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The Pennsylvania State University
MATH 231 - Calculus of Several Variables
Course Syllabus

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Office: 012 McAllister Building

Office Hours: Fridays 11:30 - 14:30, or by appointment

Sections & Meeting Time

- Section 003: Tu & Th 9:05 - 9:55, Elec Eng West 203

- Section 009: Tu & Th 15:35 - 16:25, Wartik Lab 107

- Section 011: Tu & Th 16:40 - 17:30, Willard Bldg 373

Required Materials

Calculus: Early Transcendentals by Jon Rogawski, Colin Adams, and Robert Franzosa, 4th ed, along with an activated Achieve account. This means you will need to purchase the online system that accompanies the textbook. You do not need a hard copy of the textbook as the eText comes with purchase of Achieve. You should check first if you have a still-active version of Achieve from when you took MATH 140/141 as we typically instruct you to purchase the multiple-semester access.

Achieve Instructions

When activating your Achieve account, be sure to use your PSU email address and the same name that is on the office Canvas roster. Link to Achieve course: https://achieve.macmillanlearning.com/courses/dpbzkg

Email Policy

The mathematics department has guidelines in place so that emails from students must receive a reply within 24 to 48 hours, excluding weekends. I ask that you wait no longer than 48 hours before sending a follow-up email.

Calculator Policy

A calculator, online problem solver, downloadable app, etc. is an excellent tool for crunching numbers - especially when working real-world examples with messy constants - as well as a useful study resource. If you do not have a scientific calculator, websites such as GeoGebra and Wolfram Alpha are an excellent resource for computations. Note, however, that these tools are not needed to understand and apply the concepts of the course to examples with simple coefficients (all arithmetic will be simple enough to do by hand.) No form of calculators or electronic problem solver will be permitted on any of the quizzes or exams for this course unless otherwise specified by your instructor. Their use is a violation of Penn State's Academic Integrity Policy.

TUTORS and PENN STATE LEARNING

Free mathematics tutoring is available at Penn State Learning. You can find information about their online and in-person options at the following site: https://pennstatelearning.psu.edu/tutoring/mathematics

Office Hours

Office hours are a useful resource in any course. If you have questions about course content or progress in the course, please do not hesitate to attend office hours. Office hours are **not**, however, a time and place to re-lecture content that you may have missed in class. While I can answer questions and give a very general and brief overview of what you may have missed, I cannot devote an entire office hour to the re-lecturing of material. I may have many students that attend office hours at the same time, and I need to be mindful of the questions that each student has and the time they are taking out of their day to attend office hours. I ask that you please come prepared to office hours with your questions.

Homework

- Achieve homework will be due on Thursdays at 11:59 PM.

- Written homework will have a soft deadline of Friday at 11:59 PM and hard deadline of Sunday at 11:59 PM. In GradeScope, you will see this as a "due date" and a "late due date" but please know that these correspond to those deadlines. There is not a penalty for turning it in Saturday or Sunday, but nothing will be accepted after the late due date. During the submission process, you will need to specify which problems are present on which pages (including all pages which have work, not just the first page); failure to do so may result in a zero on those problems.

Achieve homework grades will be regularly updated at the times of each of the exams on Canvas so that you have a snapshot of your grade at various points throughout the academic term.

Quizzes

There will be regular quizzes given during class. If you are going to miss a class when there is a quiz and have a valid school approved excuse for the absence you must notify your instructor of the absence and the excuse by email before the scheduled meeting time of the class to be allowed to makeup the quiz at a later time. Also, you might be asked to do an oral makeup quiz with the instructor, i.e. you need to explain your solutions and answer questions.

Calculus Review Assignment

There will be a calculus review assignment due second week of class. This is a short assignment meant to prompt your thinking about concepts prior to the course. The concepts addressed that you should review while completing these assignments include the following:

- Limits

- Differentiation and Implicit Differentiation

- Integration and Integration Techniques

- Optimization

Please note that you are responsible for the material on these assignments as these topics are not going to be covered in the material that is a part of this course.

Exams

Three exams will be given outside of class time throughout the semester - two 75- minute exams are given during the semester at 6:15pm-7:30pm and a third cumulative 110-minute exam given during final exam week.

Exam 1	10/3/2023	6:15-7:30 PM
Exam 2	11/1	6:15-7:30 PM
Comprehensive Final Exam	To Be Announced on Lionpath	

Rooms for examinations will be announced by your instructor at a later date and will be able to be found on the math department website. Be sure to bring your Penn State ID to all exams

Conflict and Makeup Exams

Students who miss or cannot take either midterm examination due to a valid and documented reason, such as illness, may be allowed to makeup the missed examination. Personal business, such as travel, employment, weddings, graduations, or attendance at public events such as concerts and sporting events is not a valid excuse. Forgetting the date or time of an examination is not a valid excuse. If the student does not have a valid reason, as explained above, a 25% penalty will be imposed. Students who have taken the original examination are not permitted to take a makeup examination.

- For each midterm, a conflict exam will be given the same night as the regular exam beginning at 4:50 pm. Students who attend the conflict exam will not be permitted to leave the exam room before the end of the time period.

- The week after each midterm, a makeup exam will be given for those students who missed the conflict and makeup exam. You need to email your instructor as soon as possible regarding last minute conflicts or illness. Students who are unable to take the regular exam but able to take the conflict exam and not allowed to sign up for the makeup exam

Makeup Exam 1	10/9
Makeup Exam 2	11/7

To sign up for a conflict or makeup exam, go to https://science.psu.edu/math/undergraduate/courses/course-information. The deadline to sign up for the conflict or makeup exam is September 29 for exam 1 and October 29 for exam 2.

Final Examination

The final examination may be scheduled on any day during the final examination period, December 11-15. Students may access their final exam schedules through Lionpath starting Monday, September 25. Notification of conflicts is given on the student's final exam schedule.

There are two types of conflict final examinations: direct and overload. Direct conflicts are two examinations scheduled at the same time. Overload examinations are defined as three or more examinations scheduled in consecutive time periods or within one calendar day. Students may elect to take the three or more examinations on the same day if they wish or request a conflict final examination. A student must take action to request a conflict exam through Lionpath between September 25 and October 15. Conflict final examinations cannot be scheduled through the Mathematics department.

Students who miss or cannot take the final examination due to a valid and documented reason, such as illness, may be allowed to take a makeup final examination at the beginning of the next semester. Personal business, such as travel, employment, weddings, graduations, or attendance at public events such, as concerts and sporting events is not a valid excuse. Forgetting the date or time of an examination is not a valid excuse. If the student does not have a valid reason, as explained above, a 25% penalty will be imposed. All such makeup examinations must be arranged through the instructor with the approval of the course coordinator, and students in such a situation should contact their instructors within 24 hours of the scheduled final examination. Students who have taken the original final examination are not permitted to take a makeup examination.

Grades and Grading Policy
The final grade for the course will be determined according to the following distribution:

Achieve Homework	10%
Written Homework	15%
Quizzes	15%
Exams 1-2	30%
Final Exam	30%
Total	**100%**

Letter grades for this course are set according to the following cutoffs:

A	92.50%-100%
A-	89.50%-92.49%
B+	86.50%-89.49%
B	82.50%-86.49%
B-	79.50%-82.49%
C+	76.50%-79.49%
C	69.50%-76.49%
D	59.50%-69.49%
F	$\leq$59.49%

Deferred Grades (DF)

If a student is passing a course but, because of illness or emergency, needs to complete the course material at a later time can opt for a deferred grade ('DF'). The completion of course materials must be done so within the first couple of weeks following the end of the term. Please note that deferred grades are only provided when the circumstances are extenuating that prevent a student from taking a final exam.

Late-Drop

Students may add/drop a course without academic penalty within the first six calendar days of the semester. A student may late drop a course within the first twelve weeks of the semester. After the first six days and before deciding to late drop this course, each student should consult with his or her academic advisor. The late drop deadline for this semester is November 10, 2023.

ACADEMIC INTEGRITY

According to Penn State policy G-9: Academic Integrity, an academic integrity violation is "an intentional, unintentional, or attempted violation of course or assessment policies to gain an academic advantage or to advantage or disadvantage another student academically." Unless your instructor tells you otherwise, you must complete all course work entirely on your own, using only sources that have been permitted by your instructor, and may not assist other students with papers, quizzes, exams, or other assessments. If your instructor allows you to use ideas, images, or word phrases created by another person (e.g., from Course Hero or Chegg) or by generative technology, such as Chat GPT, you must identify their source. You may not submit false or fabricated information, use the same academic work for credit in multiple courses, or share instructional content. Students with questions about academic integrity should ask their instructor before submitting work. Students facing allegations of academic misconduct may not drop/withdraw from the affected course unless they are cleared of wrongdoing (see G-9: Academic Integrity). Attempted drops will be prevented or reversed, and students will be expected to complete course work and meet course deadlines. Students who are found responsible for academic integrity violations face academic outcomes, which can be severe, and put themselves at jeopardy for other outcomes which may include ineligibility for Dean's List, pass/fail elections, and grade forgiveness. Students may also face consequences from their home/major program and/or The Schreyer Honors College.

Link to Academic Integrity Policy: 49-20 Academic Integrity

Disability and Accommodations

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact Student Disability Resources (SDR) at 814-863-1807 (V/TTY). For further information, please visit Student Disability Resources Web site: http://equity.psu.edu/student-disability-resources. In order to receive consideration for accommodations, you must contact SDR and provide documentation (see the documentation guidelines at http://equity.psu.edu/student-disability-resources/doc-guidelines). If the documentation supports your request for reasonable accommodations, SDR will provide you with an accommodation letter identifying appropriate academic adjustments. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

Code of Mutual Respect and Cooperation

The Eberly College of Science Code of Mutual Respect and Cooperation pertains to all members of the college

community; faculty, staff, and students. The Code of Mutual Respect and Cooperation was developed to embody the values that we hope our faculty, staff, and students possess, consistent with the aspirational goals expressed in the Penn State Principles. The University is strongly committed to freedom of expression, and consequently, the Code does not constitute University or College policy, and is not intended to interfere in any way with an individual's academic or personal freedoms. We hope, however, that individuals will voluntarily endorse the 12 principles set forth in the Code, thereby helping us make the Eberly College of Science a place where every individual feels respected and valued, as well as challenged and rewarded.

Educational Equity

Penn State is a community that fosters both a diverse and inclusive environment for the entire campus community. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through the Educational Equity on the Report Bias webpage: PSU Report Bias Webpage.

Counseling and Psychological Services

Penn State offers a variety of helpful services on campus that support the mental health of students. Counseling and Psychological Services offers such services as group and individual counseling, psychiatric services as well as virtual chats. For more information you can visit the CAPS website.
Penn State Crisis Line (24 hours/7 days/week): 877-229-6400

Questions, Problems, or Comments: If you have questions or concerns about the course, please consult your instructor first. If further guidance is needed, you may contact the course coordinator whose contact information is given below.

Course Coordinators:
Prof. Nicholas Stepanik (nxs371@psu.edu) and Prof. Matthew Willyard (mcw20@psu.edu)

Include your Name, StudentID, Course, and Section Number is any correspondence and always use your @psu.edu email address.

Important Dates

Regular Drop Deadline	Saturday, August 26, 2023
Regular Add Deadline	Sunday, August 27, 2023
Labor Day Holiday	Monday, September 4, 2023
Late Drop Deadline	Friday, November 10, 2023
Thanksgiving Break	Sunday, November 19, 2023- Saturday, November 25, 2023
Withdrawal Deadline	Friday, December 8, 2023

Learning Objectives for MATH 231

Upon completion of each section of the course, you should be able...

Chapter 12: Vectors and 3D Geometry

Vectors
- to use vectors to describe a variety of concepts, e.g. position, direction, etc.
- to arithmetically and graphically compute vector calculations involving addition, subtraction, and scalar multiplication
- to calculate the length of a vector
- to determine if two vectors are parallel
- to convert a vector into a unit vector, or to calculate a parallel vector of any given length

3d Space
- to work with points/vectors in $\mathbb{R}^3$, and graph them
- to determine proper orientation using the right hand rule
- to determine the dimension of a graph defined by a system of equations
- to work with parametrizations of lines in $\mathbb{R}^3$, and to find a parametrization for a line given enough information

Dot Product
- to calculate the dot product between two vectors, using either the standard formula or the trigonometric formula
- to calculate the angle between two vectors, or determine if the angle is acute, obtuse, or right
- to calculate a projection of one vector onto another

Cross Product
- to calculate 2×2 and 3×3 determinants
- to calculate the cross product between two vectors
- to find a vector perpendicular to two other vectors
- to calculate areas of parallelograms (in $\mathbb{R}^2$ and $\mathbb{R}^3$) and volumes of parallelepipeds

Planes
- to work with, to identify, and graph equations of planes in $\mathbb{R}^3$
- to find the equation of a plane given enough information

Quadric Surfaces
- to work with, to identify, and graph quadratic equations in $\mathbb{R}^3$
- to analyze surfaces by looking at cross-sections

Geometry in $\mathbb{R}^3$
- to solve geometric problems involving lines, planes, and quadric surfaces including problems about distance, intersections, etc.

Chapter 13: Vectors Functions and Calculus

Vector Functions
- to use vector functions to describe a variety of concepts, e.g. position, velocity, etc.
- to parametrize curves in $\mathbb{R}^2$ or $\mathbb{R}^3$ defined by an equation or system or equations
- to understand the difference between standard equations and parametric equations

Calculus of Vector Functions
- to differentiate vector functions and find tangent vectors
- to find a line tangent to a curve at a specific point
- to integrate vector functions and solve initial value problems

Motion in Space
- to use calculus of vector functions to answer questions about position, velocity, and acceleration

Arc Length
- to calculate the length of a curve
- to understand the meaning of the arc length differential ds

Chapter 14: Multivariable Functions and Differentiation

Multivariable Functions	• to evaluate and utilize multivariable functions
	• to visualize two and three variable functions via graphs, contour maps, and scalar fields
	• To approximate rates of change of multivariable functions
Partial Derivatives	• to calculate partial derivatives of multivariables functions
	• to interpret partial derivatives in application
Tangent Planes and Linear Approximation	• to approximate the values of multivariable functions using a linear approximation
	• to find the equation of a plane tangent to a function's graph at a given point
Gradient Vectors and Directional Derivatives	• to understand and use the important properties of a gradient vector of a function at a specific point
	• to calculate the rate of change of a function as both inputs change
Chain Rule	• to use the multivariable chain rule to calculate partial derivatives for composite multivariable functions
Optimization and Lagrange Multipliers	• to find and classify the local maxima and minima of a multivariable function
	• to find and classify the global maxima and minima of a multivariable function when restricted to a closed and bounded domain
	• to find critical points on a boundary path either using a parametrization or the method of lagrange multipliers