MATH 111: Techniques of Calculus II
Section 1: 110 Osmond Lab, TR 10:10 AM - 11:00 AM
Section 2: 106 Osmond Lab, TR 1:25 PM - 2:15 PM

This syllabus is subject to change. Please check the website regularly.

Instructor: Sara Jamshidi, 419 McAllister Bldg, jamshidi@math.psu.edu, (814) 863-9049

Traditional Office Hours: T 2:30 - 3:30pm in 419 McAllister Bldg, or by appointment

Piazza "Office" Hours: MW 4:30pm - 5:30pm at `https://piazza.com/psu/spring2015/math111/home`

Prerequisites: Math 110 or equivalent

Website: `http://jamshidi.weebly.com/math-111.html`

Textbook: None.

Required:

- TI-81/82/83/84 (regular or plus) calculator or equivalent software ;
- subscription to Poll Everywhere

Course Goals: Students will

- find a possible best-fit functions for a given data set and explain the strengths and weaknesses of such an approximation;
- identify relevant information using (partial) derivatives and (double) integrals;
- recognize and solve real-life optimization problems (maxima and minima) in one or more variables;
- use numerical methods to approximate optimum solutions;
- recognize and classify ordinary differential equations and know how to solve them (or approximate a solution);
- and recognize systems of ordinary differential equations and determine equilibrium point(s).

Course Description: This course will use topics you've learned from algebra and calculus to determine (sometimes from raw data) optimized solutions important to ecology and economics–like ecological yield, maximum sustainable yield and optimum sustainable yield. Below is a tentative schedule of topics.

Introduction	1/13
Terminology, Best-Fit Lines	1/13 - 1/15
Systems of Linear Equations; Matrices; Vectors	1/20 - 1/27
Nonlinear Best Fit Functions	1/29
Stocks and Flows; Derivatives	2/3 - 2/10
Partial Derivatives, Gradients & Topography	2/10 - 2/19
Calculus-based Optimization	2/24 - 3/5
Lagrange Multipliers	3/17 - 3/24
Ordinary Differential Equations	3/26 - 4/9
Systems of ODEs (Predator-Prey)	4/13 - 4/23
Review	4/28 - 4/30

Grade Policy: Points (450 total) are distributed as follows (please see note on attendance)

100 points	midterm examination
100 points	Angel quizzes
100 points	homework
150 points	comprehensive final examination

Grading: Final grades will be

A	415-450 pts	B	370-394 pts	C	315-349 pts
A-	405-414 pts	B-	360-369 pts	D	270-314 pts
B+	395-404 pts	C+	350-359 pts	F	0-269 pts

Angel Quizzes: After every class, there will be a corresponding quiz available on Angel. This quiz is due at 1:00pm on the day of the next class. For those in section 1, I highly recommend you complete the quiz BEFORE class. They are meant to assess your understanding of the concepts covered in the lecture and will be fairly straightforward. Each quiz is worth 4 points. You are allowed to take each quiz up to 3 times before its due. At the end of the semester, I will drop your lowest three quiz scores. No late quizzes are accepted.

Homework: Every two weeks, you will be given an applications-based homework assignment. Each assignment is worth 20 points and will be good practice for the exams. I will provide a grading rubric for your reference with the first assignment. No late homework will be accepted. Assignments will be submitted to a dropbox folder on Angel.

Midterm: We will have one midterm. The dates and times for the midterm, conflict midterm, and make-up midterm are listed below. The exam will be 75 minutes. You will be allowed to use calculator and/or your phone (as you would in real life). I ask that you do not communicate with fellow students (either verbally or via email/text messaging). Each student will be given a unique problem set, so communication likely will not help.

Midterm: Tuesday, March 17 at 026 Hosler from 6:30 to 7:45pm
Conflict Midterm: Tuesday, March 17 at 105 Wartik from 5:05 to 6:20pm
Make-Up Midterm: Wednesday, March 25 at 360 Willard from 6:30 to 7:45pm

Final: The final exam will be cumulative and similar in format to the midterm. It will be an hour and 50 minutes.

Academic Integrity: Academic integrity is the pursuit of scholarly activity free from fraud and deception and is an educational objective of this institution. All University policies regarding academic integrity apply to this course.

Academic dishonesty includes, but is not limited to, cheating, plagiarizing, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. All exam answers must be your own, and you must not provide any assistance to other students during exams.

Any instances of academic dishonesty WILL be pursued under the University and Eberly College of Science regulations concerning academic integrity.

> Although this statement has been directly copied from the College of Eberly Science, I want you to know that I take academic integrity very seriously. I want you to *truly* learn this material so you can use it in your everyday life.

Disability Services: The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications. If you have a disability-related need for adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807. For further information regarding ODS, please visit `http://equity.psu.edu/ods/`. In order to receive accommodations, you must contact ODS and provide documentation (see the documentation guidelines at `http://equity.psu.edu/ods/guidelines/documentation-guidelines`). Please share your academic adjustment letters at the beginning of the semester.

Attendance Policy: There is no textbook in this class. As a result, attendance is **required** for this class. I rely on your participation in class and, as a result, your presence is crucial to the course.

Attendance will be monitored using Poll Everywhere. In order to participate, you will need to bring your charged phone to class or a working device with access to internet.

You can miss a handful of classes without penalty; however, chronic absences will not be tolerated. University policy states: ***A student whose irregular attendance causes him or her, in the judgment of the instructor, to become deficient scholastically, may run the risk of receiving a failing grade or receiving a lower grade than the student might have secured had the student been in regular attendance (Policy 42-27).***

Important Dates:

MLK Day (No Classes)	January 19
Regular Drop Deadline	January 21
Regular Add Deadline	January 22 (8:00 AM EST)
Exam Conflict Filing Period	February 16 - March 8
Midterm I	March 17
Midterm I (Make-Up)	Mar 25
Spring Break (No Classes)	March 8 - 14
Late Drop Deadline	April 10
Withdrawal Deadline	May 1
Final Exams	May 4 - 8

Course Objectives:

1. I can distinguish between measurements which are stocks (quantities) versus measurements which are flows (rates).
2. I can determine the precision of a measurement and reflect that precision in my calculations.
3. I understand that a function is a mathematical description of a relationship between two or more measurements.
4. I understand the distinction between independent variable(s) and the corresponding dependent variable as well as why that distinction was chosen for the situation.
5. I can define a linear equation, recognize when two measurements may have a linear relationship, and (with a calculator) I can find the best fit line to model that relationship.
6. With a given set of linear equations, I can determine if a solution exists and (with the use of a calculator) find that solution by using matrices.
7. I can determine the meaning of a solution to a system of linear equations.
8. I can define a vector and interpret its meaning in different situations.
9. I can calculate the dot product of two vectors.
10. I can find the optimum solution for a system of linear inequaties.
11. I can define quadratic and cubic relationships, recognize when two measurements may have such a relationship, and (with a calculator) find the best fit curve to model that relationship.
12. I can define an exponential and logarithmic relationship, recognize when two variables may have such a relationship, and (with a calculator) find the best fit curve to model that relationship.
13. I can explain the physical difference between a linear, quadratic, cubic, exponential, and logarithmic relationships. I can use the situation of the problem as well as the mathematical trend to choose which might be best to determine the relationship between two variables.
14. I can use these models to make predictions and can determine the strengths and weaknesses of such predictions.
15. I know the meaning of a derivative and an integral and can phrase these values in terms of stocks and flows.
16. I can solve constraint satisfaction problems with one variable.
17. I can calculate a derivative equation by hand and I can find the derivative at a point by hand or numerically with a calculator.
18. I can calculate a integral equation by hand and I can find the integral over a range by hand or numerically with a calculator.
19. I know that natural situations often have many independent variables and I can roughly model some of those situations with the method of undetermined coefficients.

20. I can define a partial derivative and calculate it.
21. I can define the gradient and the gradient vector. I can use the gradient to identify important features of a surface like steepest ascent.
22. I can define and find a directional derivative. I can interpret its meaning for various physical situations.
23. I can use the gradient to find a linear approximation to a nearby solution.
24. I can find critical values for functions of multiple variables.
25. I can determine if a critical value is a maximum, minimum, or saddle point using the Hessian matrix.
26. I can use the concept of a gradient to optimize a constraint-satisfaction problem (called the Method of Lagrange Multipliers).
27. I can identify and classify basic differential equations. I can use this classification to interpret what the equation means for a given situation.
28. I can draw a direction field and use it to approximately solve a differential equation.
29. I can use the method of integrating factors to solve an ODE in the appropriate form.
30. I can solve separable ODEs.
31. I can determine if a solution exists and if that solution is unique.
32. I can solve a homogeneous and nonhomogeneous system of linear ODEs.
33. I can determine the critical points of such a system of linear ODEs.
34. I can classify a critical point and interpret what it means for a given situation.

Note: These course objectives may be adjusted depending on the pacing and background of the students.