**ODE HW 2**

In class we tried to find the Eigenvalues and Eigenvectors for . Recall the process:

**To find the eigenvalues**: solve the characteristic polynomial

In our case we get so that and .

**To find an Eigenvector:** An Eigenvector for the Eigenvalue is a vector v such that , or equivalently . Solve that (linear) system of equations:

In our case we get for : which gives rise to the system of equations:

or equivalently:

If you substitute the first solution into the second equation, we get:

Therefore the system has infinitely many solutions (as is usually the case) of the form

We can set to get as a particular representative the Eigenvector for the Eigenvalue . **To be sure, verify** that for the above Eigenvector and Eigenvalue.

However, if we double-check our answer using *Mathematica* (see screenshot on the right), we get the same Eigenvalues, but as Eigenvectors we get and . Neither of them is the Eigenvector we computed manually, it seems, so …

1. Resolve he conflict that is described above. Decide who is right and explain your decision.
2. Compute, *manually*, the Eigenvector for the second Eigenvalue for the above matrix A. If that one comes out different from the one Mathematica found, explain!

**Solving a Homogeneous System of Linear ODEs (Case 1)**

Consider the system of ODE’s X’= A X, where A is a 2 x 2 matrix, and and are the Eigenvalue/ Eigenvectors of A. Assume that are real. Then the solution to the above ODE system is:

1. Solve the system of ODEs . *Make sure to check your answer*! Try it (a) manually and (b) with Mathematica
2. Consider with initial condition . Solve it and *make sure to check your answer*! Try it (a) manually and (b) with Mathematica