4. Solve the differential equation \( \frac{dy}{dx} = y \sin x \) and obtain an expression for \( y \) for the boundary condition \( y = 1 \) at \( x = 0 \).

\[
\Rightarrow \int \frac{1}{y} dy = \int \sin x \, dx \\
\Rightarrow \log y = -\cos x + C
\]

Given, \( y(0) = 1 \)

\[
\Rightarrow \log(1) = -\cos 0 + C \\
\Rightarrow C = 1
\]

\[
\Rightarrow y = e^{-\cos x + 1}
\]

5. Solve the equations, \( x^2 + y^2 = 26 \) and \( x - y = 4 \) and obtain the roots.

\[
\text{Eq. 2} \Rightarrow y = x - 4
\]

\[
\text{Eq. 1} \Rightarrow x^2 + (x-4)^2 = 26
\]

\[
\Rightarrow x^2 + x^2 + 16 - 8x = 26 \\
\Rightarrow x^2 - 4x - 5 = 0 \\
\Rightarrow (x-5)(x+1) = 0
\]

\[
\Rightarrow x = 5 \quad \text{or} \quad x = -1
\]

Then, \( y = 1 \) or \( y = -5 \)

Roots \( (5, 1) \) or \( (-1, -5) \)
1. Determine the support reactions at C (forces and moments) due to 50 N vertical load at the end A of pipe. Neglect the weight of the pipe.

\[ \sum F_y = 0 \Rightarrow R_C = 50N \]
\[ \sum M_A = 0 \Rightarrow 50(2) - T_C = 0 \]
\[ T_C = 100N \text{ m} \]
\[ \sum M_C = 0 \Rightarrow M_C - 50(2) = 0 \]
\[ M_C = 100N \text{ m} \]

2. The post anchors a cable as shown. If \( \alpha = 35^\circ \) and \( \beta = 50^\circ \), find reactions in the cables AB and AC. (Your answer should be in terms of applied force T)

\[ \sum F_x = 0 \Rightarrow T \cos 20^\circ - F_{AB} \cos 35^\circ - F_{AC} \cos 35^\circ = 0 \]
\[ 0.82F_{AB} + 0.64F_{AC} = 0.94T \]  
(1)
\[ \sum F_y = 0 \Rightarrow T \sin 20^\circ + F_{AB} \sin 35^\circ - F_{AC} \sin 50^\circ = 0 \]
\[ -0.57F_{AB} + 0.77F_{AC} = 0.34T \]  
(2)

\[ \text{solve } (1) \text{ & } (2) \Rightarrow F_{AC} = 0.82T \]
\[ F_{AB} = 0.51T \]

3. Find the centroid of the shaded area shown below relative to the x- and y-axes.

Consider areas \( ABCO \), \( ADEF \)

Centroid be at dist. \( C_x \) & \( C_y \) from x- & y-axes.

Area \( ABCO = A_1 = 400 \text{ mm}^2 \)
Area \( ADEF = A_2 = 100 \text{ mm}^2 \)

Centroid of \( A_1 = (C_{1x}, C_{1y}) = (10, 10) \text{ mm} \)
Centroid of \( A_2 = (C_{2x}, C_{2y}) = (5, 15) \text{ mm} \)

\[ C_x = \frac{(A_1C_{1x} - A_2C_{2x})}{A_1 - A_2} \implies 11.66 \text{ mm} \]
\[ C_y = \frac{(A_1C_{1y} - A_2C_{2y})}{A_1 - A_2} \implies 8.33 \text{ mm} \]