Math 341 Spring 2005 **SHOW ALL YOUR WORK** **Bonus Quiz FIVE**

1. Consider the slope field for the given system

$A = \begin{pmatrix} -2 & 1/2 \\ 0 & -1 \end{pmatrix}$

$$\frac{dx}{dt} = -2x + \frac{1}{2}y$$
$$\frac{dy}{dt} = -y$$

$\begin{vmatrix} -2-\lambda & \frac{1}{2} \\ 0 & -1-\lambda \end{vmatrix} = 0$

$(-2-\lambda)(-1-\lambda) = 0$

$(2+\lambda)(1+\lambda) = 0$

$\lambda = -2$

$\lambda = -1$

$\lambda = -1$

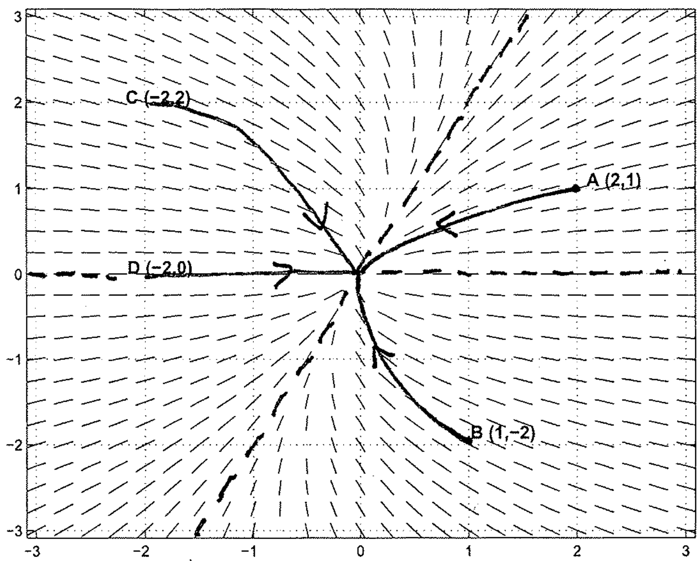
$\left(\begin{array}{cc|c} -1 & 1/2 & 0 \\ 0 & 0 & 0 \end{array}\right)$

$\vec{x} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

$\lambda = -2$

$\left(\begin{array}{cc|c} 0 & 1/2 & 0 \\ 0 & 1 & 0 \end{array}\right) \to$

$\vec{x} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$



(a) *2 points.* Determine the type of equilibrium point at the origin.

stable ~~pro~~ improper node

$0 > \lambda_1 > \lambda_2$

(0,0) is an attractive stationary point

(b) *4 points.* Indicate the trajectories for solutions which start at the initial conditions $A = (2, 1)$, $B = (1, -2)$, $C = (-2, 2)$ and $D = (-2, 0)$. (**USE ARROWS!**)

(c) *4 points.* In the space, sketch graphs of $x(t)$ and $y(t)$ on the same axis for each of the given four initial conditions. (Therefor you should have four pairs of axes, with 8 curves.) **Clearly indicate what happens as** $t \to \infty$ **for each solution.**