Exercise1 Matplotlib

April 15, 2018

1 Matplotlib

Documentation: http://matplotlib.org/

Matplotlib is a python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms.

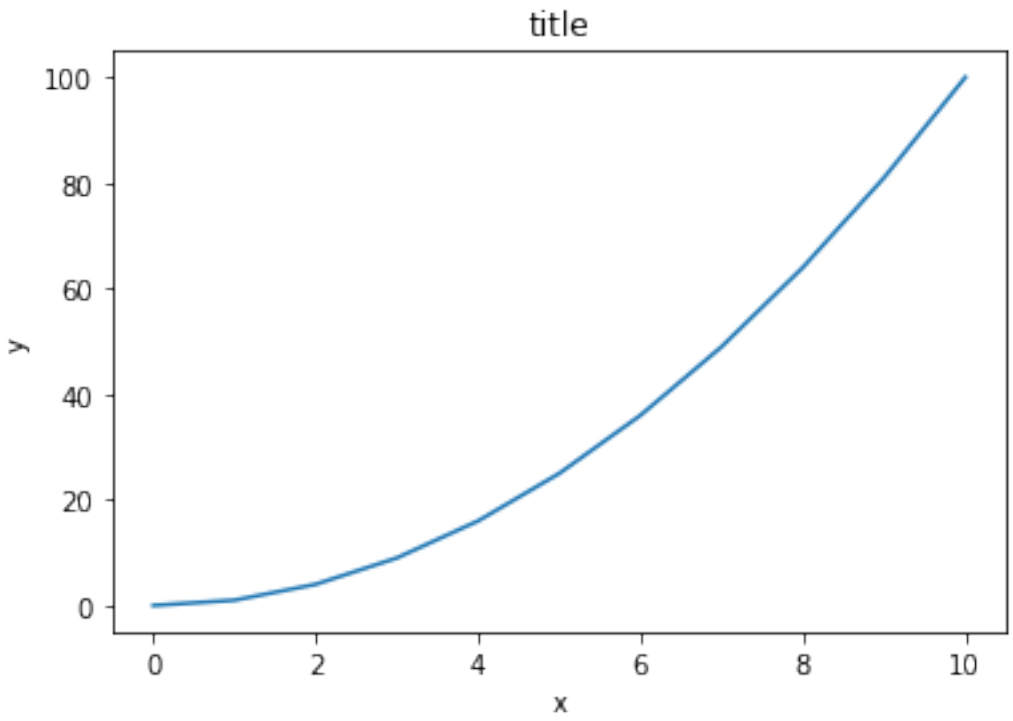
You can generate plots, histograms, power spectra, bar charts, errorcharts, scatterplots, etc.

```
In [8]: # needed to display the graphs
        %matplotlib inline
        from pylab import *
        import numpy as np
```

1.1 Task 1

- Create a plot $y = x^2$ for $x \in [1 : 10]$
- Add Title and Axes (Replicate the plot below)

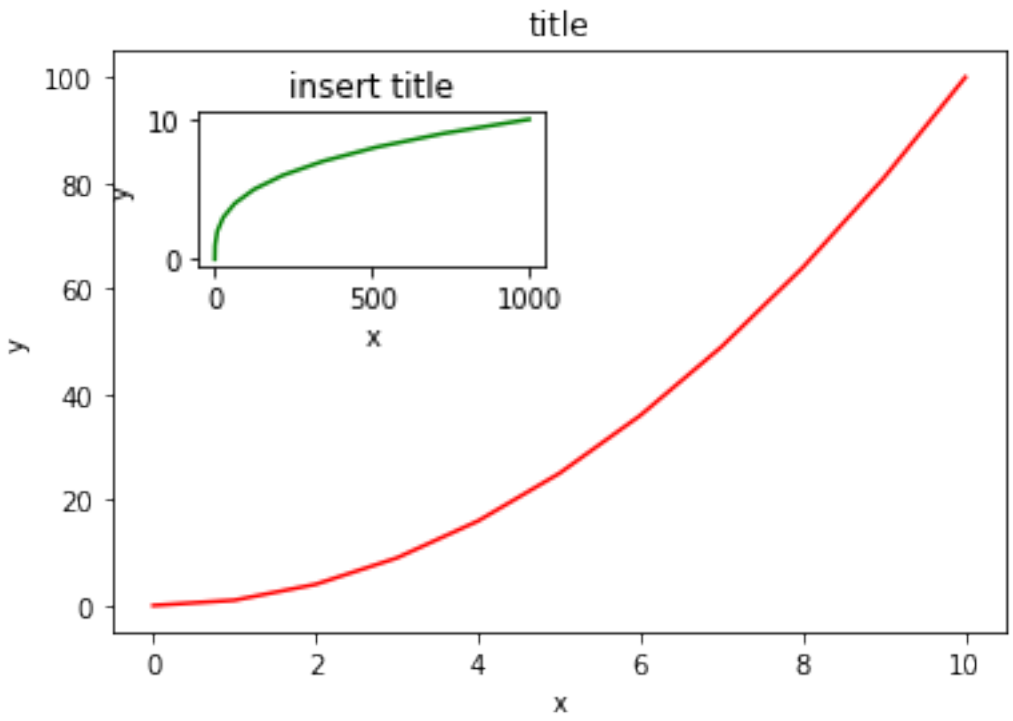
```
In [9]: x = range(11)
        y = [i**2 for i in x]
        plt.plot(x,y)
        plt.title('title')
        plt.xlabel('x')
        plt.ylabel('y')
        plt.show()
```



1.2 Task 2

Create two plots: 'main' and 'insert' and place them such that - The 'insert' plot are included into the 'main' plot - The 'insert' is next to the 'main' plot (Replicate the plots below)

```
In [3]: z = [i**3 for i in x]
        plt.plot(x,y, 'red')
        plt.xlabel('x')
        plt.ylabel('y')
        plt.title('title')
        plt.axes([0.2, 0.6,0.3,0.2])
        plt.plot(z,x, 'green')
        plt.xlabel('x')
        plt.ylabel('y')
        plt.title('insert title')
        plt.show()
```

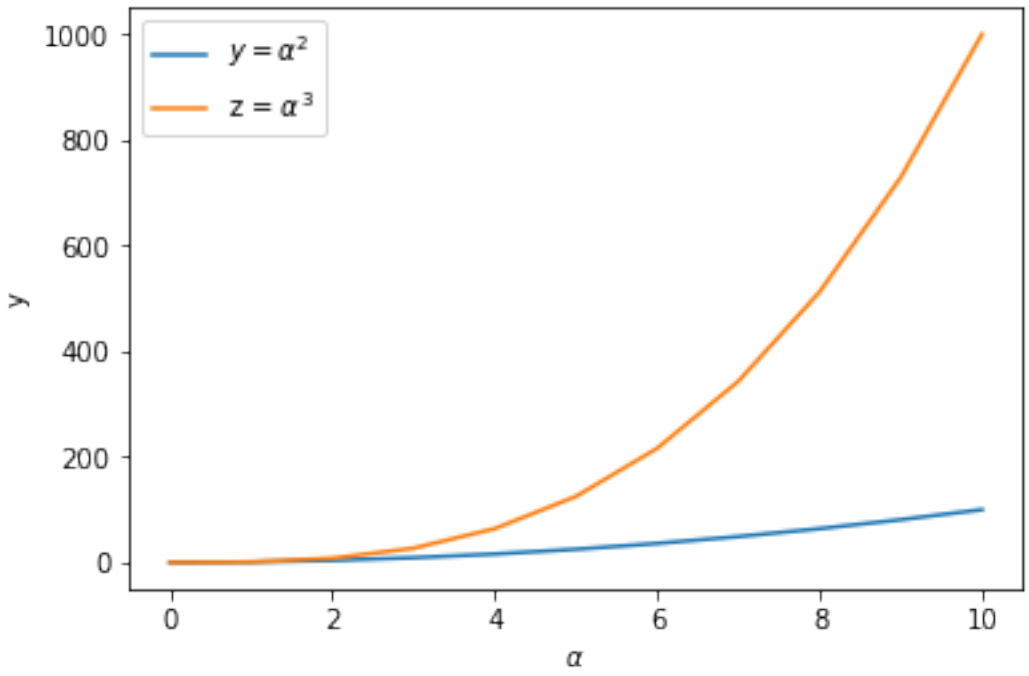



```
In [29]: plt.axes?
```

1.3 Task 3

Create a plot with a legend and latex symbols

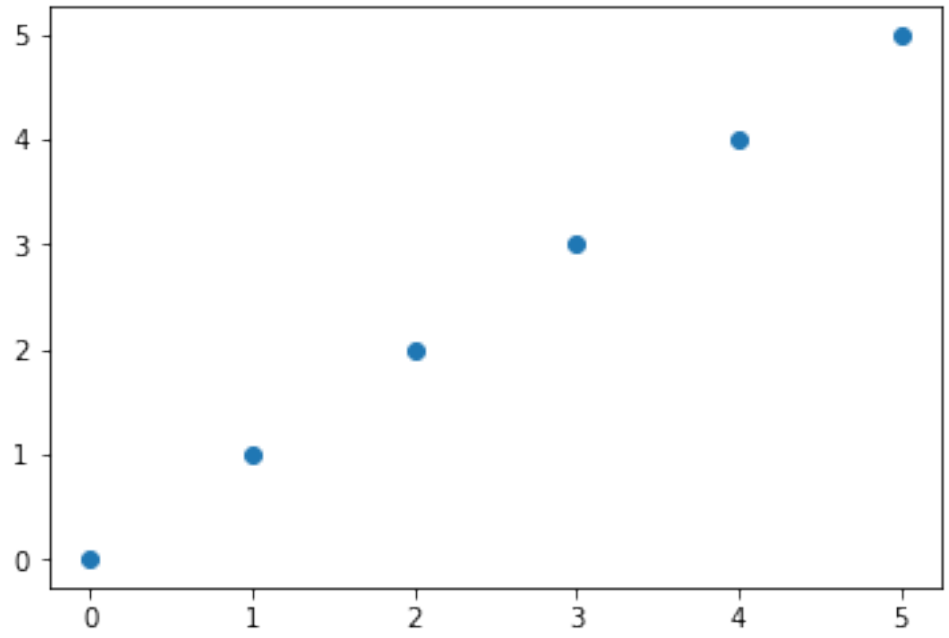
```
In [19]: z = [i**3 for i in x]
         plt.plot(x,y, label =r'$y=\alpha^2$')
         plt.plot(x,z, '-', label=r'z = $\alpha^3$')
         plt.legend(loc='upper left')
         plt.xlabel(r'$\alpha$')
         plt.ylabel('y')
         plt.show()
```

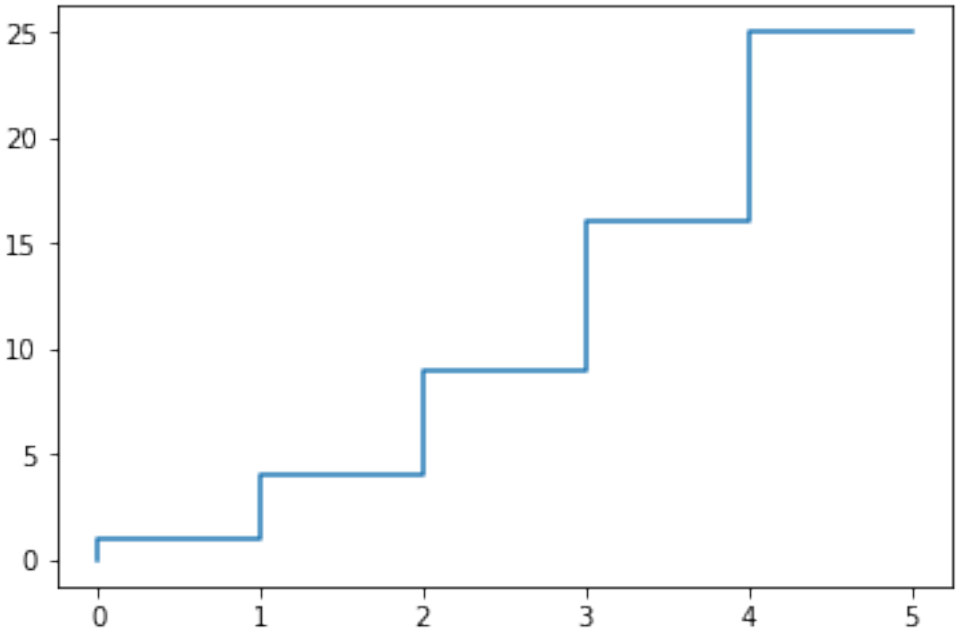


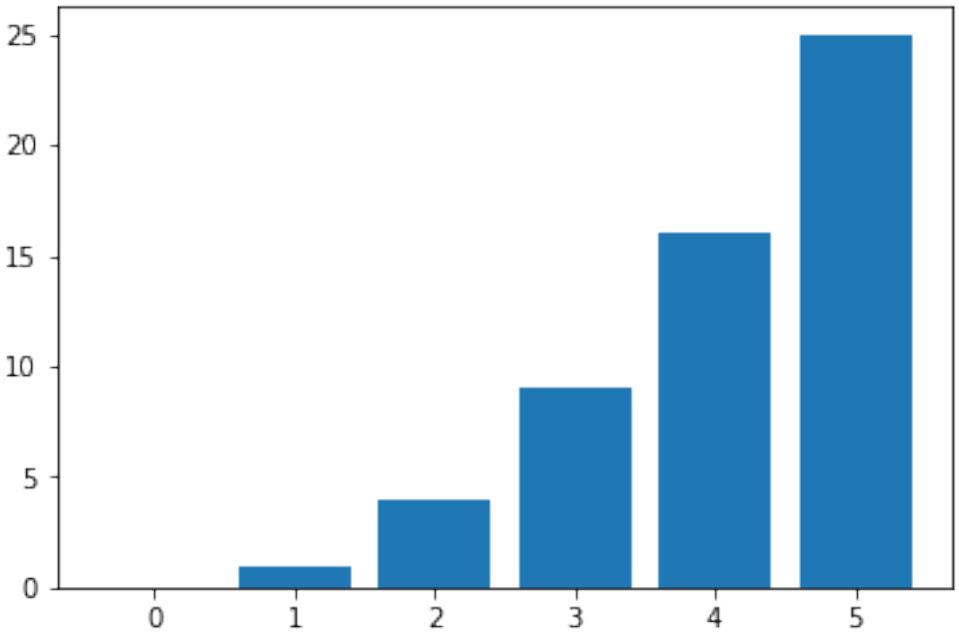
1.4 Task 4

Other plot styles. Given:

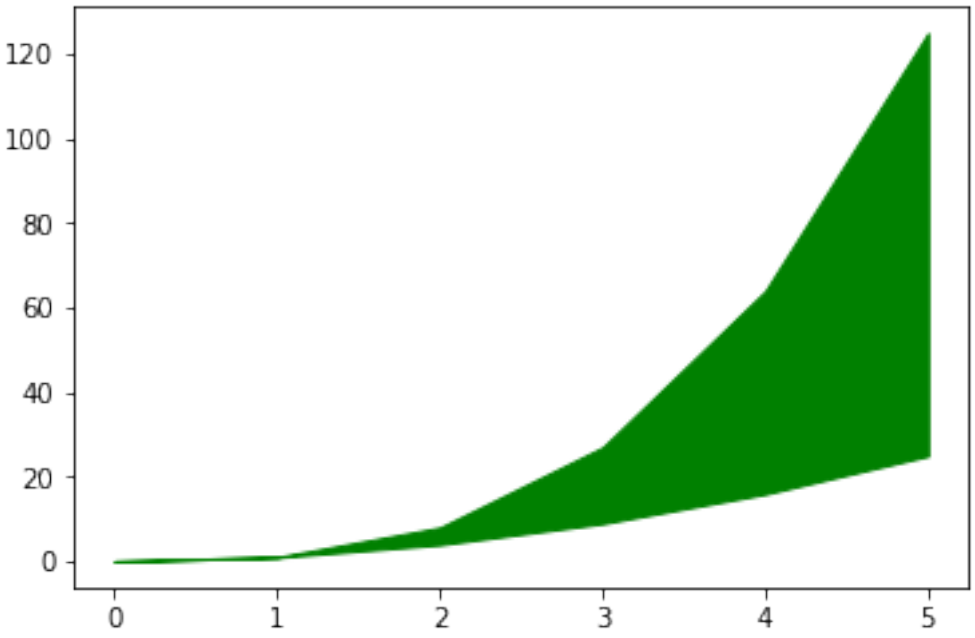
```
In [66]: xx = np.linspace(-0.75, 1., 100)
         n = array([0,1,2,3,4,5])

In [6]: y = [i**2 for i in n]
        plt.scatter(n,n)
        plt.show()
        plt.step(n,y)
        plt.show()
        plt.bar(n,y)
        plt.show()
        z = [i**3 for i in n]
        plt.fill_between(n,y,z, color='green')
```


5
4
3
2
1
0
0
1
2
3
4
5


25
20
15
10
5
0
0
1
2
3
4
5



Out[6]: <matplotlib.collections.PolyCollection at 0x7fe89d93ba90>

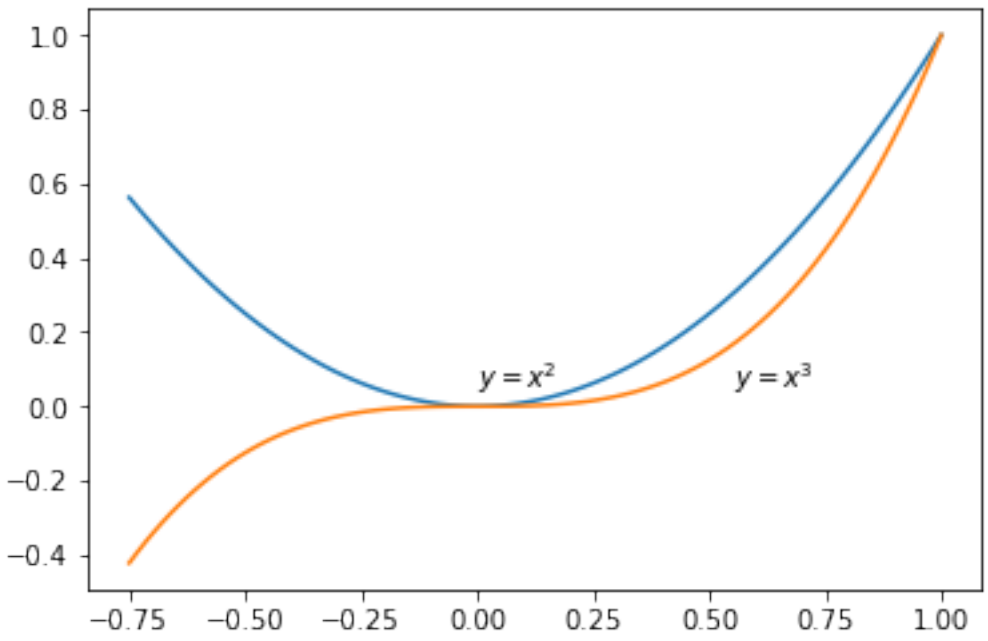


Generate: scatter, step, bar, fill_between

1.5 Task 5

Create a plot with annotations of the curves.

```
In [78]: y = [i**2 for i in xx]
         z = [i**3 for i in xx]

         plt.plot(xx,y)
         plt.annotate(r'$y=x^2$',[0,0.05])
         plt.plot(xx,z)
         plt.annotate(r'$y=x^3$',[0.55,0.05])
         plt.show()
```



1.6 Task 6

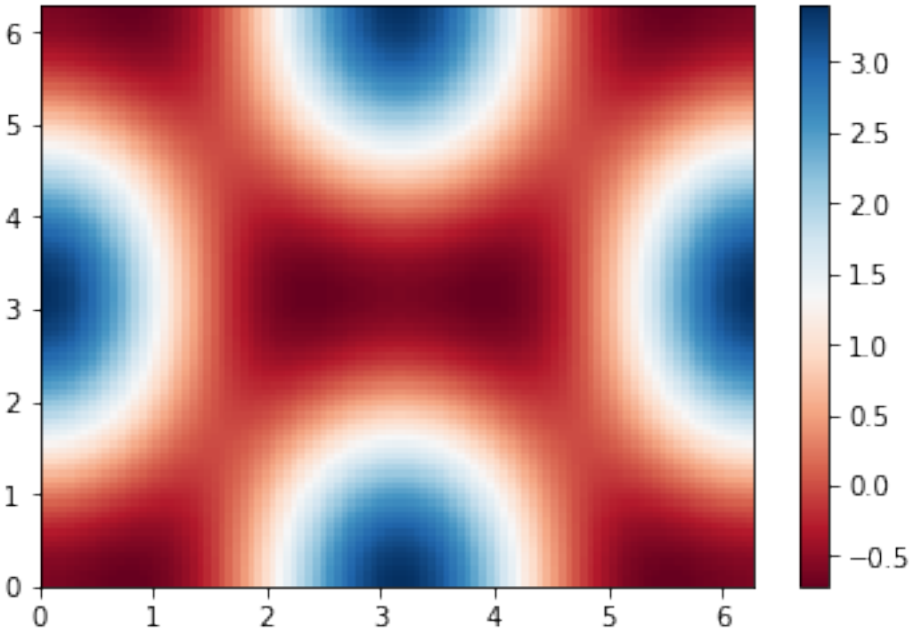
Create a color map using pcolor and colorbar functions for the following X,Y and Z

```
In [44]: alpha = 0.7
         phi_ext = 2 * pi * 0.5

         def flux_qubit_potential(phi_m, phi_p):
             return ( + alpha - 2 * cos(phi_p)*cos(phi_m) -
                 alpha * cos(phi_ext - 2*phi_p))

         phi_m = linspace(0, 2*pi, 100)
         phi_p = linspace(0, 2*pi, 100)
```

```
X,Y = meshgrid(phi_p, phi_m)
Z = flux_qubit_potential(X, Y).T
```

In [46]:
```
plt.pcolor(X,Y,Z, cmap='RdBu')
plt.colorbar()
```

Out[46]: <matplotlib.colorbar.Colorbar at 0x7fe895cda1d0>



1.7 Task 7

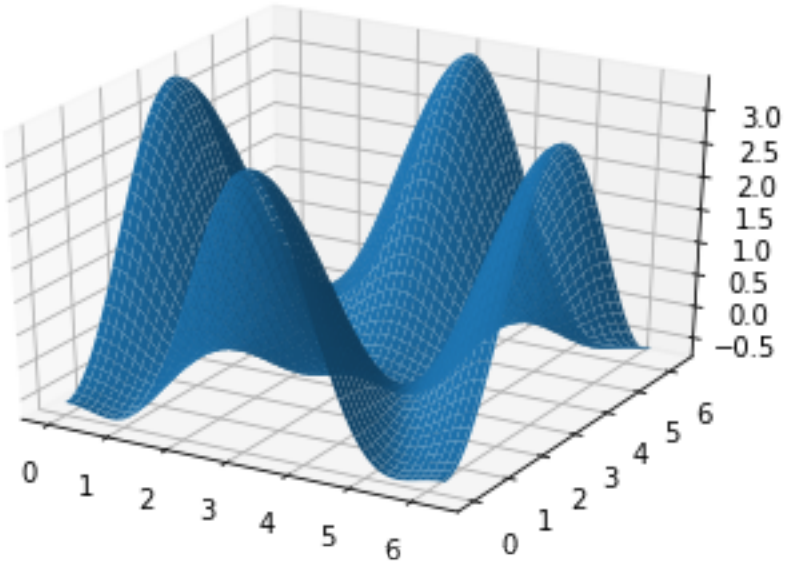
For the same data (i.e. X,Y and Z) create plot_surface, plot_wireframe, contour plot with projections, using

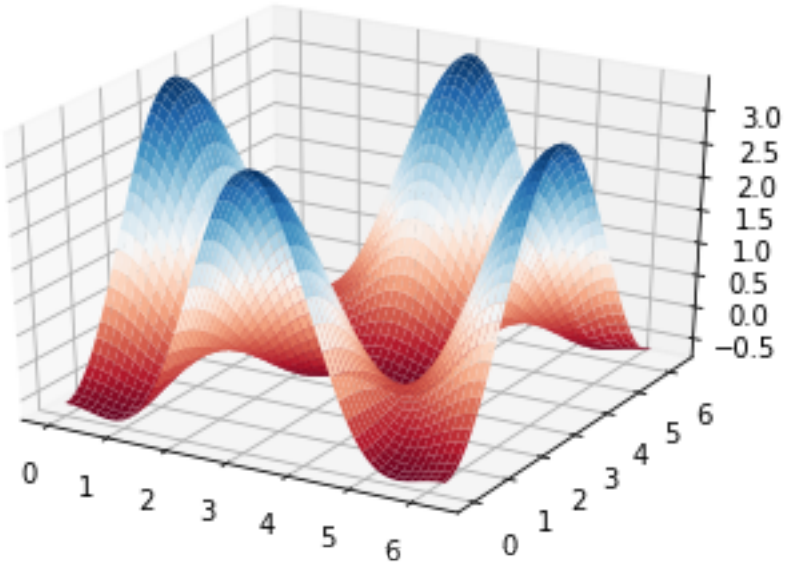
In [52]:
```
from mpl_toolkits.mplot3d.axes3d import Axes3D
```

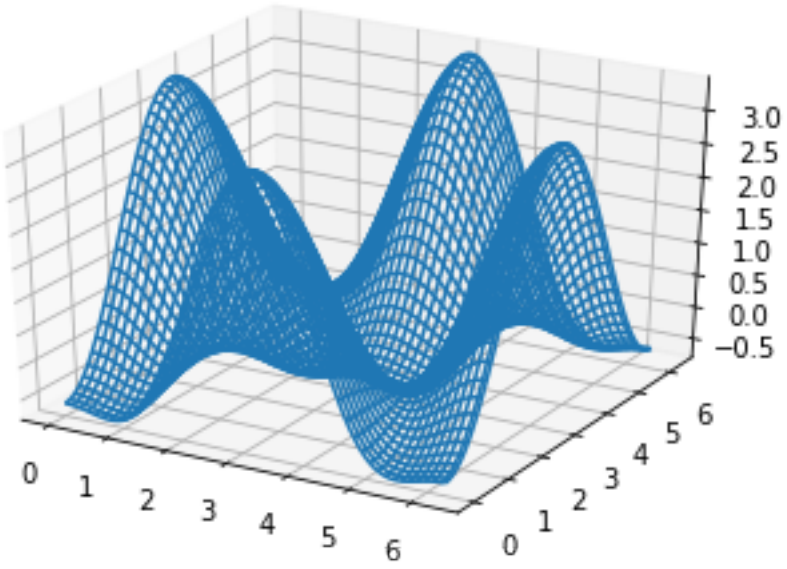
Replicate the plots introduced below (you can use your own data for this)

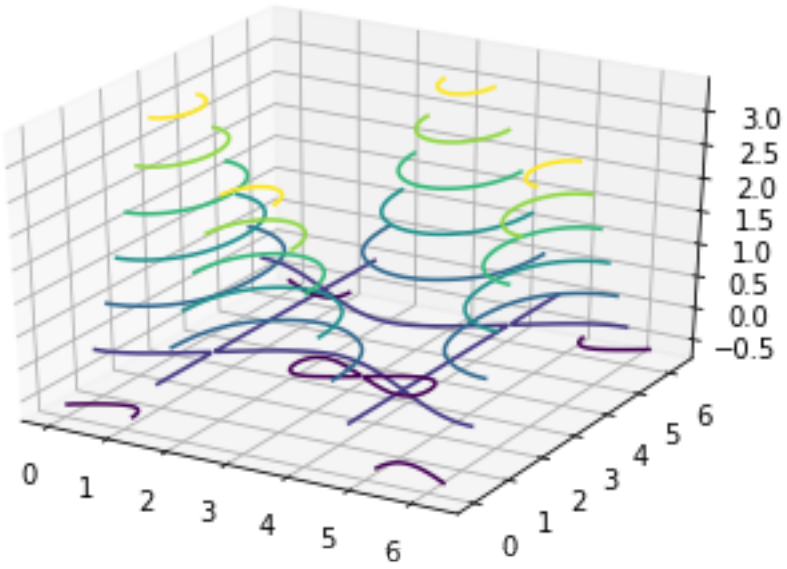
In [67]:
```
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(X,Y,Z)
plt.show()
fig1 = plt.figure()
ax1 = fig1.add_subplot(111, projection='3d')
ax1.plot_surface(X,Y,Z, cmap='RdBu')
plt.show()
fig2 = plt.figure()
```

```
ax2 = fig2.add_subplot(111, projection='3d')
ax2.plot_wireframe(X,Y,Z)
plt.show()
fig3 = plt.figure()
ax3 = fig3.add_subplot(111, projection='3d')
ax3.contour(X,Y,Z)
plt.show()
```






3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
0 1 2 3 4 5 6
0 1 2 3 4 5 6


3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
0 1 2 3 4 5 6
0 1 2 3 4 5 6