MTH744U/MTH744P Dynamical Systems 2011-2012

Syllabus

1. First-order differential equations (one-dimensional flows): linear and nonlinear equations, graphical solutions, bifurcations.

2. Two-dimensional flows: phase plane, stability of fixed points, periodic solutions, and limit cycles. Introduction to bifurcation theory, local and global bifurcations. Tools for studying global behavior of flows: Lyapunov functions, Poincare-Bendixson Theorem, gradient flows.

3. Three-dimensional flows: Lyapunov exponents, Poincare sections, strange attractors, chaos.

Learning Outcomes

On completion of this course students will be expected to be able to

1. explain how ordinary differential equations (ODEs) give rise to dynamical systems,

2. be able to define the state space, its limit sets and attractors,

3. explain how the state space dimension limits the possible dynamics,

4. sketch the limit set and starting from this characterize the main features in the flow of a dynamical system given by ODEs in the plane,

5. know about the concept of chaos in dynamical systems and state some properties of a chaotic dynamical system.

Warnings

1. The above is intended as a MINIMAL list to be mastered in order to be reasonably sure of PASSING the examination.

2. Just because knowledge of a particular definition, formula or statement of a theorem is in the list of 'Learning Outcomes' above does not guarantee that it will be on the examination paper. However, a good proportion will be, so they are worth knowing well.

Examination

The examination lasts for 3 hours. The rubric will state:
You should attempt all questions. Marks awarded are shown next to the questions. Calculators are NOT permitted in this examination. The unauthorised use of a calculator constitutes an examination offence.

Assessment ratio splits
    100% final exam

Submitted coursework will be marked for feedback, and will not count towards the overall assessment.