# Machine Problem 4 (PYTHON)



```python
import math
import numpy as np
import matplotlib.pyplot as plt

yo = float(input('What is the initial height of the projectile above the ground in meters (m)? '))
vo = float(input('What is the magnitude of the velocity in meters per second (m/s)? '))
angle = float(input('The angle (in degrees) with respect to the positive x-axis at which the projecti
ax = float(input('What is the x-component of the acceleration, considering the sign, (in m/s/s)? '))
ay = float(input('What is the y-component of the acceleration, considering the sign, (in m/s/s)? '))
theta = math.radians(angle)

if ay != 0:
    vox = vo*math.cos(theta);
    voy = vo*math.sin(theta);
    if yo == 0:  #on a level ground
        vy = -voy #since y-component of the final velocity is the same as the initial velocity, but oppo
        t = (vy-voy)/ay
        t = np.linspace(0,t,10)
        y = (voy*t) + (0.5*ay*t**2)
        x = (vox*t) + (0.5*ax*t**2)
        plt.plot(x,y)
        plt.grid()
        plt.xlabel('Range')
        plt.ylabel('Height')
        plt.title('Trajectory of a Projectile')
    else:
        yf = (vo**2*(math.sin(theta))**2)/(2*abs(ay)) #solving for max height
        t = (-voy + math.sqrt((voy**2) - (2*0.5*abs(ay)) * (yo-yf)))/(abs(ay)) #using quadratic formula
        t = np.linspace(0,t,10)
        y = yo + (voy*t) + (0.5*ay*t**2)
        x = (vox*t) + (0.5*ax*t**2)
        plt.plot(x,y)
        plt.grid()
        plt.xlabel('Range')
        plt.ylabel('Height')
        plt.title('Trajectory of a Projectile')

else: raise ValueError('If the vertical acceleration is zero, then there would be no free fall!')
```