

Quiz #6

MTH 351/651: Fall 2025

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Problem 1. Consider the following system of differential equations:

$$\dot{x} = x(x-1),$$

$$\dot{y} = x - y.$$

Calculate the nullclines and fixed points for this system, analyze the local stability of the fixed points, and use this information to plot a reasonable phase portrait on the axes below:

$$\dot{x}=0:$$

$$x=0, x=1$$

$$\dot{y}=0:$$

$$y=x$$

$$J(0,0) = \begin{bmatrix} -1 & 0 \\ 1 & -1 \end{bmatrix} \Rightarrow \lambda_{1,2} = -1 \text{ (stable node)}$$

$$J(1,1) = \begin{bmatrix} 1 & 0 \\ 1 & -1 \end{bmatrix} \Rightarrow \lambda_{1,2} = \pm 1 \text{ (saddle node)}$$

$$J(x,y) = \begin{bmatrix} 2x-1 & 0 \\ 1 & -1 \end{bmatrix}$$

