Exercise 1.1 : Underwater

u = voltage of propellers
y = camera, compass, sonar
x= position, orientation and speed of robot $(x\ y\ z\ \varphi\ vz\ vx)^T$
w = coordinates of desired position

computer is controller

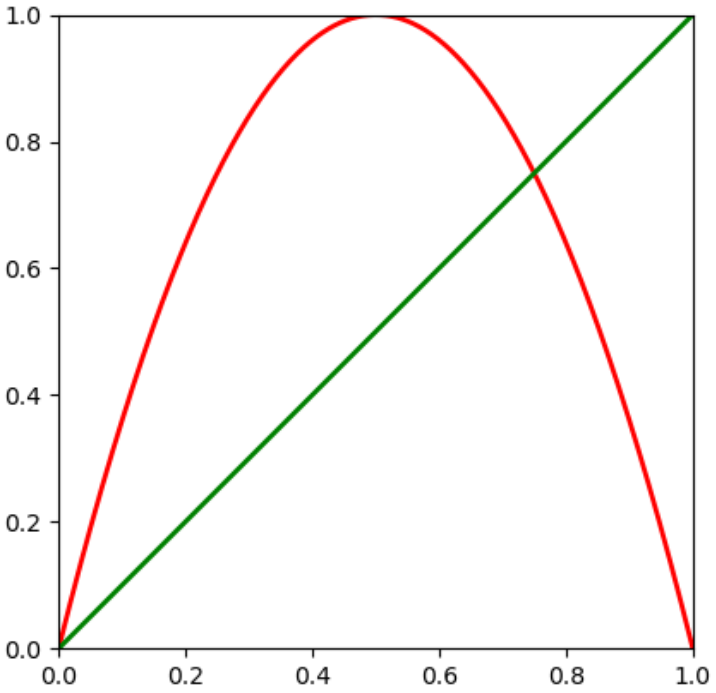
Exercice 1.2 : Sailing robot

u = orientation of rudder and length of sail
y = data of anemometer, compass, GPS
x= position, orientation and speed of robot $(x\ y\ z\ \ \varphi\ vx)^T$
w = setpoint of trajectory

Exercice 1.3 : Chaos

link of code = https://github.com/sarifou/Mooc/blob/master/AUTOmooc/exo1.3/exo1.3.py

1) Equilibrium point means we have f(x)=x.



$$x = 4x(1-x)$$

$$\Leftrightarrow \quad x = 4x - 4x^2$$

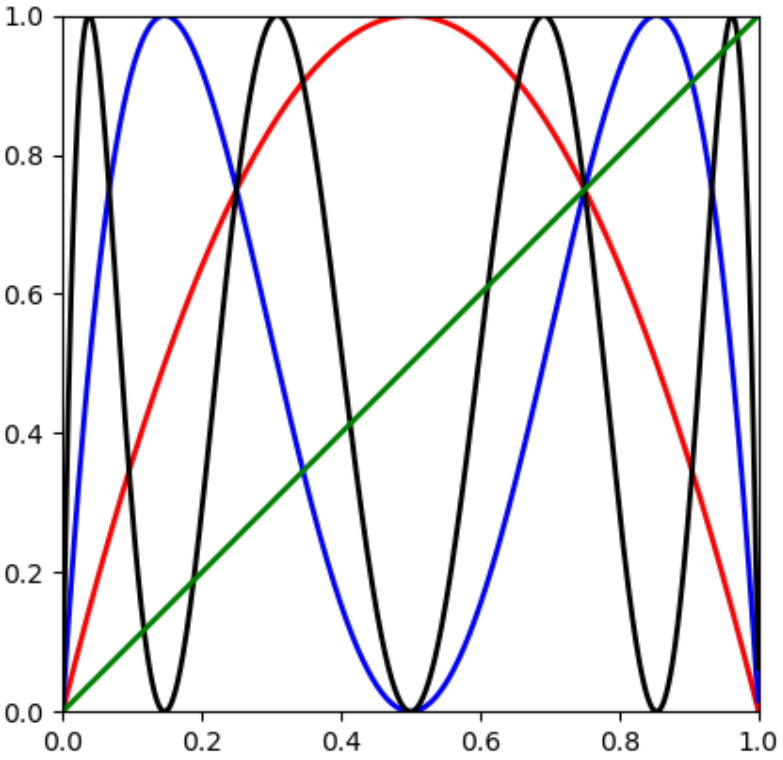
$$\Leftrightarrow \quad -4x^2 + 3x = 0$$

$$x = 0 \quad \text{or} \quad 4x = 3$$

$$x = \frac{3}{4}$$

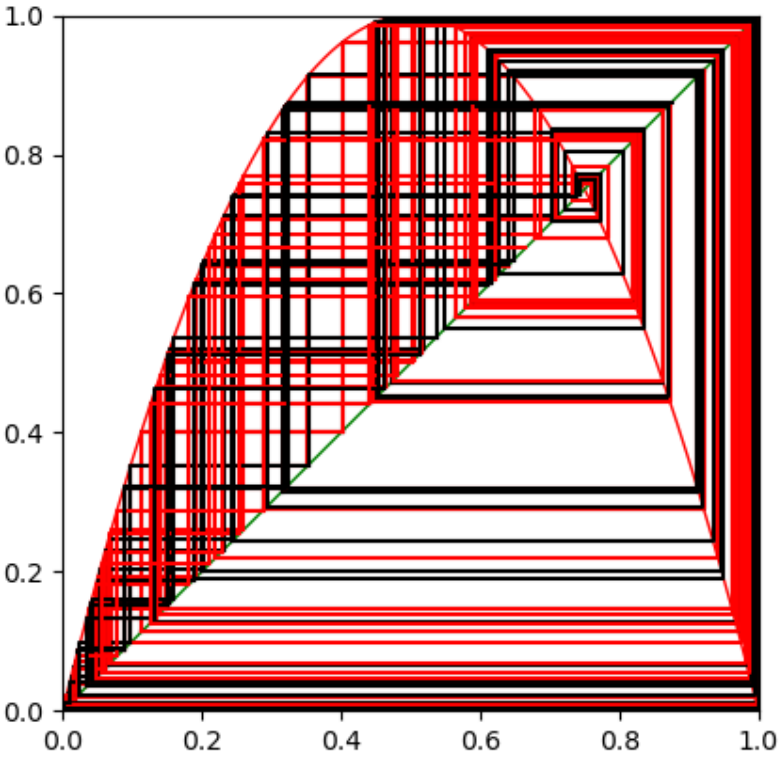
The equilibrium points equal 0 or 0.75

2) We have 3 cycles with a length 3



red →f ; blue →fof ; black → fofof

3) Simulation of the system


1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0