Rutgers University

Course Syllabus for MATH 251: Multivariable Calculus, Sections 22-24

Fall 2025

General Information

Instructor	Tom Benhamou	Meeting:	SEC-209 BUS MW 2:00 pm-3:20 pm
Email	tom.benhamou@rutgers.edu	Office Hours	11-12 am W Hill 205

TA (Recitation)	Krishna Kalluri kk1227@math.rutgers.edu	Meeting:	SEC-216 T 10:20-11:40 SEC-216 T 12:10-01:30 SEC-216 T 02:00-03:20
		Office Hours	10 - 11 am M SEC 106

Important Information

Prerequisites

Calculus 2 (Math 152, 154 or 192)

Textbook and MyLab

The official book for the course is Calculus, Early Transcendentals, 15th Edition by Hass, Heil and Weir (ISBN: 978-0137559756).

An electronic edition of the text is provided through the online homework system **MyLab**, to which you must purchase access. **Acquisition of a physical copy of the text is optional**.

1. You will be able to access your MyLab course directly through the Canvas site for our specific course.
2. In the Canvas site, navigate to Access Pearson and follow the on-screen instructions to create a Pearson account (or link an existing Pearson account) to your Canvas account.
3. You will automatically be enrolled in the MyLab course.

We will cover the following topics:

- Ch. 12: Vectors and Space Geometry [12.1, 12.2, 12.3, 12.4, 12.5, 12.6]
- Ch. 13: Vector-Valued Functions and Motion in Space [13.1, 13.2, 13.3]
- Ch. 14: Partial Derivatives [14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8]
- Ch. 15: Multiple Integrals [15.1, 15.2, 15.3, 15.4, 15.5, 15.7, 15.8]
- Ch. 16: Integrals and Vector Fields [16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8]

Websites for this Course

- **Canvas: 2025FA, Multivariable Calc 22-24**: this is our canvas site. All the information regarding the exams, assignments, and the recitations will be posted here.

Calendar [subject to change]

Week	M	T	W	Th	F
Sep 1- Sep 5		**W1**	12.1, 12.2		
Sep 8- Sep 12	12.3	**W2**	12.4		
Sep 15- Sep 19	12.5	**W3***	12.5, 12.6		
Sep 22-Sep 26	13.1	**W4***	13.2, 13.3		
Sep 29-Oct 3	14.1	**W5**	14.2		
Oct 6- Oct 10	14.3, 14.4		**Exam 1**		
Oct 13- Oct 17	14.5	**W6***	14.6		
Oct 20-Oct 24	14.7	**W7***	14.8		
Oct 27-Oct 31	15.1, 15.2	**W8***	15.2, 15.3		
Nov 3-Nov 7	15.4	**W9**	15.8		
Nov 10-Nov 14	15.5, 15.7		**Exam 2**		
Nov 17-Nov 21	15.7	**W10***	16.1, 16.2		
Nov 24-Nov 28	16.2, 16.3	**W11***	Q&A or catching up	BREAK	BREAK
Dec 1-Dec 5	16.4	**W12***	16.5, 16.6		
Dec 8-Dec 12	16.7	**W13**	16.8		
Dec 15-Dec 19	**Final exam: 12/15 12-3 pm**				

*Workshop includes quiz.

Grading Criteria

Grading Weights (track 1)	Percentages
Quizzes/Workshops	10 %
Canvas Assignment	5 %
Mylab assignments	5 %
Midterm 1	24%
Midterm 2	24%
Final	32%

Grading Weights (track 2)	Percentages
Quizzes/Workshops	10%
Canvas Assignment	5 %
Mylab assignments	5 %
Midterm 1	20%
Midterm 2	20%
Final	40%

Your grade will be computed using both tracks, and the one that gives you the highest grade will be the one that you receive by the end of the course.

- **Midterm 1**: It will take place on Thursday, Oct 9 during class time. It will cover the sections 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 13.1, 13.2, 13.3, 14.1, 14.2.
- **Midterm 2**: It will take place on Thursday, Nov 13 during class time. It will cover the sections 14.3, 14.4, 14.5, 14.6, 14.7, 14.8, 15.1, 15.2, 15.3, 15.4.
- **Final Exam** (cumulative and three hours long): Location and time will be announced towards the end of the course. The exam is cumulative, and the new sections are 15.5, 15.7, 15.8, 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8.

Letter Grade Cut-Offs:

Students will receive a grade at least as high as the one indicated by the following table (recall that your score will be computed with tracks 1 and 2, and you will receive the highest grade of the two)

A: Â Â 88%<= X <= 100%
B+:Â 80%<= X <Â 88%
B: Â Â 72%<= X < Â 80%
C+:Â 64%<= X < Â 72%
C: Â Â 56%<= X < Â 64%
D: Â Â 54%<= X <Â 56%
F: Â Â Â Â Â Â Â Â Â Â X < 54%

These percentages may be adjusted at the end of the course based on our analysis of grade data collected throughout the course, and the adjustment might be different for each class. But as indicated previously, the grade you receive will be at least as high as indicated by the above table. That is, you might get a higher grade at the end of the course than the table indicates; you will not get a grade lower than the table indicates.

General Policy:

- **Calculators will not be allowed.**
- All students in the course are expected to be familiar with and abide by the academic integrity policy. Violations of the policy are taken very seriously.
- Rutgers is fully committed to compliance with the American with Disabilities Act; policies and procedures are indicated at http://ods.rutgers.edu/
- Students who wish to request special accommodations must present a Letter of Accommodations to the instructor as early in the term as possible (see https://ods.rutgers.edu/my-accommodations/letter-of-accommodations)
- If for any reason a student will not be able to take an exam, or finds themselves in a situation, medical or otherwise, in which they will not be able to perform at their usual proficiency, they should notify the instructor right away and explain the situation. The instructor must be notified as soon as possible, and in any event *before* the exam. In the case of midterms, this does not guarantee a makeup, and the most likely solution will involve re-weighting the other exams in the course.

Student-Wellness:

In the last few years, we have all been going through a lot, individually and together. It is important to acknowledge that events and circumstances outside of the classroom can impact our ability to be present and engaged at any given moment. At Rutgers, we are focused on the whole student. If, at any point, you experience anything impacting your performance or ability to participate in this class, please reach out to me. Please also see the academic, health, and mental wellness resources on the syllabus as well as others searchable at https://success.rutgers.edu/ for further support.

- **Counseling, ADAP & Psychiatric Services (CAPS) http://health.rutgers.edu/medical-counseling-services/counseling/, (848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901.** CAPS is a university mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

- **Violence Prevention & Victim Assistance (VPVA) https://vpva.rutgers.edu, (848) 932 1181, 3 Bartlett Street New Brunswick NJ 08901.** The office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To each staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

- **Disability Services https://ods.rutgers.edu, (848) 445-6800/ Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854.** Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: https://ods.rutgers.edu/students/documentation-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please compete the Registration form on the ODS web site at: https://ods.rutgers.edu/students/getting-registered.

Overview of the Course

Up to this point your math courses have mostly studied functions of one variable, for example, $y = f(x) = x^2$. When trying to interpret such a function geometrically one draws the graph of $f(x)$, which in this case corresponds to the typical parabola. Usually in a first calculus course such a graph is considered as an static object.

Namely, the graph corresponds to some *fixed* curve on the xy plane, and then the tools of calculus allows us to find *geometric* properties of this curve, like the slope of the tangent line at a point of the curve (which uses the derivative), or the area under the curve between two points (which uses the integral).

The first thing we will do in this course is shift our point of view towards a *kinematical* interpretation of the same object. More concretely, we will think of the graph of a function like $y = x^2$ as the path a particles traces out in space as it moves over time. In other words, a curve such as $y = x^2$ will represent the total trajectory of a particle over a given time interval. From this point of view both x and y will keep track of the position of this particle as it moves, which is why we will regard both variables as functions of time, that is, $x = x(t)$ and $y = y(t)$. The most convenient way to keep track of this data is using **vectors,** which you should regard as a new kind of mathematical object. In this case, there will be a position vector $\mathbf{r}(t)$ which at time t gives us the coordinates $x(t)$, $y(t)$ of the particle, and which we will write as $\mathbf{r}(t) = (x(t), y(t))$.

A significant portion of this course will be about trying to understand the properties of vectors. For example, it is possible to add and multiple vectors, though there is more than one reasonable way to do the latter.

The second part of the course deals with functions or vectors which depend on more than one variable, which are usually known as **scalar** or **vector fields**.

An example of a scalar field will be a function like $h(x, y)$, which represents the height h of some mountain with respect to ground level at the point (x, y). For example, such a function could be something like $h(x, y) = 1 - x^2 - y^2$, and the graph of $h(x, y)$ will be a surface instead of a curve (which will look like an inverted bowl for the function I just wrote). We will learn how to find tangent planes (instead of tangent lines) to points on such a surface, and how these are related to optimization problems.

The concept of a vector field is harder to explain, since we have to understand what vectors are in the first place, but a good example to keep in mind will be the velocity vector field of a river moving downstream. In this case a vector field like $\mathbf{v}(x, y, z)$ would represent the velocity (not speed!) of the water at some point (x, y, z). This is different from the previous example since now we need to specify the *direction* of motion of the water, in addition to how fast it is moving. That is why we need to use vectors: they are required whenever we need to specify properties that have a sense of directionality as well as a magnitude. The last part of this class will consist on understanding different ways to integrate such vector fields, and what meaning these integrals carry.