

MATH 21D Winter 2020
Vector Analysis
MWF 1:10-2:00 pm, Room: GROVE 1309

Instructor: Peter R. Merkx

-**Email:** pmerkx@math.ucdavis.edu

-**Office:** MSB 1105

-**Office Hours:** MW 5:30-6:30 pm, R 3-5 pm, and by appointment.

Course TAs & discussion sections:

-Anthony Nguyen, (anthonynguyen@math.ucdavis.edu); T 6:10-7:00 pm in BAINER 1130.
Calculus Room Hours (in MSB 1118): T 2-3pm.

-Jeffrey Nichols, (jsnichols@math.ucdavis.edu); T 6:10-7:00 pm in H GYM 290.
Calculus Room Hours (in MSB 1118): M 3-4pm, R 2-3pm.

Textbook: *Thomas' Calculus Early Transcendentals, 14th Edition* (ISBN 978-0134439020) by George B. Thomas, Maurice Weir, and Joel Hass; Addison Wesley Publishers

Exam dates: Any changes to the following dates will be announced.

Midterm 1 Friday, January 31, 1:10pm-2:00pm.
Midterm 2 Friday, February 28, 1:10pm-2:00pm.
Final Exam Tuesday, March 17, 10:30am-12:30pm.

Course description: Math 21D is part four of a four quarter calculus sequence with a focus for students majoring in mathematics, engineering, physics, or other sciences. We will cover integration in the plane and in solid regions. We will introduce properties of several variable functions and vector fields that allow us to study the classical vector calculus integration theorems including Green's Theorem, Stokes' Theorem, and the Divergence Theorem. These extensions of the fundamental theorem of calculus each have important physical applications that we will discuss. The tools we will develop to detail these elegant theorems significantly enhance the precise meaning and applicability of calculus.

Prerequisites: Math 21C or equivalent.

Grade: We will have weekly homeworks, two midterms, and a cumulative final exam. Your grade in the course will be based on this work and quizzes given during discussion sections. The lowest quiz score will be dropped. The final course grade will be computed with the following weights: Homework - 10%, Quizzes - 10%, Midterm 1 - 20%, Midterm 2 - 20%, Final Exam - 40%.

Homework: We will have online homework in the MyLab system that pairs with our textbook. Discounted access to this system and an electronic copy of our text is available through UC Davis Inclusive Access Program. Late homework will not be scored, but *you should do all exercises* in any case. We will also have optional, ungraded homework exercises that you do not have to hand in, but are strongly encouraged to complete for additional practice and exam preparation. Doing these optional exercises is a critical step towards ensuring you pass the course!

Exams: Calculators will *not* be allowed on exams. Midterms will be held during the usual class time. Midterms and final exam will be held in our usual room unless announced otherwise.

Missed exams: There will be no makeup exams except in (documented) extenuating circumstances. Please let me know as soon as possible if you miss an exam. Any excused exam scores will in most cases be replaced appropriately based on grades on remaining coursework rather than by a makeup exam.

Help: Please let me know immediately when something is not clear, both in class and out. While you should expect to spend a significant amount of time reading your text, it is crucial for the success of the course (both yours and mine) that you bring any topic that is not making sense to my attention. Often, a short chat about a topic can save hours of chasing through text. We will also have graduate TAs working for the course who will also be available to you during the Calculus Room hours each week (to be announced). Other options for help include the following.

- Office hours: Please feel free to attend my office hours to discuss homework problems or any other aspect of the course. If your other obligations prevent coming during the usual times, please let me know and we can schedule a meeting.
- The Calculus Room (see below).
- Meeting with your TA during their Calculus Room hours (or by appointment).
- Tutors & help sessions through the UC Davis Academic Assistance and Tutoring Centers: <https://tutoring.ucdavis.edu/>
- Private tutors: <https://www.math.ucdavis.edu/resources/learning/tutors/>
- Also see <https://www.math.ucdavis.edu/resources/learning/calculus-help/>
- A Student Solutions Manual containing complete solutions to odd-numbered textbook exercises is available for a low cost and is recommended for making extra practice efficient.

An excellent place to get extra help with our course exercises is The Calculus Room: MSB 1118 where Math graduate students working as TAs for the 21ABCD sequence are available specifically to help with any Math 21ABCD topic during the following hours: M-R 10am-7pm, F 10am-6pm.

Suggestions: Obtaining a print version of the textbook will likely be very helpful in addition the electronic text that comes with our Inclusive Access (IA). We may discuss topics in lecture that are not covered in our textbook and *vice versa*. We may also not have time in lecture to cover every topic found in the homework exercises. This makes both attendance and careful reading of the sections we cover in your textbook essential. In addition to our text, you may benefit from expositions in some of the many other well written calculus textbooks and online resources.

Computer algebra software (CAS) may be helpful though you can (and should) complete nearly all homework exercises without it. Sage is an excellent, extremely powerful open-source (free) CAS system with a great many contributors including several UC Davis Math faculty members. Mathematica is also well suited for our purposes and available with a student discount; a related online software, Wolfram Alpha, is available freely, is flexible in syntax, and adequate for most of our purposes but is much more limited. Calculators can be used instead but are less flexible, more time consuming, and not recommended to be purchased only for this course. No CAS or calculators will be allowed for quizzes or exams.

Academic Integrity: You may discuss homework problems with your classmates, but you should be working out solutions on your own. You are expected to follow UC Davis policies on academic integrity.

Students with Disabilities: It is the policy of UC Davis to provide reasonable accommodations to students with documented disabilities. Students are responsible for registering with the Student Disability Center (SDC). Please make requests known to me in a timely manner. If you require accommodations in this class, please let me know as soon as possible so that arrangements can be made. If you believe that you need accommodations for a disability, please contact the SDC to discuss your needs and the process for requesting accommodations. For more information, please visit: <https://sdc.ucdavis.edu>.

It is your responsibility to keep informed of any announcements made in class and by email/Canvas during the semester.

Course Outline: We will aim to cover the following topics, time allowing.

1. Multiple integrals

- Double integrals over rectangles, iterated integrals
- Double integrals over general regions
- Area by double integration
- Double integrals in polar coordinates
- Triple integrals in rectangular, cylindrical, and spherical coordinates
- Change of variables / substitution in multiple integrals

2. Vectors (review)

- 3D coordinate systems
- Vectors
- Dot product, cross product
- Lines and planes
- Cylinders and quadric surfaces

3. Vector functions

- Vector functions, space curves (review)
- Derivatives and integrals of vector functions (review)
- Velocity, acceleration; tangential & normal components of acceleration
- Arc length and curvature

4. Vector calculus

- Vector fields, line integrals; work, circulation and flux; divergence & curl
- Path independence, conservative fields, potential functions
- The fundamental theorem for line integrals
- Green's Theorem in the plane
- Surface integrals; parametric surfaces and their areas
- Stokes' Theorem
- The Divergence Theorem & a Unified Theory