H.W. #3

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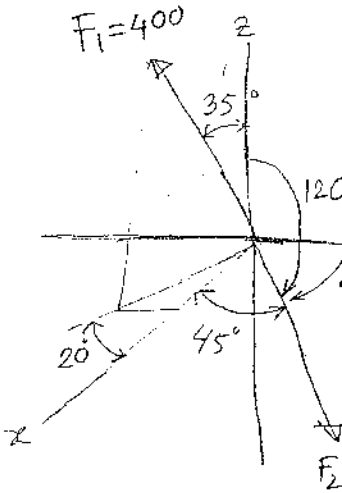

$$\begin{cases} F_{1X} = 400\cos 55\cos 20^\circ = 215.6 \\ F_{1Y} = -44_*\cos 44_*\sin 20^\circ = -78.46 \\ F_{1Z} = 400_*\cos 35^\circ = 327.66 \end{cases}$$

$$\begin{cases} F_{2X} = 400\cos 45 = 282.84 \\ F_{2Y} = 400\cos 60 = 200 \\ F_{2Z} = +400\cos 120 = -200 \end{cases}$$

$$\vec{F_1}\cdot\vec{F} = (215.6)(282.84) + (-78.46)(200) + (327.66)(-200)$$

$$= -20151$$

Again $\vec{F_1}\cdot\vec{F_2} = |\vec{F_1}\cdot\vec{F_2}|\cdot\cos\theta$

$$\therefore \cos\theta = \frac{-20151}{400\times400} \quad \therefore \theta = 97^\circ$$

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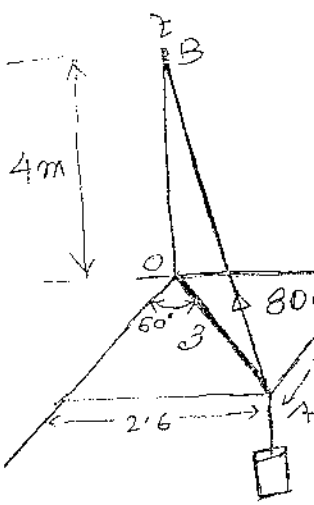


$$F_{AB} = -1.5\hat{i} - 2.6\hat{j} + 4\hat{k}$$

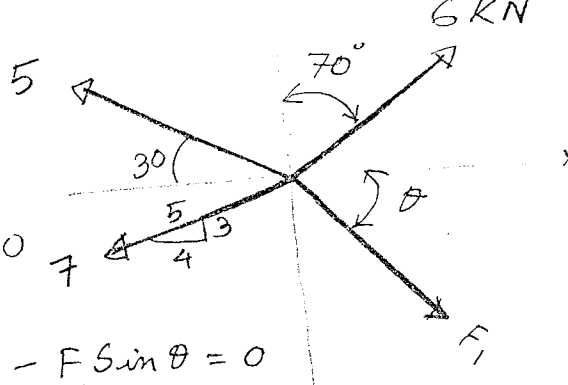
$$r = \sqrt{(-1.5)^2 + (-2.6)^2 + (4)^2} = 5$$

$$u_{AB} = \left(-\frac{1.5}{5}\hat{i} - \frac{2.6}{5}\hat{j} + \frac{4}{5}\hat{k}\right)$$

$$\therefore \vec{F} = 80\left\{-\frac{1.5}{5}\hat{i} - \frac{2.6}{5}\hat{j} + \frac{4}{5}\hat{k}\right\}$$

$$= -24\hat{i} - 41.6\hat{j} + 64\hat{k}$$

$$\vec{F_{OA}} = \sqrt{(-24)^2 + (-41.6)^2}$$



$\Sigma F_x = 0$

$6 \sin 70^\circ + F_1 \cos\theta - 5\cos 30 - \frac{7}{5} * 4 = 0$

$\Rightarrow F_1 \cos\theta = 4.29 \quad \cdots (1)$

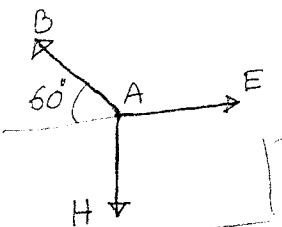
$\Sigma F_y = 0 \Rightarrow 6\cos 70^\circ + 5 \sin 30 - \frac{7}{5} * 3 - F \sin\theta = 0$

$\Rightarrow F_1 \sin\theta = 0.352 \quad \cdots (2)$

$(1)^2 + (2)^2 \Rightarrow F_1 = \sqrt{(4.29)^2 + (0.352)^2}$

$= \underline{4.3 \text{ kN}}$

$(2) \div (1) \Rightarrow \theta = \tan^{-1}\left(\frac{.352}{4.29}\right) = \underline{4.7^\circ}$



$\Sigma F_x = 0 \Rightarrow T_{AE} = T_{AB} \cos 60^\circ$

$\Sigma F_y = 0 \Rightarrow T_{AH} = T_{AB} \sin 60^\circ \quad \therefore T_{AB} = 1.154\, T_{AH}$

$\Sigma F_y = 0$

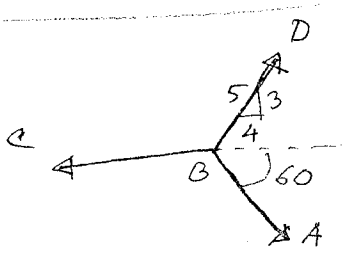
$\Rightarrow \frac{T_{BD}}{5} * 3 = T_{BA} \sin 60^\circ$

$\Rightarrow T_{BD} = \frac{5}{3}(1.154\, T_{AH}) \sin 60^\circ$

$= 1.66\, T_{AH}$

$T_{AE} = (1.154)\, T_{AH} * \cos 60$

$= 0.577\, T_{AH}$



$T_{BD} * \frac{4}{5} + T_{AB} \cos 60^\circ$

$66)\, T_{AH} * \frac{4}{5}$

$+ (1.154\, T_{AH}) \cos 60^\circ$

$= 1.9\, T_{AH}$

e set

$T_{AB} = 1.154\, T_{AH}$

$T_{BD} = 1.66\, T_{AH}$

$T_{AE} = 0.577\, T_{AH}$

$T_{CB} = 1.9\, T_{AH}$

Max^m value

$T_{CB} = 1.9\, T_{AH}$

$\Rightarrow 500 = 1.9\, T_{AH}$

$\Rightarrow T_{AH} = 263\text{ N}$

$\therefore W = \frac{269}{9.8} = \underline{26.8 \text{ kg}}$

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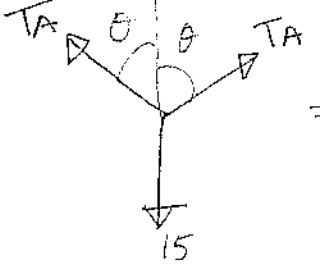
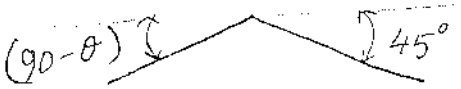


$\Sigma F_y = 0$

$\Rightarrow 2 T_A \cos\theta = 15$

$\Rightarrow T_A \cos\theta = 7.5 \quad \cdots (1)$



$\Sigma F_x = 0$

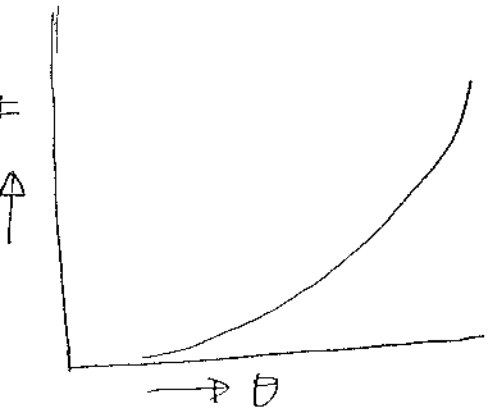
$\Rightarrow T_A \cos(90-\theta) = F \cos 45$

$\Rightarrow T_A \sin\theta = F \cos 45^\circ \quad \cdots (2)$

$(2) \div (1) \Rightarrow$

$$\tan\theta = \frac{F \cos 45}{7.5}$$

$$\Rightarrow \boxed{\tan\theta = 0.094\, F}$$



Graph F Vs θ

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$\Sigma F_x = 0$

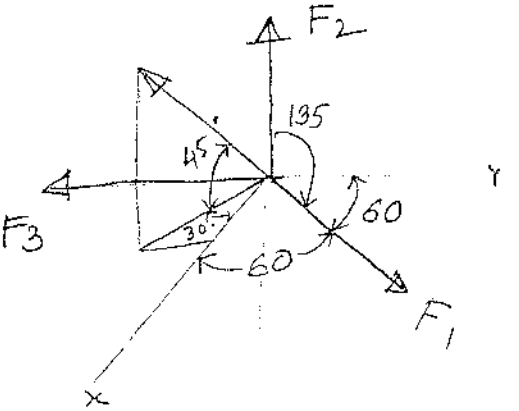
$\Rightarrow F_1 \cos 60 + 150 \cos 45^\circ \cos 30 - 225 = 0$

$\therefore F_1 = \underline{266.3}$ lb

$\Sigma F_y = 0$

$-F_3 - 150 \cos 45 \sin 30 + F_1 \cos 60^\circ = 0$

$\Rightarrow F_3 = \underline{80.15}$ lb

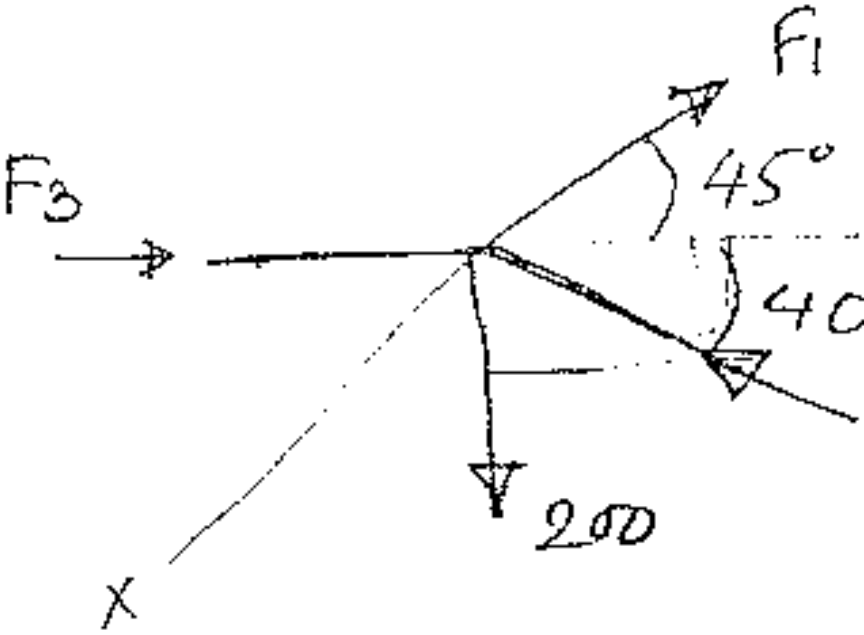


$\Sigma F_z = 0$

$\Rightarrow F_2 + 150 \cos 45 + F_1 \cos 135 = 0$

$\Rightarrow F_2 = 82.2$

2



$45^\circ = 0 \quad \therefore \boxed{F_1 = 0}$

$\cos 40 + F_1 \cos 45 = 0$

$\cos 40 + 0 = 0$

$F_2 \cos 40^\circ$

$40^\circ - 200 = 0$

$= 311 \quad \therefore \boxed{F_3 = 238}$