MATH 365: HONORS ANALYSIS I
NON-LINEAR SYSTEMS EXERCISES

Find the critical points of the following systems and discuss the stability of each. Sketch an appropriate phase portrait based on this information.

1. $\begin{aligned} dx/dt &= (2+x)(y-x) \\ dy/dt &= (4-x)(y+x) \end{aligned}$

2. $\begin{aligned} dx/dt &= x - x^2 - xy \\ dy/dt &= \tfrac{1}{2}y - \tfrac{1}{4}y^2 - \tfrac{3}{4}xy \end{aligned}$

3. $\begin{aligned} dx/dt &= -(x-y)(1-x-y) \\ dy/dt &= x(2+y) \end{aligned}$

4. $\begin{aligned} dx/dt &= (1+x)\sin(y) \\ dy/dt &= 1 - x - \cos(y) \end{aligned}$

5. $\begin{aligned} dx/dt &= 1 - xy \\ dy/dt &= x - y^3 \end{aligned}$

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