Math177: Geometric Methods in ODE

MoWeFr 10:30 – 11:20am, 381U

Instructor: Yakov Eliashberg

1. Recollections of basic notions and results in the theory of ODE.
2. Symmetries of differential equations and applications.
3. Blow-ups and resolution of singularities of differential equations.
4. Implicit equations. Legendre transform and projective duality.
5. First order partial differential equations and ODE. Hamilton-Jacobi equation.
6. Elements of symplectic, contact and Poisson geometry.
7. Differential equations and variational principles of Classical Mechanics.
8. Lagrangian and Hamiltonian formalisms in Mechanics. Hamiltonian vector fields and their dynamics. Periodic orbits of Hamiltonian systems and existence of fixed points of canonical transformations.
9. Completely integrable systems. Liouville-Arnold theorem and applications.
10. Introduction to the Perturbation Theory.
11. Structural stability.
12. Differential equations on the 2-torus, rotation number and the theory of diffeomorphisms of the circle.
13. Introduction to the hyperbolic theory. Anosov systems.