TASK of HW1_SDA1

Please apply the codes attached in today's lectures (2020.09.18), and try to plot an animal (other than an elephant) by adjusting the "parameters(p)".
You're homework should include:

1. File of codes (python)
2. Document (.pdf or .key) with a brief explanation of your code (i.e. p values you set,...) and the final plot.

It's encouraged that you can take the challenge to even make the plot animated!

ANSWER of HW1_SDA1

There are consist of 4 files including 2 python files (fourier_curve and hippo_figure), 1 animation file (anim_hippo) and 1 repot file (HW#1_0880816)

I choose to plot a Hippo and animating it .
The Hippo parameters are as follows

parameters = [50 - 15j, 5 + 2j, -10 - 10j, -14 - 60j, -15 + 30j] which they are equal to p1,p2,p3,p4, and p5 where p1 = [50 - 15j ; p2 = 5 + 2j ; p3 = -10 - 10j ; p4 = -14 - 60j; and p5 = -15 + 30j]
The Python starts the list index with 0, so the above parameters can be written in the python codes are as follows

If p = parameters, then p1 = p[0], p2= p[1]. p3 = p[2], p4 = p[3], and p5 = p[4].

There are 5 complex numbers as the parameters. The given formula of the Fourier function of a HIPPO figure is as follows (Anna's happy hippo)

$(50\sin(t)+5\sin(2t)-10\cos(3t)-14\cos(5t), -60\cos(t)-15\sin(t)+2\sin(2t)-10\sin(3t))$

The Fourier coefficients relating to the parameters that produce the Fourier function above are coded in the python through the defining objects both of Cx and Cy as follows

```
 npar  =  6
Cx = zeros((npar,), dtype='complex') #shape = (npar, )
Cy = zeros((npar,), dtype='complex')
```

The codes mean that were initialized the values of object Cx and Cy equal to 0 such as
Cx = [0. 0. 0. 0. 0. 0.], it means Cx[0] = 0, ..., Cx[5] =0

Cy = [0. 0. 0. 0. 0. 0.], it means Cy[0] = 0, ..., Cy[5] =0

By assigning the elements of Cx and Cy as following

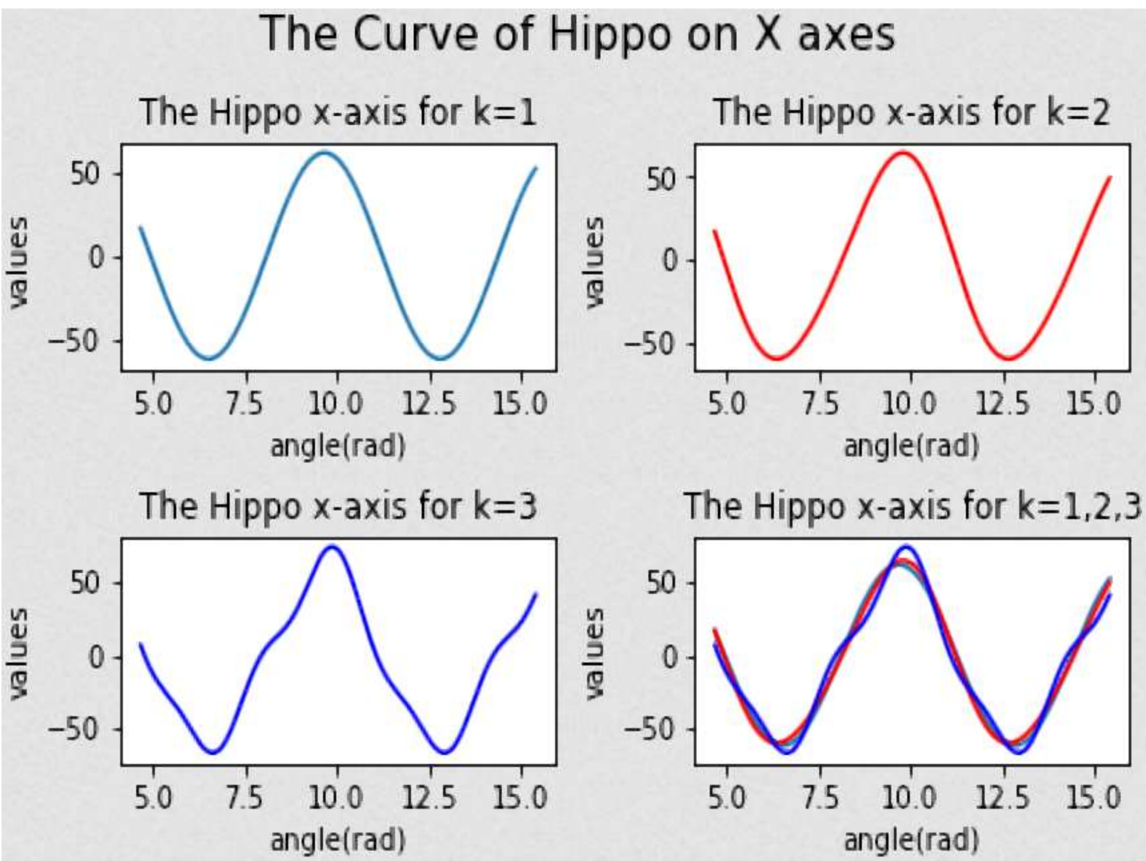
```
Cx[1] = p[0].real * 1j
Cy[1] = p[3].imag + p[0].imag * 1j
```

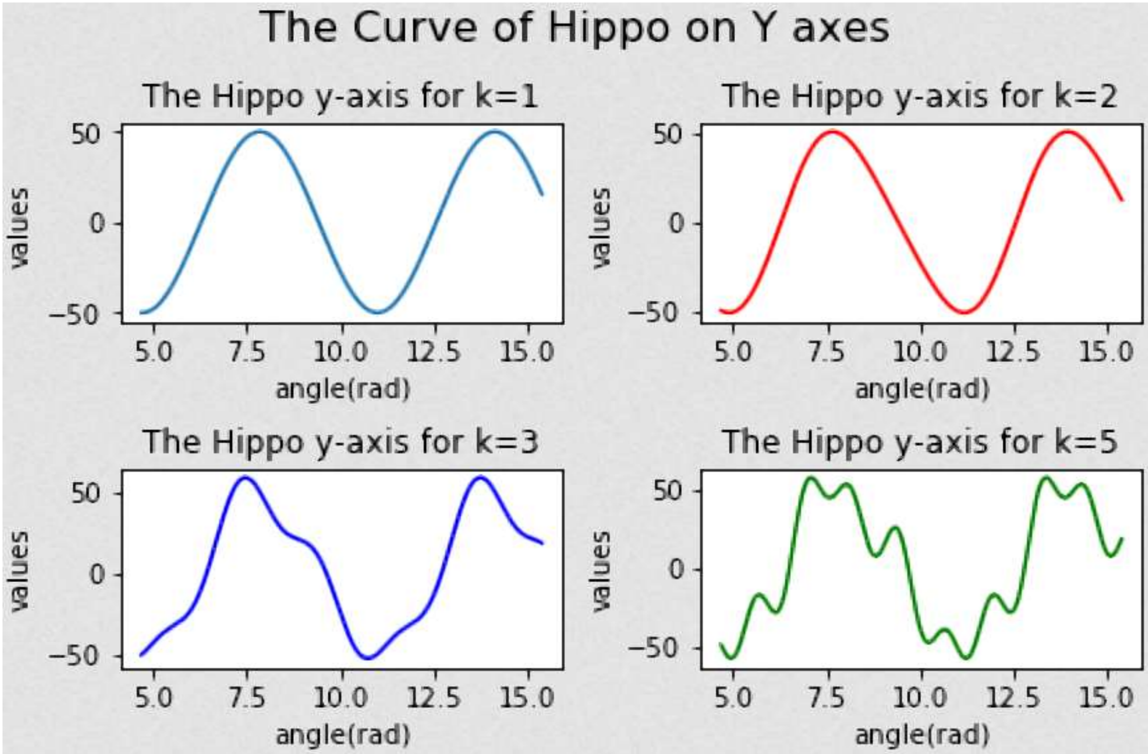
```
Cx[2] = p[1].real * 1j
 Cy[2] = p[1].imag * 1j
  Cx[3] = p[2].real
  Cy[3] = p[2].imag * 1j
   Cx[5] = p[3].real
```

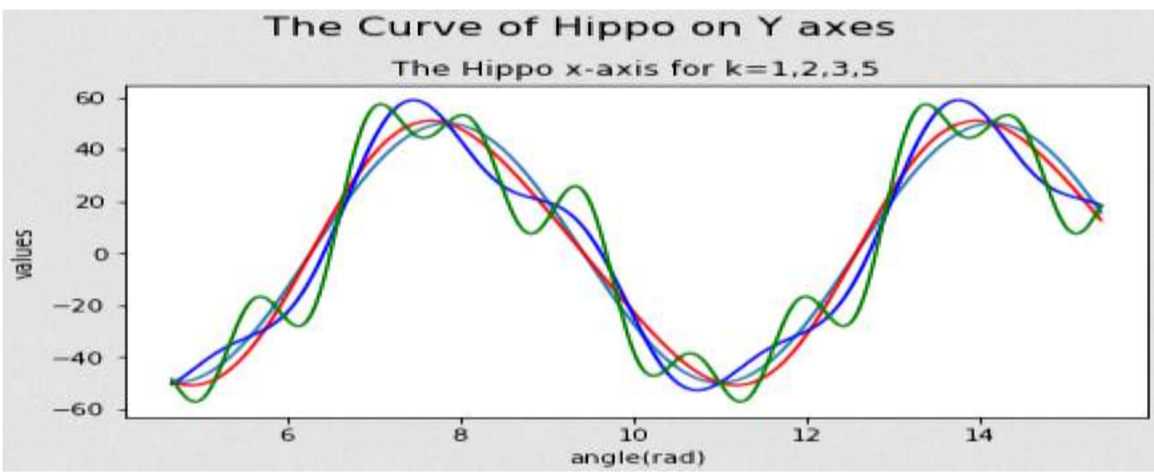
Defining the method for evaluating the Fourier function as follows

```
def fourier(t, C):
    f = zeros(t.shape)  #len(f) = len(t)
    for k in range(len(C)):
        f += C.real[k] * cos(k * t) + C.imag[k] * sin(k * t)
    return f
```

the method named "fourier()" has 2 input arguments that are t (the angle in radian unit) and C (the Fourier coefficients). The following given some figures depicting between t (in radian) and the Fourier values for some values of the Fourier coefficients of k = 1,2,3,4, and 5 with respect to both of x-axes and y-axes of the Hippo figure. The python code is given on the file named "fourier_curve"

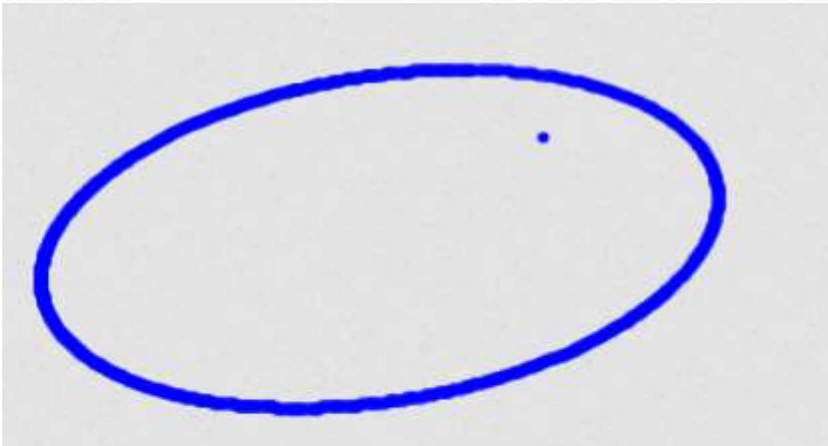




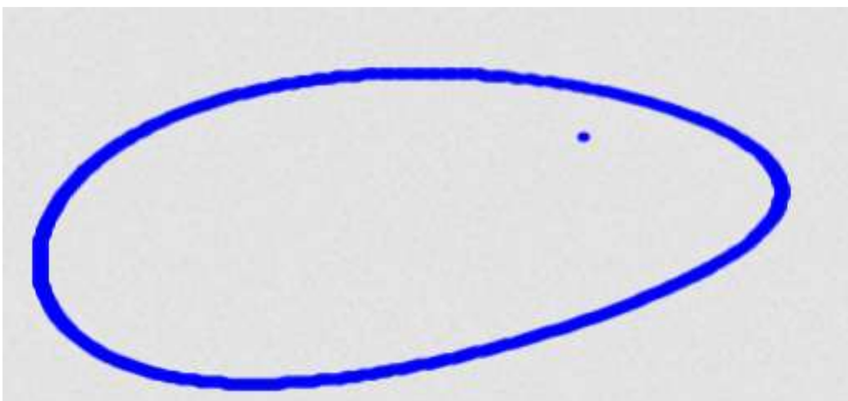


The HIPPP Plot of step by step where the pairs of x-axes and y-axes are respectively k=1, k=2, k=3 and k=5. The code is given on the file named “ hippo_figure”

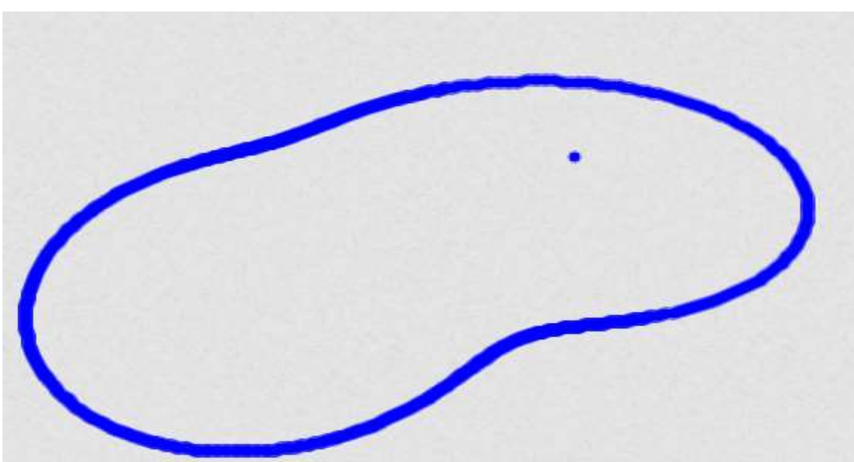
The Hippo figure where k=1



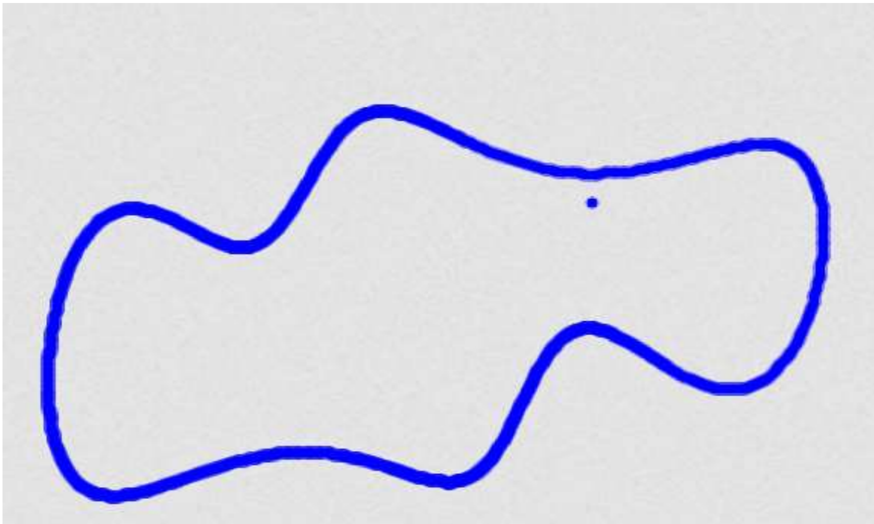
The Hippo figure where K= 2



The Hippo figure where K= 3



The Finally The Hippo figure for k = 5



The Animating Hippo

The Hippo figure will be animated on the back part of its body. The code of animated Hippo is placed on the line number 11 and the animated Hippo is saved in the fine named “anim_hipo.gif”.