

Nonlinear Dynamics, Spring 2020 CMI

Problem set 1

Due at the beginning of lecture on Monday Jan 20, 2020

Non-autonomous systems, 1d phase portrait

1. **(4)** Consider the forced oscillator equation $m\ddot{x} + \gamma\dot{x} + kx = f \cos t$ for positive constants m, γ, k and real constant f . Is it linear or non-linear, of what order and homogeneous/inhomogeneous? Write it as an autonomous system of first order ODEs. Is the system linear or nonlinear?
2. **(6)** For the system $\dot{x} = -\sin x$, draw a phase portrait. Use it to roughly plot several representative trajectories (x as a function of time t) on the t - x plane. Extend the trajectories to $t \rightarrow \pm\infty$. The trajectories should include at least 2 qualitatively different static solutions and 4 non-static solutions.