

Problems Day 25, M 3/11/2024
Topic 12: Autonomous systems (day 1 of 2)
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Problem 1. Consider $x' = 2x(x - 5)$. Do a critical point analysis leading to a phase line. Then, in the tx -plane, make a qualitative sketch of some solutions.

Problem 2. For our most important DE: $y' = -y$.

Find the critical points; draw a phase line; classify the equilibria; sketch some solutions in the ty -plane.

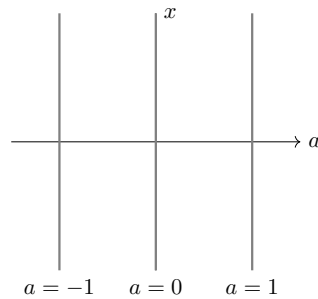
Problem 3. Consider $y' = y^2(y - 1)$. Draw the phase line, classify the equilibria, sketch some solutions.

Problem 4. For the system $y' = y(y - 5)$, draw the direction field. Explain how this shows the system is time invariant.

Problem 5. (This is hinting at bifurcation diagrams.)

(a) Find the critical points for $x' = x(a - x)$ (a a constant)

(b) Copy the ax -plane shown and draw the phase lines for the values of a shown.



(c) On your ax -plane in Part (b), draw the locus of all points (a, x) where x is a critical point of $x' = x(a - x)$.

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ES.1803 Differential Equations

Spring 2024

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