

COURSE INFORMATION

Instructor

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Section Information

Section 01 **Online**
May 20 - August 15, 2019

4 credits

Office Hours

Tuesday 3-5
Thursday 11-1
or by appointment

COURSE DESCRIPTION

This is the initial course in a sequence of courses on the fundamental ideas of the calculus of one variable. It is here that truly significant applications of mathematics begin. Topics included are functions, continuity, limits, derivatives, maxima and minima and antiderivatives.

COURSE OBJECTIVES

On successful completion of the course, students will be able to:

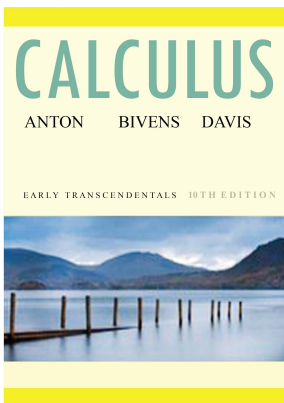
- recognize, define, and apply properties of functions, such as their domain, range, intercepts, and inverses;
- be able to evaluate a variety of limits;
- identify discontinuities of a function presented either graphically or algebraically;
- find the derivative of functions using the limit definition;
- find the derivative of sums, products, and quotients of composite polynomial, trigonometric, exponential, and logarithmic functions;
- understand conceptual relationships between derivatives, rates of change, and tangent lines;
- use properties of functions and derivatives to graph functions;
- apply differentiation procedures to solve related rates and extreme value problems;
- identify and evaluate limits involving indeterminate forms;
- compute definite and indefinite integrals using formulas and substitution;
- understand the relationship between the integral and the derivative; and
- read and interpret mathematical theorems, including checking that hypotheses are satisfied and reaching correct conclusions.

PREREQUISITES

To remain enrolled in this course, you must satisfy at least one of the following criteria:

- Score of 70 or better on the ALEKS Mathematics Placement Assessment
- Passed Math 118 (Math for the Natural Sciences), or transfer credit for equivalent
- Passed both Math 111 (College Algebra) and Math 112 (Trigonometry and Functions), or transfer credit for equivalent

REQUIRED MATERIALS



Textbook

Calculus, Early Transcendentals by Anton, Bivens, and Davis, 10th Edition. We will be covering chapters 0-5 in the textbook. If you prefer to purchase or rent an electronic version of the text, you're welcome to do so.

Internet Access

This course will be conducted entirely online using the Blackboard Learning Management System. You are responsible for ensuring that you have access to reliable internet access throughout the semester, and that you are able to access the course site on Blackboard.

Camera and Scanner

In order to receive partial credit on exam problems and to receive useful feedback on your work, you will be required to submit your written work for all exams. After completing the Blackboard exams, you will have 24 hours to submit (via Blackboard) scans or photos of your work for each problem. Please make sure you'll have access to a camera or scanner for each exam.

EXAMS

We will have four exams, one at the end of each unit. These exams will be delivered and completed online via Blackboard.

Exam Availability

Each exam will be available for a period of three days, as shown on the course schedule. Once you begin an exam, you will have two hours to complete it. You may not log out of Blackboard and return to an unfinished exam later, so be sure to leave enough time before you begin.

Submitting Work

In order to award partial credit and provide comments on your work, **you will be required to submit a scan or photo of your written work** through Blackboard. Your exam will not be considered complete without this work, and you will not receive a grade for the exam until it is submitted.

Academic Honesty Expectations

Even though you'll be taking your exams at home, your exam grades should still reflect what you have learned and how well you understand it. All exams are "closed book" exams, meaning you are not permitted to use your notes, textbook, or any other materials while taking an exam. You are also not permitted to seek or provide assistance from anyone else while taking exams, including students in the course. Students found to be violating any of these policies will receive an exam grade of 0.

Missed Exams

If you will be unable to take a unit exam during the planned period on the course schedule, please let me know in advance so I can adjust the dates for your exam. If you miss an exam and do not contact me until after the exam window has closed, you will receive a 0 for that exam.

HOMEWORK

A list of recommended homework problems from the textbook is available in this syllabus and on Blackboard. While your work for these problems will not be collected, practicing the material as much as possible is the best (and only) way to learn it. You are strongly encouraged to work through additional problems as well.

QUIZZES

Keeping up with the homework will ensure that you are prepared for the quizzes, which will feature problems very similar to those in the homework as well as more conceptual questions about the concepts and definitions you'll see each week.

You will have 1 hour to complete each quiz from the time you begin, so please be sure that you allow time to finish a quiz before starting. You will not be required to submit any written work for your quizzes, and you'll receive your grade immediately upon completing the quiz. You are not permitted to work with other students on quizzes.

Each unit will have 2-3 quizzes (for a total of 11). The quizzes for each unit will be due *before* the unit exam opens. When the exam is available, you'll be able to see all questions and answers for the quizzes to help prepare for the exam.

GRADING

Each quiz, exam, and discussion assignment will contribute to your grade as follows:

Component	Value	Total Points
Quizzes (11)	15 points	165 points
Exams (4)	100 points	400 points
Discussions (5)	7 points	35 points
		600 points

Your letter grade will be based on the total number of points you earn throughout the semester:

Grade	Percentage	Points Needed
A	90	540
B+	87	522
B	80	480
C+	77	462
C	70	420
D+	67	402
D	60	360

DISCUSSION BOARD

A portion of your grade will also be based on your participation in the class discussion board. There will be five discussion posts with prompts related to course material. Further instructions to receive full credit for each discussion post will be provided within the post. You will have several weeks to complete each discussion assignment.

OTHER COURSE INFORMATION

- Not all material for the course will be available on the Blackboard Mobile app, so it is highly recommended that you work on the course materials using a computer. However, the app will alert you to course announcements and reminders, so it is a good idea to have it installed if you have a compatible mobile device.
- Please ask questions - via Blackboard, office hours, email, or phone - as soon as you feel stuck. Mathematics is a naturally cumulative subject. If you do not understand a particular topic, you will not understand topics that come after.
- I will attempt to answer email as quickly as possible, but please allow up to 24 hours for a response (particularly on weekends).
- You are neither expected nor required to purchase any materials for the course, aside from the textbook and a device that allows you to access the course and upload documents. Graphing calculators and mathematical software could be used to check your work, but should not be relied on to do the work for you.
- Math Department Tutoring is not available during the summer semester.

FREE ONLINE RESOURCES

- Kahn Academy Calculus I: <https://www.khanacademy.org/math/calculus-1>
Featuring videos and exercises for the topics we'll see in this course.
- Kahn Academy Algebra II: <https://www.khanacademy.org/math/algebra2>
A review of the algebraic tools you'll need for calculus, many of which appear in Chapter 0 of this course.
- Kahn Academy Trigonometry: <https://www.khanacademy.org/math/trigonometry>
A review of the trigonometric tools you'll need for calculus.
- Community Calculus: <https://www.whitman.edu/mathematics/multivariable/>
An extra calculus textbook, available as a free PDF with inexpensive print copies available.
- Marsden and Weinstein Calculus: <http://www.cds.caltech.edu/marsden/volume/Calculus/>
Another extra calculus textbook, available as a free PDF with print copies available.
- Wolfram Alpha: <https://www.wolframalpha.com/>
Ask it just about anything (not just math!). May be useful for plotting functions and checking your homework.

ACADEMIC HONESTY

Students are expected to contribute actively to the development of an atmosphere of academic integrity. Mercyhurst University assumes, therefore, that students will not resort to plagiarism or any other form of academic dishonesty. Students found guilty of willful academic dishonesty may be subject to a broad range of sanctions. At the discretion of their instructor, they may be required to redo the plagiarized assignment, or they may receive an automatic F for the exam/assignment and/or course. Students found to be in collaboration with other students involved in willful academic dishonesty are subject to disciplinary action.

LEARNING DIFFERENCES

In keeping with college policy, any student with a disability who needs academic accommodations must call Learning Differences Program secretary at (814) 824-3017, to arrange a confidential appointment with the director of the Learning Differences Program during the first week of classes.

OFFICE HOURS

I will be available during the hours listed at the top of this syllabus in my office on the Mercyhurst Erie campus, in Old Main 404. If you will be away from Erie, you can join a Google Hangouts video chat session by searching for my Mercyhurst email lwilliams@mercyhurst.edu or by accessing video chat directly at <https://hangouts.google.com/call/0TzYJnEt3EvcGBDeGWUAAEEE>. You may also make an appointment if you would like to chat remotely outside office hours.

COURSE UNITS

Unit 1: Prerequisites, Limits, and Continuity

May 20 - June 9

We'll start with a review of necessary algebra skills and the properties of functions. Then we'll begin our study of limits, which are the true basis of calculus. For this first unit of the semester, we'll focus on computing limits and how to interpret them. We'll finish with an introduction to continuity and why it's important, and learn to identify discontinuities of a function.

Unit Objectives:

- Manipulate and simplify algebraic expressions using order of operations and properties of real numbers
- Identify properties of functions, including domain, range, and inverses
- Classify families of functions and their associated properties
- Gain intuition about the concept of limits and their geometric interpretation
- Compute limits at finite values or infinity and understand their relationship with functions
- Decide if a function is continuous, or locate and name its discontinuities

Textbook Sections: 0.1, 0.2, 0.3, 0.4, 05, 1.1, 1.2, 1.3, 1.5, 1.6

Unit 2: The Derivative

June 10 - June 30

Derivatives allow us to measure change over time, and are vitally important to all lab sciences, economics, finance, social sciences, and of course, mathematics. We'll see how to understand the derivative geometrically, then use limits to compute the derivative of a function. We'll also see how to apply theorems to simplify the computation of derivatives, and how to evaluate the derivative of some useful families of functions.

Unit Objectives:

- Use the limit definition of the derivative to find the derivative of a function
- Apply the power rule, product rule, quotient rule, and chain rule to simplify the computation of a derivative
- Find the first and second derivatives of an implicitly defined function
- Compute the derivatives of trigonometric, exponential, and logarithmic functions

Textbook Sections: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.1, 3.2

Unit 3: Applications of the Derivative

July 8 - July 28

If you've ever wondered why calculus is important, the answer will likely be found in this unit. We'll see how to solve several types of problems using the derivative, including finding optimal solutions, predicting trends, and understanding systems with multiple factors. We'll also learn how to use calculus to sketch graphs of functions and find useful information about them.

Unit Objectives:

- Correctly interpret and solve related rates problems: real life situations with two changing variables, each under the influence of the other
- Evaluate limits of indeterminate forms using l'Hôpital's Rule
- Find critical values, inflection points, asymptotes, and relative extrema of functions, and use them to sketch their graph
- Find the optimal solutions to real life situations under financial or spatial constraints

Textbook Sections: 3.4, 3.5, 3.6, 4.1, 4.2, 4.3, 4.4, 4.5

Unit 4: Integration

July 29 - August 15

After a few remaining topics involving the derivative, we'll move to the last major topic of Calculus I: an introduction to integration. An understanding of the meaning and purpose of the integral will lead to evaluating indefinite and definite integrals. Direct integration and integration by substitution methods will be used to evaluate integrals, with other techniques of integration reserved for Calculus II.

Unit Objectives:

- Apply Rolle's Theorem and the Mean Value Theorem
- Gain an intuitive understanding of the indefinite and definite integral
- Compute integrals using direct integration and substitution techniques
- Evaluate definite integrals using the
- Fundamental Theorem of Calculus

Textbook Sections: 4.8, 5.1, 5.2, 5.3, 5.5, 5.6, 5.9

COURSE EVALUATIONS

Near the end of the semester, you will be asked to complete an online course evaluation. The evaluation may be completed using any laptop, tablet, or mobile device. The response tool allows you to note aspects of the course that helped you learn, as well as aspects that might be modified to help future students learn more effectively. You will receive an email letting you know when the evaluation window for our class is open. Please note that these course evaluations are anonymous and instructors do not see the results until after the grades for the course are submitted.

SEMESTER SCHEDULE

Week	Dates	Topics
1	May 20 to May 26	Functions: Definitions, Families, and Properties Composition of Functions and Inverses Exponential and Logarithmic Functions
2	May 27 to June 2	Limits: Intuition and examples Computing limits Limits at infinity: End behavior of functions
3	June 3 to June 9	Continuity: Definitions and essential theorems Continuity of trigonometric, exponential, and inverse functions Unit I recap
June 6		Quiz 1, 2, 3 Due
June 7 - 9		Unit I Exam Open
4	June 10 to June 16	Tangent lines and rates of change Limit definition of the derivative The derivative function
5	June 17 to June 23	Techniques of differentiation Product and quotient rules The chain rule
6	June 24 to June 30	Implicit differentiation Derivatives of logarithms and inverse trigonometric functions Unit II recap
June 27		Quiz 4, 5, 6 Due
June 28 - 30		Unit II Exam Open
<i>July 1 to July 7: Summer Break</i>		
7	July 8 to July 14	Related rate problems Local linear approximations L'hospital's rule
8	July 15 to July 21	Properties of functions: increase, decrease, concavity Relative extrema and derivative tests Graphing polynomials and rational functions
9	July 22 to July 28	Absolute extrema Applied minimum/maximum problems Unit III recap
July 27		Quiz 7, 8, 9 Due
July 26 - 28		Unit III Exam Open
10	July 29 to August 4	Rolle's Theorem and The Mean Value Theorem The area problem The indefinite integral
11	August 5 to August 11	Substitution method The Fundamental Theorem of Calculus Definite integrals: substitution method
12	August 12 to August 15	Unit IV Recap
August 12		Quiz 10, 11 Due
August 13 - 15		Unit IV Exam Open

HOMEWORK LIST

Your homework will not be collected, but these problems (and similar questions) are likely to appear on quizzes and exams. Answers to most of the questions are available near the back of the textbook. Working on additional problems is highly recommended.

Sec.	Page	Problems
0.1	12	1, 3, 5, 7, 9, 15, 19, 23, 27, 29, 31a-c
0.2	24	1, 3, 5, 11, 13, 17, 25, 27, 29, 31, 33, 35, 39, 41, 49, 53, 61, 63
0.3	35	1, 3, 11, 15, 17, 19, 25, 29, 31
0.4	49	1, 3, 5, 9, 13, 17, 19, 25, 27, 31, 39, 41
0.5	61	1, 5, 9, 11, 13, 15, 17, 21, 23, 25, 27, 47, 57
1.1	77	1, 3, 5, 7, 9, 17-20, 21, 23, 25, 31
1.2	87	1, 3, 7, 11, 13, 15, 19, 21, 25, 31
1.3	96	1, 3, 5, 9, 13, 15, 21, 31, 33, 37, 43
1.4	106	You are not responsible for this section (but try 17 and 21 anyway!)
1.5	118	1, 3, 5, 7, 11, 13, 17, 21, 29, 31, 35, 45, 47
1.6	125	1, 7, 9, 13, 17, 19, 21, 23, 27, 31, 37, 49, 67
2.1	141	3, 11, 13, 15, 17, 23
2.2	152	1, 3, 7, 9, 11, 21, 23, 25, 29
2.3	161	1, 3, 5, 7, 9, 13, 15, 17, 21, 23, 29, 37, 39, 41, 43, 45, 49
2.4	168	1, 3, 5, 7, 11, 13, 19, 21, 23, 27, 29, 31, 33, 39
2.5	172	1, 5, 11, 15, 17, 21, 23, 27, 29, 31
2.6	178	3, 7, 9, 11, 15, 17, 19, 23, 27, 35, 37, 39, 45, 49, 51, 53, 77
3.1	190	3, 5, 7, 9, 11, 13, 15, 17, 27
3.2	195	1, 3, 7, 9, 13, 19, 23, 25, 27, 35, 37, 41
3.3	201	15, 17, 19, 21, 23, 25, 37, 43, 51, 65
3.4	208	1, 5, 13, 15, 17, 19, 25, 27
3.5	217	3, 5, 7, 23, 25, 29, 31, 43
3.6	226	1, 7, 9, 11, 13, 17, 21, 23, 27, 29, 33, 57
4.1	241	1, 5, 7, 9, 15, 17, 19, 21, 25, 29, 39
4.2	252	3, 5, 7, 9, 11, 19, 25, 27, 29, 33, 37, 41, 43, 45, 53
4.3	264	1, 3, 5, 9, 13, 19, 23, 25, 31
4.4	272	3, 7, 9, 11, 13, 21, 23, 25, 27, 31, 33
4.5	283	3, 5, 13, 19, 21, 23, 27, 29, 31, 37, 55
4.6	294	1, 3, 13, 17, 19, 33
4.8	308	1, 3, 5, 7, 15, 25, 41
5.1	321	7, 9, 13, 15, 17
5.2	330	5, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 43, 45
5.3	338	1, 3, 7, 9, 11, 15, 17, 21, 23, 27, 31, 33, 39, 41, 47, 53, 55, 61, 69, 71
5.5	360	13, 15, 19, 21, 23, 25, 33
5.6	373	7, 9, 13, 15, 17, 19, 23, 29, 31, 59, 61
5.9	393	1, 5, 9, 15, 17, 19, 21, 31, 33, 35, 37, 43, 45, 49, 53