18.034 REVIEW SHEET FOR EXAM 1

Instructions: You will have approximately 50 minutes for the exam. The exam is closed book, closed notes and calculators are not permitted. You will not need a blue book, there will be lots of scratch paper provided, as well as a stapler and paper clips in case you have to attach pages to the exam packet.

The test will consist of 5 problems, many with several parts. The point value of each problem and each part of a problem will be given. The test will cover the material from Unit I. As in all tests, you should first read through all the problems and then manage your time accordingly. The test is mostly computational, but the computations are simple (not much multiplying or dividing), if done properly. What follows are a list of suggestions to help you in studying for the exam.

1: Know the homework. There will be at least one problem on the exam which is very similar to a problem or problems from the first two problem sets (but not Problem 1 from Problem Set 2).

2: Know how to model a simple system: given a real-world problem, how to find an ODE that the state variable satisfies.

3: Know how to use the method of integrating factors to find the general solution of a first-order linear ODE.

4: Given a particular solution to a first-order linear ODE, know how to find the general solution. Know how to identify the steady-state solution, and the half-life if applicable.

5: Given a first-order ODE in normal form, an initial value, and a first-approximation $y_0(t)$ to the solution, know how to compute the first few Picard iterates.

6: Given a first-order ODE, know how to find the isoclines and give a rough sketch of the slope field. If asked, know how to prove that *given* curves are envelopes/fences (you will not be asked to find the curves yourself).

7: Know how to solve a first-order separable ODE. Know how to solve a first-order exact ODE. Know how to determine if any solutions are lost by this process.

8: Know the difference between integral curves and solution curves. Know how to say what parts of an integral curve are solution curves.

9: Given a first-order autonomous ODE, know how to determine all equilibrium solutions, how to sketch the state line, how to give a rough sketch of the slope field and solution curves, and how to determine whether an equilibrium solution is stable, unstable or neither.

10: You **will not** be asked to quote theorems. You **will not** be asked to prove theorems. You **will not** be asked to numerically approximate solutions of an ODE. You **will** be asked to justify your answers, but your arguments need only be convincing, not 100% rigorous. Also, if you refer to a theorem, it is just as good – in fact better – to state what the theorem asserts with all necessary hypotheses.

Obviously you won't be tested on all the concepts just listed, but if you are comfortable with these concepts, you should do well on the test. Focus especially on the computational concepts above.

Date: Spring 2004.