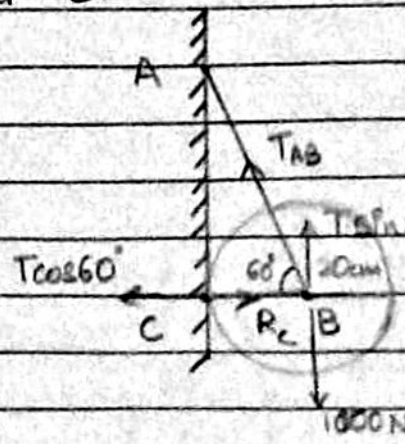
LTCE

47_ YASH SARANG

Assignment 3 : Equilibrium

1) A circular roller of weight 1000N and radius 20 cm hangs by a rope AB of length 40 cm and rests against a smooth vertical wall at C as shown. Determine the tension in the rope and reaction at C.



$\cos\theta = \frac{20}{40}$

$\therefore \theta = 60°$

System is in equilibrium. $\therefore \Sigma F_y = 0$ ($\uparrow$ +ve)

$T\sin 60° - 1000 = 0.$

$\therefore T = 1154.7\,N$

Also $\Sigma F_x = 0$. ($\rightarrow$ +ve) $\therefore R_c - T\cos 60° = 0.$

$R_c = T\cos 60 = 1154.7 \times 1/2.$

$\therefore R_c = 577.35N\ (\rightarrow)$

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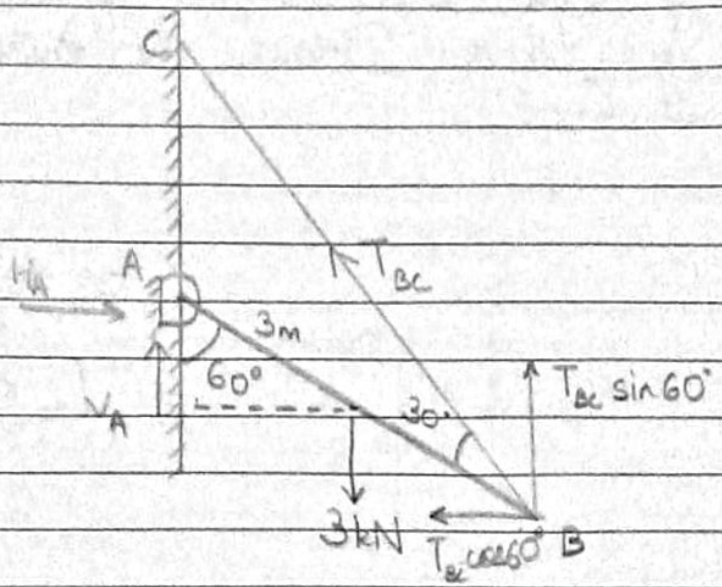
2) A prismatic bar AB of length 6m & weight 3kN is hinged to a wall and supported by a cable BC. Find hinge reaction and tension in cable BC.



System is in equilibrium $\therefore \Sigma M_A^F = 0$.

$$-(3 \times 2.6) - (T\cos 60 \times 3) + (T\sin 60 \times 5.2) = 0$$

$$\therefore T = 2.6\,kN$$

Also,

$$\Sigma F_x = 0 \quad (\rightarrow \text{tve})$$

$$H_A - T\cos 60 = 0.$$

$$\therefore H_A = 1.3\,kN \ (\rightarrow)$$

Also,

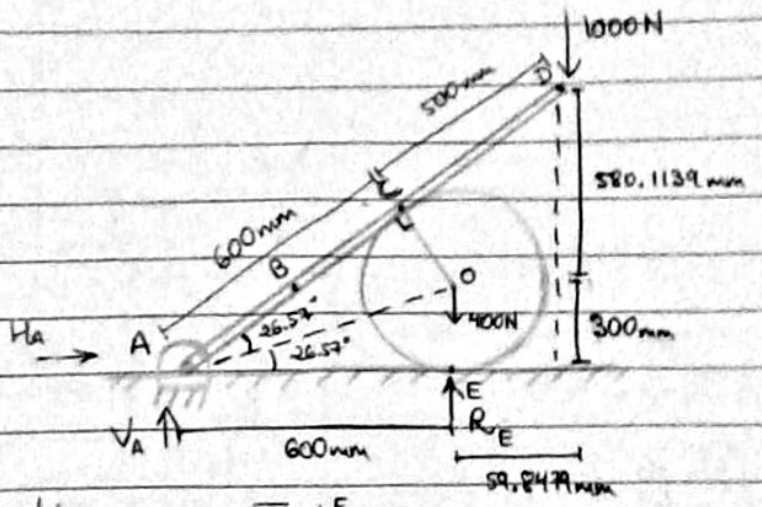
$$\Sigma F_y = 0 \quad (\uparrow \text{tve})$$

$$T\sin 60 + V_A - 3 = 0.$$

$$V_A = 3 - \frac{2.6 \times \sqrt{3}}{2}$$

$$\therefore V_A = 0.748\,kN \ (\uparrow)$$

3) A weightless bar ABCD hinged at A rests on a smooth cylinder of weight 400N at point C. It is also supported by a cable BO. A vertical load of 1000N acts at D. Determine the support reactions and tensions in the cable.



System is in equilibrium. $\therefore \Sigma M_A^F = 0$.

$$-1000 \times (600+59.8479) - 400 \times 600 + R_E \times 600 = 0.$$

$$\therefore R_E = 1500N (\uparrow)$$

Also, $\Sigma F_x = 0$ ($\rightarrow$ tve)

$$\therefore H_A = 0$$

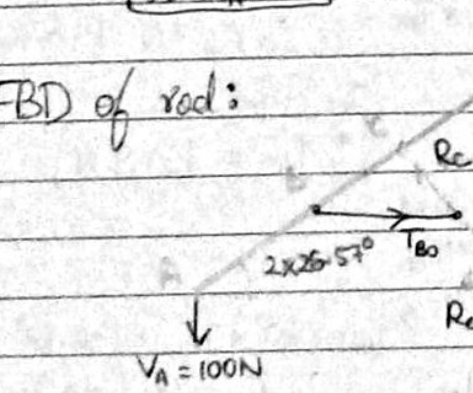
and $\Sigma F_y = 0$ ($\uparrow$ tve)

$$R_E - 1400 + V_A = 0.$$

$$\therefore V_A = -100N$$

$$\therefore V_A = 100N (\downarrow)$$

FBD of rod:



$\therefore \Sigma F_y = 0$ ($\uparrow$ tve)

$$R_c \sin 36.87 - 1100 = 0$$

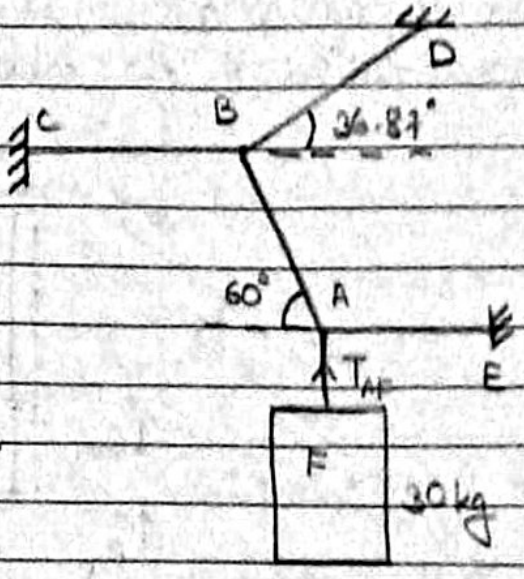
$$\therefore R_c = 1833.3N$$

$\therefore \Sigma F_x = 0$ ($\rightarrow$ tve)

$$T_{BO} - R_c \cos 36.87 = 0.$$

$$\therefore T_{BO} = 1466.6N (\rightarrow)$$

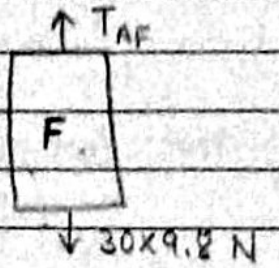
4) A 30 kg pipe is supported at A by a system of five chords. Determine the force in each chord for equilibrium



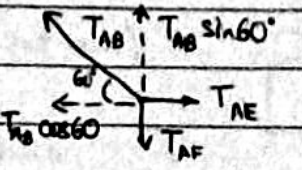
for 30 kg pipe,

$\Sigma F_y = 0$ (↑ tve)

$T_{AF} = 294.3\,N$



for FBD at joint A,



$\Sigma F_y = 0$ (↑ tve)

$T_{AB}\sin 60 - T_{AF} = 0$

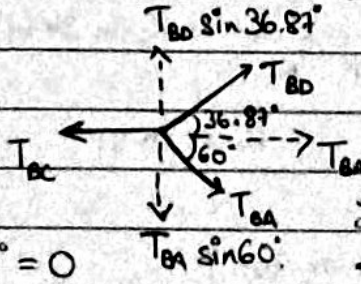
$\therefore T_{AB} = 339.8\,N$

$\Sigma F_x = 0$ (→ tve)

$T_{AE} - T_{AB}\cos 60 = 0$

$\therefore T_{AE} = 169.9\,N$

for FBD at joint B,



$\therefore \Sigma F_y = 0$ (↑ tve)

$T_{BD}\sin 36.87° - T_{BA}\sin 60° = 0$

$\therefore T_{BD} = 490.96\,N$

$\therefore \Sigma F_x = 0$ (→ tve)

$T_{BA}\cos 60° + T_{BD}\cos 36.87° - T_{BC} = 0$

$\therefore T_{BC} = 562.3\,N$