Math 320 (spring 2011) ∼ About the second midterm

Here is a list of the topics which we have covered in class since the previous midterm. You should also see also the assigned homework problems on the course web page.

Linear algebra – The definition of linear independence. Know the definition (see page 248). "Know the definition" means "know the definition," i.e., if you are asked for the definition, then you should be able to state it. Know how to use the definition (in combination with row reduction) to prove a given list of vectors is independent or not (as in examples 5 and 6 on pages 249–250.)

Linear algebra – subspaces. *Know the definition*: in this course we have adopted theorem 1 on page 241 as the definition. Be able to prove/disprove that a given set S is a linear subspace of $\mathbb{R}^n$. Be able to find a basis for the solution space of a given set of linear equations (see the algorithm and example on pages 258/259).

You should also know the definition of ***a basis***, and you should know the definition of when a set of vectors ***spans a given subspace.***

The above topics are covered in the book in §§4.2–4.4.

Differential equations – first order. You should know how to solve separable equations ($y' = f(x)g(y)$, see §1.4) and linear equations ($y' + P(x)y = Q(x)$, see §1.5). None of this is new, as you have already seen this material in math 222.

Differential equations – equilibria, stability & phase diagrams. Understand how to draw the phase diagram for a diffeq of the form $\frac{dy}{dt} = f(y)$, how to find its equilibrium solutions, and how to decide on their (in)stability. Know that you can do all this without ever solving a differential equation! Know how to draw *a bifurcation diagram* for differential equations containing one parameter, i.e. $x'(r) = f(x(t), r)$.

This material can be found in §2.2.

Differential equations – 1st order, Euler's method. Understand how it works. Be able to formulate how it works. Be able to use Euler's method to approximate the solution of some initial value problem (by hand: problems will be carefully chosen so you can do this without a calculator.)

This is described in §2.4. The "algorithm" on page 114 summarizes how the method is applied. Example 1 on page 114 is typical of what you should be able to do (and again, without a calculator you won't be asked to do more than one or two steps of the method, and the numbers will be "easy.")

Differential equations – higher order, linear. Given n solutions $y_1, \ldots, y_n$ of an n^{th} order equation know how to use the Wronskian to determine if $c_1y_1(x) + \cdots + c_ny_n(x)$ is the general solution of the homogeneous equation (this is contained in theorems 3 and 4 of §5.2, pages 308/309 of our book; examples 4, 5 on pages 306/307 show you how to compute the Wronskian.) Know how to find a solution satisfying certain given initial conditions.

Know how to solve constant coefficient linear homogeneous differential equations (this is reviewed in §5.3).