

Math 2250-4
Exam 1 Review Questions
October 2, 2013.

We will use the first 15 minutes of class today to finish the loose ends from section 3.6 determinants. Please look over the determinants notes from Monday and Tuesday, and have them available at the start of class, to facilitate this discussion. The order we will go in is:

- 1) why A^{-1} exists when $|A| \neq 0$ and doesn't exist when $|A| = 0$. This is the last page of Monday's notes, and is a good review of elementary row operations and their effects on determinants; it is good to go through and understand. Also, the determinant test and reduced row echelon form test for whether A^{-1} exists are facts you need to know for the exam.*
- 2) the adjoint formula for matrix inverses....exercises 2,4 on Tuesday's notes...know and be able to use.*
- 3) Cramer's rule....exercise 5 on Tuesday's notes...know and be able to use.*

Then we'll go over the logistics for the exam, below.

Finally, the concept-organizing questions for Chapters 1-3 are on the following pages. I've put the Chapter 3 questions first because the Chapter 1-2 questions are the same ones you thought about before the super quiz.

The exam is this Friday October 4, from 8:30-9:30 a.m. Note that it will start 5 minutes before the official start time for this class, and end 5 minutes afterwards, so you should have one hour to work on the exam. Get to class early, and bring your University I.D. card, which we will ask you to show if we don't recognize you from sections or lecture. Chuanhao, Stephen, and I will be here. You will sit in an alternate seating pattern.

This exam will cover textbook material from 1.1-1.5, 2.1-2.4, 3.1-3.6. The exam is closed book and closed note. You may use a scientific (but not a graphing) calculator, although symbolic answers are accepted for all problems, so no calculator is really needed. (Using a graphing calculator, which can do matrix computations for example, is grounds for receiving grade of 0 on your exam. So please ask before the exam if you're unsure about your calculator.)

I recommend trying to study by organizing the conceptual and computational framework of the course so far. Only then, test yourself by making sure you can explain the concepts and do typical problems which illustrate them. The class notes and text should have explanations for the concepts, along with worked examples. Old homework assignments and quizzes are also a good source of problems. It could be helpful to look at quizzes/exams from my previous Math 2250 classes, which go back several years from the link

<http://www.math.utah.edu/~korevaar/oldclasses.html>.

Chapter 3:

3a) Can you recognize an algebraic linear system of equations?

3b) Can you interpret the solution set geometrically when there are 2 or three unknowns?

3c) Can you use Gaussian elimination to compute reduced row echelon form for matrices? Can you apply this algorithm to augmented matrices to solve linear systems ?

3d) What does the shape of the reduced row echelon form of a matrix A tell you about the possible solution sets to $A\mathbf{x} = \mathbf{b}$ (perhaps depending, and perhaps not depending on \mathbf{b})?

3e) What properties do (and do not) hold for the matrix algebra of addition, scalar multiplication, and matrix multiplication?

3f) What is the matrix inverse, A^{-1} for a square matrix A ? Does every square matrix have an inverse? How can you tell whether or not a matrix has an inverse, using reduced row echelon form? What's the row operations way of finding A^{-1} , when it exists? Can you use matrix algebra to solve matrix equations for unknown vectors \underline{x} or matrices \mathbf{X} , possibly using matrix inverses and other algebra manipulations?

3g) Can you compute $|A|$ for a square matrix A using cofactors, row operations, or some combination of those algorithms? What does the value of $|A|$ have to do with whether A^{-1} exists? What's the magic formula for the inverse of a matrix? Can you work with this formula in the two by two or three by three cases? What's Cramer's rule? Can you use it?

Chapters 1-2:

1a) What is a differential equation? What is its order? What is an initial value problem, for a first or second order DE?

1b) How do you check whether a function solves a differential equation? An initial value problem?

1c) What is the connection between a first order differential equation and a slope field for that differential equation? The connection between an IVP and the slope field?

1d) Do you expect solutions to IVP's to exist, at least for values of the input variable close to its initial value? Why? Do you expect uniqueness? What can cause solutions to not exist beyond a certain input variable value?

1e) What is Euler's numerical method for approximating solutions to first order IVP's, and how does it relate to slope fields?

1f) What's an autonomous differential equation? What's an equilibrium solution to an autonomous differential equation? What is a phase diagram for an autonomous first order DE, and how do you construct one? How does a phase diagram help you understand stability questions for equilibria? What does the phase diagram for an autonomous first order DE have to do with the slope field?

1g) *Can you recognize the first order differential equations for which we've studied solution algorithms, even if the DE is not automatically given to you pre-set up for that algorithm? Do you know the algorithms for solving these particular first order DE's?*

2) *Can you convert a description of a dynamical system in terms of rates of change, or a geometric configuration in terms of slopes, into a differential equation? What are the models we've studied carefully in Chapters 1-2? What sorts of DE's and IVP's arise? Can you solve these basic application DE's, once you've set up the model as a differential equation and/or IVP?*