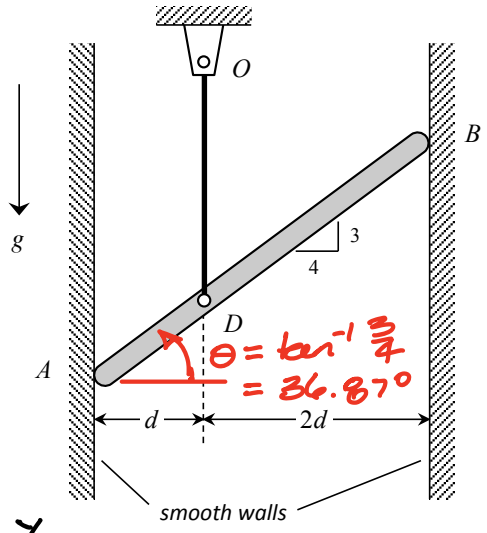
***Quiz No. 3*** ***Name*** SOLUTION

***ME 270 – Summer 2024 – Prague***

***Given***: A homogeneous bar of a *known* weight *W* is supported by a vertical cable at point D, and by smooth, vertical walls at ends A and B.

***Find***: Determine the reactions on the bar at ends A and B. Express your answers in terms of *W*.




***Solution***:

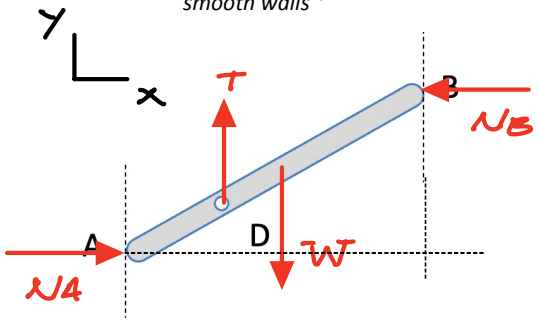
*Step 1 – FBD:* Complete the FBD of the bar in the figure provided to the right.

*Step 2 – Equilibrium:* Using the FBD, write down the three equilibrium equations for the bar.

(1) $\sum F_x = N_A - N_B = 0 \Rightarrow N_A = N_B$

(2) $\sum F_y = T - W = 0 \Rightarrow T = W$

(3) $\sum M = Td - W\left(\frac{3d}{2}\right) + N_B(3d\tan\theta) = 0$




*Step 3 – Solvability:* Write down the number of equations and the number of unknowns.

3 equations / 3 unknowns ($T, N_A, N_B$)

*Step 4 – Solve:* Find the reactions on the bar at ends A and B. Write your answers in terms of *W*.

(2) & (3): $Wd - \frac{3}{2}Wd + 3N_B d\tan\theta = 0$

$\hookrightarrow N_B = \frac{W/2}{3\tan\theta} = \frac{1}{6}\frac{W}{(3/4)} = \frac{2}{9}W$ ← $N_B$

(1) $\Rightarrow N_A = N_B = \frac{2}{9}W$ ← $N_A$