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

$$\implies \begin{pmatrix} \cos 30 \\ \cos 60 \\ \cos 90 \end{pmatrix}$$

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

The unit vector of the given vector is given by $\frac{\sqrt{3}}{2}\,\mathbf{i} + \frac{1}{2}\,\mathbf{j}$

Python Code

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

# Angle in radians
theta = np.deg2rad(30)

# Components of the unit vector
x = np.cos(theta)
y = np.sin(theta)
```

Python Code

```
# Plot settings
plt.figure(figsize=(5,5))
plt.axhline(0, color='black', linewidth=0.5)
plt.axvline(0, color='black', linewidth=0.5)

# Draw the unit vector
plt.quiver(0, 0, x, y, angles='xy', scale_units='xy', scale=1,
    color='r')
```

Python Code

```
 # Set axis limits
plt.xlim(-0.2, 1.2)
plt.ylim(-0.2, 1.2)

# Labels
plt.text(x/2, y/2, r'$\frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat
    {j}$', fontsize=12, color='blue')
plt.title("Unit Vector at 30 with X-axis")
plt.gca().set_aspect('equal')

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;
}
```

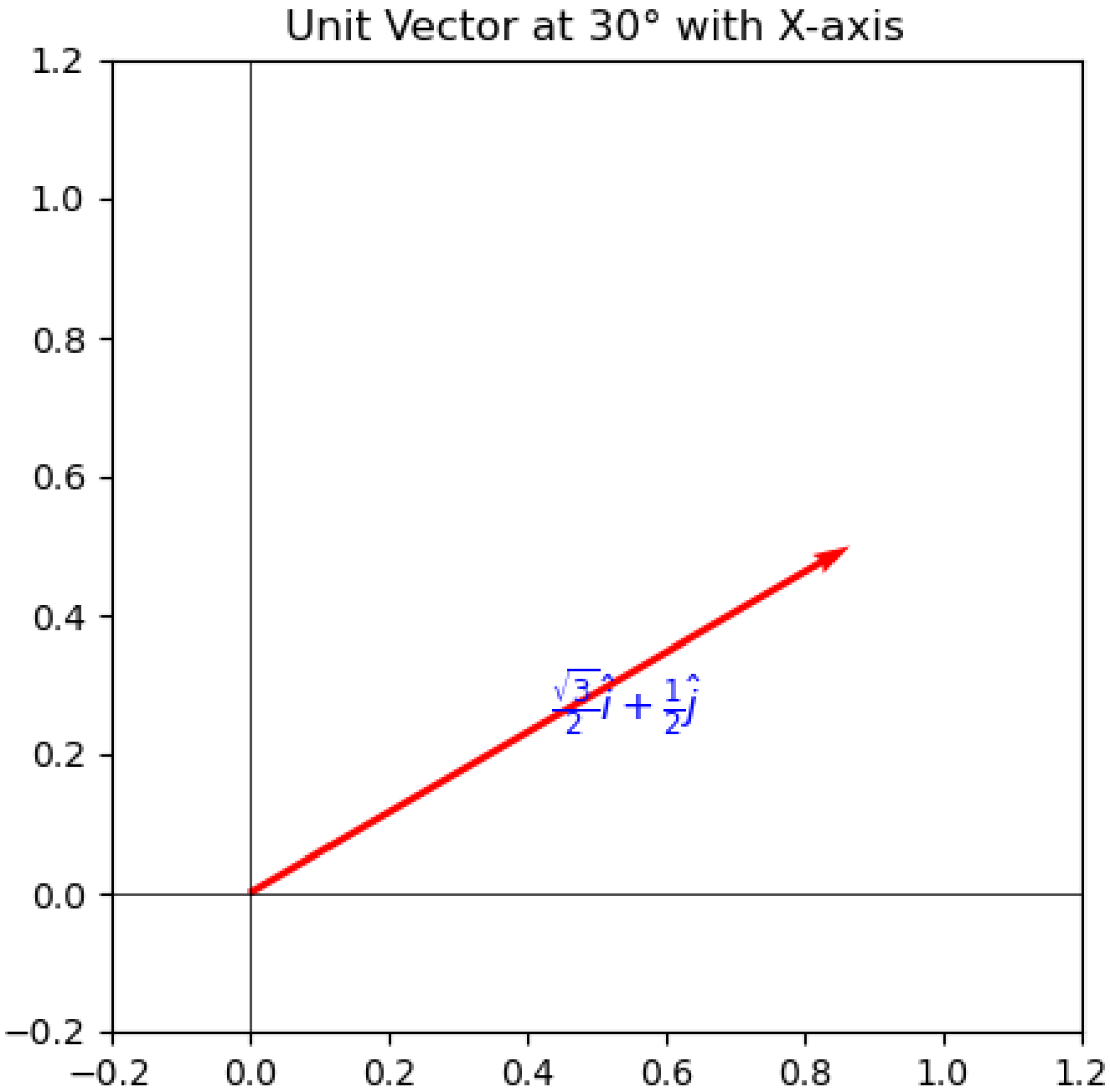
Python and C Code

```
 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 at 30° with X-axis
1.2
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.2
0.0
0.2
0.4
0.6
0.8
1.0
1.2
$\frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}$