About the written exam.

The written exam should test whether the learning goals of the course have been attained. Please look at
`http://www.math.chalmers.se/Math/Grundutb/GU/MMA421/mma421.pdf`
to see what they are, if you have not already done so.

The exam consists of problems related to these learning goals. Some of the problems are more theoretical (like "State and prove a theorem that ...") and some are more computational (like "Find all the fixed points to the system ...", or "assume that ... then prove that ..."). At least one theory question will concern the statement and/or proof of one of the theorems/lemmas/definitions in the list below, but that list is not exclusive.

LIST OF THEOREMS

N.B. This list refers to Teschl's book as of **April 2012**, which should be equivalent to the printed book. If you have a different edition, check carefully that the numbering of pages, theorems et.c. has not changed.

- The contraction principle (Theorem 2.1 in Teschl), and the related definitons
- Theorem 2.2 (Picard-Lindelöf), and the related definitons (*e.g. Lipschitz continuity*)
- The Gronwall inequality (Lemma 2.7)
- Theorem 2.8 on the well-posedness of ODE's.
- The definition of extensions of solutions and Theorem 2.13 existence of a unique maximal solution.
- Theorem 2.17 on global exitence of solutions to equations with linear growth
- Theorem 2.18 (Arzela-Ascoli; you need to understand the concept of equicontinuity)
- Definition of stability and Theorem 3.4 on the stability of linear systems, Corollary 3.5, Corollary 3.6
- Theorem 3.9 on systems with possibly time dependent coefficients. If you refer to other theorems in the proof, don't forget to check all assumptions required.
- Definition of flow, and Theorem 6.1
- Lemma 6.2 on the "straightening out of vector fields"
- The definitions in Chapter 6.3: orbit, stationary point (and the synonyms), periodic points, invariant sets, $\omega_\pm$-limit sets
- Lemma 6.4, 6.5, 6.6, about invariant sets, orbits and ω-limit sets. You should know these well enough to be able to prove variations of the Lemmas
- Lemma 6.11, Lemma 6.12 and Theorem 6.13, all dealing with Lyapunov's stability theory.

- The definitions in Chapter 9.1, 9.2 concerning the behaviour near fixed poinst. You should be able to use Theorem 9.1, 9.2.
- The definition of stable and unstable manifolds (in Ch. 9.2)
- Theorem 9.4 about the existence of a stable manifold, and the Hartman-Grobman Theorem 9.9 (I will not ask for the full proof of these, but you should be able to explain the meaning and implications of the theorems)
- Definition of conjugacy for maps (see equation 9.39)