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

## NAME:

In this problem, consider the system of differenetiation equations $\boldsymbol{x}^{\prime}=\boldsymbol{A} \boldsymbol{x}$, where $\boldsymbol{A}=\left[\begin{array}{cc}\alpha & 1 \\ -1 & \alpha\end{array}\right]$ and $\alpha$ is a parameter.
(a) Determine the eigenvalues of $\boldsymbol{A}$ in terms of $\alpha$.
(b) Find the critical value or values of $\alpha$ where the qualitative nature of the phase portrait for the system changes.
(c) Draw a phase portrait for a value of $\alpha$ slight below, and for another value slightly above, each critical value.
(d) Draw a phase portrait when $\alpha$ 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.


