Assignment 1

1. Sketch the vector fields for the following examples, and then plot the fixed points as a function of r.

(a) $\dot{x} = r^2 - x^2$ (b) $\dot{x} = x - rx(1 - x)$ (c) $\dot{x} = x + \frac{rx}{1+x^2}$

2. $\dot{x} = h + rx - x^3$. Examine the effect of varying h and r on fixed points. Use graphical approach. Guess h vs r and x vs r for fixed h (mentioned in today's class).

3. The velocity v(t) of an object falling to the ground is governed by $m\dot{v} = mg - kv^2$ where m is the mass of the object, g is the acceleration due to gravity, and k > 0 is a constant related to the amount of air resistance.

(a) Obtain the analytical solution for v(t), assuming that v(0) = 0. (b) Find the limit of v(t) as t -> ∞ (terminal velocity). (a) Perform a graphical analysis of this problem, and thereby re-derive a formula for the terminal velocity.

Due date: 17/10/2018