

1. (2 points) Draw the phase line for $y' = (2 - y)|y - 4|$ and then find and classify the critical points.

2. (3 points) Find and classify the critical points for $\begin{cases} x' = x(3 - y + x) \\ y' = (y - 1)(x - y) \end{cases}$.

3. (3 points) Find the eigenvalues and eigenfunctions for $X'' + \lambda X = 0$ if $X(0) = 0$ and $X'(\pi) = 0$. Show details.
4. (2 points) Find the general solution for $u_t = 2u_{xx}$ if $u(0, t) = 0$ and $u(1, t) = 0$. Give steps as specified in lecture.