1.10.28

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Question

Write a unit vector in **XY** plane making an angle 30with positive direction of **X** axis

given data

Axis	Angle (in degrees)
X-axis	30°
Y-axis	60°
Z-axis	0°

Table: Angles made by the X, Y, Z axes

Angle made by the vector with **X** axis = 30
Angle made by the vector with **Y** axis =90-30=60
Angle made by the vector with **Z** axis =90

Unit vector

Unit vector is given by

$$\implies \begin{pmatrix} cos30 \\ cos60 \\ cos90 \end{pmatrix}$$

$$\implies \begin{pmatrix} \frac{\sqrt{3}}{2} \\ \frac{1}{2} \\ 0 \end{pmatrix}$$

The unit vector of the given vector is given by

$$\frac{1}{2}\begin{pmatrix} \sqrt{3} \\ 1 \\ 0 \end{pmatrix}$$

Python Code

```
 import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D


angle_deg = 30

angle_rad = np.radians(angle_deg)

x = np.cos(angle_rad)
y = np.sin(angle_rad)
z = 0
```

Python Code

```
  # Create a 3D plot
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

# Plot the vector
ax.quiver(0, 0, 0, x, y, z, color='r', label=f'Unit vector at {
    angle_deg}')
ax.set_xlim([0, 1])
ax.set_ylim([0, 1])
ax.set_zlim([0, 1])
```

Python Code

```
 # Plot the axes
ax.plot([0, 1], [0, 0], [0, 0], color='b', label="X-axis") # X
    axis
ax.plot([0, 0], [0, 1], [0, 0], color='g', label="Y-axis") # Y
    axis
ax.plot([0, 0], [0, 0], [0, 1], color='y', label="Z-axis") # Z
    axis
```

Python Code

```
# Labels and title
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
ax.set_title('Unit Vector in XY Plane at 30')

# Show the plot
plt.legend()
plt.show()
```

C Code

```c
 #include <stdio.h>
#include <math.h>
int main() {
    double angle = 30.0;
    double angle_rad = angle * M_PI / 180.0;
    double x_component = cos(angle_rad);
    double y_component = sin(angle_rad);
    printf("Unit vector in the XY plane making a 30 degree angle
        with the X-axis: \n");
    printf("r = %.2f i + %.2f j\n", x_component, y_component);
    return 0;
}
```

Python and C Code

```
 import subprocess

# Compile the C program
subprocess.run(["gcc", "points.c", "-o", "points"])

# Run the compiled C program
result = subprocess.run(["./points"], capture_output=True, text=
    True)

# Print the output from the C program (solution steps)
print(result.stdout)
```

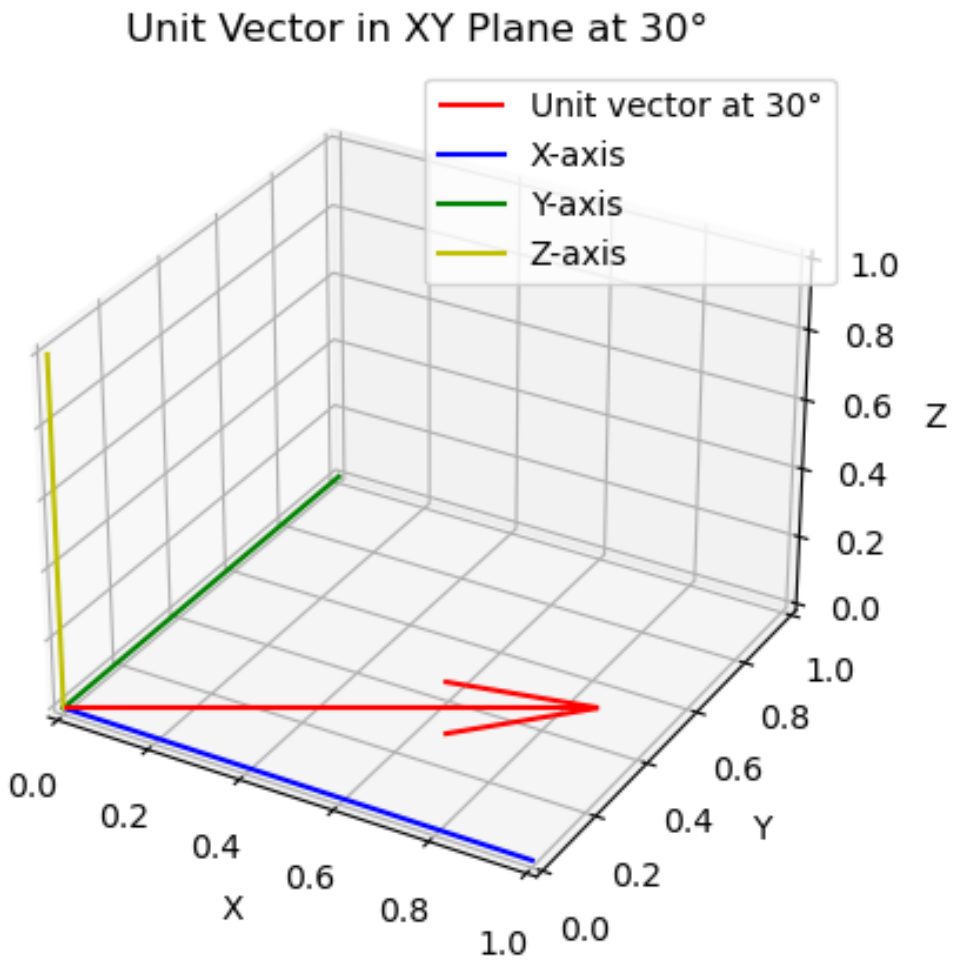
Unit Vector in XY Plane at 30°
Unit vector at 30°
X-axis
Y-axis
Z-axis
1.0
0.8
0.6
Z
0.4
0.2
0.0
1.0
0.8
0.6
0.4
Y
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
X

Figure: Plot