Math 241

Calculus III

Spring 2022, Sections BL1 and BL2

Instructor: Matthew C. Russell. I invite you to call me "Matthew". If you're uncomfortable with that much informality, then you can use the title "Dr.' in conjunction with my name ("Dr. Russell", "Dr. Matthew"), but please do use my name.

Email: `mcr39@illinois.edu`

Credit: 4 undergraduate hours.

Meeting times and place:

BL1: Mondays, Wednesdays, and Fridays, 12:00 noon — 12:50 p.m., Altgeld 314.

BL2: Mondays, Wednesdays, and Fridays, 1:00 p.m. — 1:50 p.m., Altgeld 314.

Office and office hours: To be announced. Initially, office hours will only be offered through Zoom. These may (or may not) convert over to in-person later in the semester.

Discussion sections:

BD1: Tuesdays, Thursdays 11:00 a.m. – 12:50 p.m., 159 Altgeld

BD2: Tuesdays, Thursdays 1:00-2:50 – 159 Altgeld

BDA: Tuesdays, Thursdays 8:00-8:50 – 147 Altgeld

BDB: Tuesdays, Thursdays 9:00-9:50 – 241 Altgeld

BDC: Tuesdays, Thursdays 10:00-10:50 – 441 Altgeld

BDD: Tuesdays, Thursdays 11:00-11:50 – 445 Altgeld

BDE: Tuesdays, Thursdays 12:00-12:50 – 445 Altgeld

BD@: Tuesdays, Thursdays 1:00-1:50 – 111A Pennsylvania Lounge Bld - PAR

BDG: Tuesdays, Thursdays 2:00-2:50 – 343 Altgeld

BDH: Tuesdays, Thursdays 3:00-3:50 – 147 Altgeld

BDI: Tuesdays, Thursdays 4:00-4:50 – 343 Altgeld

BDK: Tuesdays, Thursdays 10:00-10:50 – 137 Henry

BDL: Tuesdays, Thursdays 12:00-12:50 – 162 Noyes

BDF: Tuesdays, Thursdays 1:00-1:50 – 443 Altgeld

BDM: Tuesdays, Thursdays 2:00-2:50 – 445 Altgeld

BDN: Tuesdays, Thursdays 3:00-3:50 – 443 Altgeld

BDJ: Tuesdays, Thursdays 9:00-9:50 – 441 Altgeld

BDF: Tuesdays, Thursdays 1:00-1:50 – 443 Altgeld

Official catalog description: Third course in calculus and analytic geometry including vector analysis: Euclidean space, partial differentiation, multiple integrals, line integrals and surface integrals, the integral theorems of vector calculus. Credit is not given for both MATH 241 and MATH 292. Prerequisite: MATH 231. This course satisfies the General Education Criteria for Quantitative Reasoning II.

Learning goals: Students who complete the course successfully will be able to:

- understand and apply vectors in two and three dimensions
- sketch, analyze, and perform calculus on vector-valued functions
- sketch, analyze, and perform calculus on functions of multiple variables
- optimize functions of multiple variables
- set up and evaluate integrals in two and three dimensions
- integrate vector-valued functions over curves and surfaces
- understand and apply famous and important theorems from vector calculus
- and many other topics from the study of vector calculus.

In this course, we will extend many concepts from calculus I and II to functions of several variables and functions whose values are vectors (as opposed to real numbers). Some notions that will be revisited include continuity, differentiation, optimization, and integration. The highlight of the course will be three theorems (Green's theorem, Stokes's Theorem, and the Divergence Theorem), which relate seemingly disparate types of integrals in surprising ways.

For many people, vector calculus is the most challenging term in the calculus sequence. There are a larger number of interrelated concepts than before, and solving a single problem can require thinking about one concept or object in several different ways. Because of this, conceptual understanding is more important than ever, and it is not possible to learn a short list of "problem templates" in lecture that will allow you to do all the HW and exam problems. Thus, while lecture and discussion section will include many worked examples, you will still often be asked to solve a HW problem that doesn't match up with one that you've already seen. The goal here is to get a solid understanding of vector calculus so you can solve any such problem you encounter in mathematics, the sciences, or engineering. That requires trying to solve new problems from first principles, if only because the real world is complicated.

Text: James Stewart, *Calculus: Early Trascendentals*, 8th Ed., with enhanced WebAssign

Please note that this course uses the 8th edition rather than the 9th. You will also need WebAssign access to do the homework. (Note: WebAssign gives you access to an electronic version of the textbook.) For complete information on purchasing options for both, see `https://www.cengage.com/coursepages/UIUC_Calculus_Moodle1`. If you have the standard text and WebAssign package from Math 220, 221, or 231 from last semester, then you already have everything you need for this course. Even before you purchase WebAssign, you can freely use it for the first two weeks of class and so not miss any homework assignments.

Online resources: This course will use Moodle (`learn.illinois.edu`). Announcements, grades, and resources will be posted. You are responsible for checking the email address that the announcements are delivered to.

This course will also use Campuswire. You should have received an email inviting you to join the Campuswire site; please contact me if this is not the case. Campuswire is an online forum that will be used for questions and answers Questions/Answers that are related to the course material. All students need to register on Campuswire. Students need to use their Illinois email address to register on Campuswire. You will be able to post questions and answers in a way so that you are anonymous to other students, but myself and the TAs will be able to know your identity. Questions posted on Campuswire forum generally will be answered within 24 hours during the working week. Here are some guiding principles for Campuswire usage:

- When posting a question or a note, please tag it with the most suitable available tag. If you are referring to an item in the book, notes, tests, worksheet, etc, please identify it clearly, in order to ensure a prompt and relevant answer.
- Mathematical symbols can easily be typeset in Campuswire; you would use LaTeX syntax within double dollar signs.
- You are welcome — and encouraged! — to answer other students' questions posted on Campuswire, rather than waiting for a response from the instructor or TA.
- Another feature of Campuswire are the chatrooms. Feel free to use these to get to know each other, and emulate the conversations you would have with your peers, TAs, and instructors before and after in-person classes.
- While Campuswire is great for asking and answering questions about the course content and policies applicable to everyone in the course, you should use email for issues specific only to you, and for conversations where privacy is desired.

Homework on WebAssign: Following most lectures, a WebAssign assignment will be posted designed to develop the computational skills and understanding for that lecture. Due dates will be announced at the same time. The due time will always be 11:59 pm.

You are encouraged to take advantage of the many features of WebAssign. In particular, it is recommended that you use the "Ask your teacher" feature, which will be frequently

monitored.

You are free to discuss the homework with your classmates, but we strongly encourage you to understand the solution yourself. Do not assume you understand something just because someone told you how to do it. Remember that no collaboration will be allowed during in-class tests and the final examination.

For up to four assignments throughout the course of the semester, you may request an extension, which will be granted as long as you have not viewed the key for the assignment. No further extensions will be permitted. Extensions need to be requested within 48 hours of the original due date, and will give you a few extra days to complete it. Your homework average makes up 10% of your final grade.

Quizzes on PrairieLearn: Quizzes will be periodically posted on PrarieLearn. This will tend to test more your understanding of the concepts than your computational skills.

The PrairieLearn quizzes will count for 10% of your final grade.

Tests: There will be four written tests, given during regular class times. You may **not** use notes, books, calculators, or computers during any of the tests. You may be provided by the course instructor with a formula sheet on each test; you cannot use your own formula sheet.

The test with your lowest score will be dropped. If you miss a test, that will count as your lowest graded test. Each of the remaining tests will be worth 15% of your final grade.

Final examination: There will be one cumulative final examination at the end of the semester at the day and time specified by the University. You may **not** use notes, books, calculators or computers during the final. You may be provided by the course instructor with a formula sheet on each test; you cannot use your own formula sheet. The final will be worth 25% of your final grade.

Discussion sections and participation: Most discussion sections will involve you working on a worksheet with your peers as the TA facilitates discussion. At the end of the session, you will complete and turn in an "exit ticket" that will serve as a record of your attendance for the session. Grading for these discussion sections will follow a 2–1–0 scale, with "2" representing that you showed up on time, worked reasonably hard throughout the session, and completed the exit ticket, and "0" representing an unexcused absence.

There may be other participation assignments due throughout the semester that will be graded for effort and completion. Your participation, based on these participation assignments and the discussion section grade, will combined count for 10% of your final grade.

Make ups: Make up tests will be given **only** if you present written evidence, as soon as possible, that you did (or will have to) miss an examination for a legitimate reason. Medical conditions, religious time conflicts and university related sports competition are examples of reasons for a justified absence. A note that you have visited McKinley is **not** proof of

a legitimate reason. Travel and leisure plans are not legitimate reasons. If circumstances beyond your control prevent you from attending an examination, it is important that you contact the instructor as quickly as possible.

At the instructor's discretion, a student who would otherwise be given a makeup test may instead be excused from the test, with the corresponding grade weight instead coming from the portion of the final examination pertaining to the content of the missed test.

Grading: You will receive a numerical score rather than a letter grade on assignments and tests, and your final score will then be converted to a letter grade.

Letter grades will be assigned at the end of the semester based on your combined score in the class (from graded homework, quizzes, worksheets, midterms, and final). However, at any time during the semester you are welcome to ask us what grade your performance so far corresponds to so that you have an idea of how you are doing.

The overall course grade will be based on the results of the tests, final examination, written homework, and quizzes given in class, according to the following scheme:

Final examination	25%
Best three tests	45%
WebAssign	10%
PrairieLearn quizzes	10%
Discussion sections and other participation	10%

Calculators: Calculators and other electronic devices are not permitted for quizzes and examinations.

Academic integrity: All University of Illinois students are expected to be familiar with and abide by the academic integrity policy. Violations of the policy are taken very seriously. For more information, see `https://las.illinois.edu/academics/integrity`.

Attendance and class preparation: Class attendance is expected. While attendance in lecture will not constitute part of your grade, coming to lecture regularly can increase your chances for success in the course. You can assume that anything that is covered in class may be tested in the tests and final examination (unless we say otherwise). We will inform you in advance of the material that will be covered and strongly encourage you to read ahead. That way you can come to class prepared for the discussion and know which topics you want to have further clarified. If you entertain the notion that you can succeed in the course by learning the material on your own, please think again. **Please avoid any use of electronic devices during class that causes distraction to nearby students.**

Email etiquette: While you don't have to be overly formal, using a greeting, your name at the end, and good grammar is a good idea. I will do my best to answer all emails within 48 hours (though emails sent later on Friday or over the weekend might not get a response until Monday).

Inclusivity and respect: In order to allow everyone to succeed in this course, we all need to work together to create an encouraging and safe classroom environment. Please always treat all of your peers with respect. At minimum, we expect every student, instructor, and TA to help establish and maintain an environment where you and your peers can contribute without fear of ridicule.

Suggestions for success in the class

- Never fall behind in a mathematics course! The ideas we will discuss need time to sink in, and are very difficult to learn quickly right before an exam, so it is important to clear up your confusions sooner rather than later.
- An excellent way to improve your understanding of the subject is to study and work on homework together with classmates. Explaining mathematical ideas to others is often the most effective way to sort out your own confusions and clarify your understanding; you don't know just what it is that you don't know until you try explaining it to someone else.
- Please come to class prepared. This does not mean you have to understand everything. In fact, if you don't understand something you will have the opportunity to ask about it and we can discuss it in class.
- Please let us know if you are having trouble with something, and do so **before** it becomes an issue on a test. Do make use of office hours.
- While reading your text we strongly encourage you to work through the proofs and examples yourself on paper. This is a very useful way to increase your understanding of the material.
- After reading something, try to summarize the important concepts. This will help create a mental framework into which to fit the problems you will be working on.

I very much want you to succeed in this course. If there is anything I can do that will help you learn, please don't hesitate to ask.

Caution: The information in this syllabus is subject to change, as announced in class or via Moodle. No major changes are anticipated, but you are expected to attend class and check email regularly. We may cover topics either slightly faster or slightly slower than indicated by the schedule of topics.

Week 1	January 19, 21	12.1
Week 2	January 24, 26, 28	12.2, 12.3, 12.4, 12.5
Week 3	January 31, February 2, 4	12.6, 13.1, 13.2
Week 4	February 7, 9, 11	13.3, 13.4, 14.1
Week 5	February 14, 16, 18	14.2, 14.3, 14.4, **Test 1** on February 16
Week 6	February 21, 23, 25	14.5, 14.6, 14.7
Week 7	February 28, March 2, 4	14.8, 15.1, 15.2, 15.3
Week 8	March 7, 9, 11	15.4, 15.5 **Test 2** on March 9
Week 9	March 21, 23, 25	15.6, 15.7, 15.8
Week 10	March 28, 30, April 1	15.9, 16.1, 16.2
Week 11	April 4, 6, 8	16.3, 16.4, **Test 3** on April 6
Week 12	April 11, 13, 15	16.5, 16.6, 16.7
Week 13	April 18, 20, 22	16.7, 16.8, 16.9
Week 14	April 25, 27, 29	16.10, Review, **Test 4** on April 27
Week 15	May 2, 4	Review