



In the above problem, $P=100\text{kN}$ and the rod has a radius of 1cm .

1. Plot the normal stress (σ) and shear stress (τ) on the red surface shown as a function of the angle θ . You need to vary θ between 0 and 2π . Make sure that the stresses are calculated in the unit of Pascal. You can create two different plots for this part, one for σ and another for τ .
2. On the σ plot, mark the angles where σ is maximum or minimum. The planes which these angles represent are called principal planes. Print out the angles of the principal planes in this problem, how these planes are oriented w.r.t the x axis, and what are the normal and shear stresses on these planes. Do you see a pattern in the values of τ on the principal planes?
3. On the τ plot, mark the angles where τ is maximum or minimum. Print out the angles of these planes, how these planes are oriented w.r.t the x axis, and what are the normal and shear stresses on these planes. Some materials (such as aluminum alloys) will fail under shear stress. From this plot, what can you say about the orientation of the fracture surface in such materials?

Submission requirements:

- A single pdf document should be submitted. It should include
 - your python code
 - All the plots asked above
 - All the printouts asked above

On the next page are some instructions on adding markers to a plot to highlight certain points:

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

# Generating a larger dataset
x = np.linspace(0, 10, 100) # 100 points from 0 to 10
y = np.sin(x) # Just an example relationship

# Specific x values you want to highlight
x_to_highlight1 = 3
x_to_highlight2 = 7

# Find the corresponding y values
y_to_highlight1 = np.sin(x_to_highlight1)
y_to_highlight2 = np.sin(x_to_highlight2)

# Create the plot
plt.plot(x, y, label='y = sin(x)') # Plot the curve

# Highlight the points with different markers
plt.scatter(x_to_highlight1, y_to_highlight1, color='red', s=50, label='Highlight point 1', zorder=5) # Larger zorder to draw over the line
plt.scatter(x_to_highlight2, y_to_highlight2, color='blue', s=50, marker='s', label='Highlight point 2', zorder=5) # Square marker

# Add titles and labels
plt.title('Plot with Two Highlighted Points')
plt.xlabel('x')
plt.ylabel('y')
plt.legend()

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

