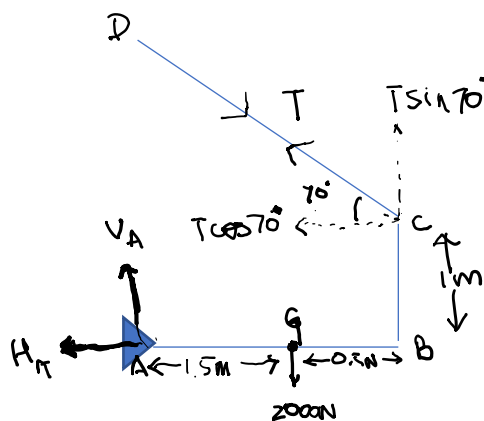


Convention used in this assignment :

- Force towards the right = +ve
- Force towards the left = -ve
- Upward force = +ve
- Downward force = -ve
- Counter-Clockwise moment = +ve
- Clockwise moment = -ve

1.

(a)



(b) Vertical component of tension(T) acting at C =  $T \sin 70^\circ = 0.939T$

The horizontal component of tension(T) acting at C =  $-T \cos 70^\circ = -0.342T$

(c)  $\Sigma F_x = 0$  equation:  $H_A - T \cos 70^\circ = 0 \rightarrow \text{Eq. 1}$

$\Sigma F_y = 0$  equation:  $V_A + T \sin 70^\circ - 2000 = 0 \rightarrow \text{Eq. 2}$

(d)  $M_A = T \cos 70^\circ \times 1 + T \sin 70^\circ \times 2 - 2000 \times 1.5 = 0 \rightarrow \text{Eq. 3}$

(e) From Eq. 1, we get

$$T(\cos 70^\circ + 2 \sin 70^\circ) = 3000$$

$$T = 3000 / (0.342 + 2 \times 0.9397) = 1350.4997\text{N}$$

(f) From Eq. 1,  $H_A = -T_A \cos 70^\circ = -1350.4997 \times 0.342$

$$H_A = -461.87\text{N (Towards the right)}$$

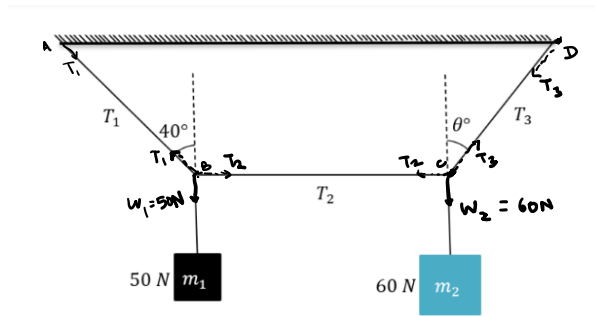
$$\text{From Eq. 2, } V_A = 2000 - T_A \sin 70^\circ = 2000 - (1350.4997 \times 0.9797)$$

$$= 2000 - 1269.0646$$

$$V_A = 730.9354\text{N (Upwards)}$$

2.

(a)



(a) At B:

$$\begin{aligned} \text{Component of } T_1 \text{ in vertical direction (upwards)} &= T_1 \cos 40^\circ \\ &= 0.766T_1 \end{aligned}$$

$$\begin{aligned} \text{Component } T_1 \text{ in horizontal direction (towards left)} &= T_1 \sin 40^\circ \\ &= 0.6428T_1 \end{aligned}$$

(b) On  $m_1$ :

$$\text{Weight acting downward} = w_1 = -50\text{N}$$

$$\text{Tension acting upward} = 0.766T_1 \text{ (From (b))}$$

$$\therefore \text{By vertical force equilibrium at B: } 0.766T_1 - 50 = 0 \rightarrow \text{Eq. 1}$$

$$\text{The horizontal force equilibrium equation: } T_2 - 0.6428T_1 = 0 \rightarrow \text{Eq. 2}$$

(c) From Eq. 1:  $0.766T_1 = 50$

$$T_1 = 65.274\text{N}$$

$$\text{From Eq. 2: } T_2 = 0.6428T_1$$

$$T_2 = 41.9582\text{N}$$

(d) Component of  $T_3$  in vertical direction  $= T_3 \cos \theta$

$$\text{Component of } T_3 \text{ in horizontal direction} = T_3 \sin \theta$$

(e) On  $m_2$ :

$$\text{Vertical force equilibrium equation at C: } T_3 \cos \theta - 60 = 0 \rightarrow \text{Eq. 3}$$

$$\text{Horizontal force equilibrium equation at C: } T_3 \sin \theta - T_2 = 0 \rightarrow \text{Eq. 4}$$

(e) From Equations 3 and 4,

$$T_3 \cos \theta = 60$$

$$T_3 \sin \theta = T_2$$

Dividing these 2 equations, we get

$$\cot \theta = 60/T_2$$

$$= 1.43$$

$$\theta = \cot^{-1}(1.43) = 34.965^\circ$$

$$\begin{aligned}T_3 &= 60/\cos\theta \\&= 60/0.8195 \\&= 73.2152\text{N}\end{aligned}$$