UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

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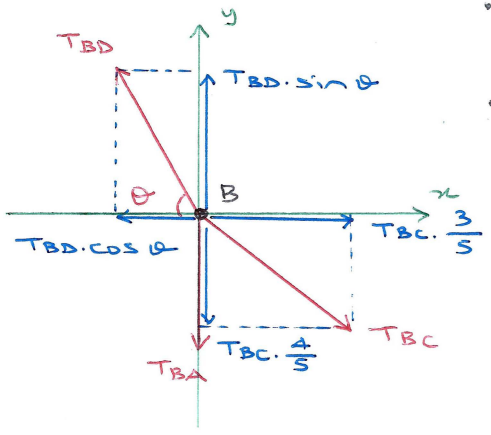
NAME: S. GUNER

COURSE NO.	COURSE NAME	2
CIV100F	Mechanics	student #

Quiz 1 - Solution

1.



- First, draw a FBD. Logically assume the directions of unknowns.
- Either T_{BC} will reach the rupture tension or T_{BD}. Assume $\boxed{T_{BD} = 1{,}0\,kN}$
- Apply equations of equilibrium.

$\boxed{\Sigma F_x = 0}$ $\quad T_{BC}\cdot\frac{3}{5} = T_{BD}\cdot\cos\theta$ (I)

($T_{BD} = 1{,}0\,kN$)

$\boxed{\Sigma F_y = 0}$ $\quad T_{BD}\sin\theta = T_{BC}\cdot\frac{4}{5} + T_{BA}$ (II)

($T_{BD} = 1{,}0\,kN$; $T_{BA} = T_{BC}$)

- From Eq. (I): $T_{BC} = \frac{5}{3}\cdot\cos\theta$
- Sub into Eq. (2): $1{,}0\cdot\sin\theta = \frac{5}{3}\cdot\cos\theta\left(\frac{4}{5}+1\right)$

$$\Rightarrow \tan\theta = \frac{5}{3}\left(\frac{4}{5}+1\right) \Rightarrow \theta = 71{,}57°$$

$$\Rightarrow T_{BC} = \frac{5}{3}\cdot\cos 71{,}57° = 0{,}527\,kN$$

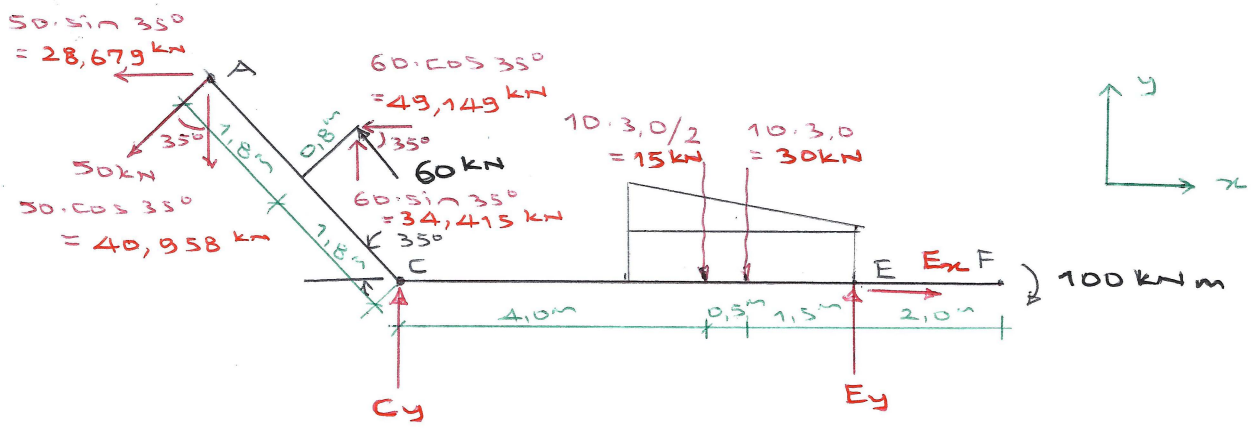
$\therefore T_{BC} < 1{,}0\,kN \Rightarrow T_{BD}$ will fail first. Assumption is correct.

Answers:

i. $W = T_{BC} = 0{,}53\,kN$

ii. $\theta = 71{,}6°$

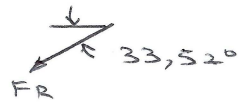
2. First, draw a FBD. Find all force components.



(i) $F_{Rx} = \Sigma F_x = -28,679 - 49,149 = -77,828$ kN (F_{Rx} ←)

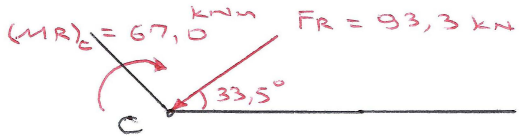
$F_{Ry} = \Sigma F_y = 34,415 - 40,958 - 15 - 30 = -51,543$ kN (F_{Ry} ↓)

$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} = 93,348$ kN



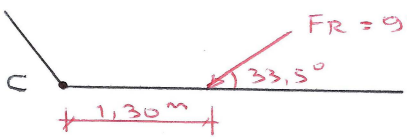
$(M_R)_C = 60^{kN} \cdot 0,8^{m} + 50^{kN} \cdot 3,6^{m} - 15^{kN} \cdot 4,0^{m} - 30^{kN} \cdot 4,5^{m} - 100 = -67,00$ kNm ↻

Answer:



(ii) $(M_R)_C = F_{Ry} \cdot d \Rightarrow -67,00^{kNm} = -51,543^{kN} \cdot d \Rightarrow d = 1,30$ m

Answer:



(must shift it to right to get the same rotation direction at point C.)

(iii) Apply equilibrium eq'ls.

$\Sigma M_C = 0 \Rightarrow -67,00^{kNm} + E_y \cdot 6,0^{m} = 0 \Rightarrow E_y = 11,167^{kN}$ (↑)

$\Sigma F_x = 0 \Rightarrow F_{Rx} + E_x = 0 \Rightarrow E_x = 77,828$ kN (→)

$\Sigma F_y = 0 \Rightarrow F_{Ry} + C_y + E_y = 0 \Rightarrow -51,543 + C_y + 11,167 = 0$

$\Rightarrow C_y = 40,376$ kN (↑)

Answer: