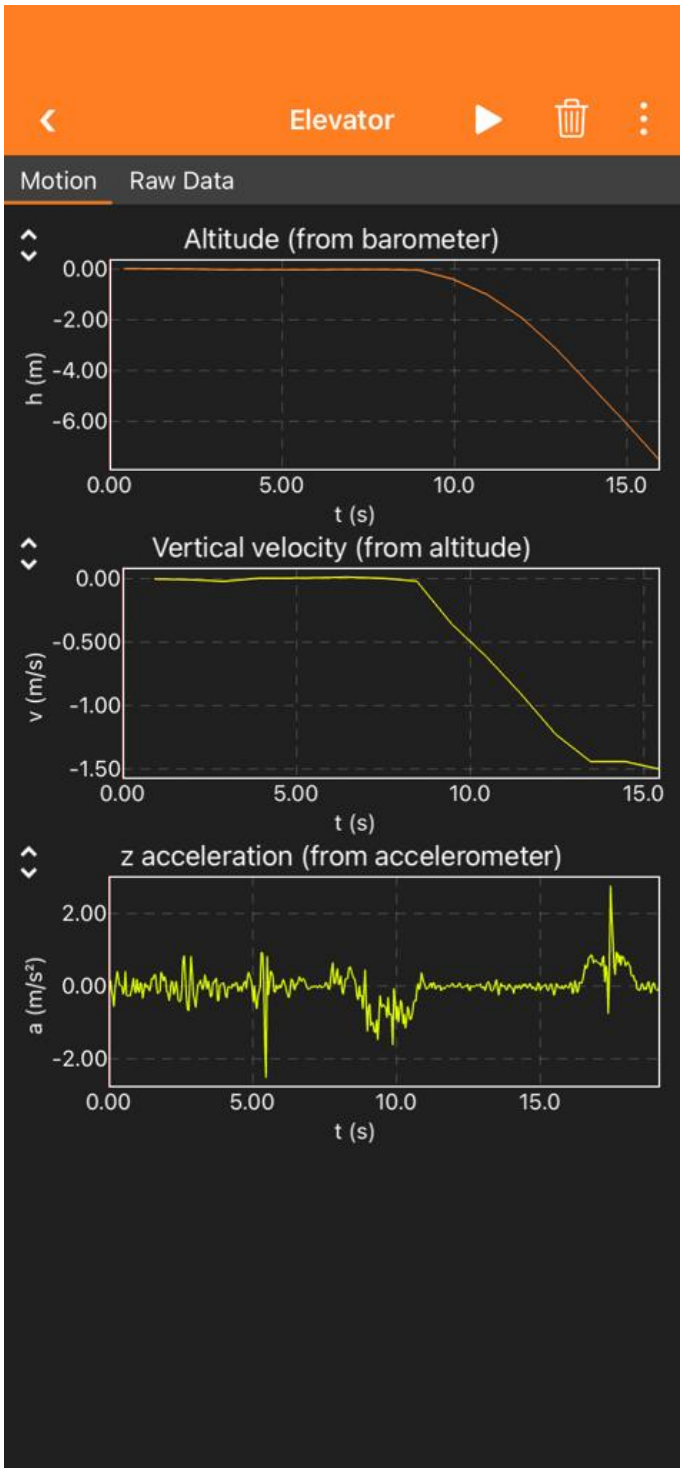
HW 9 experiment 2

In this experiment, I am going to collected the data of accelertion in elevator using the phyphox app on my phone. Using the pressure sensors (barometer) of the phone the app will take the altitue data. The app also shows the velocity as well as acceleration data at the same time .

Acceleration in Elevator Experiment (with g)

First, Using the app I am going to take data for the acceleration. I let the app to take the data while the elovator was going down for from 3rd floor to 1st floor floor. The data plotted in the app looks like this :


Elevator
Motion
Raw Data
Altitude (from barometer)
h (m)
0.00
-2.00
-4.00
-6.00
0.00
5.00
10.0
15.0
t (s)
Vertical velocity (from altitude)
v (m/s)
0.00
-0.500
-1.00
-1.50
0.00
5.00
10.0
15.0
t (s)
z acceleration (from accelerometer)
a (m/s²)
2.00
0.00
-2.00
0.00
5.00
10.0
15.0
t (s)

As the elevator went downward and its inital positionis set to zero, the altitude values are negetvie.

I will use pandas to import the data and plot it .

```
import math
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

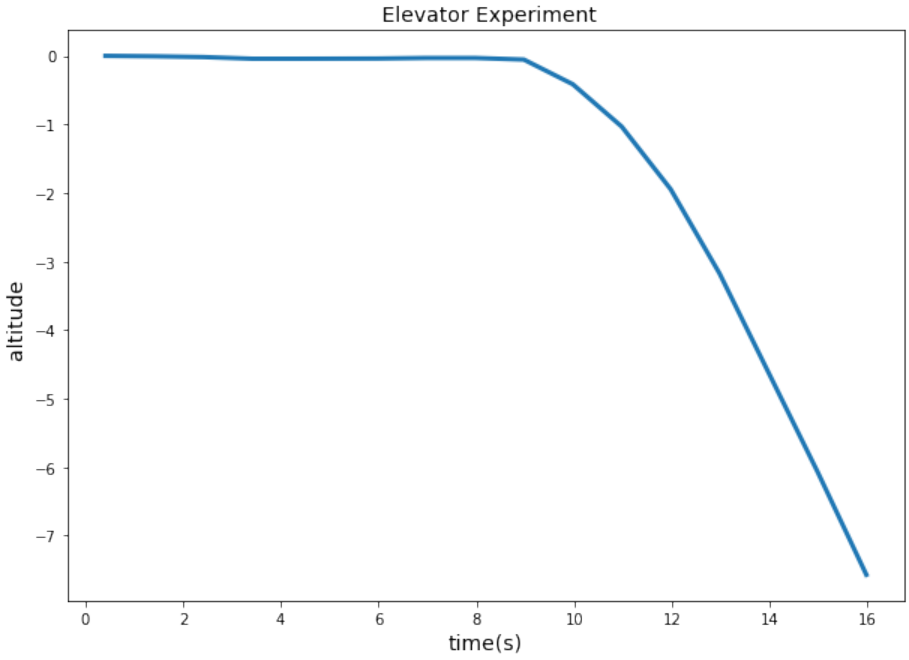
```
df = pd.read_csv('elevator.csv', usecols =["Time (s)", "Altitude (m)"] )
df
```

```
     Time (s)  Altitude (m)
0    0.416288      0.000000
1    1.416865     -0.006441
2    2.417444     -0.017392
3    3.418018     -0.041869
4    4.418594     -0.041869
5    5.970119     -0.039292
6    6.970694     -0.030918
7    7.971272     -0.030918
8    8.971849     -0.054107
9    9.972424     -0.414170
10  10.973000     -1.032495
11  11.973578     -1.945746
12  12.974155     -3.177027
13  13.974731     -4.621921
14  14.975310     -6.067258
15  15.975882     -7.573542
```

```
X = df['Time (s)']
Y = df['Altitude (m)']
```

```
fig, ax = plt.subplots(figsize=(10,7))
ax.plot(X,Y, lw=3)
ax.set_xlabel('time(s)',fontsize=14)
ax.set_ylabel('altitude ',fontsize=14)
ax.set_title(' Elevator Experiment', fontsize=14)
```

```
Text(0.5, 1.0, ' Elevator Experiment')
```



Analysis

I am interested to calculate the velocity of the elevator .

From the altitude, we can determine the velocity of the elevator by differentialting the altitude values. Out motion is in - y direction only.

Velocity

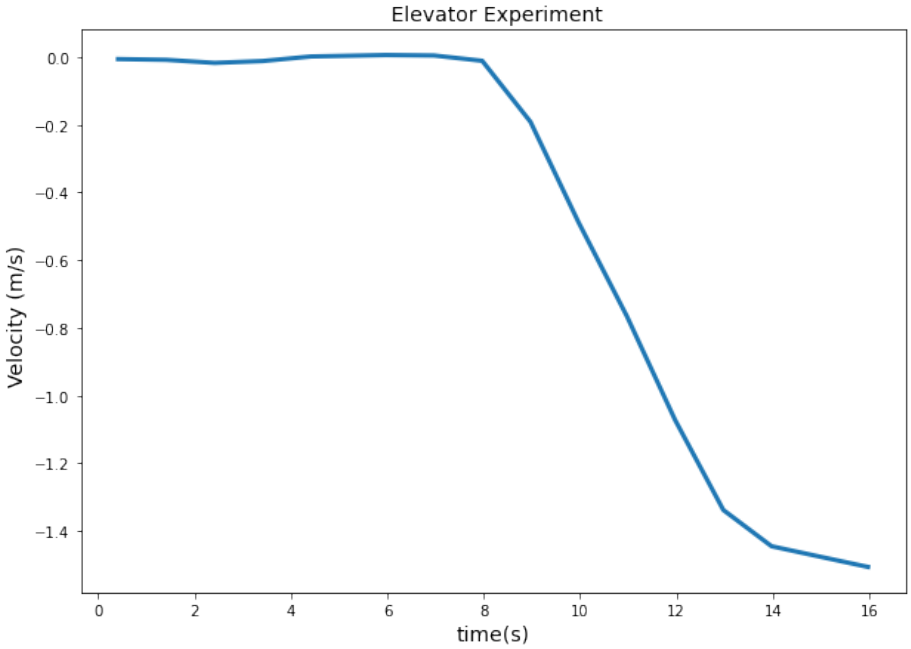
Necessary imports (I am going to use gradient from numpy) .

```
from numpy import gradient
```

```
Vel = np.gradient(Y)
```

```
fig, ax = plt.subplots(figsize=(10,7))
ax.plot(X,Vel, lw=3)
ax.set_xlabel('time(s)',fontsize=14)
ax.set_ylabel('Velocity (m/s) ',fontsize=14)
ax.set_title(' Elevator Experiment', fontsize=14)
```

```
Text(0.5, 1.0, ' Elevator Experiment')
```



The velocity plot matches with the plot above given by phyphox.