MATH 54 – HINTS TO HOMEWORK 23

PEYAM TABRIZIAN

Here are a couple of hints to Homework 23. Enjoy!

SECTION 9.5: HOMOGENEOUS LINEAR SYSTEMS WITH CONSTANT COEFFICIENTS

If you're lost about this, check out the handout 'Systems of differential equations' on my website! Essentially all you have to do is to find the eigenvalues and eigenvectors of A.

Also, to deal with the 'finding the eigenvalues' part, remember the following theorem:

Rational roots theorem: If a polynomial p has a zero of the form $r = \frac{a}{b}$, then a divides the constant term of p and b divides the leading coefficient of p.

This helps you 'guess' a zero of p. Then use long division to factor out p.

9.5.17. First, draw two lines, one spanned by $\mathbf{u_1}$ and the other one spanned by $\mathbf{u_2}$. Then on the first line, draw arrows pointing *away* from the origin (because of the e^{2t}-term in the solution, points on that line *move away* from the origin). On the second line, draw arrows pointing *towards* the origin (because of the e^{-2t}-term, solutions move towards the origin). Finally, for all the other points, all you have to do is to 'connect' the arrows (think of it like drawing a force field or a velocity field).

If you want a picture of how the answer looks like, google 'saddle phase portrait differential equations' and under images, check out the second image you get!

9.5.21. The fundamental solution set is just the matrix whose columns are the solutions to your differential equation. Basically find the general solution to your differential equation, ignore the constants, and put everything else in a matrix!

Date: Monday, December 1, 2014.

9.5.35. For (c), you don't need to derive the relations, just solve the following equation for $\mathbf{u_2}$: $A\mathbf{u_2} = \mathbf{u_1}$.

Section 9.6: Complex eigenvalues

Again, for all those problems, look at the handout 'Systems of differential equations', where everything is discussed in more detail!

9.6.19. Use use equation (10) on page 541 with $m_1 = m_2 = 1$, $k_1 = k_2 = k_3 = 2$.

Note: The trick where you let $y_1 = x_1$, $y_2 = x_1'$, $y_3 = x_2$, $y_4 = x_2'$ is important to remember! It allows you to convert second-order differential equations into a system of differential equations!