Math 2080: Differential Equations Worksheet 4.8: Stability of phase portraits

NAME:

In this problem, consider the system of differentiation equations x' = Ax, where $A = \begin{bmatrix} \alpha & 1 \\ -1 & \alpha \end{bmatrix}$ and α is a parameter.

(a) Determine the eigenvalues of \mathbf{A} in terms of α .

(b) Find the critical value or values of α where the qualitative nature of the phase portrait for the system changes.

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(c) Draw a phase portrait for a value of α slight below, and for another value slightly above, each critical value.

(d) Draw a phase portrait when α is exactly the critical value.

(e) Summarize Parts (b)–(d) by dividing the number line below into regions corresponding to phase portraits of the same types. Clearly label your diagram.



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