Math UN 1201
Calculus III (Section 007 and 008)
Fall 2021

Time and location: Section 007: TR 2:40-3:55pm in 207 Mathematics. Section 008: TR 4:10-5:25pm in 207 Mathematics.

Instructor: Inbar Klang (email: klang@math.columbia.edu), pronouns: she/her/hers. You can call me Prof. Klang, Dr. Klang, or Inbar.

Office hours: Tuesdays 5:40-7:10pm in 622 Mathematics, Thursdays 5:40-7:10pm in 629 Mathematics, or by appointment (in person or Zoom meetings possible.)

Teaching assistants: TBA.
Their office hours will be held in the math help room; see here for hours.

Textbook: James Stewart, *Calculus: Early Transcendentals*, 8th Edition. This is available for purchase at the Columbia bookstore, or you can acquire it as an ebook online.

Prerequisites: Calculus I or equivalent.

Course overview: Welcome to Calculus III! In this class, we will cover the following topics:

- Vectors and the geometry of space (Section 10.5 and Chapter 12)

- Vector functions (Chapter 13)

- Functions of several variables and partial derivatives (Chapter 14)

You can find a detailed outline on the last page of the syllabus.

Alternate classes: Are you wondering whether this is the right class for you? Here are some other options:

- Math UN 1205, Accelerated Multivariable Calculus: a faster-paced multivariable calculus course (covers chapters 12-16 of Stewart's textbook rather than chapters 12-14.)

- Math UN 1207, Honors Math A: the first semester of a rigorous, proof-based sequence of classes on multivariable calculus and linear algebra.

- APMA 2000, Multivariable Calculus: If you are a SEAS student, this is the class you should take.

On help hours: An essential part of learning mathematics is asking questions. Office hours (whether the instructor's, the TAs', or those of other TAs in the help room) are an opportunity to go over material covered in class, get homework help, and ask any other class-related questions. Other academic resources include the Columbia tutoring services, which can match you with a tutor for this course, and Khan academy, which has a variety of multivariable calculus videos and texts.

Structure of the course:

This course will have an "active learning" structure. Students will be responsible for engaging with the course material **before** class sessions, by reading the notes posted on Courseworks, watching the videos posted on Courseworks, or some combination thereof. I highly recommend attempting the exercises given in the notes as you come upon them. Each Monday and Wednesday night, a pre-class reading questionnaire will be due, to help me determine which topics to focus on in class. Class will be devoted to reviewing concepts according to the reading questionnaire, Q & A, and working on problems in small groups. **Please do not attend class if you are unwell, quarantined, or have tested positive for COVID-19.** The TAs and I will be happy to help you make up any material you've missed.

Grading policy:

There will be weekly homework, twice-weekly pre-class questionnaires, two midterms, and a final exam (which students may choose to replace by a group project.) Their default weight will be as follows, although there is some flexibility (see "contract weighting" below):

- Homework: 25%

- Pre-class questionnaires: 5%

- Midterm 1: 20%

- Midterm 2: 25%

- Final exam / project: 25%

Contract weighting. You have the opportunity to individualize the weight you would like each component of this course to have, within constraints. To opt in, email me by **Thursday, September 23**, with subject line "weighting", with your preferred weights. (If you do not email me, your weights will be as above.) The sum of weights must be 100%, subject to these constraints:

- Homework: 10-25%

- Pre-class questionnaires: 2-8%

- Midterm 1: 10-25%

- Midterm 2: at least 15%

- Final exam / project: at least 20%

There will be a "renegotiation" period (October 24-31) in which you can modify the weights of everything except midterm 1.

Homework: There will be 12 homework assignments. The homework grade will be obtained as $0.1\times$(sum of problem set scores), up to a maximum of 100%, so you can miss up to two problem sets and still obtain a full grade on homework. Please submit your homework on Gradescope, as a pdf file if possible, either typed or handwritten clearly and legibly. Homework will be due every Tuesday (except exam weeks) at 11pm Eastern time.

Late homework is highly discouraged, to avoid placing an undue burden on graders. I recognize, however, that this is a difficult semester; if you are experiencing extraordinary circumstances, please reach out to me and we will figure out a solution. You are allowed and encouraged to collaborate on homework, but you must write up your own solutions. Please cite any references used (e.g. websites.) Homework assignments may feature more challenging or involved problems that will count for extra credit.

Pre-class questionnaires: Pre-class questionnaires will comprise 3-5 questions about the reading material for the following day's class. A questionnaire will be due every Monday and Wednesday at 11pm, except for the first week and election week, Thanksgiving week (only a Monday questionnaire), and exam weeks (no questionnaire.) The main purpose of these questionnaires is to determine topics to focus on during class. All good-faith attempts (i.e. attempts that indicate thought and effort) will be awarded full points. For example, all partial solutions, progress towards a solution, or reflections on what you don't understand about the question will be awarded full points. Your average on the questionnaires will be multiplied by 1.2 at the end of the semester (up to a maximum of 100%), so that you can miss several questionnaires and still obtain a full score.

Exams: There will be two midterms and a final exam. Exams will take place via timed quizzes on Courseworks, which you can take at any point during a time period of a few days. Midterm 1 will be available October 6-8, and midterm 2 will be available November 10-12. The exams will be open-book and open-notes, and any calculator may be used. You are allowed to look up information online during the exam, but you may not ask a person or website about a specific exam question.

Optional project. Students may choose to replace the final exam with a group project, to be completed in groups of 3-5 students. You can opt-in to this about halfway through the semester, and the projects will be due at the beginning of exam week. Projects will typically include studying and providing a clear exposition on a topic related to course material, and providing detailed solutions to several problems. Projects must be typed, not handwritten.

Academic Honesty Policy: Please read the Columbia University Undergraduate Guide to Academic Integrity.

Accessibility and accommodations: Your success in this class is important to me. We all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. We can develop strategies to meet both your needs and the requirements of the course.
If you think you might need official accommodations, such as extended time on exams, I encourage you to contact the Office of Disability Services (Columbia) or CARDS (Barnard) for a confidential discussion. Once you register with them, they can provide you with an accommodation letter, which will allow you to receive official accommodations.

Student well-being: Your well-being is of primary importance. If you are facing challenges related to your physical or mental health, or obstacles like housing or food insecurity, you are encouraged to contact your advising dean and/or the Student Health Service. If you feel comfortable doing so, please do not hesitate to get in touch with me to discuss ways we can put you in the best possible position to succeed.

Inclusivity: We are part of a learning community and must treat one another with respect at all times. This is especially important with regard to race, religion, nationality, sexual orientation, gender, disability, age, size, immigration status, parental status, and any other aspect of identity. I am committed to ensuring that this class is a supportive, inclusive, and safe environment for all students, and that all students are treated with dignity and respect. See also the Columbia College Notice of Non-Discrimination here.

Tentative Course Outline:

Week	Content
Sep 9	• Overview, coordinate systems; 10.3, 15.7 p. 1040-1041, 15.8 p.1045-1046, 12.1
Sep 14,16	• vectors, dot product, cross product; 12.2-12.4 • HW 1 due Tuesday Sep 14
Sep 21, 23	• Parametric curves, equations of lines and planes; 10.1, 12.5 • HW 2 due Tuesday Sep 21
Sep 28, 30	• Conic sections, quadric surfaces; 10.5, 12.6 • HW 3 due Tuesday Sep 28
Oct 5,7	• Review, Midterm 1 • review Oct 5, no class Oct 7 (midterm 1)
Oct 12, 14	• Vector functions and their derivatives and integrals, review of limits; 13.1-13.2 and some Chapter 2 • HW 4 due Tuesday Oct 12
Oct 19, 21	• Arc length, curvature, motion in space; 13.3-13.4 • HW 5 due Tuesday Oct 19
Oct 26, 28	• Functions of several variables, limits and continuity, partial derivatives; 14.1-14.3 • HW 6 due Tuesday Oct 26
Nov 4	• Tangent planes; 14.4 • HW 7 due Wednesday Nov 3
Nov 9, 11	• Review, Midterm 2 • review Nov 9, no class Nov 11 (midterm 2)
Nov 16, 18	• Chain rule, directional derivatives and gradient; 14.5-14.6 • HW 8 due Tuesday Nov 16
Nov 23	• Directional derivatives and gradient cot'd; 14.6 • HW 9 due Tuesday Nov 23
Nov 30, Dec 2	• Maxima and minima; 14.7 • HW 10 due Tuesday Nov 30
Dec 7, 9	• Lagrange multipliers, complex numbers; 14.8 and Appendix H • HW 11 due Tuesday Dec 7; HW 12 due Tuesday Dec 14