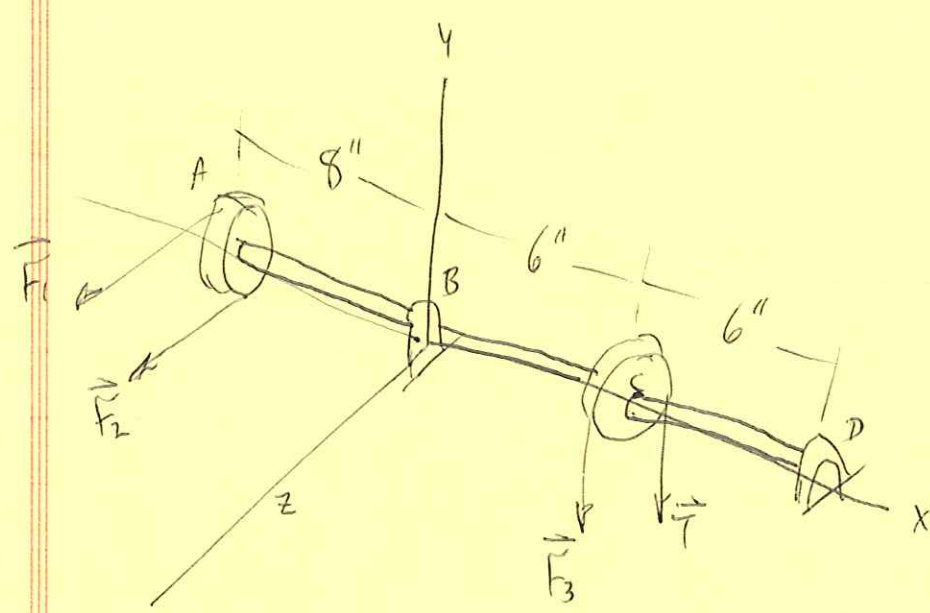


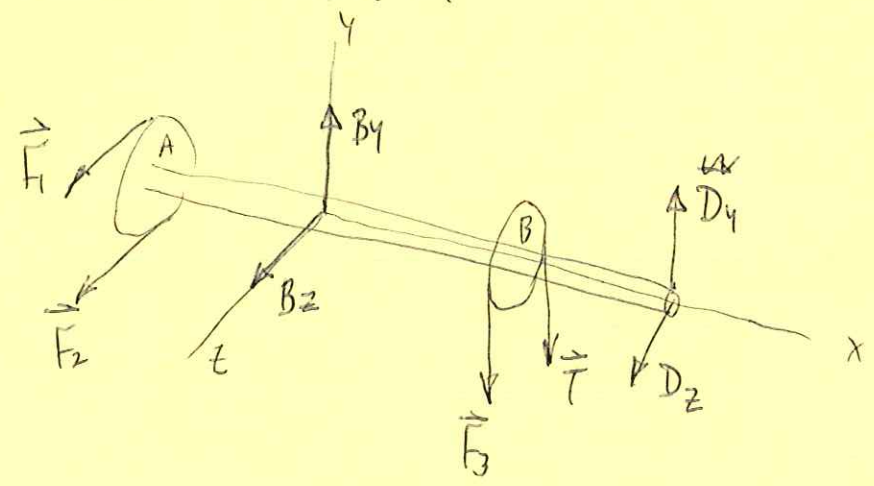
EXAMPLE PROB. 4.93



$F_A = 2.5 \text{ IN}$, $F_C = 2 \text{ IN}$

FIND $|\vec{T}|$, REACTIONS AT B AND D

FREE-BODY DIAGRAM:



FIND POSITION VECTORS:

$\vec{r}_1 = (-8)\hat{i} + (2.5)\hat{j} \text{ IN}$

$$\vec{r}_2 = (-8)\hat{i} + (-2.5)\hat{j} \text{ IN}$$

$$\vec{r}_3 = (6)\hat{i} + (2)\hat{k} \text{ IN}$$

$$\vec{r}_T = (6)\hat{i} + (-2)\hat{k} \text{ IN}$$

~~$$\vec{r}_B =$$~~
$$\vec{r}_D = (12)\hat{i} \text{ IN}$$

FIND FORCES:

$$\vec{F}_1 = (24)\hat{k} \text{ LB}$$

$$\vec{F}_2 = (18)\hat{k} \text{ LB}$$

$$\vec{F}_3 = (-30)\hat{j} \text{ LB}$$

$$\vec{T} = (-T)\hat{j} \text{ LB}$$

$$\vec{B} = (B_y)\hat{j} + (B_z)\hat{k} \text{ LB}$$

$$\vec{D} = (D_y)\hat{j} + (D_z)\hat{k} \text{ LB}$$

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

$$(-30) + (-T) + (B_y) + (D_y) = 0 \quad \text{EQN. (1)}$$

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

$$(24) + (18) + (B_z) + (D_z) = 0$$

$$B_z + D_z = -42 \quad \text{EQU. (2)}$$

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

NO DATA

$$\underline{\Sigma \vec{M}_B = 0}$$

$$\vec{r}_1 \times \vec{F}_1 + \vec{r}_2 \times \vec{F}_2 + \vec{r}_3 \times \vec{F}_3 + \vec{r}_T \times \vec{T} + \vec{r}_D \times \vec{D} = 0$$

$$\vec{M}_1 = \vec{r}_1 \times \vec{F}_1 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -8 & 2.5 & 0 \\ 0 & 0 & 24 \end{vmatrix}$$

$$\vec{M}_1 = [(2.5)(24)]\hat{i} - [(-8)(24)]\hat{j}$$

$$\vec{M}_1 = (60)\hat{i} + (192)\hat{j} \quad \text{N-LB}$$

$$\vec{M}_2 = \vec{r}_2 \times \vec{F}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -8 & -2.5 & 0 \\ 0 & 0 & 18 \end{vmatrix}$$

$$\vec{M}_2 = [(-2.5)(18)]\hat{i} - [(-8)(18)]\hat{j} \quad \text{N-LB}$$

$$\vec{M}_2 = (-45)\hat{i} + (144)\hat{j} \quad \text{IN-LB}$$

$$\vec{M}_3 = \vec{r}_3 \times \vec{F}_3 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 6 & 0 & z \\ 0 & -30 & 0 \end{vmatrix}$$

$$\vec{M}_3 = [0 - (z)(-30)]\hat{i} - [0]\hat{j} + [(6)(-30)]\hat{k}$$

$$\vec{M}_3 = (60z)\hat{i} + (-180)\hat{k} \quad \text{IN-LB}$$

$$\vec{M}_4 = \vec{r}_7 \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 6 & 0 & -z \\ 0 & -7 & 0 \end{vmatrix}$$

$$\vec{M}_4 = [0 - (-z)(-7)]\hat{i} - [0]\hat{j} + [(6)(-7)]\hat{k}$$

$$\vec{M}_4 = (-21)\hat{i} + (-67)\hat{k} \quad \text{IN-LB}$$

$$\vec{M}_5 = \vec{r}_D \times \vec{D} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 12 & 0 & 0 \\ 0 & D_y & D_z \end{vmatrix}$$

$$\vec{M}_5 = (0)\hat{i} - [(12)(D_z)]\hat{j} + [(12)(D_y)]\hat{k}$$

$$\vec{M}_5 = (-12D_z)\hat{j} + (12D_y)\hat{k} \quad \text{IN-LB}$$

PROB. 4.93 CONT.

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

$$(60) + (-45) + (60) + (-2T) = 0$$

$$\boxed{T = 37.5 \text{ LB}}$$

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

$$(192) + (144) + (-12 D_z) = 0$$

$$\boxed{D_z = 28 \text{ LB}}$$

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

$$(-180) + (-6T) + (12 D_y) = 0$$

$$\boxed{D_y = 33.7 \text{ LB}}$$

EQN. (1) :

$$B_y = 30 + T - D_y = 30 + 37.5 - 33.7$$

$$\boxed{B_y = 33.8 \text{ LB}}$$

EQN. (2) :

$$B_z = -42 - D_z = -42 - 28$$

PROB. 4.93 CONT.

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$$B_z = -70 \text{ LB}$$

$$\vec{B} = (33.8)\hat{j} + (-70)\hat{k} \text{ LB}$$
$$\vec{D} = (33.7)\hat{j} + (28)\hat{k} \text{ LB}$$
$$\vec{T} = (-37.5)\hat{j} \text{ LB}$$