1.7 Parametric Equation

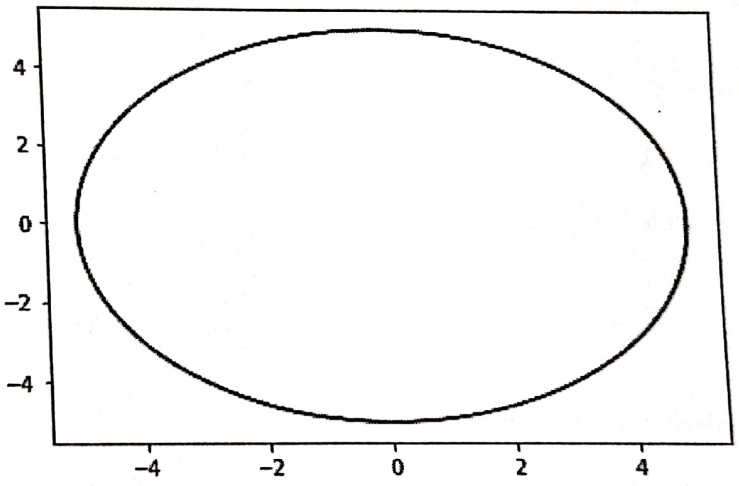
1. Circle: $x = acos(\theta); y = asin(\theta)$

```
import numpy as np
import matplotlib.pyplot as plt
def circle(r):
  x = [] #create the list of x coordinates
  y = [] #create the list of y coordinates

  for theta in np.linspace(-2*np.pi, 2*np.pi, 100):
    #loop over a list of theta, which ranges from -2 pi to 2 pi
    x.append(r*np.cos(theta))
    #add the corresponding expression of x to the x list
    y.append(r*np.sin(theta))
    #same for y

  plt.plot(x,y)  #plot using matplotlib.piplot
  plt.show()  #show the plot

circle(5) #call the function
```



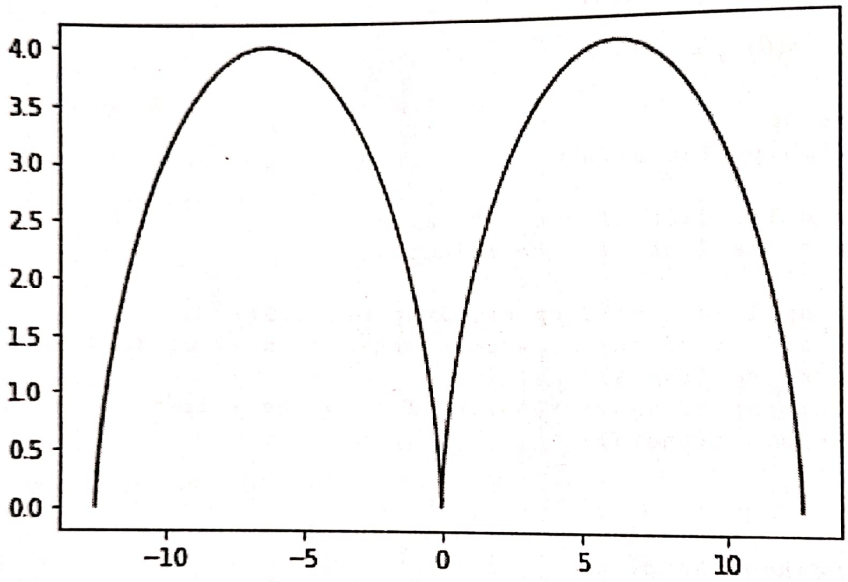
2. **Cycloid:** $x = a(\theta - sin\theta); y = a(1 - cos\theta)$

```
def cycloid(r):
  x = [] #create the list of x coordinates
  y = [] #create the list of y coordinates

  for theta in np.linspace(-2*np.pi, 2*np.pi, 100):
    #loop over a list of theta, which ranges from -2 pi to 2 pi
    x.append(r*(theta - np.sin(theta)))
    #add the corresponding expression of x to the x list
    y.append(r*(1 - np.cos(theta))) #same for y

  plt.plot(x,y)  #plot using matplotlib.piplot
  plt.show()  #show the plot

cycloid(2) #call the function
```



1.8 Exercise:

Plot the following:

1. Parabola $y^2 = 4ax$
2. Hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$
3. Lower half of the circle: $x^2 + 2x = 4 + 4y - y^2$
4. $cos(\frac{\pi x}{2})$
5. $1 + sin(x + \frac{\pi}{4})$
6. Spiral of Archimedes: $r = a + b\theta$
7. Limacon: $r = a + b\,cos\theta$