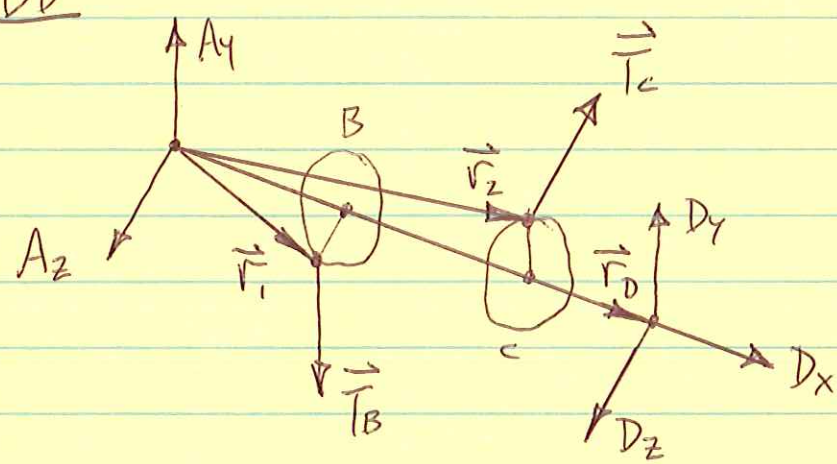
PROB. 4.92

$R_B = 30^{mm}$, $R_C = 50^{mm}$, $T_B = 80^{N}$, FIND $\vec{A}$ AND $\vec{D}$. ASSUME $A_x = 0$.

FBD



EQUILIBRIUM EQNS.: $\Sigma \vec{F}_x = 0$, $\Sigma \vec{M}_A = 0$

LOCATE POINTS: POINT 1: $(90, 0, 30)^{mm}$,

POINT 2: $(210, 50, 0)^{mm}$, POINT D: $(300, 0, 0)^{mm}$

$\vec{r}_1 = (90)\hat{i} + (30)\hat{k}$ mm

$\vec{r}_2 = (210)\hat{i} + (50)\hat{j}$ mm, $\vec{r}_D = (300)\hat{i}$ mm

$\vec{T}_B = (-80)\hat{j}$ N, $\vec{T}_C = (-T_C)\hat{k}$ N

PROB. 4.92 CONT.

$\vec{A} = (A_y)\hat{j} + (A_z)\hat{k}$ N

$\vec{D} = (D_x)\hat{i} + (D_y)\hat{j} + (D_z)\hat{k}$ N

$\Sigma F_x = 0: \quad D_x = 0$ ①

$\Sigma F_y = 0: \quad -80 + A_y + D_y = 0 \Rightarrow A_y = 80 - D_y$ ②

$\Sigma F_z = 0: \quad -T_C + A_z + D_z = 0 \Rightarrow A_z = -D_z + T_C$ ③

$\Sigma \vec{M}_A = 0: \quad \vec{M}_1 + \vec{M}_2 + \vec{M}_3 = 0$

$$\vec{M}_1 = \vec{r}_1 \times \vec{T}_B = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 90 & 0 & 30 \\ 0 & -80 & 0 \end{vmatrix}$$

$\vec{M}_1 = [0 - (30)(-80)]\hat{i} - (0)\hat{j} + [(90)(-80) - 0]\hat{k}$

$\vec{M}_1 = (2400)\hat{i} + (-7200)\hat{k}$ N·mm

$$\vec{M}_2 = \vec{r}_2 \times \vec{T}_C = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 210 & 50 & 0 \\ 0 & 0 & -T_C \end{vmatrix}$$

$\vec{M}_2 = [(50)(-T_C) - 0]\hat{i} - [(210)(-T_C) - 0]\hat{j}$

$+ [0]\hat{k}$

PROB. 4.92 CONT.

$$\vec{M}_2 = (-50T_c)\hat{i} + (210T_c)\hat{j} \quad N\cdot mm$$

$$\vec{M}_3 = \vec{r}_D \times \vec{D} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 300 & 0 & 0 \\ 0 & D_y & D_z \end{vmatrix}$$

$$\vec{M}_3 = (0)\hat{i} - [(300)D_z - 0]\hat{j} + [(300)D_y - 0]\hat{k}$$

$$\vec{M}_3 = (-300D_z)\hat{j} + (300D_y)\hat{k} \quad N\cdot mm$$

$$\Sigma M_x = 0: \quad 2400 - 50T_c = 0 \Rightarrow T_c = 48^N \quad (4)$$

$$\Sigma M_y = 0: \quad 210T_c - 300D_z = 0$$

$$\underline{D_z} = \left(\frac{210}{300}\right)(48) = \underline{33.6^N} \quad (5)$$

$$\Sigma M_z = 0: \quad -7200 + 300D_y = 0 \Rightarrow \underline{D_y = 24^N}$$

$$(2): \quad \underline{A_y} = 80 - D_y = 80 - (24) = \underline{56^N}$$

$$(3): \quad \underline{A_z} = -D_z + T_c = -(33.6) + (48) = \underline{14.4^N}$$

$$\underline{\vec{A} = (56)\hat{j} + (14.4)\hat{k}^N, \quad \vec{D} = (24)\hat{j} + (33.6)\hat{k}^N}$$