Review for second exam

Section 3.2: This section contains two important theoretical facts you should pay attention to (see pages 168 to 170).

First, the general solution of a linear homogeneous equation of order n is a linear combination of n linearly independent solutions. That is, if you can find n different solutions $y_1(x)$, $y_2(x)$, ... , $y_n(x)$ which are independent of each other (none of them can be expressed as a combination of the others), then the general solution is

$$y_c(x) = C_1 y_1(x) + C_2 y_2(x) + \cdots + C_n y_n(x).$$

Second, for a linear inhomogeneous equation, if you can find just one particular solution $y_p(x)$, and you know the general solution $y_c(x)$ of the corresponding homogeneous equation, then the general solution of the inhomogeneous equation is

$$y_c(x) + y_p(x).$$

These statements apply to any linear equation, whether the coefficients are constants or not. In the remaining sections of Chapter 3, we consider only equations with constant coefficients.

Section 3.3: This section describes how to solve linear differential equations with constant coefficients by looking for solutions of the form e^{rx} or $x^n e^{rx}$. The idea is that the value of r can be found by solving a polynomial equation called the characteristic equation. If r is a complex number, it may be more convenient to write the solution in terms of sines and cosines. The situation is pretty well summarized by the three theorems shaded in blue in this section.

The method described in this section can be used to find the general solution of a linear homogeneous equation. For inhomogeneous equations, use the method described in Section 3.5.

Section 3.4: There were no homework problems assigned from this section, and there won't be problems from this section on the exam. But, when you have time, you should learn the material in this section. It's as important to know the physical interpretation of the equations and solutions we are studying as it is to know mathematical algorithms for solving them.

Section 3.5: This section describes the method of undetermined coefficients for finding a particular solution of a linear inhomogeneous equations. It's important to remember that this method only works when the inhomogeneous terms (the terms which is are functions of x with no y or derivative of y in them) are of a certain special form: they have to be of the form $Ce^{ax}\cos bx$ or $Ce^{ax}\sin bx$.

There is a definite procedure for finding the form of the particular solution, described in "Rule 1" on page 201 and "Rule 2" on page 205. You should take a look at these rules and try to understand them. But it's almost as effective just to work enough examples that you can find the correct form of the particular solution by experienced guesswork.

On pages 207 to 210 there is described another, more general method for finding particular solutions of inhomogeneous equations, called the method of “variation of parameters”. We did not cover this in class, so you can skip this material.

Section 7.1: In this section, the Laplace transform is defined, and the Laplace transform of several basic functions is computed.

On the test, I'll provide a table like the the one in Figure 7.1.2.

We haven't talked in class yet about the material on pages 447 to 450 in the section titled “General Properties of Transforms”. You can skip that section for now.

Section 7.2: You should be familiar with the formulas in Theorems 1 and 2 from this section, and how to use them. Review Examples 1, 2, 4, 5, and 6. You can skip the subsection titled “Linear Systems” (pages 456 – 458).

Section 7.3: You should know the formula in Theorem 1 of this section, and be familiar with the process of finding inverse Laplace transforms using partial fractions, as illustrated in the examples in this section.

Section 7.4: For the second exam, you should be familiar with the formulas in Theorems 2 and 3 of this section, which are illustrated in Examples 3 through 7. There will not be material on the exam about convolutions, so for now you can skip the material on pages 474 and 475, and Examples 1 and 2. This will show up on Exam 3.