MATH 341 Fall 2023, QUIZ 12

In each problem, the eigenvalues of a 2×2 matrix A are given, along with one eigenvector for each. (The matrix A is not specified.) In each case, we will consider the system $\vec{x}\,' = A\vec{x}$ and you should do 3 things: circle the correct classification of the critical point at $(0,0)$; circle the correct description of the stability of the critical point at $(0,0)$; and sketch the phase-plane portrait of the system.

1. $\lambda = 2$: $\vec{v} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ $\lambda = -1$: $\vec{v} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

The critical point at the origin is a _____ . (node **saddle point** spiral center)

It is _____ . (asymptotically stable stable but not asymptotically **unstable**)

2. $\lambda = 3 + i$: $\vec{v} = \begin{bmatrix} 1 \\ 1+i \end{bmatrix}$ $\lambda = 3 - i$: $\vec{v} = \begin{bmatrix} 1 \\ 1-i \end{bmatrix}$

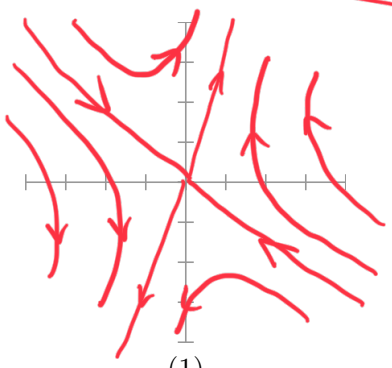
The critical point at the origin is a _____ . (node saddle point **spiral** center)

It is _____ . (asymptotically stable stable but not asymptotically **unstable**)

3. $\lambda = -2$: $\vec{v} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ $\lambda = -5$: $\vec{v} = \begin{bmatrix} -1 \\ -1 \end{bmatrix}$

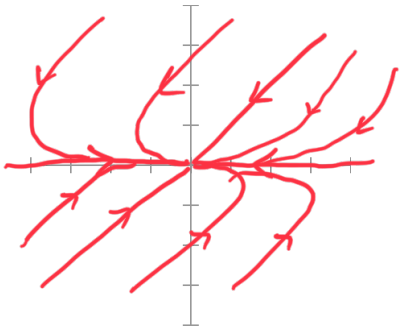
The critical point at the origin is a _____ . (**node** saddle point spiral center)

It is _____ . (**asymptotically stable** stable but not asymptotically unstable)



(1)

(2)



(3)

4. $\lambda = 4i$: $\vec{v} = \begin{bmatrix} -i \\ 1 \end{bmatrix}$ $\lambda = -4i$: $\vec{v} = \begin{bmatrix} i \\ 1 \end{bmatrix}$

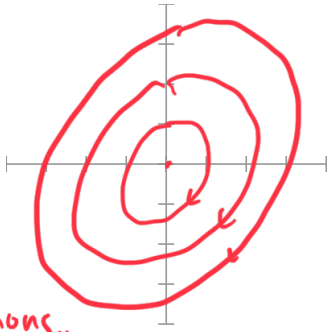
The critical point at the origin is a _____ . (node saddle point spiral **center**)

It is _____ . (asymptotically stable **stable but not asymptotically** unstable)

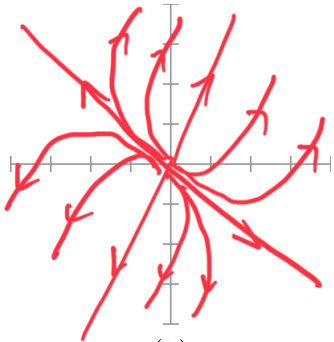
5. $\lambda = 6$: $\vec{v} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ $\lambda = 5$: $\vec{v} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

The critical point at the origin is a _____ . (**node** saddle point spiral center)

It is _____ . (asymptotically stable stable but not asymptotically **unstable**)



(4)



(5)