than an isolated set of rules, facts, and formulae. The teacher of mathematics must demonstrate knowledge of the following mathematical concepts and procedures and the connections among them:		
Sub. 3.C. 7	algebraic and transcendental numbers;	Students recognize transcendental numbers when differentiating and extending other differentiation rules. (Chapter 3 homework and exam)
Sub. 3.G A teacher of mathematics is able to reason mathematically, solve problems mathematically, and communicate in mathematics effectively at different levels of formality and knows the connections among mathematical concepts and procedures as well as their application to the real world. The teacher of mathematics must be able to:		
Sub. 3.G.4. make mathematical connections by:		
Sub. 3.G.4. a	demonstrating the interconnectedness of the concepts and procedures of mathematics;	Students use the connections between differentiation and integration with the Fundamental Theorem of Calculus. (Chapter 5 homework and activity)
Sub. 3.G.4. c	making connections between mathematics and daily living; and	Students use differentiation to investigate position, velocity, and acceleration with relation to gravity and motion. (Chapter 4 homework and activity)

8710.3320 (Middle Lvl Math)		
Sub. 3.C. A teacher with a middle level endorsement for teaching mathematics in grades 5 through 8 must demonstrate knowledge of fundamental concepts of mathematics and the connections among them. The teacher must know and apply:		
Sub. 3.C.1. concepts of patterns, relations, and functions:		
Sub. 3.C.1. f	apply concepts of derivatives to investigate problems involving rates of change;	•The students compare average and instantaneous rates of change and analyze motion data. •The students compare and contrast derivatives of polynomials, exponential, logarithmic, and trigonometric functions. •The students solve applied problems that require the use of the derivative, including related rate and optimization problems. (Chapter 3 & 4 homework, activities, and exam)
Sub. 3.D A teacher with a middle level endorsement for teaching mathematics in grades 5 through 8 must understand the content and methods for teaching reading, including:		
Sub. 3.D.2. ability to use a wide range of instructional practices, approaches, methods, and curriculum materials to support reading instruction, including:		
Sub. 3.D.2. e.iii	use of equations to model life situations; asking students to create or restate, in words or sentences, the relations between symbols; and the situation being modeled;	•The students identify the variables, select the essential ones, formulate a model to describe the relationships between the variables, analyze the relationships with derivatives to draw conclusions and interpret the results back into context. (Chapter 4 exam and activity)
Sub. 3.D.2. f	model strategies for representing mathematical ideas in a variety of modes (literal, symbolic, graphic, digital), which includes asking students to restate symbolic representations (numerals, equations, and graphs), in words or sentences.	•The students determine an appropriate method (graphical, tabular, symbolic, verbal) means of presenting data and explaining concepts of limits, derivatives, and applications. (Chapter 2 & 3 homework, activities, exams) •The students apply technology to analyze and model real-life problems that relate to differentiation. (Chapter 4 homework, activity, and exam)