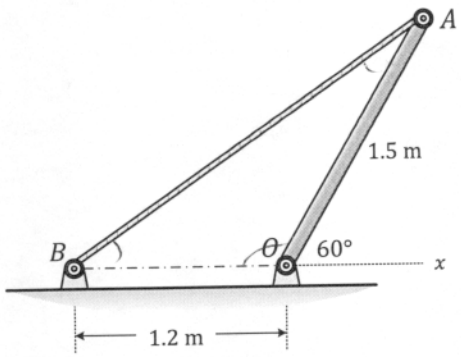
Question 2:

(2 Marks)

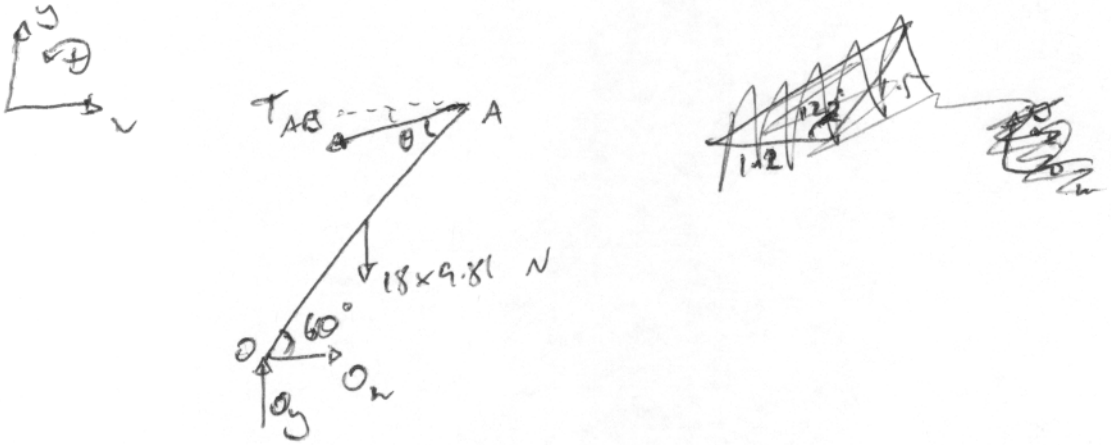
The uniform 18 kg bar OA is held in the position shown by the smooth pin at O and the cable AB. Determine the following:

(Proceed according to the steps provided in solution boxes)

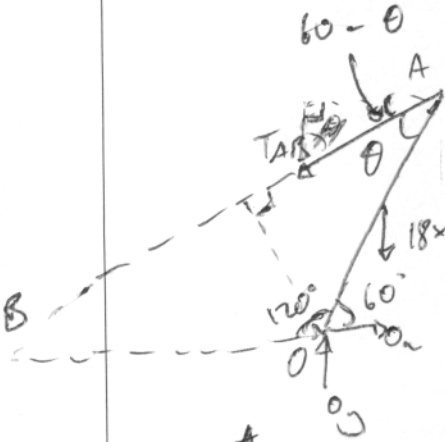


Solution:

(a) Draw the FBD of member OA (also calculate and show any angles that are needed in the FBD)



(b) Use the equilibrium equations to determine the tension (T) in the cable and the magnitude (R_O) and direction (θ) of the external pin reaction at O, measured counterclockwise from the positive x-axis



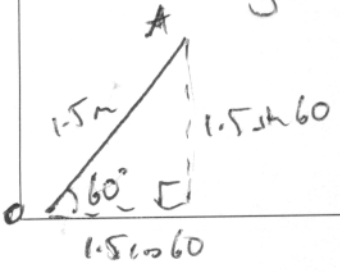
$$BA^2 = OA^2 + OB^2 - 2\cdot OA\cdot OB\cos(\angle AOB)$$

$$= 1.5^2 + 1.2^2 - 2\times 1.5\times 1.2\cos(120)$$

$$\therefore BA = \sqrt{5.49}\ \text{m}$$

$$\frac{\sin\theta}{1.2} = \frac{\sin(120)}{\sqrt{5.49}}$$

$$\therefore \theta = 26.329...^\circ \Rightarrow \text{"A"}$$



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Continue your working for part (b) here:

$\therefore \Sigma F_y = 0$

$-18 \times 9.81 + O_y - T_{AB} \sin(60-\theta) = 0$

$\Sigma M_O = 0$

$T_{AB} \sin(60-\theta) \times (1.5\cos 60) + T_{AB} \cos(60-\theta) \times (1.5 \sin 60)$ 2.1

$- 18 \times 9.81 \times \left(\frac{1.5}{2} \sin 60\right) = 0$

$T_{AB}\left(\sin(60-\theta)(1.5\cos 60) + \cos(60-\theta)(1.5 \sin 60)\right) = 114.69...$

$\therefore T_{AB} = 76.6 \text{ N}$ $\Rightarrow$ "B"

$\Sigma F_O = 0$

$O_y - T_{AB} \sin(60-\theta) - 18 \times 9.81 = 0$

$\therefore O_y = 219 \text{ N} \uparrow$ $\Rightarrow$ "C"

$\Sigma F_h = 0$

$O_h - T_{AB} \cos(60-\theta) = 0$

$\therefore O_h = 63.765 \approx 63.8 \text{ N} \rightarrow$ $\Rightarrow$ "D" 2.2

$\therefore |R_O| = \sqrt{O_h^2 + O_y^2} = 228.15 \text{ N}$

$\therefore \text{Arg}(R_O) = \tan^{-1}\left(\frac{O_y}{O_h}\right) = 73.77°$ come from +ve x-axis.

Answers:	$T =$ 76.6 N	$R_O =$ 228.15 N	$\theta =$ 73.77°	X4ESYIPU 4

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