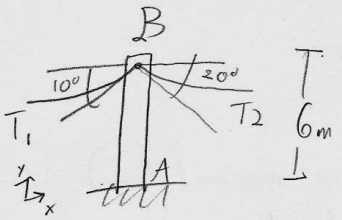
4.46



$W = 1.6\,kN$

$T_1 = .6\,kN$

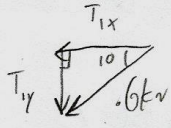
$T_2 = .375\,kN$

$\vec{A} = ?$

$\Sigma F = 0 \therefore \Sigma F_x = 0, \Sigma F_y = 0 \quad \Sigma F_z = 0$

$\Sigma M = 0$

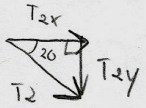
$\vec{T_1}$:



$T_{1x} = \cos 10° \cdot .6\,kN = -.5909\,kN$

$T_{1y} = \sin 10° \cdot .6\,kN = -.1042\,kN$

$\vec{T_2}$:



$T_{2x} = \cos 20° \cdot .375\,kN = .3524\,kN$

$T_{2y} = \sin 20° \cdot .375\,kN = -.1283\,kN$

$\vec{W}$:

$\vec{W} = -1.6\,kN\,\vec{j}$

pt A: A_x, A_y, M_A

$\Sigma \vec{F}_x = 0 = \vec{T}_{1x} + \vec{T}_{2x} + \vec{W}_x + \vec{A}_x$

$= -.5909 + .3524 + 0 + A_x\,kN$

$A_x = .2385\,kN$

$\Sigma \vec{F}_y = 0 = T_{1y} + T_{2y} + W_y + A_x$

$= -.1042 - .1283 - 1.6 + A_y\,kN$

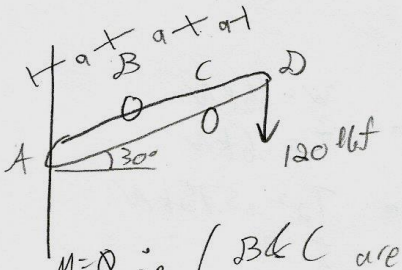
$A_y = 1.8325\,kN$

$\Sigma \vec{M}_A = 0 = -T_{2x} \cdot r + T_{1x} \cdot r + M_A$

$= -(.3524)\,kN\,(6)\,m + (.5909)\,kN\,(6)\,m + M_A$

$\vec{M}_A = -1.432\,\vec{k}\,kNm$

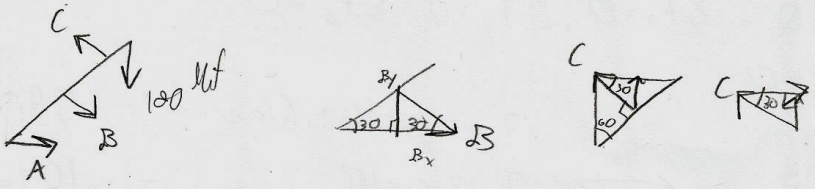
4.35



$a = 8''$

$M = 0 \therefore$ { B & C are normal ($\perp$) to the rod; A is $\perp$ to wall

FBD:



$$\sum \vec{F} = 0: \quad \sum F_x = 0 = A + \cos 30\, B - \cos 30\, C \quad (1)$$

$$\sum F_y = 0 = -120 - \sin 30\, B + \sin 30\, C \quad (2)$$

$$\sum \vec{M}_A \left(\circlearrowleft\right) = 0 = -8''B + 16''C - \underbrace{(\cos 30 \cdot 24'')}_{20.785''} D \quad (3)$$

(1) $0 = A(1) + B(.866) + C(-.866)$ lbf

(2) $120 = A(0) + B(-.5) + C(.5)$ lbf

(3) $2494.2 = A(0) + B(-8) + C(16)$ lbf-in

	A	B	C	LHS
(1)	1	.866	-.866	0
(2)	0	-.5	.5	120
(3)	0	-8	16	2494.2

$A = 207.84$ lbf

$B = -168.225$

$C = 71.775$

4.35 (cont.)

$\vec{A} = \langle 207.84, 0, 0 \rangle$ lbf

$\vec{B}$: $B_x = \cos 30 B = -145.7$

$B_y = -\sin 30 B = 84.1125$

$B_z = 0$

$\vec{B} = \langle -145.7, 84.1, 0 \rangle$ lbf

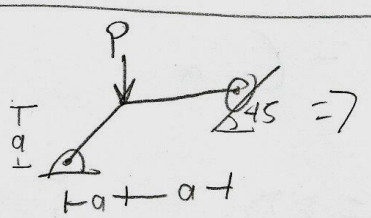
$\vec{C}$: $C_x = -\cos 30 C = -63.6$

$C_y = \sin 30 C = 35.8875$

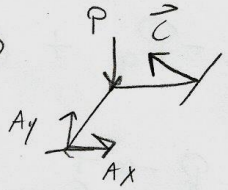
$\vec{C} = \langle -63.6, 35.9, 0 \rangle$ lbf

For Vector Decomp. see previous page

4.153 a)



$\Rightarrow$ FBD

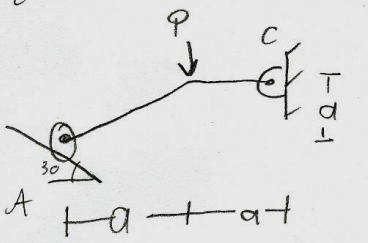


$\Sigma F_x = 0 = A_x - \cos 45 C$

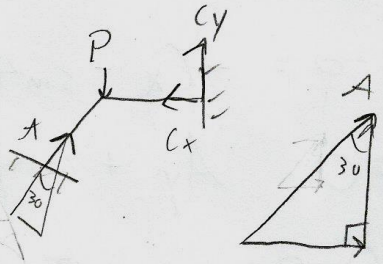
$\Sigma F_y = 0 = A_y - P + \sin 45 C$

$\Sigma \vec{M}_C \circlearrowleft = 0 = (A_x)(a) - (A_y)(2a) + P(a)$

b)



$\Rightarrow$ FBD

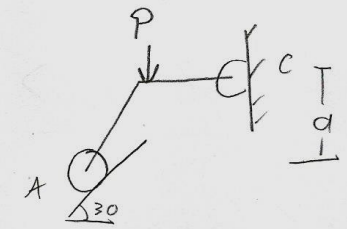


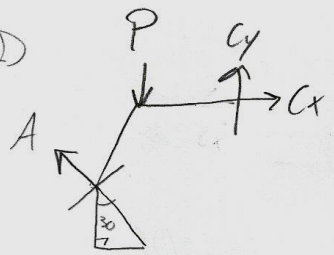
$\Sigma F_x = 0 = \sin 30 A - C_x$

$\Sigma F_y = 0 = \cos 30 A + C_y - P$

$\Sigma \vec{M}_A \circlearrowleft = 0 = -P(a) + C_x(a) + C_y(2a)$

$\vdash a + a \dashv$

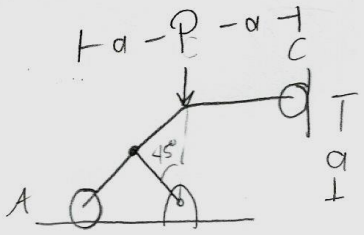
c) 

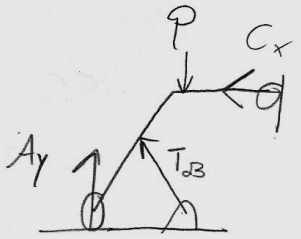
$\Rightarrow$ FBD 

$\sum \vec{F}_x = 0 = -\sin 30\, A + C_x$

$\sum \vec{F}_y = 0 = \cos 30\, A + C_y - P$

$\sum \vec{M}_A \circlearrowleft = 0 = -Pa + C_y 2a - C_x a$

d) $\vdash a - P - a \dashv$ C 

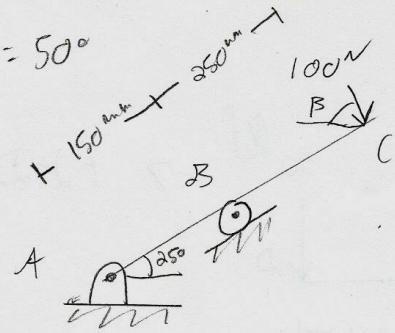
$\Rightarrow$ FBD 

$\sum \vec{F}_x = 0 = -C_x - \sin 45\, T_B$

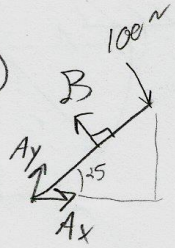
$\sum \vec{F}_y = 0 = A_y + \cos 45\, T_B - P$

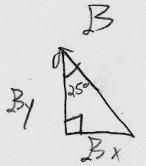
$\sum \vec{M}_A \circlearrowleft = 0 = \cos 45\, T_B (a) - Pa + C_x a$

4.149 $\beta = 50°$



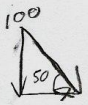
=> FBD





$B_x = \sin 25° \cdot B = -.423B\ i$

$B_y = \cos 25° B = .906B\ j$



$= \langle \cos 50 \cdot 100, -\sin 50 \cdot 100, 0 \rangle$ N

$= \langle 64.3, -76.6, 0 \rangle$ N

$\Sigma \vec{F} = 0$

$\Sigma F_x = -.423B + A_x + 64.3$ N

$\Sigma F_y = 0 = .906B + A_y - 76.6$ N

$\Sigma \vec{M}_A \overset{+}{\circlearrowleft} = 0 = (150\text{ mm})B + [-\sin 25 (150+250)\text{ mm}\ 64.3\text{ N} - \cos 25 \cdot 400\text{ mm}\ (76.6)\text{ N}]$

$150B\ \text{N mm} = 38639\ \text{N mm}$

$B = 257.6$ N

$A_x = 44.7$ N

$A_y = -156.8$ N

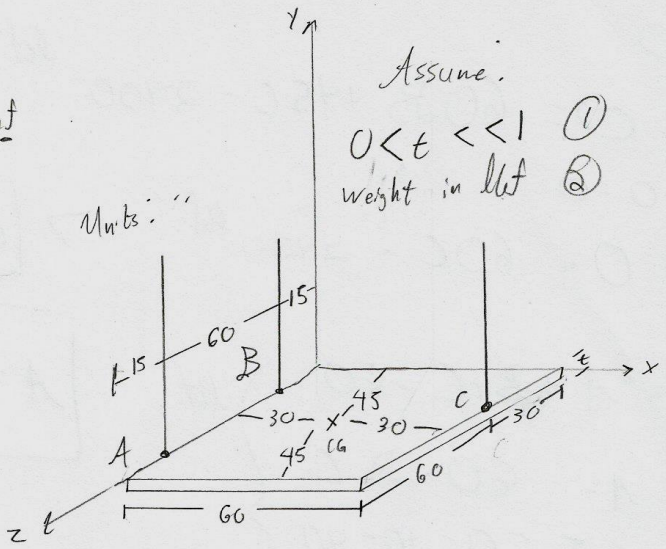
4.99

$W = 80$ lbf

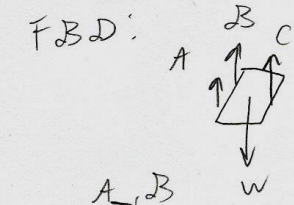
Assume:

$0 < t << 1$ ①

weight in lbf ②



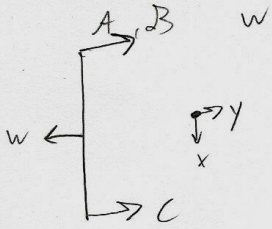
FBD:



$\Sigma \vec{F} = 0$; $\Sigma F_x = 0$

$\Sigma F_y = A + B + C - 80\ \text{lbf} = 0$

$\Sigma \vec{M}_A \circlearrowleft = 0 = \vec{M}_{B/A} + \vec{M}_{W/A} + \vec{M}_{C/A}$



$\vec{M}_{B/A}$: $\vec{r} = \langle 0, 0, -60 \rangle$

$\vec{B} = \langle 0, B, 0 \rangle$

$\vec{M}_{B/A} = \langle 60B, 0, 0 \rangle$ lbf"

$\vec{M}_{W/A}$: $\vec{r} = \langle 30, 0, -30 \rangle$

$\vec{w} = \langle 0, -80, 0 \rangle$

$\vec{M}_{W/A} = \langle -2400, 0, -2400 \rangle$ lbf"

$\vec{M}_{C/A}$: $\vec{r} = \langle 60, 0, -45 \rangle$

$\vec{C} = \langle 0, C, 0 \rangle$

$\vec{M}_{C/A} = \langle 45C, 0, 60C \rangle$ lbf"

$\Sigma \vec{M}_A = 0$

$\vec{M}_A \cdot \vec{i} = 0 = 60B + 45C - 2700$ lbf'' $\Rightarrow$ $B = 10$ lbf

$\vec{M}_A \cdot \vec{j} = 0 = 0$

$\vec{M}_A \cdot \vec{k} = 0 = 60C - 2700$ lbf'' $\Rightarrow$ $C = 40$ lbf

$\Sigma F_y = 0 = A + B + C - 80$ lbf

$A = 80 - B - C$

$= 80 - 10 - 40$

$A = 30$ lbf