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) $\dot{x} = 1 - e^{-x^2}$