

MA 532 Homework 2

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1. Sketch the phase portrait. Be sure to include equilibria.

(a) $\ddot{x} + x - x^2 = 0$

(b) $\ddot{x} - x + x^3 = 0$

2. Consider the system

$$\dot{x} = x(8 - 2x - y),$$

$$\dot{y} = y(8 - x - 2y),$$

which represents populations of two competing species.

- (a) Draw the nullclines, find the equilibria, draw representative vectors (including vectors on the nullclines), and draw some typical solution curves. If the system starts with both $x > 0$ and $y > 0$, what do you expect the populations to be (approximately) after a long time?
- (b) Check your work by using Maple or a similar program to draw the vector field and some representative solution curves that start with both $x > 0$ and $y > 0$.