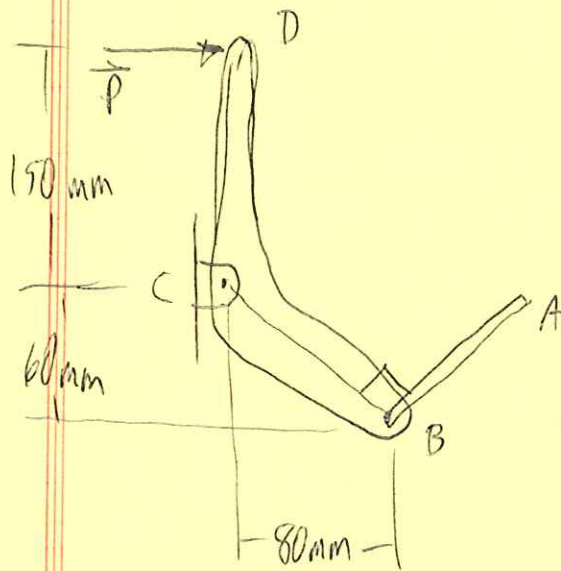
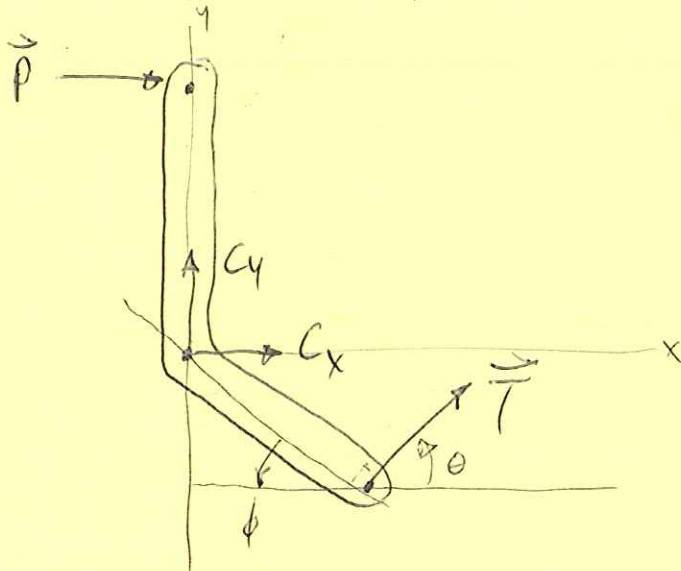


PROB. 4.20



FIND \vec{P} IF $|\vec{C}| = 1000 \text{ N}$

FREE-BODY DIAGRAM:



$$\phi = \text{TAN}^{-1}\left(\frac{60}{80}\right) = 36.9^\circ$$

$$\theta = 90^\circ - \phi = 53.1^\circ$$

FIND POSITION VECTORS:

$$\vec{r}_P = (150)\hat{j} \text{ mm}$$

PROB. 4.20 CONT

$$\vec{r}_T = (80)\hat{i} + (-60)\hat{j} \text{ mm}$$

FIND FORCES:

$$\vec{P} = (P)\hat{i} \text{ N}$$

$$\vec{C} = (C_x)\hat{i} + (C_y)\hat{j} \text{ N}$$

$$\vec{T} = (T \cos 53.1^\circ)\hat{i} + (T \sin 53.1^\circ)\hat{j} \text{ N}$$

$$\vec{T} = (0.6T)\hat{i} + (0.8T)\hat{j} \text{ N}$$

$$\underline{\Sigma M_c = 0}$$

$$\vec{r}_P \times \vec{P} + \vec{r}_T \times \vec{T} = 0$$

$$\vec{M}_1 = \vec{r}_P \times \vec{P} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 150 & 0 \\ P & 0 & 0 \end{vmatrix}$$

$$\vec{M}_1 = (-150P)\hat{k} \text{ N-mm}$$

$$\vec{M}_2 = \vec{r}_T \times \vec{T} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 80 & -60 & 0 \\ 0.6T & 0.8T & 0 \end{vmatrix}$$

$$\vec{M}_2 = (100T)\hat{k}$$

PROB. 4.20 CONT.

$$(-150 P) + (100 T) = 0$$

$$T = 1.5 P \quad \text{EQN. (1)}$$

$$\underline{\Sigma F_x = 0}$$

$$(P) + (C_x) + (0.6T) = 0$$

$$C_x = -P - 0.6(1.5P)$$

$$C_x = -1.9P \quad \text{EQN. (2)}$$

$$\underline{\Sigma F_y = 0}$$

$$(C_y) + (0.8T) = 0$$

$$C_y = -0.8(1.5P)$$

$$C_y = -1.2P \quad \text{EQN. (3)}$$

FROM $|\vec{C}| = 1000 \text{ N}$,

$$\sqrt{C_x^2 + C_y^2} = 1000$$

$$C_x^2 + C_y^2 = 10^6$$

$$(-1.9P)^2 + (-1.2P)^2 = 10^6$$



PROB. 4.20 CONT.

$$5.05 P^2 = 10^6$$

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$$P = 445 \text{ N}$$

$$C_x = -1.9(445 \text{ N})$$

~~$$C_x = -845 \text{ N}$$~~

~~$$C_y = -1.2(445 \text{ N})$$~~

~~$$C_y = -534 \text{ N}$$~~