

# Math 20A Multivariable Calculus (section 1)

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**Course Website:** The course page is on LATTE. All assignments and announcements will be posted there

**Lectures:** 9 - 9.50 am each Monday, Wednesday and Thursday (Goldsmith Math 317)

**Office Hours:** Wednesday 2 - 5 PM in Goldsmith 116 or by appointment

**Prerequisites:** Generally, proficiency in differential and integral calculus. Specifically, the courses Math 10A and 10B. It is also possible to satisfy the prerequisites by examination — you should contact me directly if you are pursuing this option.

**Course Overview:** Multivariable calculus provides a valuable toolkit both for studying higher level mathematics and for solving real-world problems in many other fields (not least physics, engineering, economics and statistics). We will cover vectors, vector-valued functions, partial derivatives, multiple integrals, extremum problems (Lagrange multipliers), and line and surface integrals. The course will conclude with two fundamental results in elementary analysis: Green's and Stokes's theorems. The teaching and assessment of this course will primarily focus on practical calculations but you will also develop conceptual understanding alongside computational technique.

**Textbook:** Calculus: Multivariable Calculus, 8th ed. by James Stewart, Cengage Learning, 2016. We will cover chapters 12 - 16 (and I may supplement the textbook with additional notes or exercises where necessary).

**Learning Outcomes:** Upon successful completion of Math 20A students will be able to:

- L1 Interpret and manipulate vectors, and perform dot and cross product calculations
- L2 Extend the definition of the derivative and integral to vector functions
- L3 Define and compute partial derivatives
- L4 Construct level curves and find tangent planes to vector functions
- L5 Interpret and compute directional derivatives
- L6 Define and determine differential and gradient of a multivariable function
- L7 Compute double and triple integrals (incl. changing the order of integration)
- L8 Interpret vector fields and compute line integrals
- L9 Compute and interpret the curl and divergence of vector fields
- L10 State Green's and Stoke's theorems and apply them to solve integration problems

**Content Timetable (approximate):**

- Vectors and the Geometry of Space — 2 weeks [L1]
- Vector functions (curves & surfaces) — 3 weeks [L2]

- Partial differentiation — 3 weeks [L3 - L6]
- Multiple integrals — 3 weeks [L2 & L7]
- Vector calculus — 3 weeks [L8 - L10]

**Assessment:** There will be two mid term exams and one final exam – the material for each exam is cumulative, i.e. each exam includes all material covered in the course up to that point in time. Calculators are allowed in exams but graphing calculators are not – in general I encourage students to only use calculators to double check answers. There will also be weekly homework assigned on LATTE. Late homework submissions will not be accepted (without evidence of extenuating circumstances) and your homework grade will neglect your two lowest scoring submissions.

*Collaboration and discussion on homework is encouraged but you must write up your solutions independently of your classmates. Do not consult solution manuals when preparing homework.*

Homework will be due each Friday at 5pm EST (starting in week 2) and can be left in my mail slot or dropped directly to my office.

Each students final course grade will be calculated on the following basis:

- Homework – 20% (weekly)
- Mid term 1 – 20% (February 14th)
- Mid term 2 – 20% (April 4th)
- Final exam – 40% (TBA, will be between May 6th and 14th)

**Grader:** Mr Zach Larsen (PhD candidate, Math) – Office hours: Goldsmith 106 on Mondays 2 - 3 pm and Thursdays 4 - 5 pm.

**Succeeding in this Course:** You should spend 9 hours each week working towards achieving the learning outcomes (above) *in addition to* attending lectures and office hours (the latter as needed). I suggest that you spend one hour preparing for each lecture by carefully reading through the material in the textbook beforehand so that you can get the maximum benefit from each lecture — it is generally more productive if you enter lectures with questions you need answered, rather than leaving lectures with questions you need answered! You should spend a small amount of time reviewing the material covered in each lecture (perhaps 30 minutes per lecture) and the remainder of your time (4.5 hours per week) would be best devoted to homework and solving other practice problems. Your understanding of the material will mostly be tested by solving problems so it is sensible to devote the majority of your time to becoming proficient at these calculations.

**Accessibility Support:** If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please contact me immediately.

**Academic Integrity:** You are expected to be honest in all of your academic work. Please consult [Brandeis University Rights and Responsibilities](#) for all policies and procedures related to academic integrity. Allegations of alleged academic dishonesty will be forwarded to the Director of Academic Integrity. Sanctions for academic dishonesty can include failing grades and/or suspension from the university.