Mathematics 224A, Fall 2022
Fraydoun Rezakhanlou

Lectures: MWF, 11–12, Barker 110
Office Hours: M 3–4, WF 4-5 803 Evans

Prerequisites : Math 104

The majority of the fundamental processes of our natural world are described by differential equations. Some examples are the vibration of solids, the flow of fluids, the formation of crystals, the spread of infections, the diffusion of chemicals, the structure of molecules, etc. These examples are responsible for our interest in partial differential equations such as Hamilton-Jacobi equation, Euler equation, Navier-Stokes equation, Diffusion equation, Wave equation and Korteweg-deVries equation. As the primary goal of the course, I discuss some of the above equations and explain some mathematicals tools that are needed to solve them. I also use these equation as an excuse to introduce students to some basic questions in fluid mechanics and statistical physics. Some of the topics are:

1. Advection, diffusion, Brownian motion, sources, Green's function.
2. Some classical transforms.
3. Fluid mechanics, Euler and Navier-Stokes equation, incompressible limit, shallow water equation.
4. Shock waves, Rarefaction waves, Riemann invariants.
5. Scattering theory, Korteweg-deVries equation.

There is no required text and I will post lecture notes on my homepage.

Grading: There will be weekly homework assignments (due Mondays) and one take-home exam.