

## REVIEW QUESTIONS FOR STUFFS AFTER MIDTERM 2

### 1. REVIEW QUESTIONS FOR THE CHAPTER 7

- (1) How to write a higher order differential equation into a first order linear system? (Section 7.1, Example 1)
- (2) How to add and multiply two matrices? How to multiply a number to a matrix? What is the transpose, conjugate or adjoint of a matrix? How to multiply a matrix to a vector? What is an identity matrix? How to compute the determinant of a matrix? What is the inverse to a matrix and how to compute it? (Section 7.2)
- (3) How to solve a system of linear equations? How to use the augmented matrix to proceed? What happens if the matrix of the (homogeneous or nonhomogeneous) system is nonsingular? What happens if the matrix of the (homogeneous or nonhomogeneous) system is singular? How does the solution look like? (Section 7.3, Example 1, 2)
- (4) How to determine if a set of vectors is linear dependent or independent? If linear dependent, how to find a relation? (Section 7.3, Example 3)
- (5) How to find the eigenvalues and eigenvectors to a given matrix? (Section 7.3, Example 4)
- (6) What is the structure of the solutions to a (homogeneous) linear system of ODE? What is a fundamental set of solutions and how to verify if you have a fundamental set of solutions? (Section 7.4, Theorem 7.4.1 to 7.4.4)
- (7) How to solve a homogeneous linear system of ODE with constant coefficient? How to deal with the case when you have distinct real eigenvalues? How to deal with the case when you have distinct complex eigenvalues? And why can you do this? (Section 7.5 and 7.6, all examples and exercises, also look at Theorem 7.4.5 for why)

**2. REVIEW QUESTIONS FOR THE CHAPTER 5**

- (1) How to use the ratio test to determine the region of convergence for a given power series?  
(Section 5.1, Example 1, 2)
- (2) How to shift the index? How to write a sum of different series into one single power series  
(Section 5.1, Example 3, 4, 5)
- (3) Given an arbitrary ODE, what is a series solution? How to set up the series solution near different points? How to obtain a recurrence relation for the series solution? How to solve the coefficients of the series from the recurrence relation? How many free variable do you have? What does the final general solution looks like? (Section 5.2, all examples)
- (4) What is an ordinal point for an ODE? What is a singular point for an ODE? Without knowing the explicit series solution, how to give a lower bound to the radius of convergence for the series solution from the ODE itself? (Section 5.3, Example 2, 3, 4)
- (5) What does a Euler's equation look like? How to solve such equations? (Section 5.4, Example 1, 2, 3)
- (6) What is a regular singular point for an ODE? What is an irregular singular point for an ODE? (Section 5.4, Example 4, 5, 6, Exercise 19, 20, 21, 24, 25, 29)