Python for Physics

Vector

Representation of a Vector in the Form of Unit Vectors,i,j and k

r = xi + yj + zk

Magnitude of a Vector

A = A_{xi} + A_{yj} + A_{zk}

A = $\sqrt{(Ax^2 + Ay^2)}$

```
import numpy as np
vector = np.array([2,4,7])
magnitude_vector = np.linalg.norm(vector)
print("The magnitude of the vector ", vector, "is: ", magnitude_vector)
```

```
The magnitude of the vector  [2 4 7] is:  8.306623862918075
```

```
# can also be done like this
np.sqrt(2 ** 2 + 4 ** 2 + 7 ** 2)
```

```
8.306623862918075
```

Horizontal and Vertical Components of a Vector

A_x=ACosx

A_y=ASinx

```
an = 45
A = np.array([5,4])
Ax = A[0] * np.cos(an)
Ay = A[1] * np.sin(an)
Ax, Ay
```

```
(2.626609944088649, 3.4036140981364738)
```

Find angle between "a" and "b'

where a = 5i + 4j - 6k

b = -2i + 2j +3k A.B = ABcosθ

$\theta = \cos^{-1}(A.B/AB)$

Code;

```
import numpy as np
import math
a = np.array([5,4,-6])
b = np.array([-2,2,3])
MagA=np.linalg.norm(a)
MagB=np.linalg.norm(b)
AdotB=np.dot(a,b)

Angle=np.arccos(AdotB/(MagA*MagB))
print("Angle in radians is",Angle)
print("Angle in degrees is",math.degrees(Angle))
```

```
Angle in radians is 2.1565049037442687
Angle in degrees is 123.55862948381244
```

Angle with respect to x , y and z axes

Angle between vector a and x axis

```
# Vector 'a' declared in code block above so no need to declare again.
a_x = a[0]
vec_a_xaxis_angle = np.degrees(np.arccos(a_x/MagA))
print(vec_a_xaxis_angle)
```

```
55.26351871874204
```

Angle between vector a and y axis

```
a_y=a[1]
vec_a_yaxis_angle=np.degrees(np.arccos(a_y/MagA))
print(vec_a_yaxis_angle)
```

```
62.88085722661892
```

Angle between vector a and x axis

```
a_z=a[2]
vec_a_zaxis_angle=np.degrees(np.arccos(a_z/MagA))
print(vec_a_zaxis_angle)
```

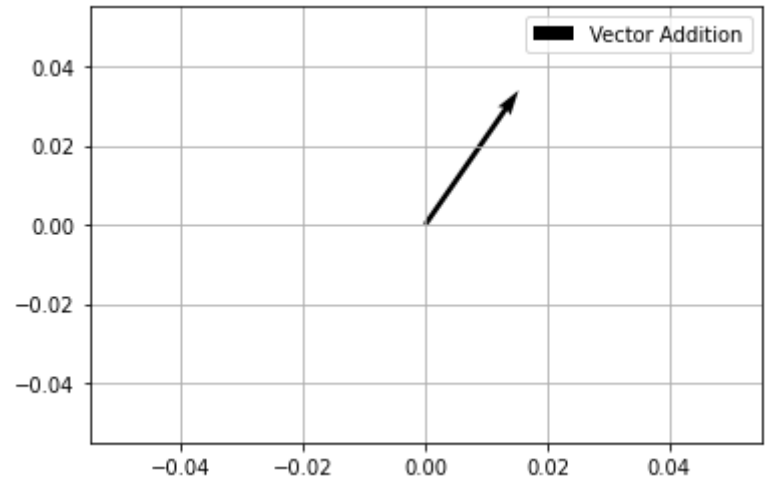
```
133.13843761967107
```

Resultant Vector

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

vector1 = np.array([12,32,12])
vector2= np.array([13,4,23])
resultant=vector1+vector2
plt.quiver(0,0,resultant[0],resultant[1],scale=180)
plt.grid()
plt.legend(['Vector Addition'])
plt.show
print(resultant)
mag=np.linalg.norm(resultant)
print(mag)
```

```
[25 36 35]
56.089214649520635
```



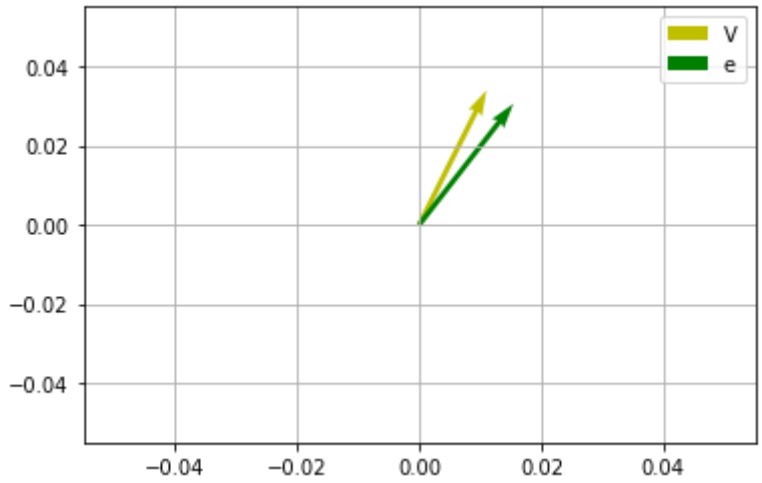
Question 1

draw two vectors using matplotlib and quiver commands

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

vec1=([5,10,15])
vec2=([7,9,11])
plt.quiver(0,0,vec1[0],vec1[1],scale=50,color='y')
plt.quiver(0,0,vec2[0],vec2[1],scale=50,color='g')
plt.grid()
plt.legend('Vector1')
plt.legend('Vector2')
plt.show
print(vec1)
print(vec2)
```

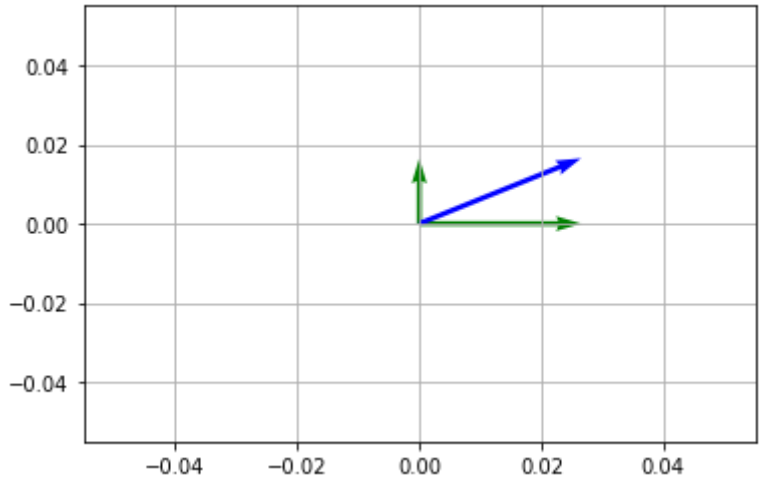
```
[5, 10, 15]
[7, 9, 11]
```



Question 2

```
import math
import matplotlib.pyplot as plt
import numpy as np
y = 13 * np.sin((math.radians(22)))
x = 13 * np.cos((math.radians(22)))

plt.quiver([0,0], [0,0], [x, 0], [0, y], color = 'g', scale = 50)
plt.quiver(0,0, x, y, color = 'b', scale = 50)
plt.grid()
plt.show()
print(x)
print(y)
```




```
12.053390109368237
4.869885714406856
```