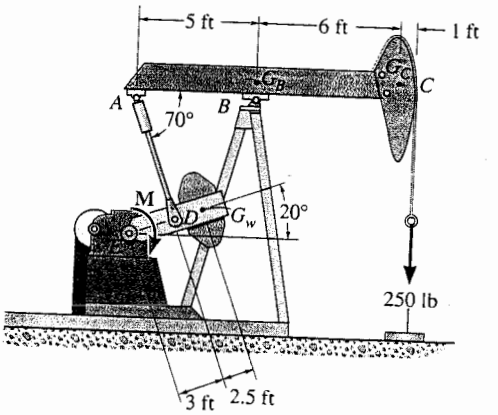
CE-201-2 (041)
H.W. # 10

Prob. 6-94 (P.-309)

Given: Forces shown in Fig.



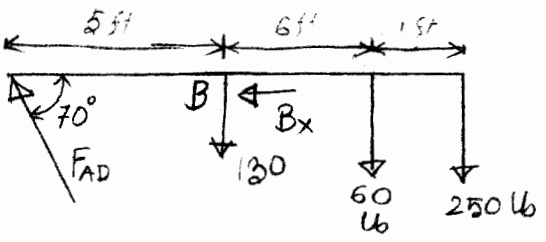
Req.d: The torque "M" exerted by the motor.

Soln:

$\Sigma M_B = 0$

$\Rightarrow 60 \times 6 + 250 \times 7 + F_{AD} * \sin 70^\circ \times 5 = 0$

$\Rightarrow F_{AD} = -449.083$ lb

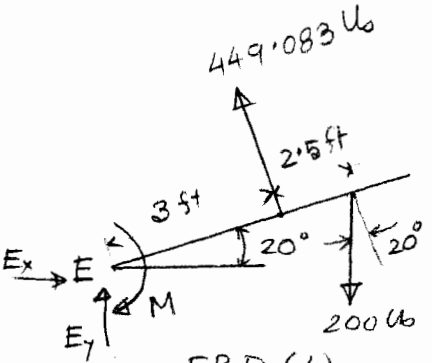


FBD (a)

$\circlearrowleft + \Sigma M_E = 0$

$\Rightarrow M + 200 \cos 20^\circ * 5.5 - 449.083 * 3 = 0$

$\Rightarrow \boxed{M = 313.59 \text{ lb.ft}}$



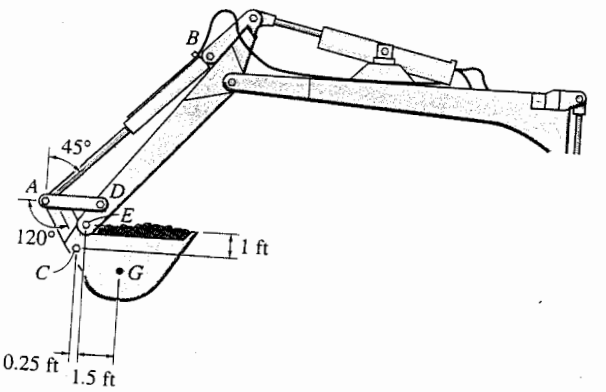
FBD (b)

Prob. 6-102 (P.-311)

Given: Forces shown in Figure.

Req.d:

F_{AB}, F_{AD} and F_{AC}.



Soln:

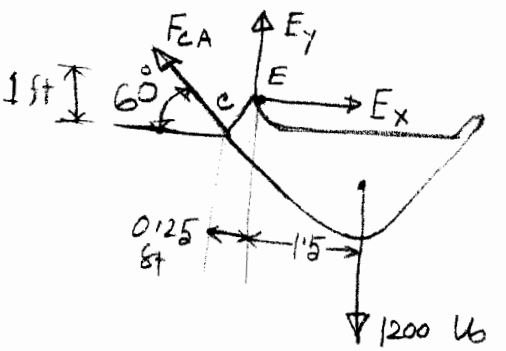
From FBD(a)

$\Sigma M_E = 0$

$F_{CA} \cos 60 * 1 + F_{CA} \sin 60 * 0.25 - 1200 * 1.5 = 0$

$\Rightarrow F_{CA} = 2512.19$ lb

$\Rightarrow \boxed{F_{CA} = 2.5122 \text{ kip}}$



FBD (a)

Taking joint "A"

$\Sigma F_y = 0$

$F_{AB} \cos 45° - 2.5122 \sin 60 = 0$

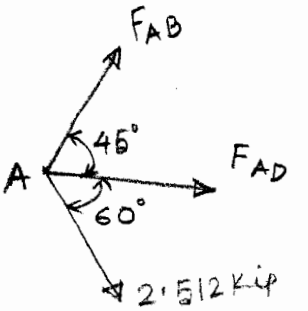
$\Rightarrow \boxed{F_{AB} = 3.0768 \text{ kip}}$

$\Sigma F_x = 0$

$\Rightarrow F_{AD} + 3.0768 * \cos 45 + 2.5122 * \cos 60° = 0$

$\Rightarrow F_{AD} = -3.4317$ kip

$\boxed{F_{DA} = 3.4317 \text{ kip}}$



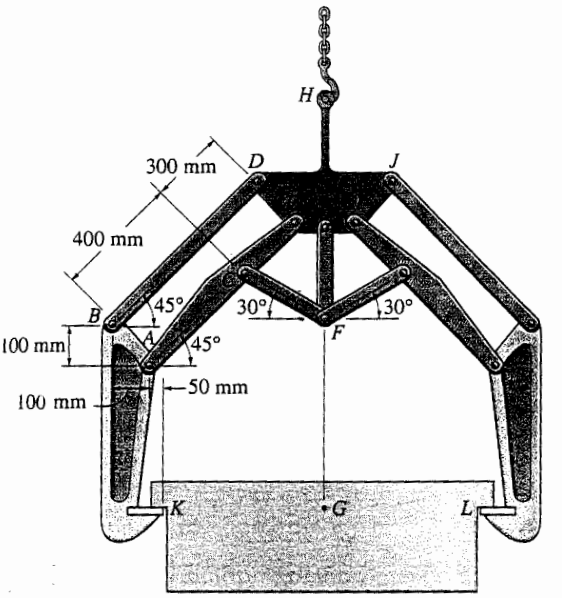
FBD (b)

Prob. 6-107 (P. - 313)

Given: The forces shown in Fig

Req. d:

Horizontal and vertical components of force on Plate DEIJH at D and E.



Soln:

From FBD (a)

$E_y = 400\ kg = 400 * \frac{9.81}{1000}\ kN$

$E_y = 3.924\ kN$

From FBD (a)

$\Sigma M_A = 0$

$3.924 * 50 + F_{BD} \sin 45 * 100 + F_{BD} * \cos 45 * 100 = 0$

$\Rightarrow F_{BD} = -1.3873\ kN$

$\Sigma F_x = 0$

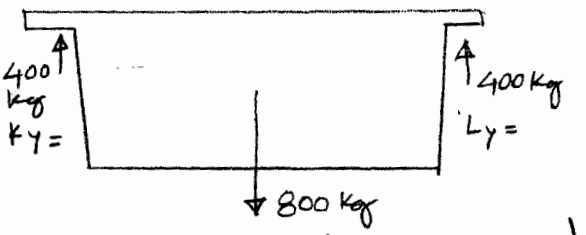
$A_x - 1.387 * \sin 45 = 0$

$\therefore A_x = 0.981\ kN$

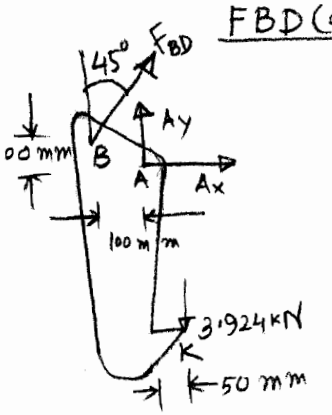
$\Sigma F_y = 0$

$\Rightarrow A_y - 1.387 \cos 45 - 3.924 = 0$

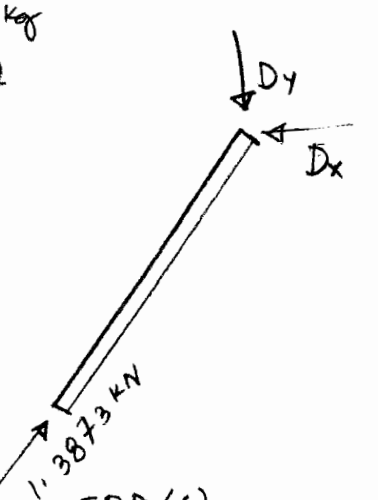
$\Rightarrow A_y = 4.905\ kN$



FBD (a)



FBD (b)



FBD (c)

From FBD (c)

$\Sigma F_x = 0 \Rightarrow D_x = 1.3873 \cos 45$

$\Rightarrow \boxed{D_x = 0.981\ kN}$

$\Sigma F_y = 0 \Rightarrow \boxed{D_y = 0.981\ kN}$

From FBD (d)

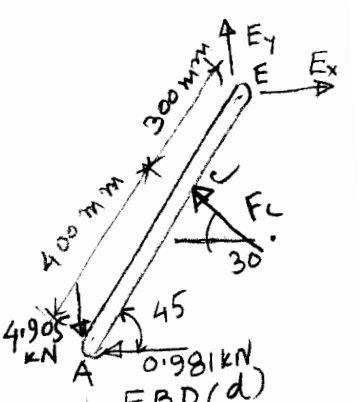
$\Sigma M_C = 0 \Rightarrow .981 \sin 45 * 400 - 4.905 \sin 45 * 400 + E_x \cos 45 * 300 - E_y \cos 45 * 300 = 0$

$\Rightarrow E_x - E_y = 5.232 \cdots (1)$

$\Sigma F_x = 0 \Rightarrow -0.981 + E_x - F_C \cos 30^\circ = 0 \quad (2)$

$\Sigma F_y = 0 \Rightarrow F_y - 4.9 + F_C \sin 30^\circ = 0 \cdots (3)$

Solving (1), (2) & (3) $\boxed{E_x = 6.79\ kN}$, $\boxed{E_y = 1.55\ kN}$

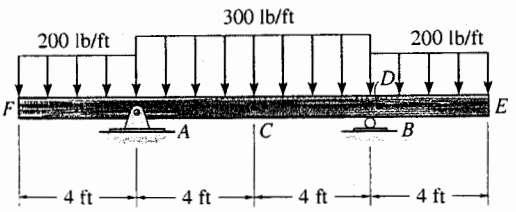


FBD (d)

Prob. 7-13 (P.-335)

Given:

Forces are shown in Fig.

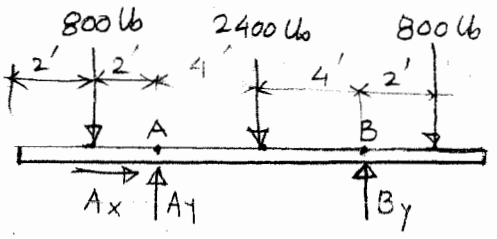


Prob. 7–13

Req.d:

The internal normal force, shear force, and moment at C and D.

Soln:



FBD (a)

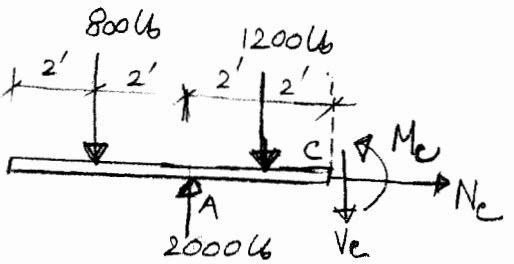
From FBD (a)

$A_y = B_y = \frac{800+2400+800}{2}$

$= 2000$ lb (Symetry)

$A_x = 0$

From FBD (b)



FBD (b)

$\Sigma F_y = 0$

$\Rightarrow 2000 - V_c - 800 + 1200 = 0$

$\Rightarrow \boxed{V_c = 0}$

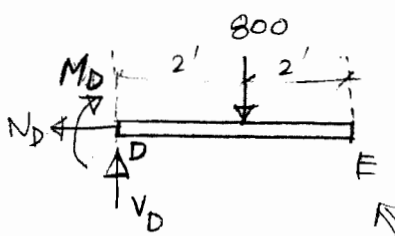
$\Sigma F_x = 0 \Rightarrow \boxed{N_c = 0}$

$(+\circlearrowleft) \Sigma M_c = 0$

$\Rightarrow -M_c + 2000 \times 4 - 800 \times 6 - 1200 \times 2 = 0$

$\Rightarrow \boxed{M_c = 800 \text{ lb-ft}}$

From FBD (c)



FBD (c)

$\Sigma F_y = 0$

$\Rightarrow V_D - 800 = 0 \therefore \boxed{V_D = 800 \text{ lb}}$

$\Sigma F_x = 0$

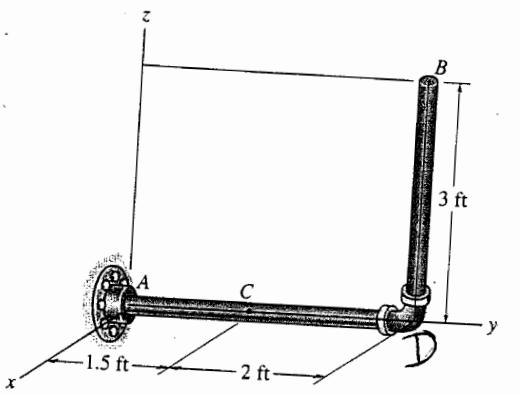
$\boxed{N_D = 0}$

$(+\circlearrowleft) \Sigma M_D = 0 \Rightarrow 800 \times 2 + M_D = 0 \therefore \boxed{M_D = 1600 \text{ lb-ft}}$

You can take the left part

Prob. 7-40 (P- 339)

Given: Forces shown in Fig.
$F_1 = \{-24i - 10k\}$ lb and $M = \{-30k\}$ lb-ft at B and $F_2 = \{-80i\}$ lb at D.



Prob. 7–40

Req.d:

x, y, z components of force and moment at C.

Soln:

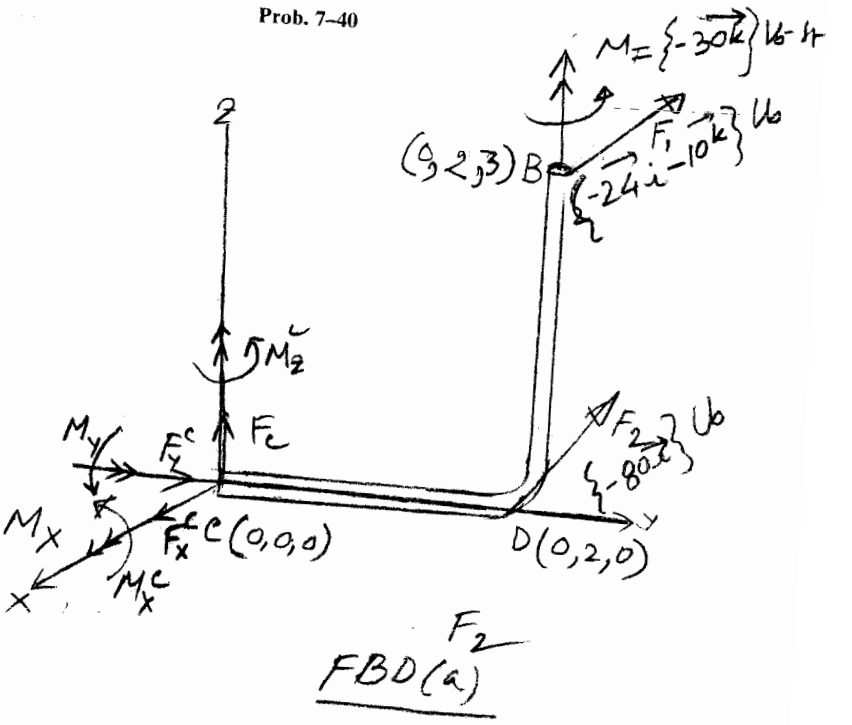
From FBD(a)

$\sum \vec{F} = 0$

$\Rightarrow \vec{F_1} + \vec{F_2} + \vec{F_c} = 0$

$\Rightarrow -24\vec{i} - 10\vec{k} - 80\vec{i} + \vec{F_c} = 0$

$\Rightarrow \boxed{\vec{F_c} = \{104\vec{i} + 10\vec{k}\}\ lb}$



FBD(a)

$\sum M_C = 0$

$\Rightarrow \vec{M_C} + \vec{M} + \vec{r}_{CB} \times \vec{F_1} + \vec{r}_{CD} \times \vec{F_2} = 0$

$\Rightarrow \vec{M_C} + \{-30\vec{k}\} + \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & 2 & 3 \\ -24 & 0 & -10 \end{vmatrix} + \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & 2 & 0 \\ -80 & 0 & 0 \end{vmatrix} = 0$

$\Rightarrow \vec{M_C} - 30\vec{k} + \vec{i}(-20) - \vec{j}(72) + \vec{k}(48) + \vec{i}(0) + \vec{j}(0) + \vec{k}(160) = 0$

$\Rightarrow \vec{M_C} - 30\vec{k} - 20\vec{i} - 72\vec{j} + 48\vec{k} + 160\vec{k} = 0$

$\Rightarrow \boxed{\vec{M_C} = \{20\vec{i} + 72\vec{j} - 178\vec{k}\}\ lb\cdot ft}$

$\boxed{M_{Cx} = 20\ lb.ft}$ $\boxed{M_{Cy} = 72\ lb.ft}$ $\boxed{M_{Cz} = -178\ lb\text{-}ft}$