MATH 341, Spring 2023-050, Nathan Reading
Review: Test 1
This is an overview of the most important skills and understanding I expect you to have developed. I don't promise that every exam problem will match with something on this sheet. Rather, my intention is for this to be an overview of the most important skills and understanding I expect you to have developed.

Exam questions might test your understanding of some of the following important terms and concepts:

differential equation (ODE)	solution	general solution
order of an ODE	independent variable	dependent variable
direction field	existence and uniqueness of solutions	initial value problem (IVP)
homogeneous linear ODE	nonhomogeneous linear ODE	superposition
principle of superposition	auxiliary equation	

The exam might reasonably test your ability to carry out some of the following procedures.

- Determine if a given function satisfies a given ODE.
- Solve an initial value problem (IVP), possibly using a method mentioned below.
- Analyze a given ODE in terms of the Existence and Uniqueness Theorem (p. 11 of your text). The statement of the theorem will be provided as part of the question.
- Given a direction field and a starting point, sketch a reasonable approximation to a solution.
- Demonstrate understanding of how direction fields are generated.
- Carry out a few steps of Euler's method. Formulas will not be given. You can remember the method by understanding that it consists of repeated linear approximations.
- Solve a separable ODE by separating and integrating. Keep track of "extra" constant solutions that might arise when you separate.
- Solve a linear first-order ODE using an integrating factor.
- Given a first-order ODE in differential form, determine if the differential form is exact.
- Given an ODE in exact differential form, find the general solution in the form of level curves of a function.
- Write and solve an ODE modeling a "mixing" problem.
- Solve a second-order (or possibly first- or third-order) linear ODE with constant coefficients using the "auxiliary equation" method. (Write the general solution and/or solve a given IVP.) There are three case: distinct real roots, repeated roots and complex roots.
- Given a non-homogeneous linear equation, find a particular solution using the Method of Undetermined Coefficients. Then find the general solution and/or solve a given IVP.

I will ask a few challenge questions at the end of the exam, worth very few points, and these problems are exempt from anything I have told you or will tell you about what I will or will not ask on the test.

Closed book, closed notes, no calculators.