

Math 450H
Fall 2009
Problem Set 4

In each problem below, a linear first order system of differential equations is given. In each system: 1) Identify the critical point $(0, 0)$ as a nodal sink or source, a saddle point, a center, a spiral sink or source, or "other" by examining the associated eigenpairs. 2) Analyze the specific role of the eigenvectors in the $u - v$ phase plane 3) Predict the long term behavior of the system for various initial conditions 4) Confirm your analysis by viewing the associated $u - v$ phase plane. 5) Find a 2nd order differential equation corresponding to the system.

Problem 1 $u'(t) = -2u;$ $v'(t) = -2v$

Problem 2 $u'(t) = 2u;$ $v'(t) = -2v$

Problem 3 $u'(t) = -2u;$ $v'(t) = -v$

Problem 4 $u'(t) = u;$ $v'(t) = 3v$

Problem 5 $u'(t) = -v;$ $v'(t) = 4u$

Problem 6 $u'(t) = 2v;$ $v'(t) = -2u$

Problem 7 $u'(t) = v;$ $v'(t) = -5u - 4v$

Problem 8 $u'(t) = -u;$ $v'(t) = -v$