

3.4.

$$(a) F_x = 300 \cos 25^\circ = 271.8 \text{ N}$$

$$F_y = 300 \sin 25^\circ = 126.78 \text{ N}$$

$$M_B = 271.8 \times 0.2 - 126.78 \times 0.1$$

$$= 41.70 \text{ N}\cdot\text{m}$$

$$(b) F = \frac{M_B}{D_{1B}} = \frac{41.70}{0.2 \sin 25^\circ} = 147.45 \text{ N}$$

$$\vec{F}_{AE} = \vec{F} \cdot \vec{AE} = 315\vec{i} - 240\vec{j} + 180\vec{k}$$

$$\vec{M}_O = \vec{r}_{O/A} \times \vec{F}_{AE}$$

$$= \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -0.09 & 0.16 & 0 \\ 315 & -240 & 180 \end{vmatrix}$$

$$= 216\vec{i} + 16\vec{j} - 216\vec{k}$$

3.11.

$$\vec{CB} = 12\vec{i} - 2.33\vec{j}$$

$$|\vec{CB}| = \sqrt{12^2 + 2.33^2} = 12.22 \text{ in}$$

$$\vec{T}_{CB} = \vec{F} \cdot \lambda_{CB} = 125 \frac{12\vec{i} - 2.33\vec{j}}{12.22}$$

$$= 122.75\vec{i} - 23.83\vec{j}$$

$$\vec{r}_{A/B} = 15.3\vec{i} - 14.33\vec{j}$$

$$\vec{M}_A = \vec{r}_{A/B} \times \vec{T}_{CB}$$

$$= (1394.41 \text{ lb}\cdot\text{in}) \vec{k}$$

(b) According to symmetry:

$$\vec{M}_O = -216\vec{i} - 16\vec{j} + 216\vec{k}$$

$$3.3] \cos \theta = \frac{\vec{AB} \cdot \vec{AO}}{|\vec{AB}| |\vec{AO}|}$$

$$= \frac{(450\vec{i} + 600\vec{j}) \cdot (-500\vec{i} + 600\vec{j} + 360\vec{k})}{750 \times 860}$$

$$= 0.21$$

$$\theta = 78^\circ$$

3.24.

$$(a) \vec{AE} = 0.21\vec{i} - 0.16\vec{j} + 0.12\vec{k}$$

$$|\vec{AE}| = \sqrt{0.21^2 + 0.16^2 + 0.12^2}$$

$$= 0.3 \text{ m}$$

$$3.77. M_{16} = -16 \times 30 \vec{k} = -480 \vec{k}$$

$$M_{40} = 17\vec{i} + 53\vec{j} + 268\vec{k}$$

$$M_{20} = 30 \times 20 \vec{j} = 600 \vec{j}$$

$$M_T = M_{16} + M_{40} + M_{20} = 17\vec{i} + 113\vec{j} - 212\vec{k}$$

$$|M_T| = \sqrt{17^2 + 113^2 + 212^2} = 242.6 \text{ lb}\cdot\text{in}$$

$$\theta_1 = 81^\circ \quad \theta_2 = 14^\circ \quad \theta_3 = 100^\circ$$

3.97.

$$\vec{r}_{AJ} = (63, 0, 25) - (45, 14, 28) \\ = (18, -14, -3)$$

$$|\vec{r}_{AJ}| = \sqrt{18^2 + 14^2 + 3^2} = 23$$

$$\hat{r}_{AJ} = \frac{\vec{r}_{AJ}}{|\vec{r}_{AJ}|} = \left(-\frac{18}{23}, -\frac{14}{23}, -\frac{3}{23}\right)$$

$$\vec{F}_{AJ} = 4616 \left(-\frac{18}{23}, -\frac{14}{23}, -\frac{3}{23}\right)$$

$$= 36\vec{i} - 28\vec{j} - 3\vec{k}$$

$$\vec{F}_{AC} = \vec{F}_C - \vec{F}_A$$

$$= (0, 14, 0) - (45, 14, 28)$$

$$= (-45, 0, -28)$$

$$|\vec{F}_{AC}| = \sqrt{45^2 + 28^2} = 53$$

$$\hat{r}_{AC} = \frac{\vec{F}_{AC}}{|\vec{F}_{AC}|} = \left(-\frac{45}{53}, 0, -\frac{28}{53}\right)$$

$$\vec{F}_A = 2120 \cdot \left(-\frac{45}{53}, 0, -\frac{28}{53}\right)$$

$$= -180\vec{i} - 112\vec{k}$$

$$\vec{F}_{AH} = \vec{F}_A - \vec{F}_H = (45, 14, 0)$$

$$\vec{M}_A = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 45 & 14 & 0 \\ 36 & -28 & -6 \end{vmatrix}$$

$$= -84\vec{i} + 27\vec{j} - 1764\vec{k}$$

$$\vec{M}_H = \vec{M} + \vec{M}_A = -1884\vec{i} + 27\vec{j} - 2884\vec{k}$$

4.11.

$$2.75A - 2.25B + 1.5P - 0.75Q = 0 \\ \Rightarrow Q = 37.5 - 3B$$

$$0.5A - 0.75P + 2.25D - 3Q = 0$$

$$\Rightarrow Q = 0.75D$$

$$\therefore 0 \leq B \leq 12, 0 \leq D \leq 12$$

$$\therefore 1.5 \text{ kN} \leq Q \leq 37.5 \text{ kN}$$

$$0 \leq Q \leq P \text{ kN}$$

$$\therefore 1.5 \text{ kN} \leq Q \leq P \text{ kN}$$

$$4.1P \text{ (a) } \begin{matrix} \text{for C:} \\ T_x \times 0.18 - 240 \times 4 - 240 \times 0.8 = 0 \\ \Rightarrow T_x = 1600 \text{ N} \end{matrix}$$

$$T_y = \frac{0.48}{0.24} T_x = 1200 \text{ N}$$

$$\therefore T = \sqrt{T_x^2 + T_y^2} = 2000 \text{ N}$$

$$(b) C_x = T_x = 1600 \text{ N} \rightarrow$$

$$C_y - T_y - 240 - 240 = 0$$

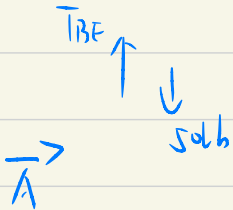
$$\Rightarrow C_y = 1680 \text{ N} \uparrow$$

$$Q = 46.4^\circ$$

$$C = \sqrt{C_x^2 + C_y^2} = 2320 \text{ N}$$

4.36.

← D



$$A = 10$$

$$T_{BE} = 50 \text{ lb}$$

$$8A - 50 \times 3 = 0$$

$$\Rightarrow A = 18.75 \text{ lb}$$

$$D = 18.75 \text{ lb}$$

4.P7.

$$\begin{aligned} M_{B'} = 0: & \left[r_{G/B'} \times T_c \right]_z + \left[r_{A/B'} \times T_A \right]_z \\ & + \left[r_{B/B'} \times T_B \right]_z + \left[r_{G/B'} \times T_j \right]_z = 0 \\ \Rightarrow & \left(2T_c + 10T_A + 50 \right)_z \\ & + \left(20T_A + 4T_c + 4T_B \right)_z = 0 \end{aligned}$$

$$\Rightarrow \begin{cases} 2T_c + T_A = -56 \\ 5T_A + T_B + T_c = -140 \\ T_A + T_B + T_c = 56 \end{cases}$$

$$\Rightarrow \begin{cases} T_A = 21 \text{ lb} \\ T_B = 73.5 \text{ lb} \\ T_c = -38.5 \text{ lb} \end{cases}$$