Fall 2025 **Principles of Real Analysis II 21-356** **CMU**

Lecture: MWF 12:00 pm – 12:50 pm, WH 8220

Lecturer: Tomasz Tkocz, Wean Hall 8117, `ttkocz@math.cmu.edu`

TA: Pedro Motta, Wean Hall 6213, `pmotta@andrew.cmu.edu`

Office Hours: Wednesday 1:30 - 3:00 pm (Tomasz), Wednesday 4:30 - 5:30 pm (Pedro), or by email appointment

Course website: `Canvas` and/or `http://math.cmu.edu/~ttkocz`

Course description: This course is a rigorous introduction to multivariate calculus, starting from topology of Euclidean space, developing continuity and differentiability of multivariate functions, concluding with basics of theory of integrals. The highlights include a solution to the isoperimetric problem, or elements of Fourier analysis and applications (time permitting).

Prerequisites: Principles of Real Analysis I, Basic linear algebra

Literature:

- Taylor, J. L., Foundations of Analysis, AMS, 2012.
- Folland, G. B., Advanced calculus, 2002.
- Tao, T., Analysis II, 2016 (available on-line via CMU Library)

Course content: $\mathbb{R}^n$, continuity, differentiation, inverse and implicit function theorem, Lagrange multipliers, integral, change of variable formula, Stokes' theorem, Fourier series (time permitting)

Learning objectives: Students should

- gain understanding of basic properties of differentiable functions of several variables
- advance their insight into the interplay between geometric and analytic ideas
- develop an improved ability and use the methods and results of real analysis,

Course format: This is an in person class. You are expected to fully participate in class, viz. please ask and answer questions, initiate or participate in discussions. We follow rather closely Taylor's textbook.

Homework: There will be about 8 homework assignments during the semester. Late submissions will not be accepted, but the lowest homework score will not count towards the final grade.

Exams: There will be 3 in-class tests throughout the semester (based on HW problems and the lecture material), each test contributing equally to the final score. *No* final exam, *but* suggested grades will be out before the end of the semester and you can request an oral final examination to improve your grade. Plagiarism and cheating are not tolerated.

Grades: The midterm grade will be based solely on Test 1. The final grade will be based on all the tests (each contributing equally), and homework (each contributing equally):

$$30\% \textbf{ Homework} + 70\% \textbf{ Tests}$$

Rough guide on "score" $\to$ "grade" map: `https://en.wikipedia.org/wiki/Academic_grading_in_the_United_States` (but the grades will be "curved" if needed)

I turn away in fright and horror from this
lamentable plague of functions that do not have derivatives.

–C. Hermite, 1893