MONTGOMERY COLLEGE - Germantown Campus
Mathematics, Statistics, & Data Science Department
Course Syllabus

I. Instructor Information

Professor: Zhou Dong
Email: Zhou.Dong@MontgomeryCollege.edu
Phone: (240) 567-7810
Office: HT 134 Germantown campus

Office Hours:

Monday, Wednesday, Friday 11:00 am – 11:50 am	Drop-in or appointments
Tuesday, Thursday 12:30 pm – 1:30 pm	By appointment only

Click here to book an appointment

II. General Course Information

Calculus I – MATH181

4 credits / 5 hours (For computation of tuition, this course is equivalent to five semester hours. Five hours each week.)

Intended primarily for students of the physical sciences, engineering, and mathematics. An introduction to major ideas of single variable calculus including limits, derivatives, and integrals of algebraic and transcendental functions; applications.

MATH181 fulfills a General Education Program Mathematics Foundation requirement.

PREREQUISITE:
A grade of C or better in MATH 165, appropriate score on mathematics assessment test, or consent of department. Assessment Level(s): ENGL 101/ ENGL 011 or AELW 940/ELAI 990, AELR 930/ELAR 980.

Fall 2024: CRN 21623
Class Times: MWF 12:00 pm – 1:40 pm
Classroom: HT 203

III. Common Course Student Learning Outcomes

Upon course completion, a student will be able to:

- Determine when and how to apply the Fundamental Theorem of Calculus.
- Evaluate limits graphically, algebraically, and numerically.

- Explain and distinguish between average and instantaneous rates of change and be able to interpret each within the context of an applied problem.
- Find a derivative directly from the definition of a derivative.
- Identify and apply the appropriate rule(s) for symbolic differentiation.
- Implicitly differentiate a function.
- Interpret derivatives verbally in the context of an application.
- Interpret limits verbally.
- Interpret the definite integral as a limit of sums.
- Interpret the indefinite integral as an inverse process of differentiation and evaluate indefinite integrals.
- Set up and evaluate definite integrals to solve applied problems, such as problems involving area, motion, and net change.
- Use derivatives to determine the extreme values of a function.
- Use derivatives to model and analyze a variety of applications, such as problems involving optimization, related rates, and motion.
- Use first and second derivatives to obtain information about the graph of a function and use the graph of a function to obtain information about its first and second derivatives.
- Use technology to discover, explore, illustrate, and understand limits, derivatives, and integrals.

IV. Textbooks, Workbooks, and Supplies

Required materials for the course:

- *Calculus: Concepts and Contexts*, 5th edition by James Stewart and Steve Kokoska
  - Available as ebook via WebAssign
- *WebAssign*
  - Online homework and ebook access
  - Class Key: **montgomerycollege 8259 7726**
- *Graphing calculator*
  - A TI-83 or TI-83 Plus (http://wabbitemu.org/) – required for assessments
  - Desmos (www.desmos.com/calculator) – may be used for studying, but not allowed on assessments
- *Microsoft Teams*– for course announcements and communication outside of class
  - MC students can download these programs for free from their Microsoft 365 account accessed through MyMC.
  - **Link to Team**

V. Course Design

This course is designed to give the student a high degree of autonomy and students are expected to self-direct their learning. While many resources are provided for the student to aid in their learning, the final course grade is based solely on the student's mastery of the course standards as determined through assessments (see section B. Course Grade for details). This means it is up to the student to determine which resources to use (e.g. class

attendance, textbook, lecture videos, online practice problems, etc.) in order to gain mastery of the course standards. Feedback on online assignments are provided for learning purposes only and will not affect the student's final course grade.

A. Bloom's Taxonomy

This class has been designed based on Bloom's Taxonomy. A basic understanding of Bloom's Taxonomy will help the student understand the course design as well as make better choices about how best to gain mastery of the material and be successful in this class.

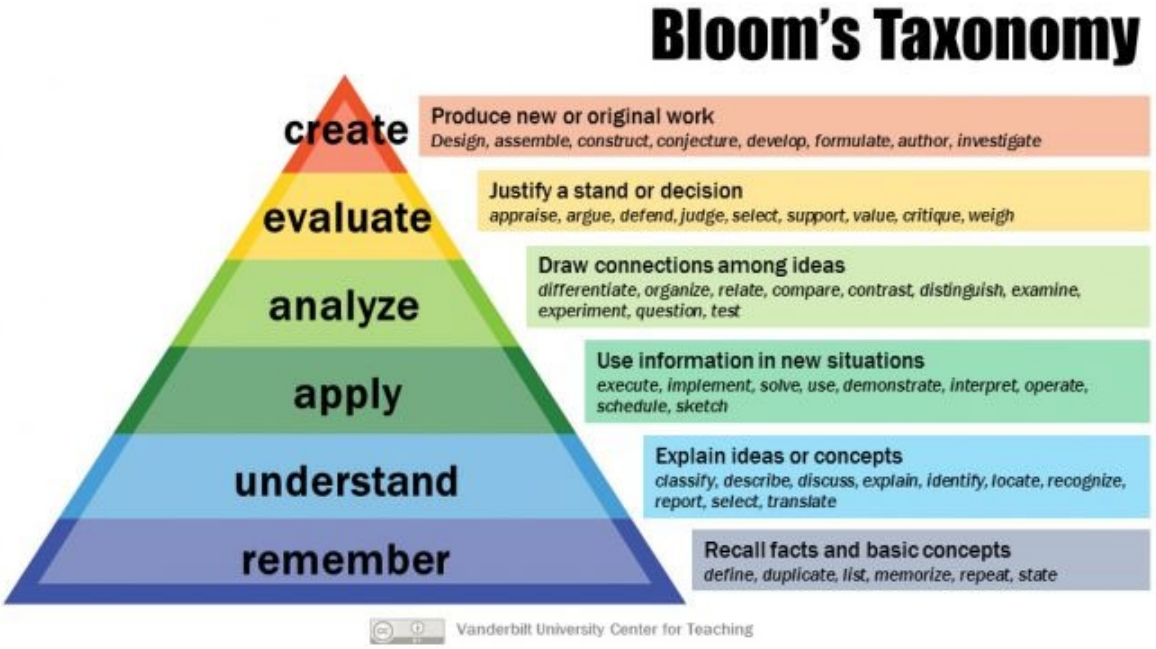

Figure 1 - Bloom's Taxonomy, from https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/

B. Flipped Classroom Instruction

Under the flipped classroom model, students begin learning the course material at home before class, while class time is focused on solidifying understanding through active discussion and problems solving:

Before class:

- Read textbook or lecture slides, or watch lecture videos
- Self-assess using Pre-class Assessment on WebAssign
- Prepare questions for class discussion

During class:

- Participate in class discussion
- Work in groups or individually on in-class assignments
- Receive individual and/or small group instruction as needed
- Take assessments as scheduled

After class:

- Complete Practice Problem Assignments on WebAssign

- Take practice quizzes in the Personal Study Plan on WebAssign
- Get help from instructor during office hours or by appointment
- Utilize MAPEL Center tutoring

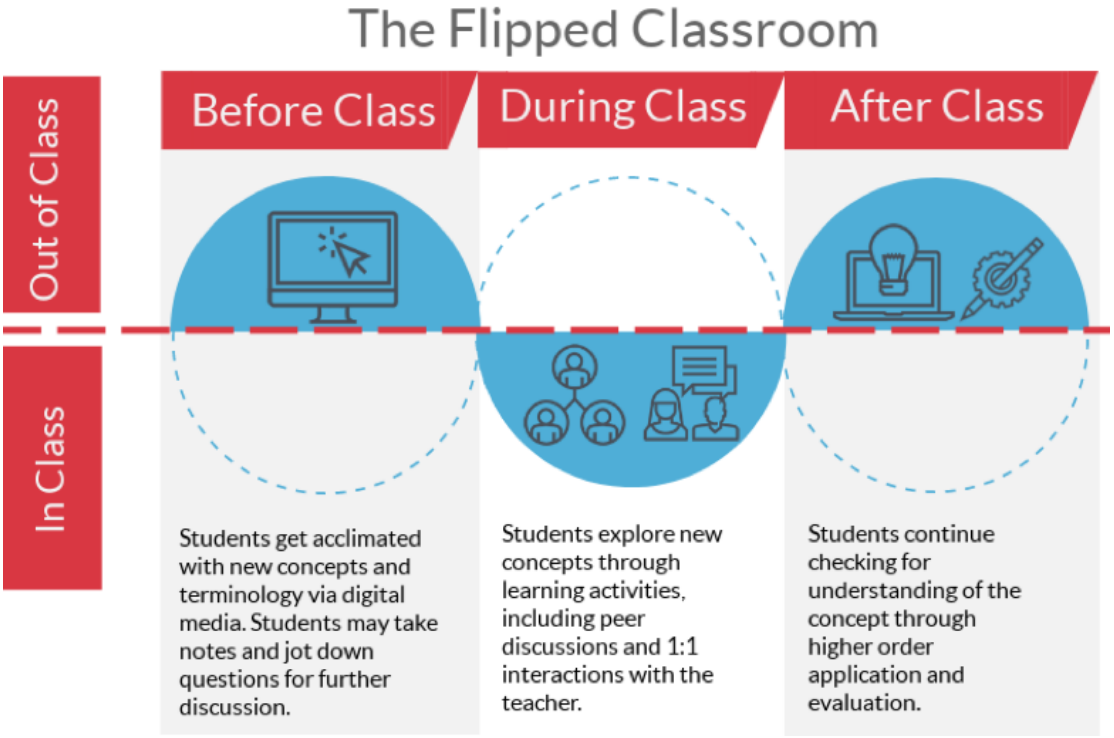

Figure 2 - The Flipped Classroom, from https://www.odysseyware.com/blog/using-classpace-flipped-classroom

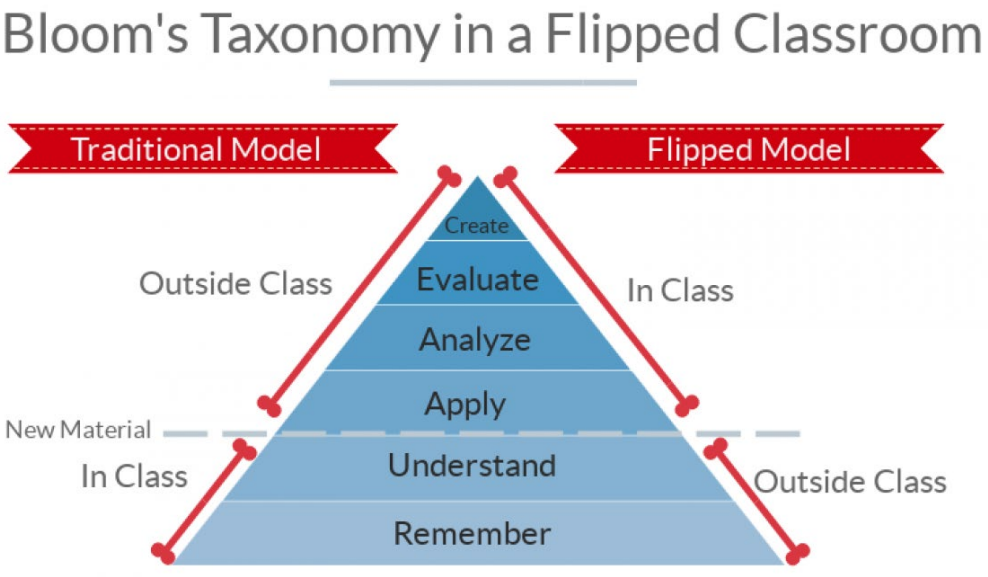

Figure 3- Bloom's Taxonomy in a Flipped Classroom, from https://www.odysseyware.com/blog/using-classpace-flipped-classroom

While preparing for class, students have their initial exposure to the new material through reading the textbook and lecture slides and watching lecture videos. The focus at this time is on the *Remember* and *Understand* levels of Bloom's Taxonomy:

- Memorize definitions and theorems
- Paraphrase definitions and theorems
- Understand worked examples

During class, students work with each other and the instructor to develop the *Apply*, *Analyze*, and *Evaluate* levels of Bloom's Taxonomy. Occasionally, students are expected to reach the *Create* level of Bloom's Taxonomy. After class, students should focus on consolidating their learning through additional practice and self-assessment in order to demonstrate mastery of course standards.

It is essential that students put in the time and effort necessary in and out of class. It is generally recommended that for each hour of in-class time, the student spends 2-3 hours out of class studying. This class meets for 5 hours each week, therefore, ***students should expect to spend 10 – 15 hours outside class time studying for this class.***

VI. Course Requirements

A. Course Standards

This course uses Standards Based Grading (SBG). Under SBG, students are graded based on demonstrated mastery of the course standards. The standards are separated into core standards and elective standards. The core standards are essential material and EACH standard must be mastered in order to earn a grade of "C" or above. Most core standards are at the Apply and Analyze levels of Bloom's Taxonomy. The elective standards are either optional topics or a higher level question for a core standard topic. Detailed grading criteria can be found in section D. Course Grade and section E. Standards.

MATH181 Calculus I Course Standards		
Code		Standard description
C	**2.1TG**	**Explain the relationship between the slope of tangent lines and slope of secant lines**
C	**2.1VL**	**Estimate instantaneous velocity by computing relevant average velocities**
C	**2.2LE**	**Estimate limits and one-sided limits graphically and numerically, and also recognize when a limit does not exist**
E	2.2LD	Determine whether a statement about limits is true or false and provide examples or counter-examples
C	**2.3LL**	**Use limit laws to evaluate limits and one-sided limits and demonstrate when a limit does not exist**
E	2.3SQ	Apply the Squeeze Theorem appropriately to evaluate limits
C	**2.4CT**	**Apply the definition of continuity to determine where a function is continuous or discontinuous and describe the type of discontinuity**
E	2.4IV	Apply the Intermediate Value Theorem appropriately and state its consequences
C	**2.5AS**	**Graphically work with vertical and horizontal asymptotes and limits involving infinity**
E	2.5LI	Evaluate limits involving infinity using limit laws and infinite arithmetic

C	**2.6DI**	**Interpret the derivative as the slope of the tangent line and as the instantaneous rate of change**
E	2.6DC	Compute the derivative using its definition as the limit of a difference quotient
C	**2.7DG**	**Analyze f, f', f'' using their graphs**
C	**2.7DF**	**Apply the definition of differentiability to determine where a function is differentiable and describe why it is not differentiable**
E	2.7DC	Compute the derivative function using the limit definition of a derivative
C	**3.1PE**	**Apply the power rule, constant multiple rule, sum rule, and difference rule to compute derivatives of power functions and exponential functions**
E	3.1TN	Analyze the tangent and normal lines of power functions and exponential functions.
C	**3.2PQ**	**Apply the product and quotient rules to compute derivatives of products and quotients of power functions and exponential functions**
E	3.2DV	Apply the constant multiple rule, sum rule, difference rule, product rule, and quotient rule to compute derivative values from given function values or graphs
C	**3.3TR**	**Apply the constant multiple rule, sum rule, difference rule, product rule, and quotient rule to compute derivatives of functions involving trigonometric functions.**
E	3.3PT	Recognize patterns in the derivative of trigonometric functions.
C	**3.4CR**	**Apply the chain rule, along with constant multiple rule, sum rule, difference rule, product rule, and quotient rule, to compute derivatives of functions**
E	3.4CV	Apply the chain rule, along with constant multiple rule, sum rule, difference rule, product rule, and quotient rule, to compute derivatives values from given function values or graphs
E	3.4PC	Analyze tangent lines of parametric curves
C	**3.5ID**	**Apply implicit differentiation to compute derivatives**
E	3.5IC	Analyze curves defined by implicit equations
C	**3.6IT**	**Compute derivatives involving inverse trigonometric functions**
C	**3.7LG**	**Compute derivatives involving logarithmic functions**
E	3.7LD	Apply logarithmic differentiation to compute derivatives
C	**3.8VA**	**Derive velocity and acceleration from the position function and use them to answer questions about an object in motion**
E	3.8AP	Other applications of the derivative in physics, chemistry, biology, economics, etc.
C	**3.9LZ**	**Calculate the linearization for a function and determine whether it is an over or under approximation**
E	3.9DF	Use differentials to approximate change and error
E	4.1RR	Model related rates as a mathematical equation and solve the problem using calculus
C	**4.2CM**	**Use the Closed Interval Method to determine absolute extrema of a function on a closed interval**
E	4.2MM	Analyze the local and absolute extrema of a function on a given interval
C	**4.3GA**	**Use f' and f'' to analyze the graph of f.**
E	4.3MV	Apply the Mean Value Theorem appropriately and state its consequences
E	4.4CG	Use technology and calculus to graph a function showing all of its important features.
C	**4.5IF**	**Recognize all indeterminate forms: 0/0, inf/inf, 0*inf, inf-inf, 1^inf, inf^0, 0^0**
C	**4.5LH**	**Evaluate limits of the form 0/0 and inf/inf**
E	4.5LO	Evaluate limits of the difference, product, and exponential indeterminate forms
E	4.6OP	Model the quantity to be optimized as a mathematical function and solve the optimization problem using calculus.

C	**4.7NA**	**Apply Newton's Method to approximate zeros to a given degree of accuracy**
E	4.7NF	Recognize when and explain why Newton's Method fails to converge to the desired zero
C	**4.8CA**	**Compute the most general and specific antiderivatives of basic functions**
C	**5.1RS**	**Compute left, right, and midpoint approximations of areas and state (if possible) whether the approximations are over or under estimates**
C	**5.2RS**	**Express definite integrals as limits of Riemann sums, including the use of sigma notation**
C	**5.2AP**	**Compute definite integrals by interpreting them as areas and using their properties**
C	**5.3EV**	**Evaluate indefinite and definite integrals, using the Evaluation Theorem when appropriate**
E	5.3NC	Apply the Net Change Theorem to solve application problems
C	**5.4FT**	**State both parts of the FTC and explain its consequences and significance.**
C	**5.4FC**	**Apply the FTC and chain rule to compute the derivative of area functions.**
E	5.4AF	Analyze an "area under f" function from a graph of f.
	30	**Core Standards**
	24	Elective Standards
	54	Total

B. Course Grade

This course uses Standards Based Grading. Your course grade will be based solely on mastery of the course standards. Assessments of standards will be graded as follows:

Score	Mastery Level	Student work
4	**Perfect Mastery**	Demonstrates complete understanding of the underlying concept and provides correct solution with appropriate notation and use of language
3	**Imperfect Mastery**	Demonstrates complete understanding of the underlying concept but has minor errors in calculation and/or problems with notation and use of language
2	Developing	Demonstrates developing but incomplete understanding of the concept and/or major errors in the computation and presentation of the solution
1	Novice	Demonstrates little to no understanding of the concept with some relevant computations
0	No evidence	Demonstrates no evidence of understanding or not attempted

Both Perfect Mastery (score = 4) and Imperfect Mastery (score = 3) are considered mastery. A student is only required to demonstrate mastery on a standard once.

There will be three (3) opportunities for demonstrating mastery on each standard:

1. Initial assessments (weekly)
2. Reassessment on the 4 Exams as scheduled
3. Final assessment on the Final Exam as scheduled

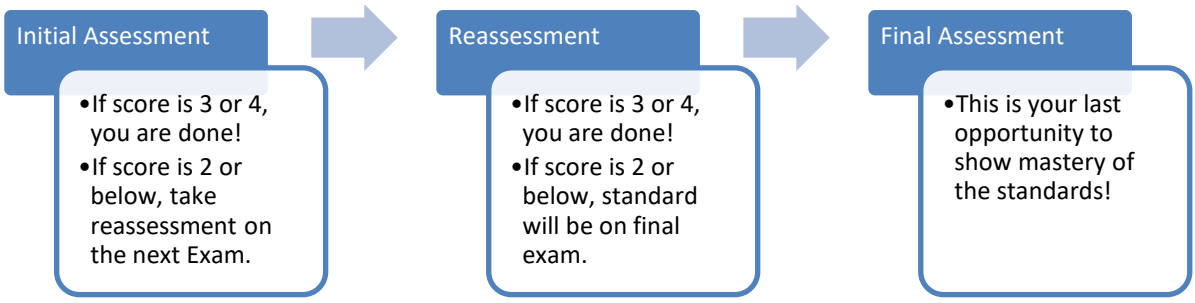

Figure 4 Assessment flow chart

C. Standards

Final letter grades will be determined according to this rubric:

Grade	**Core Standards**	**All standards (Core and Elective)**
A	Mastery on all	Average score is 3.5 or above
B	Mastery on all	Average score is between 3 and 3.5
C	Mastery on all	Average score is below 3
D	Not all mastered	Average score is above 2
F	Not all mastered	Average score is below 2

Note:

- Mastery means a score of 3 or 4.
- For the grades of A, B, or C, you must demonstrate mastery on ALL Core Standards.

D. Assessments and Make-up Policy

Make-ups for missed assessments will not be available. However, the instructor will make every effort to arrange for alternate assessment times if student notifies the instructor of the need ahead of time. All WebAssign assignments have been setup for unlimited automatic extensions when requested.

VII. Student Code of Conduct

A. Standards of College Behavior

Students are expected to adhere to the Montgomery College Student Code of Conduct: https://www.montgomerycollege.edu/_documents/policies-and-procedures/42001-student-code-of-conduct.pdf

B. Academic Honesty

All assessments in this class are closed-notes, closed-book, and individual. No collaboration is allowed on any assessment. Students should refer to the Student Code of Conduct or the following excerpt for more details: https://www.montgomerycollege.edu/_documents/academics/support/learning-centers/writing-reading-learning-ctr-germantown/academic-dishonesty-and-how-it-is-handled.pdf

VIII. Collegewide Policies and Procedures

A. Attendance Policy

Students are encouraged to attend and actively participate in all class meetings. As group work is often part of class, students who regularly miss class will no longer be assigned a group. Students who miss more than one week of class and assessments may be dropped from the course for excessive absences as per the Montgomery College Academic Regulations and Standards.

B. Withdrawal and Refund Dates

- Refund Drop Deadline – September 19, 2024
- No Grade Drop & Audit/Credit Deadline – October 3, 2024
- W Grade Drop Deadline – November 21, 2024

C. Audit Policy

All students registered for audit are required to consult with the instructor before or during the first class session in which they are in audit status, and students are required to participate in all course activities unless otherwise agreed upon by the student and instructor at the time of consultation. Failure to consult with the instructor or to so par-ticipate may result in the grade of "W" being awarded. This action may be taken by the in-structor by changing the "AU" to "W" before the drop with "W" date.

D. Disability Support Services

Any student who needs an accommodation due to a disability should make an appointment to see me during my office hours. In order to receive accom-modations, a letter from Disability Support Services (G-SA 189; R-CB 122; or TP/SS-ST 122) will be needed. Any student who may need assistance in the event of an emergency evacuation must identify to the Disability Support Services Office; guidelines for emergency evacuations for individuals with disabilities are found at: http://www.montgomerycollege.edu/dss

E. Veteran's Services

If you are a veteran or on active or reserve status and you are interested in infor-mation regarding opportunities, programs and/or services, please visit the Combat2Col-lege website at http://www.montgomerycollege.edu/combat2college

F. Delayed Opening or Closing of the College

If a class can meet for 50% or more of its regularly scheduled meeting time OR if the class can meet for 50 minutes or more, it will meet. Montgomery College will always operate on its regular schedule unless otherwise announced. Depending on the nature of the incident, notifications of emergencies and changes to the College's operational status will be communicated through one or more communication methods including the College's website http://www.montgomerycollege.edu. For the most up-to-date information regarding College openings, closings, or emergencies, all students, faculty, and staff are encouraged to sign up for email and text alerts via Montgomery College ALERT. Registration information is available at http://www.montgomerycollege.edu/emergency.

G. Communication

This course will use your official Montgomery College email address and Microsoft Teams for communication. This course will NOT use Blackboard for communication.

IX. Schedule

A. Class Meeting Schedule

	MATH 181 Fall 2024 Class Meeting Schedule		
Week	**Date**	**Topic**	**Initial Assessment (Reassessment)**
1	Mon 9/02	*No meetings* *Class starts on Week 3*	
	Wed 9/04		
	Fri 9/06		
2	Mon 9/09		
	Wed 9/11		
	Fri 9/13		
3	Mon 9/16	2.1 The Tangent and Velocity Problems	
	Wed 9/18	2.2 The Limit of a Function	
	Fri 9/20	2.3 Calculating Limits Using Limit Laws	
4	Mon 9/23		2.1, 2.2
	Wed 9/25	2.4 Continuity	
	Fri 9/27	2.5 Limits Involving Infinity	
5	Mon 9/30		2.3, 2.4 (2.1, 2.2)
	Wed 10/02	2.6 Derivatives and Rates of Change	
	Fri 10/04	2.7 The Derivative as a Function	
6	Mon 10/07		2.5, 2.6 (2.3, 2.4)
	Wed 10/09	3.1 Derivatives of Polynomials and Exponential Functions	
	Fri 10/11	3.2 The Product and Quotient Rules	
7	Mon 10/14	3.3 Derivatives of Trigonometric Functions	2.7, 3.1, 3.2 (2.5, 2.6)
	Wed 10/16	3.4 The Chain Rule	
	Fri 10/18	3.5 Implicit Differentiation	
8	Mon 10/21	3.6 Inverse Trigonometric Functions and Their Derivatives	3.3, 3.4, 3.5 (2.7, 3.1, 3.2)
	Wed 10/23	3.7 Derivatives of Logarithmic Functions	
	Fri 10/25	3.8 Rates of Change in the Natural and Social Sciences	
9	Mon 10/28	3.9 Linear Approximations and Differentials	3.6, 3.7, 3.8 (3.3, 3.4, 3.5)
	Wed 10/30	4.1 Related Rates	
	Fri 11/01		
10	Mon 11/04	4.2 Maximum and Minimum Values	3.9, 4.1 (3.6, 3.7, 3.8)

	Wed 11/06		
	Fri 11/08	4.3 Derivatives and the Shapes of Curves	
11	Mon 11/11	4.4 Graphing with Calculus and Technology	4.2, 4.3 (3.9, 4.1)
	Wed 11/13	4.5 Indeterminate Forms and L'Hospital's Rule	
	Fri 11/15	4.6 Optimization Problems	
12	Mon 11/18		4.4, 4.5 (4.2, 4.3)
	Wed 11/20	4.7 Newton's Method	
	Fri 11/22	4.8 Antiderivatives	
13	Mon 11/25	5.1 Areas and Distances	4.6, 4.7, 4.8 (4.4, 4.5)
	Wed 11/27	*Thanksgiving Break*	
	Fri 11/29		
14	Mon 12/02	5.2 The Definite Integral	5.1 (4.6, 4.7, 4.8)
	Wed 12/04	5.3 Evaluating Definite Integrals	
	Fri 12/06	5.4 The Fundamental Theorem of Calculus	
15	Mon 12/09	5.5 The Substitution Rule (not assessed)	5.2, 5.3, 5.4 (5.1)
	Wed 12/11	Final Exam Review	
	Fri 12/13	Final Exam Review	(5.2, 5.3, 5.4)
	Mon 12/16	**Final Exam (12:30 pm - 2:30 pm)**	

The professor reserves the right to make changes to this syllabus.

Last Updated September 12, 2024