

STUDY GUIDE FOR TEST 2

CHAPTERS COVERED

The test will cover Sections 3.1-3.6, 3.8 and 4.1; that is, the material we covered in class from February 6 until March 23 (inclusive). The homework problems for these days will be the best guide for the material you have to know. The way the test will be designed is that 90 percent of the points will come from problems similar to the homework, whereas the other 10 percent will be problems that test your understanding of the material in a deeper way.

FORMULAE

Two of the formulae will be given to you if needed for a problem in the test. These are the variation of parameters formula in Section 3.5, and the formula for $C(\omega)$, the amplitude of a mass-spring system undergoing an external force $F_0 \cos(\omega t)$ in Section 3.6. Note that you will not be given the amplitude or time-dependent amplitude formulae for unforced systems in Section 3.4. Furthermore, if a problem can be done in either the undetermined coefficients method or by the variation of parameters formula, I will NOT give you the formula (in these cases, the undetermined coefficients method is easier anyway). For the purposes of calculating Wronskians, I will expect you to know how to calculate determinants of 2×2 and 3×3 matrices.

PROOFS OF THEOREMS

The only theorem for which you need to understand the proof is the superposition principle (i.e., if y_1, y_2 are both solutions of a homogeneous linear differential equation, then $y = C_1 y_1 + C_2 y_2$ is also). Related to that, you are also expected to understand why $y = y_c + y_p$ is the general solution for a nonhomogeneous equation.

You do not need to memorize the proofs of the variation of parameters formula or the proofs for the amplitude formulae. For homogeneous equations with a repeated root, you are not expected to know why a repeated root a of the characteristic polynomial corresponds to solutions $y_1 = e^{ax}, y_2 = x e^{ax}, y_3 = x^2 e^{ax} \dots$. You are however expected to understand every other step for solving homogeneous linear differential equations. E.g., you should understand WHY a differential equation $y'' + py' + qy = 0$ corresponds to a characteristic polynomial $r^2 + pr + q = 0$, and you are expected to understand WHY a root $r = a + bi$ corresponds to solutions $y_1 = e^{at} \cos(bt), y_2 = e^{at} \sin(bt)$.

SAMPLE TEST

There will be no sample test for the second midterm. I regard sample tests of some value for the first midterm, as it gives students some familiarity about how I typically write questions. However, you all have already taken one of my tests, so a sample test will be unnecessary for that purpose.

There are of course copies of the midterms I gave last semester on my website. I would like to discourage you from using them as practice, since this semester's midterm 2 does not cover exactly the same material. Furthermore, I have made

some changes in how I have taught Chapter 3 this semester, so last fall's test might not be a good guide for questions that will appear in this test.