**Instructor:** Jonathan "Nate" Wells
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**Course Description:** This course will cover the core concepts in multivariable integral calculus required for students of physical sciences and mathematics, with focus on modeling. Emphasis will be placed on the development of mathematical reading and writing skills.

**Prerequisites:** MATH 281 or equivalent.

**Textbook:** *Multivariable Calculus*, 8th Edition by Stewart. We will cover roughly chapters 15 and 16. Reading assignments will be given on frequent basis, so daily access to the textbook is necessary. This textbook is also used for Math 281. Older editions of the textbook may be used, but a student should consult with the instructor before purchase to verify suitability and discuss potential complications with assignments.

**Course Website:** Documents, a daily schedule, assignments, and grades will be posted on our Canvas page at `http://canvas.uoregon.edu`

**Technology:** Access to the Computer Algebra System *Mathematica* will be required for this course. University of Oregon students can obtain a free copy of *Mathematica* from `https://it.uoregon.edu/software/mathematica` Computers in the Knight library also have *Mathematica* installed. Unless otherwise specified, **no calculators or other electronic devices** may be used during exams.

**Communication:** If you would like to contact me, I can most easily be reached by email weekdays between 10am and 6pm. While I try to answer email as soon as possible, in some cases, I may not be able to respond until the following school day. You are also welcome to schedule an appointment outside my usual office hours.

**Course Outcomes:** By the end of the course, a student should be able to:

1. set up and evaluate integrals of multivariable functions over regions in the plane (double integrals) and over regions in space (triple integrals) using iterated integrals.
2. use the polar coordinate system to set up and evaluate double integrals.
3. use the cylindrical and spherical coordinate systems to set up and evaluate triple integrals.
4. use double integrals to compute moments, center or mass, and the moment of inertia of a lamina with a variable density.
5. define and apply line integrals of scalar functions and vector fields.
6. use the fundamental theorem of line integrals to evaluate the line integral of a conservative vector field.
7. evaluate and interpret the physical meaning of the curl and divergence of a field.
8. use multivariable vector function parametrization of a surface to find the tangent plane to the surface at a point and the area of the surface.
9. use parametrization to define the integral of a multivariable function or a vector field over the surface.
10. interpret and apply Green's Theorem, Stokes' Theorem, and the Divergence Theorem to compute line integrals and surface integrals of vector fields.

**Workload:** A prepared student will attend class for 1 hour per day, four days each week, and spend about two to three hours per day of class on work outside the classroom (reading, doing homework, discussing, studying, etc.). Together, this represents a 12 - 15 hour per week commitment.

**Grading Criteria:** $A = 90 - 100\%$; $B = 80 - 89\%$; $C = 70 - 79\%$; $D = 60 - 69\%$; $F < 60$ (with upper and lower 2% of each division corresponding to $+/-$, respectively).

Your grade in the class will be determined by assessments of your proficiency in each of the *Course Outcomes*, weighted as follows:

| | | |
|---|---|---|
| 1 | Daily Reading | 5% |
| 2 | Weekly Quiz | 5% |
| 3 | WebWork | 15% |
| 4 | Written Homework | 10% |
| 5 | Midterm Exams | 25% |
| 6 | Final Exam | 40% |

**Daily Reading / Participation:** Mathematical knowledge takes time to develop, and understanding deepens upon revisiting a concept a $2^{\text{nd}}$, $3^{\text{rd}}$, or $n^{\text{th}}$ time. Studying basic terminology and elementary examples in the textbook before class means that lectures can be spent clarifying and expanding ideas, rather than introducing them. Daily reading assignments will be posted under the "Assignments" tab of Canvas. These assignments will list the specific section(s) to read for each day, along with several basic questions to check comprehension. Answers are due by 10am each day of class, and can be submitted by following the same link on Canvas where the assignment was found and then either a) uploading a Word / .pdf file, or b) by clicking the "Text Entry" button and typing directly into the text-box. Grades will be awarded on an all-or-nothing basis, with full points given if a sincere attempt is made to answer the questions (independent of correctness). In some cases, fewer points may be awarded if significant portions of the assignment are incomplete. Up to two daily reading assignments may be missed without penalty.

**Weekly Quiz:** Each week, a take-home quiz will be posted on Canvas, to be completed by the start of class on Monday the following week. Although the quizzes will not be proctored, it is expected that you will work on these quizzes on your own, without outside help from classmates, tutors, or the internet.

**WebWork Homework:** The best way to improve mathematical skills is through regular practice. Homework will be due weekly on Sundays at midnight (but note I won't often be available to answer emails after 6pm on Friday). Homework assignments will be completed electronically through the WebWork portal. More information about WebWork can be found below. Additionally, each week an optional Extra Practice assignment will be posted. Each point earned on these assignments will count as 0.5 points of extra credit toward your WebWork homework grade.

**Written Assignments:** Each week, a written assignment will be posted on Canvas, to be completed and handed in at the start of class on the following Wednesday. These assignments will usually include one longer or more challenging problem, along with one or two problems selected from the previous WebWork assignment. Solutions to each problem must be written in complete sentences, and include brief explanation of the steps used.

**Midterm Exams:** Two 50-minute midterm exams will be given during the term: tentatively, the first is scheduled for Monday, April 29 (Week 5), and the second for Monday, May 20 (Week 8).

**Final Exam:** A cumulative, final exam will be given in class on Wednesday, June 12, from 2:45pm-4:45 pm. *If you foresee a conflict with the time of the exam, please contact me during the first week of class so that appropriate arrangements can be made. Barring that, the final exam cannot be taken at any other time.*

**A few notes on late assignments:** Up to twice throughout the term, you may request a two-day extension on either your WebWork or written assignments, but requests must be made prior to an assignment's deadline. No extensions will be given on reading assignments or quizzes, but at the end of the term, the two lowest reading assignment scores and the lowest quiz score will be dropped.

**Tentative Schedule:**

| Week | Sections Covered | Week | Sections Covered |
|---|---|---|---|
| 1 | 15.1, 15.2 | 6 | 16.3, 16.4 |
| 2 | 15.3, 15.4 | 7 | 16.5, 16.6 |
| 3 | 15.5, 15.6 | 8 | 16.7 (Midterm 2) |
| 4 | 15.7, 15.8 | 9 | 16.8, 16.9 |
| 5 | 16.1, 16.2 (Midterm 1) | 10 | Review |

**A Typical Week:**

| Day | Assignment Due |
|---|---|
| Monday | Daily Reading, Take-home Quiz |
| Tuesday | Daily Reading |
| Wednesday | Daily Reading, Written Assignment |
| Thursday | Daily Reading |
| Sunday | WebWork |

**Accessibility:** The University of Oregon is dedicated to creating inclusive learning environments. Please notify me as soon as possible if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation. You may also wish to contact the Accessible Education Center in 164 Oregon Hall at 541-346-1155 or uoaec@uoregon.edu.

**Academic Integrity:** Students are allowed and encouraged to collaborate on most in-class and homework assignments. However, any work that you turn in for grading must be your own. Exams will be closed book, closed notes, and closed colleague, unless otherwise specified. All written work that references material outside of the textbook should be accompanied by an appropriate citation (APA or AMS format is preferred). The University of Oregon requires that all instances of academic dishonesty be reported, no matter the scope.

**Working with WebWork**
WebWork is a free online homework system that allows for instant feedback on each question so that timely corrections can be made. However, since the assignments are graded automatically and electronically, it also requires careful attention to detail and precise use of correct mathematical syntax. You may log in to WebWork using your DuckID and password by clicking on the link on the weekly assignment under the "Assignments" tab on Canvas, or by using the following address: `https://webwork.uoregon.edu/webwork2/Math282-41318/`

When working on your assignment, you should have scratch paper available, and neatly write out your thought process in solving the problem. While WebWork does not grade you on this process, writing it out carefully will allow you to more easily return to the question at a later time, to track down any mistakes in your work, and to train you in the skills you will need to demonstrate on quizzes and exams.

If you have questions about a homework problem, one excellent resource is the "Email Instructor" button at the bottom of the WebWork screen. This button will send me a link to the problem you are currently on, as well a list of your current and past answers. It is essential that you include a short message describing what steps you've already taken to solve the problem (along with all calculations you've made) in order to help me diagnose the issue. On most homework problems, it is impossible for me to figure out what you've done incorrectly if I only see the answers you've submitted.