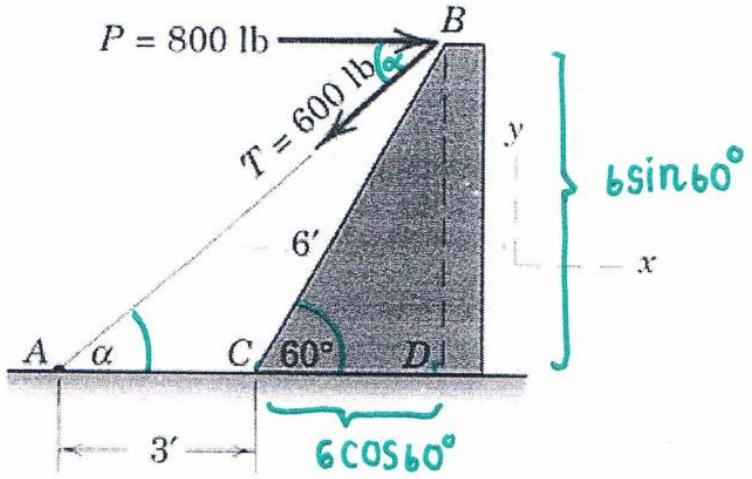
1) จงหาค่า α และแรงลัพธ์ของแรง P และ T

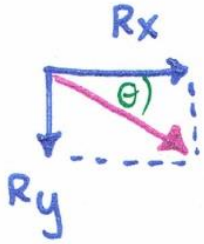


$+\rightarrow \quad R_x = 800 - 600\cos\alpha$

$= 346.5 \quad lb \rightarrow$

$+\uparrow \quad R_y = -600\sin\alpha = -392.8\ lb$

$= 392.8\ lb \downarrow$



$R = \sqrt{R_x^2 + R_y^2}$

$= 524 \quad lb$

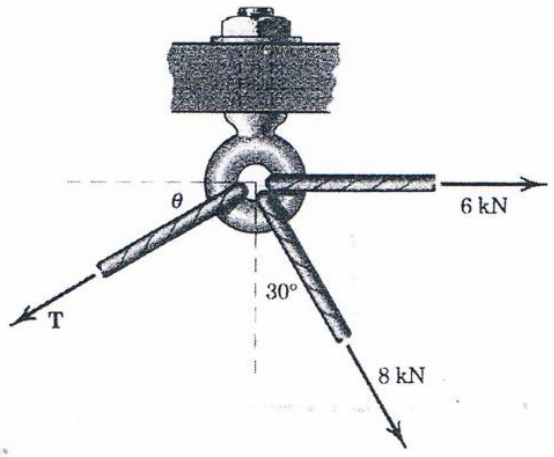
$\tan\theta = \frac{392.8}{346.5} \rightarrow \theta = 48.6^\circ$

$\therefore \quad R = 524\ lb \ \angle 48.6^\circ$ #

$\Delta ABD: \quad \tan\alpha = \frac{6\sin60^\circ}{3 + 6\cos60^\circ}$

$\alpha = 40.9^\circ$ #

2) จงคำนวณหาค่าแรง T และ มุม θ ถ้าทราบว่าแรงลัพธ์มีค่าเท่ากับ 15 kN ทิศทางลงตามแนวแกน y



สมดุล

$\overset{+}{\rightarrow} \Sigma F_x = 0 \; ; \quad 6 + 8\sin 30^\circ - T\cos\theta = 0$

$T\cos\theta = 10 \quad -(1)$

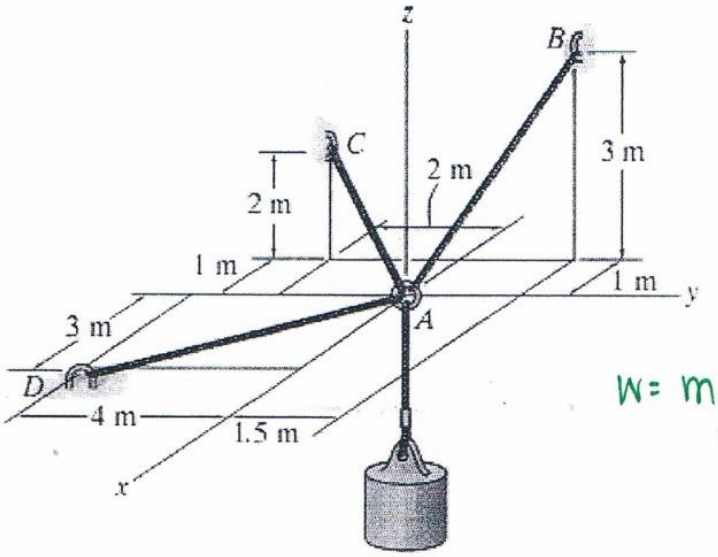
$+\uparrow \Sigma F_y = -T\sin\theta - 8\cos 30^\circ = (-15)$ ค่าแรงลัพธ์ทิศ ↓

$T\sin\theta = 8.07 \quad -(2)$

$\frac{(2)}{(1)} \; ; \quad \tan\theta = \frac{8.07}{10} \rightarrow \theta = 38.9^\circ$ #

จาก (1) ; $T\cos 38.9^\circ = 10 \rightarrow T = 12.85 \text{ kN}$ #

3) จงคำนวณหาค่าแรงตึงในเคเบิล AB, AC และ AD เมื่อระบบอยู่ในสภาพสมดุล กำหนด ทรงกระบอกเหล็ก หนัก 75 kg



$W = mg = 75(9.81) = 735.75$ N

Step 1 $A(0,0,0)$ $B(-1,1.5,3)$ $C(-1,-2,2)$ $D(3,-4,0)$

Step 2 $\frac{F}{d} = \frac{F_x}{d_x} = \frac{F_y}{d_y} = \frac{F_z}{d_z}$ $d = \sqrt{d_x^2 + d_y^2 + d_z^2}$

แรง	ระยะ (m)				แรงย่อย (N)		
	d_x	d_y	d_z	d	F_x	F_y	F_z
T_{AB}	-1	1.5	3	3.5	$-0.2857T_{AB}$	$0.4286T_{AB}$	$0.8571T_{AB}$
T_{AC}	-1	-2	2	3	$-0.3333T_{AC}$	$-0.6667T_{AC}$	$0.6667T_{AC}$
T_{AD}	3	-4	0	5	$+0.6T_{AD}$	$-0.8T_{AD}$	0
W	-	-	-	-	-	-	-735.75

$+\swarrow \Sigma F_x = 0$: $-0.2857T_{AB} - 0.3333T_{AC} + 0.6T_{AD} = 0$

$+\rightarrow \Sigma F_y = 0$: $0.4286T_{AB} - 0.6667T_{AC} - 0.8T_{AD} = 0$

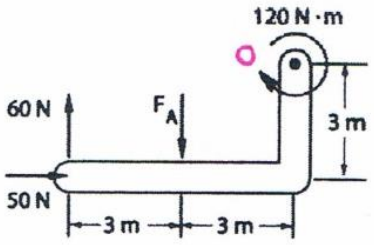
$+\uparrow \Sigma F_z = 0$: $0.8571T_{AB} + 0.6667T_{AC} - 735.75 = 0$

$T_{AB} = 831$ N

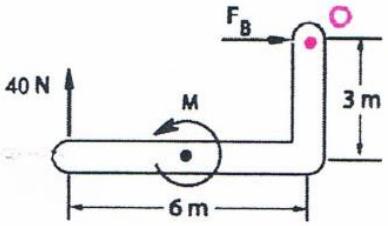
$T_{AC} = 35.6$ N

$T_{AD} = 415$ N #

4) ถ้าระบบแรงทั้งสองในรูป (ก) และ (ข) เป็นระบบเทียบเท่าซึ่งกันและกัน จงหาค่าของ F_A , F_B และ M



(ก)



(ข)

$+\uparrow (\Sigma F_y)_ก = (\Sigma F_y)_ข$; $60 - F_A = 40$ ค่าที่ได้ตามรูปโจทย์

$F_A = 20$ N ↓ #

$+\rightarrow (\Sigma F_x)_ก = (\Sigma F_x)_ข$; $50 = F_B \rightarrow F_B = 50$ N → #

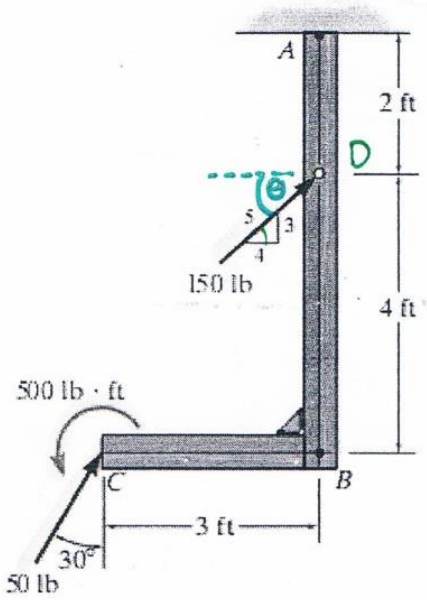
$+\circlearrowleft (\Sigma M_O)_ก = (\Sigma M_O)_ข$; $-120 - 60(6) + 50(3) + 20(3) = M - 40(6)$

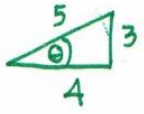
ต้อง take ที่จุดเดียวกัน

$M = -30$ Nm

$\therefore M = 30$ Nm ↷ #

5) Replace the force and couple system acting on the frame by an equivalent resultant force and specify where the resultant's line of action intersects member AB, measured from A.

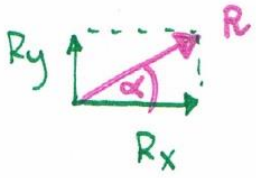




ย้ายไปที่ D

$\overset{+}{\rightarrow} R_x = 150\cos\theta + 50\sin 30^\circ = 145$ lb

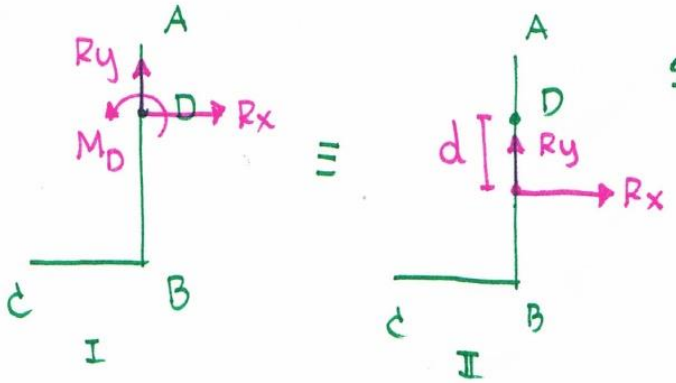
$+\uparrow R_y = 150\sin\theta + 50\cos 30^\circ = 133.3$ lb



$R = \sqrt{R_x^2 + R_y^2} = 197.0$ lb

$\tan\alpha = \frac{133.3}{145} \rightarrow \alpha = 42.6^\circ$

$\circlearrowleft \Sigma M_D = 500 + (50\sin 30^\circ)(4) - 50\cos 30^\circ(3) = 470$ lb.ft $\circlearrowleft$



$\circlearrowleft (\Sigma M_D)_I = (\Sigma M_D)_{II}$: $M_D = R_x d$

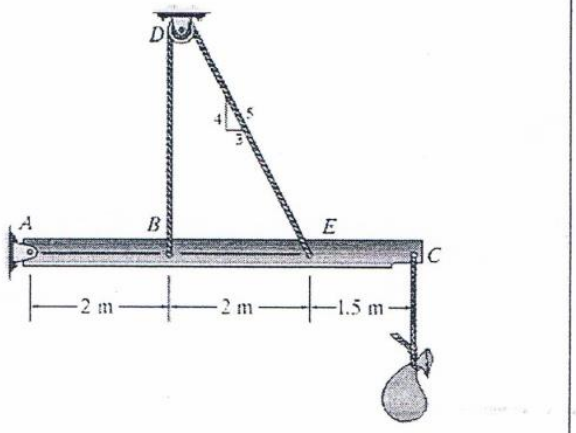
$470 = 145d$

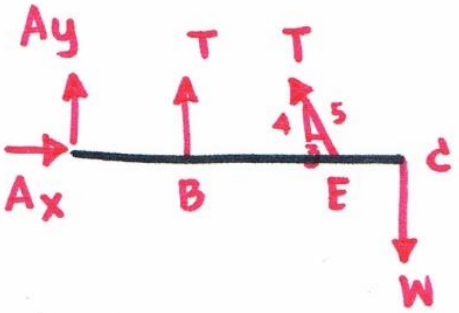
$d = 3.24$ ft

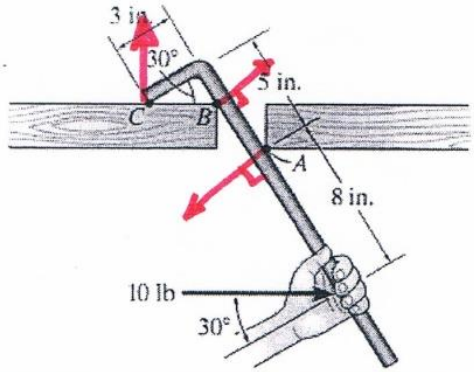
$\therefore$ $R = 197.0$ lb $\angle 42.6^\circ$

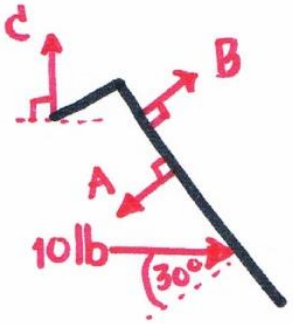
ตัดต่ำกว่า A ลงเป็นระยะ 5.24 ft #

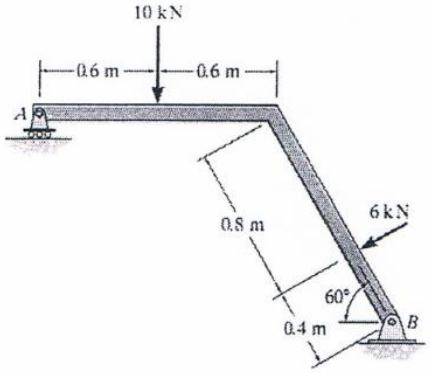
6) จงเขียนแผนภาพวัตถุอิสระของชิ้นวัตถุที่กำหนดดังรูป

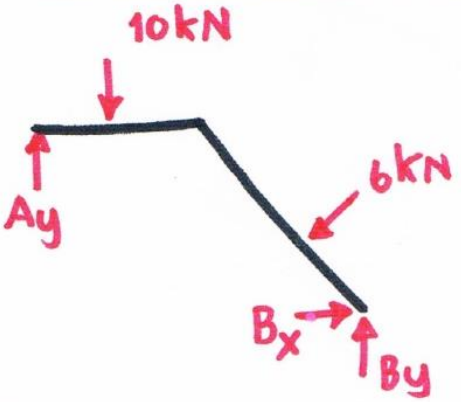


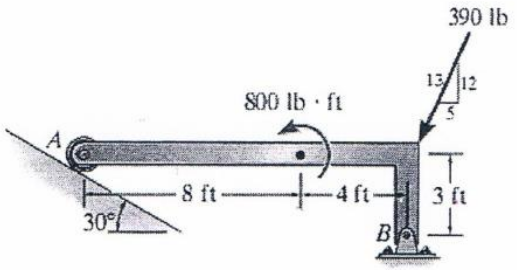


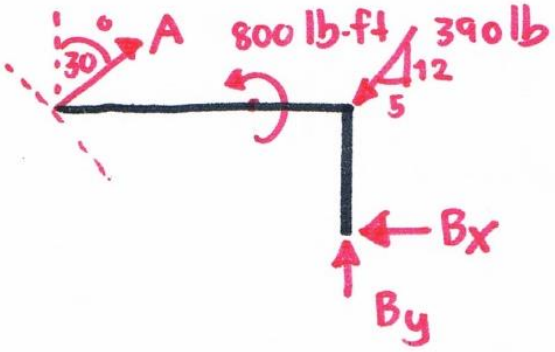




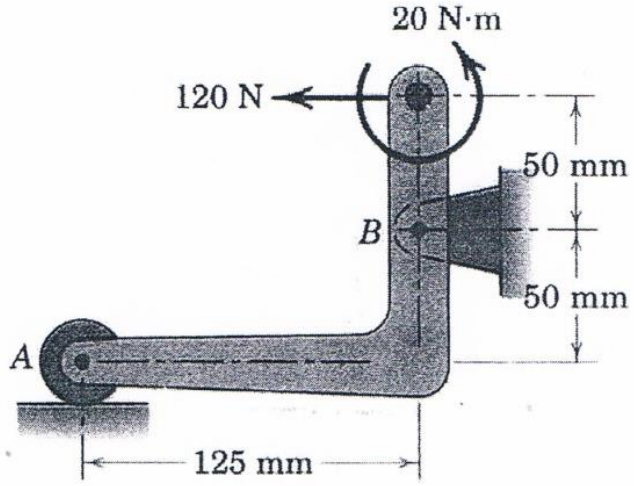


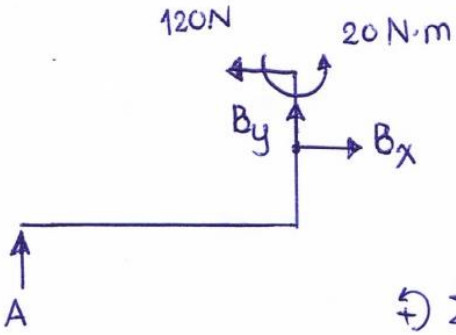






7) จงคำนวณหาแรงปฏิกิริยาที่ A และ B เมื่อระบบอยู่ในสภาพสมดุล





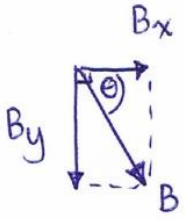
$\overset{+}{\rightarrow} \Sigma F_x = 0$; $B_x - 120 = 0$

$B_x = 120 \text{ N} \rightarrow$

$\circlearrowleft \Sigma M_A = 0$; $120(0.1) + 20 + B_y(0.125) - 120(0.05) = 0$

$B_y = -208 \text{ N}$

$B_y = 208 \text{ N} \downarrow$



$B = \sqrt{B_x^2 + B_y^2} = 240 \text{ N}$

$\tan\theta = \frac{208}{120} \rightarrow \theta = 60.0^\circ$

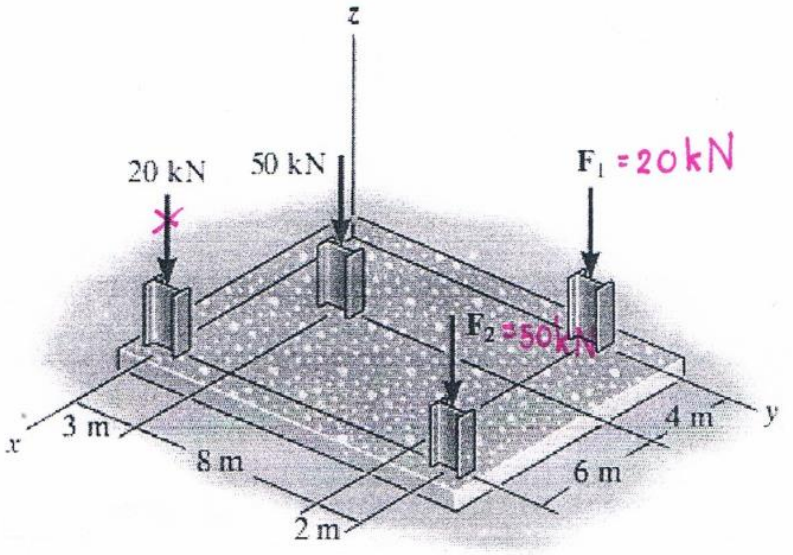
#

$+\uparrow \Sigma F_y = 0$; $A + B_y = 0 \rightarrow A - 208 = 0$

$A = 208 \text{ N} \uparrow$

#

8) The building slab is subjected to four parallel column loadings. Determine the equivalent resultant force and specify its location (x, y) on the slab. Take $F_1 = 20$ kN, $F_2 = 50$ kN.



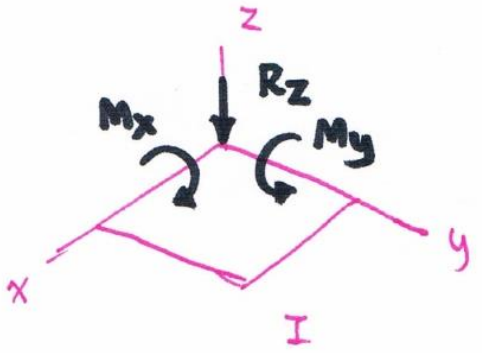
ย้ายไปที่ Z

$+\uparrow \Sigma F_z = -20-50-20-50 = -140$ kN $\therefore$ $R_z = 140$ kN ↓

$+\circlearrowleft \Sigma M_x = -20(11) - 50(13) - 50(3) = -1020$ kN.m

$\Sigma M_x = 1020$ kN.m ↷

$+\circlearrowleft \Sigma M_y = 50(10) + 50(4) + 20(10) = 900$ kN.m ↶



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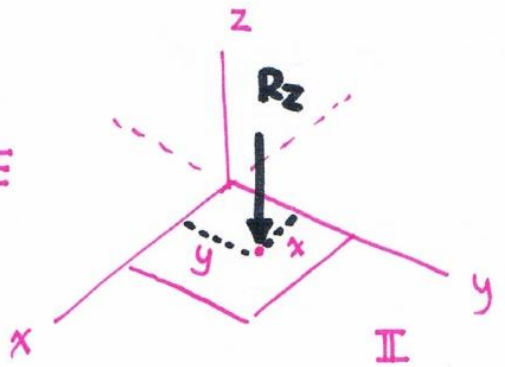
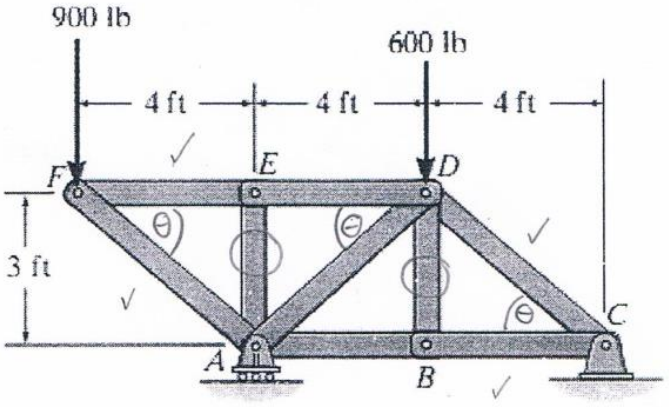


$+\circlearrowleft (\Sigma M_x)_I = (\Sigma M_x)_{II}$ ∴ $-1020 = -140y \rightarrow y = 7.29$ m

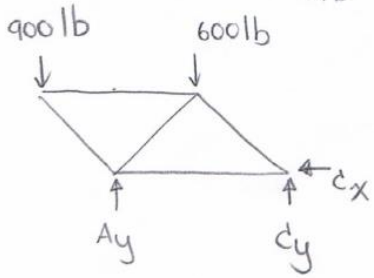
$+\circlearrowleft (\Sigma M_y)_I = (\Sigma M_y)_{II}$ ∴ $900 = 140x \rightarrow x = 6.43$ m

∴ $R_z = 140$ kN ↓ กระทำที่ ต.ม. $(x, y) = (6.43, 7.29)$ m

10) Determine the force in each member of the truss, and state if the members are in tension or compression.



$\Sigma F_{AE} = F_{BD} = 0$ lb



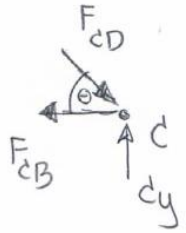
$\circlearrowleft \Sigma M_A = 0$: $C_y(8) + 900(4) - 600(4) = 0$

$C_y = -150$ lb. $\therefore C_y = 150$ lb ↓

$+\uparrow \Sigma F_y = 0$: $A_y - 150 - 900 - 600 = 0 \rightarrow A_y = 1650$ lb. ↑

$C_x = 0$ lb

จุด C



$+\uparrow \Sigma F_y = 0$: $C_y - F_{CD}\sin\theta = 0$

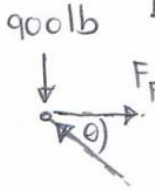
$-150 - \frac{3}{5}F_{CD} = 0 \rightarrow F_{CD} = -250$ lb $\rightarrow F_{CD} = 250$ lb (T)

$\stackrel{+}{\rightarrow} \Sigma F_x = 0$: $F_{CD}\cos\theta - F_{CB} = 0$

$-250\left(\frac{4}{5}\right) - F_{CB} = 0 \rightarrow F_{CB} = -200$ lb

$= 200$ lb (C) $= F_{AB}$ #

จุด F



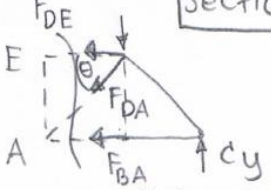
$+\uparrow \Sigma F_y = 0$: $F_{FA}\sin\theta - 900 = 0$

$F_{FA}\left(\frac{3}{5}\right) - 900 = 0 \rightarrow F_{FA} = 1500$ lb (C) #

$\stackrel{+}{\rightarrow} \Sigma F_x = 0$: $F_{FE} - F_{FA}\cos\theta = 0$

$F_{FE} - 1500\left(\frac{4}{5}\right) = 0 \rightarrow F_{FE} = 1200$ lb (T) $= F_{ED}$ #

600 lb Section



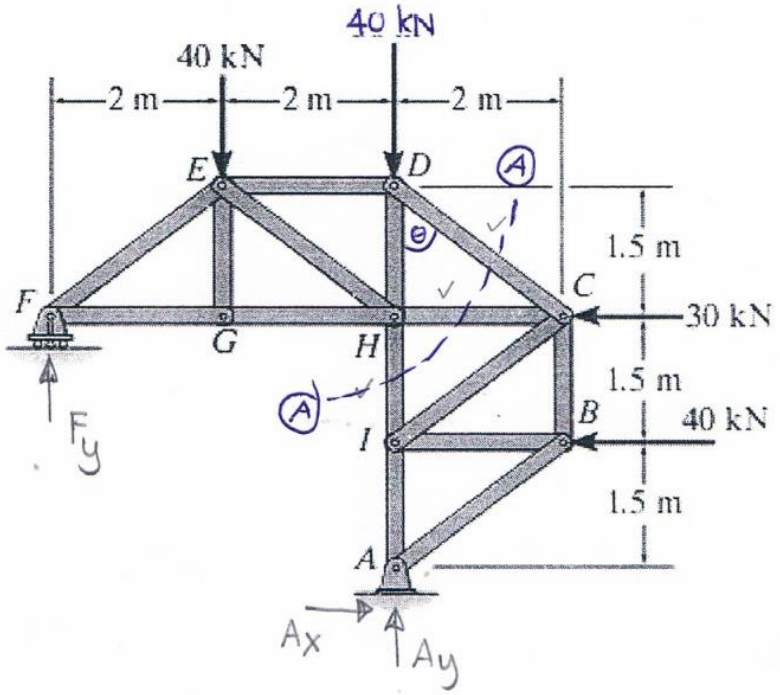
$+\uparrow \Sigma F_y = 0$: $-600 - F_{DA}\sin\theta + C_y = 0$

$-600 - \frac{3}{5}F_{DA} + 150 = 0$

$F_{DA} = -1250$ lb

$F_{DA} = 1250$ lb (C) #

11) Determine the force in members DC, HC, and HI of the truss, and state if the members are in tension or compression.

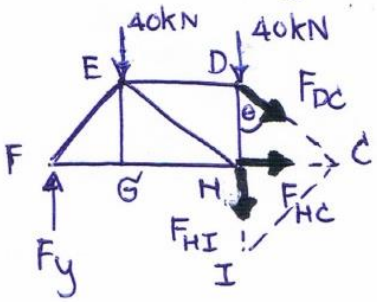


$\circlearrowleft +\ \Sigma M_A = 0$: $-F_y(4) + 40(2) + 40(1.5) + 30(3) = 0$ → $F_y = 57.5$ kN ↑

$+\uparrow\ \Sigma F_y = 0$: $F_y + A_y - 40 - 40 = 0$ → $A_y = 22.5$ kN ↑

$\overset{+}{\rightarrow}\ \Sigma F_x = 0$: $A_x - 30 - 40 = 0$ → $A_x = 70.0$ kN →

Section Ⓐ-Ⓐ



$\tan\theta = \frac{2}{1.5} \rightarrow \theta = 53.1^\circ$

$\circlearrowleft +\ \Sigma M_C = 0$: $(F_{HI} + 40)(2) + 40(4) - F_y(6) = 0$

$F_{HI} = 52.5$ kN (T) #

$+\uparrow\ \Sigma F_y = 0$: $F_y - 40 - 40 - F_{HI} - F_{DC}\cos\theta = 0$

$F_y - 80 - 52.5 - F_{DC}\cos\theta = 0$

$F_{DC} = -124.9$ kN

$F_{DC} = 124.9$ kN (C) #

$\overset{+}{\rightarrow}\ \Sigma F_x = 0$: $F_{HC} + F_{DC}\sin\theta = 0$

$F_{HC} - 124.9\sin 53.1^\circ = 0 \rightarrow F_{HC} = 100.0$ kN (T) #