

Assignment 1

Due: October 1, 2015, 23:30 (IST)

1 Geometric Intuition

- 1) [*Geometrical interpretation*] Consider the system $\dot{x} = \sin x$.
 - a) Find all the fixed points of the flow.
 - b) At which points x does the flow have greatest velocity to the right?
 - c) Find the flow's acceleration \ddot{x} as a function of x .
 - d) Find the points where the flow has maximum positive acceleration

2 Fixed points and stability

- 1) [*Analyse graphically*] For the following systems, sketch the vector field on the real line, find all the fixed points, classify their stability.
 - a) $\dot{x} = 4x^2 - 16$
 - b) $\dot{x} = 1 - 2 \cos x$

3 Local stability analysis

- 1) Use linear stability analysis to classify the fixed points of the following systems. If linear stability analysis fails because $f'(x^*) = 0$, use a graphical argument to decide the stability.
 - a) $\dot{x} = x(1 - x)$
 - b) $\dot{x} = x^2(6 - x)$
 - c) $\dot{x} = 1 - e^{-x^2}$