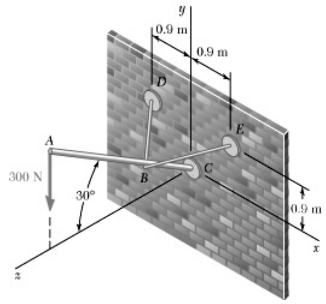
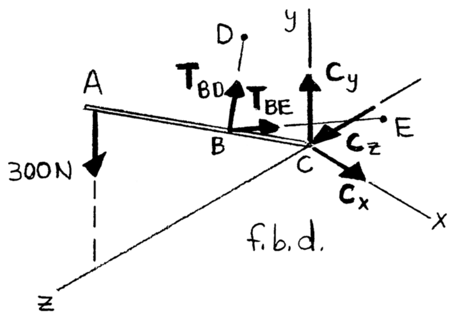


PROBLEM 4.112

The 3-m flagpole *AC* forms an angle of 30° with the *z* axis. It is held by a ball-and-socket joint at *C* and by two thin braces *BD* and *BE*. Knowing that the distance *BC* is 0.9 m, determine the tension in each brace and the reaction at *C*.

SOLUTION



T_{BE} can be found from ΣM about line *CE*

From f.b.d. of flagpole

$$\Sigma M_{CE} = 0: \quad \lambda_{CE} \cdot \left(\mathbf{r}_{B/C} \times \mathbf{T}_{BD}\right) + \lambda_{CE} \cdot \left(\mathbf{r}_{A/C} \times \mathbf{F}_A\right) = 0$$

where $$\lambda_{CE} = \frac{(0.9\text{ m})\mathbf{i} + (0.9\text{ m})\mathbf{j}}{\sqrt{(0.9)^2 + (0.9)^2}\text{ m}} = \frac{1}{\sqrt{2}}(\mathbf{i} + \mathbf{j})$$

$$\mathbf{r}_{B/C} = \left[(0.9\text{ m})\sin 30^{\circ}\right]\mathbf{j} + \left[(0.9\text{ m})\cos 30^{\circ}\right]\mathbf{k}$$

$$= (0.45\text{ m})\mathbf{j} + (0.77942\text{ m})\mathbf{k}$$

$$\mathbf{T}_{BD} = \lambda_{BD}T_{BD} = \left\{\frac{-(0.9\text{ m})\mathbf{i} + \left[0.9\text{ m} - (0.9\text{ m})\sin 30^{\circ}\right]\mathbf{j} - \left[(0.9\text{ m})\cos 30^{\circ}\right]\mathbf{k}}{\sqrt{(0.9)^2 + (0.45)^2 + (0.77942)^2}\text{ m}}\right\}T_{BD}$$

$$= \left[-(0.9\text{ m})\mathbf{i} + (0.45\text{ m})\mathbf{j} - (0.77942\text{ m})\mathbf{k}\right]\frac{T_{BD}}{\sqrt{1.62}}$$

$$= (-0.70711\mathbf{i} + 0.35355\mathbf{j} - 0.61237\mathbf{k})T_{BD}$$

$$\mathbf{r}_{A/C} = (3\text{ m})\sin 30^{\circ}\mathbf{j} + (3\text{ m})\cos 30^{\circ}\mathbf{k} = (1.5\text{ m})\mathbf{j} + (2.5981\text{ m})\mathbf{k}$$

$$\mathbf{F}_A = -(300\text{ N})\mathbf{j}$$

$$\therefore \begin{vmatrix} 1 & 1 & 0 \\ 0 & 0.45 & 0.77942 \\ -0.70711 & 0.35355 & -0.61237 \end{vmatrix}\left(\frac{T_{BD}}{\sqrt{2}}\right) + \begin{vmatrix} 1 & 1 & 0 \\ 0 & 1.5 & 2.5981 \\ 0 & -300 & 0 \end{vmatrix}\left(\frac{1}{\sqrt{2}}\right) = 0$$

PROBLEM 4.112 CONTINUED

or $$-1.10227T_{BD} + 779.43 = 0$$

$$\therefore \quad T_{BD} = 707.12 \text{ N} \qquad \text{or } T_{BD} = 707 \text{ N} \blacktriangleleft$$

Based on symmetry with *yz*-plane, $T_{BE} = T_{BD} = 707.12 \text{ N}$ or $T_{BE} = 707 \text{ N} \blacktriangleleft$

The reaction forces at C are found from $\Sigma\mathbf{F} = 0$

$$\Sigma F_x = 0: \quad -\left(T_{BD}\right)_x + \left(T_{BE}\right)_x + C_x = 0 \qquad \text{or} \qquad C_x = 0$$

$$\Sigma F_y = 0: \quad \left(T_{BD}\right)_y + \left(T_{BE}\right)_y + C_y - 300 \text{ N} = 0$$

$$C_y = 300 \text{ N} - 2(0.35355)(707.12 \text{ N})$$

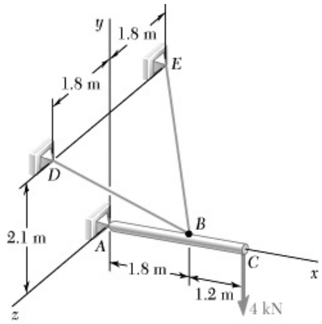
$$\therefore \quad C_y = -200.00 \text{ N}$$

$$\Sigma F_z = 0: \quad C_z - \left(T_{BD}\right)_z - \left(T_{BE}\right)_z = 0$$

$$C_z = 2(0.61237)(707.12 \text{ N})$$

$$\therefore \quad C_z = 866.04 \text{ N}$$

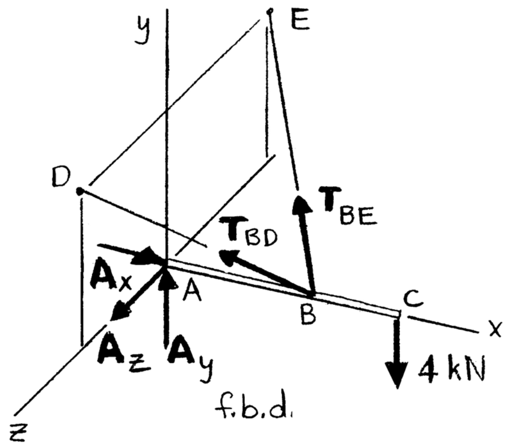
$$\text{or } \mathbf{C} = -(200 \text{ N})\mathbf{j} + (866 \text{ N})\mathbf{k} \blacktriangleleft$$



PROBLEM 4.113

A 3-m boom is acted upon by the 4-kN force shown. Determine the tension in each cable and the reaction at the ball-and-socket joint at *A*.

SOLUTION



From f.b.d. of boom

$$\Sigma M_{AE} = 0: \quad \boldsymbol{\lambda}_{AE} \cdot \left(\mathbf{r}_{B/A} \times \mathbf{T}_{BD}\right) + \boldsymbol{\lambda}_{AE} \cdot \left(\mathbf{r}_{C/A} \times \mathbf{F}_C\right) = 0$$

where

$$\boldsymbol{\lambda}_{AE} = \frac{(2.1 \text{ m})\mathbf{j} - (1.8 \text{ m})\mathbf{k}}{\sqrt{(2.1)^2 + (1.8)^2} \text{ m}}$$

$$= 0.27451\mathbf{j} - 0.23529\mathbf{k}$$

$$\mathbf{r}_{B/A} = (1.8 \text{ m})\mathbf{i}$$

$$\mathbf{T}_{BD} = \boldsymbol{\lambda}_{BD} T_{BD} = \frac{(-1.8 \text{ m})\mathbf{i} + (2.1 \text{ m})\mathbf{j} + (1.8 \text{ m})\mathbf{k}}{\sqrt{(1.8)^2 + (2.1)^2 + (1.8)^2} \text{ m}} T_{BD}$$

$$= (-0.54545\mathbf{i} + 0.63636\mathbf{j} + 0.54545\mathbf{k}) T_{BD}$$

$$\mathbf{r}_{C/A} = (3.0 \text{ m})\mathbf{i}$$

$$\mathbf{F}_C = -(4 \text{ kN})\mathbf{j}$$

PROBLEM 4.113 CONTINUED

$$\therefore \begin{vmatrix} 0 & 0.27451 & -0.23529 \\ 1.8 & 0 & 0 \\ -0.54545 & 0.63636 & 0.54545 \end{vmatrix} T_{BD} + \begin{vmatrix} 0 & 0.27451 & -0.23529 \\ 3 & 0 & 0 \\ 0 & -4 & 0 \end{vmatrix} = 0$$

$$(-0.149731 - 0.149729)1.8T_{BD} + 2.82348 = 0$$

$$\therefore \quad T_{BD} = 5.2381 \text{ kN}$$

or $T_{BD} = 5.24 \text{ kN}$ ◀

Based on symmetry, $T_{BE} = T_{BD} = 5.2381 \text{ kN}$

or $T_{BE} = 5.24 \text{ kN}$ ◀

$$\Sigma F_z = 0: \quad A_z + (T_{BD})_z - (T_{BE})_z = 0 \qquad A_z = 0$$

$$\Sigma F_y = 0: \quad A_y + (T_{BD})_y + (T_{BD})_y - 4 \text{ kN} = 0$$

$$A_y + 2(0.63636)(5.2381 \text{ kN}) - 4 \text{ kN} = 0$$

$$\therefore \quad A_y = -2.6666 \text{ kN}$$

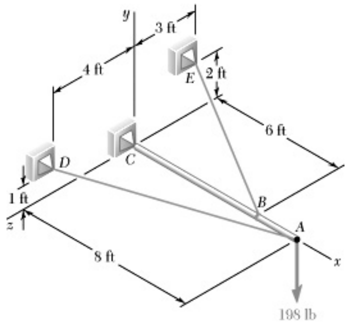
$$\Sigma F_x = 0: \quad A_x - (T_{BD})_x - (T_{BE})_x = 0$$

$$A_x - 2(0.54545)(5.2381 \text{ kN}) = 0$$

$$\therefore \quad A_x = 5.7142 \text{ kN}$$

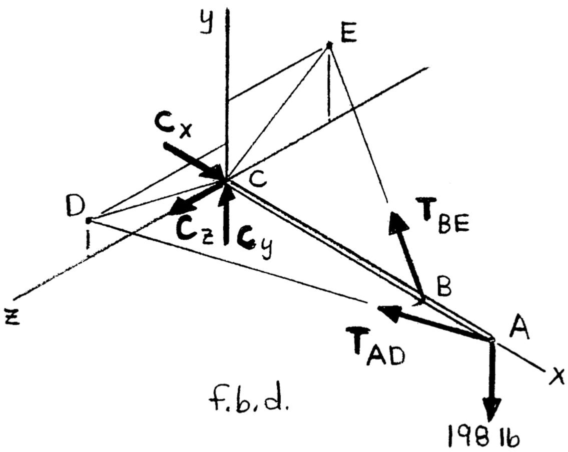
and $\mathbf{A} = (5.71 \text{ N})\mathbf{i} - (2.67 \text{ N})\mathbf{j}$ ◀

PROBLEM 4.114



An 8-ft-long boom is held by a ball-and-socket joint at C and by two cables AD and BE. Determine the tension in each cable and the reaction at C.

SOLUTION



From f.b.d. of boom

$$\Sigma M_{CE} = 0: \quad \boldsymbol{\lambda}_{CE} \cdot \left(\mathbf{r}_{A/C} \times \mathbf{T}_{AD}\right) + \boldsymbol{\lambda}_{CE} \cdot \left(\mathbf{r}_{A/C} \times \mathbf{F}_{A}\right) = 0$$

where

$$\boldsymbol{\lambda}_{CE} = \frac{(2\text{ ft})\mathbf{j} - (3\text{ ft})\mathbf{k}}{\sqrt{(2)^2 + (3)^2}\text{ ft}} = \frac{1}{\sqrt{13}}(2\mathbf{j} - 3\mathbf{k})$$

$$\mathbf{r}_{A/C} = (8\text{ ft})\mathbf{i}$$

$$\mathbf{T}_{AD} = \boldsymbol{\lambda}_{AD} T_{AD} = \frac{-(8\text{ ft})\mathbf{i} + (1\text{ ft})\mathbf{j} + (4\text{ ft})\mathbf{k}}{\sqrt{(8)^2 + (1)^2 + (4)^2}\text{ ft}} T_{AD}$$

$$= \left(\frac{1}{9}\right) T_{AD}(-8\mathbf{i} + \mathbf{j} + 4\mathbf{k})$$

$$\mathbf{F}_A = -(198\text{ lb})\mathbf{j}$$

$$\therefore \quad \begin{vmatrix} 0 & 2 & -3 \\ 8 & 0 & 0 \\ -8 & 1 & 4 \end{vmatrix} \left(\frac{T_{AD}}{9\sqrt{13}}\right) + \begin{vmatrix} 0 & 2 & -3 \\ 8 & 0 & 0 \\ 0 & -1 & 0 \end{vmatrix} \left(\frac{198}{\sqrt{13}}\right) = 0$$

PROBLEM 4.114 CONTINUED

$$(-64 - 24)\frac{T_{AD}}{9\sqrt{13}} + (24)\frac{198}{\sqrt{13}} = 0$$

$$\therefore \quad T_{AD} = 486.00 \text{ lb}$$

or $T_{AD} = 486 \text{ lb}$ ◀

$$\Sigma M_{CD} = 0: \quad \boldsymbol{\lambda}_{CD} \cdot \left(\mathbf{r}_{B/C} \times \mathbf{T}_{BE}\right) + \boldsymbol{\lambda}_{CD} \cdot \left(\mathbf{r}_{A/C} \times \mathbf{F}_A\right)$$

where $\boldsymbol{\lambda}_{CD} = \dfrac{(1 \text{ ft})\mathbf{j} + (4 \text{ ft})\mathbf{k}}{\sqrt{17} \text{ ft}} = \dfrac{1}{\sqrt{17}}(1\mathbf{j} + 4\mathbf{k})$

$$\mathbf{r}_{B/C} = (6 \text{ ft})\mathbf{i}$$

$$\mathbf{T}_{BE} = \boldsymbol{\lambda}_{BE}T_{BE} = \frac{-(6 \text{ ft})\mathbf{i} + (2 \text{ ft})\mathbf{j} - (3 \text{ ft})\mathbf{k}}{\sqrt{(6)^2 + (2)^2 + (3)^2} \text{ ft}}T_{BE} = \left(\frac{1}{7}\right)T_{BE}(-6\mathbf{i} + 2\mathbf{j} - 3\mathbf{k})$$

$$\therefore \quad \begin{vmatrix} 0 & 1 & 4 \\ 6 & 0 & 0 \\ -6 & 2 & -3 \end{vmatrix}\frac{T_{BE}}{7\sqrt{17}} + \begin{vmatrix} 0 & 1 & 4 \\ 8 & 0 & 0 \\ 0 & -1 & 0 \end{vmatrix}\frac{198}{\sqrt{17}} = 0$$

$$(18 + 48)\frac{T_{BE}}{7} + (-32)198 = 0$$

$$\therefore \quad T_{BE} = 672.00 \text{ lb}$$

or $T_{BE} = 672 \text{ lb}$ ◀

$$\Sigma F_x = 0: \quad C_x - (T_{AD})_x - (T_{BE})_x = 0$$

$$C_x - \left(\frac{8}{9}\right)486 - \left(\frac{6}{7}\right)672 = 0$$

$$\therefore \quad C_x = 1008 \text{ lb}$$

$$\Sigma F_y = 0: \quad C_y + (T_{AD})_y + (T_{BE})_y - 198 \text{ lb} = 0$$

$$C_y + \left(\frac{1}{9}\right)486 + \left(\frac{2}{7}\right)672 - 198 \text{ lb} = 0$$

$$\therefore \quad C_y = -48.0 \text{ lb}$$

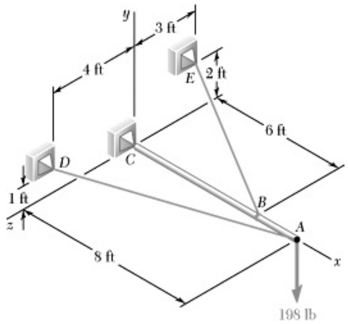
$$\Sigma F_z = 0: \quad C_z + (T_{AD})_z - (T_{BE})_z = 0$$

$$C_z + \left(\frac{4}{9}\right)486 - \left(\frac{3}{7}\right)(672) = 0$$

$$\therefore \quad C_z = 72.0 \text{ lb}$$

or $\mathbf{C} = (1008 \text{ lb})\mathbf{i} - (48.0 \text{ lb})\mathbf{j} + (72.0 \text{ lb})\mathbf{k}$ ◀

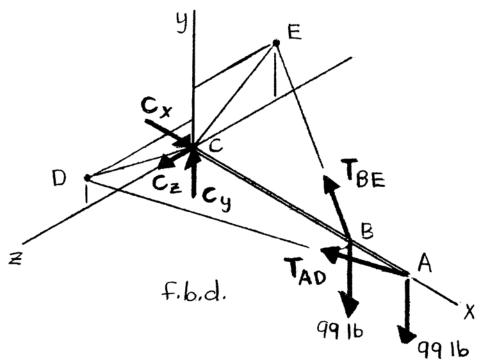
PROBLEM 4.115



Solve Problem 4.114 assuming that the given 198-lb load is replaced with two 99-lb loads applied at *A* and *B*.

P4.114 An 8-ft-long boom is held by a ball-and-socket joint at *C* and by two cables *AD* and *BE*. Determine the tension in each cable and the reaction at *C*.

SOLUTION



From f.b.d. of boom

$$\Sigma M_{CE} = 0: \quad \boldsymbol{\lambda}_{CE} \cdot \left(\mathbf{r}_{A/C} \times \mathbf{T}_{AD}\right) + \boldsymbol{\lambda}_{CE} \cdot \left(\mathbf{r}_{A/C} \times \mathbf{F}_{A}\right) + \boldsymbol{\lambda}_{CE} \cdot \left(\mathbf{r}_{B/C} \times \mathbf{F}_{B}\right) = 0$$

where
$$\boldsymbol{\lambda}_{CE} = \frac{(2\text{ ft})\,\mathbf{j} - (3\text{ ft})\,\mathbf{k}}{\sqrt{(2)^2 + (3)^2}\text{ ft}} = \frac{1}{\sqrt{13}}(2\mathbf{j} - 3\mathbf{k})$$

$$\mathbf{r}_{A/C} = (8\text{ ft})\,\mathbf{i}$$

$$\mathbf{r}_{B/C} = (6\text{ ft})\,\mathbf{i}$$

$$\mathbf{T}_{AD} = \boldsymbol{\lambda}_{AD} T_{AD} = \frac{-(8\text{ ft})\,\mathbf{i} + (1\text{ ft})\,\mathbf{j} + (4\text{ ft})\,\mathbf{k}}{\sqrt{(8)^2 + (1)^2 + (4)^2}\text{ ft}} T_{AD}$$

$$= \left(\frac{1}{9}\right) T_{AD}\left(-8\mathbf{i} + \mathbf{j} + 4\mathbf{k}\right)$$

$$\mathbf{F}_A = -(99\text{ lb})\,\mathbf{j}$$

$$\mathbf{F}_B = -(99\text{ lb})\,\mathbf{j}$$

$$\therefore \quad \begin{vmatrix} 0 & 2 & -3 \\ 8 & 0 & 0 \\ -8 & 1 & 4 \end{vmatrix} \frac{T_{AD}}{9\sqrt{13}} + \begin{vmatrix} 0 & 2 & -3 \\ 8 & 0 & 0 \\ 0 & -1 & 0 \end{vmatrix} \frac{99}{\sqrt{13}} + \begin{vmatrix} 0 & 2 & -3 \\ 6 & 0 & 0 \\ 0 & -1 & 0 \end{vmatrix} \frac{99}{\sqrt{13}} = 0$$

PROBLEM 4.115 CONTINUED

$$\left(-64-24\right)\frac{T_{AD}}{9\sqrt{13}}+\left(24+18\right)\frac{99}{\sqrt{13}}=0$$

or

$$T_{AD}=425.25\text{ lb}$$

or $T_{AD}=425\text{ lb}$ ◀

$$\Sigma M_{CD}=0:\quad \boldsymbol{\lambda}_{CD}\cdot\left(\mathbf{r}_{B/C}\times\mathbf{T}_{BE}\right)+\boldsymbol{\lambda}_{CD}\cdot\left(\mathbf{r}_{A/C}\times\mathbf{F}_{A}\right)+\boldsymbol{\lambda}_{CD}\cdot\left(\mathbf{r}_{B/C}\times\mathbf{F}_{B}\right)=0$$

where

$$\boldsymbol{\lambda}_{CD}=\frac{(1\text{ ft})\mathbf{j}+(4\text{ ft})\mathbf{k}}{\sqrt{17}}=\frac{1}{\sqrt{17}}(\mathbf{j}+4\mathbf{k})$$

$$\mathbf{r}_{B/C}=(6\text{ ft})\mathbf{i}$$

$$\mathbf{r}_{A/C}=(8\text{ ft})\mathbf{j}$$

$$\mathbf{T}_{BE}=\boldsymbol{\lambda}_{BE}T_{BE}=\frac{-(6\text{ ft})\mathbf{i}+(2\text{ ft})\mathbf{j}-(3\text{ ft})\mathbf{k}}{\sqrt{(6)^2+(2)^2+(3)^2}\text{ ft}}T_{BE}=\frac{T_{BE}}{7}\left(-6\mathbf{i}+2\mathbf{j}-3\mathbf{k}\right)$$

$$\therefore\quad \begin{vmatrix}0&1&4\\6&0&0\\-6&2&-3\end{vmatrix}\left(\frac{T_{BE}}{7\sqrt{17}}\right)+\begin{vmatrix}0&1&4\\8&0&0\\0&-1&0\end{vmatrix}\left(\frac{99}{\sqrt{17}}\right)+\begin{vmatrix}0&1&4\\6&0&0\\0&-1&0\end{vmatrix}\left(\frac{99}{\sqrt{17}}\right)=0$$

$$\left(18+48\right)\left(\frac{T_{BE}}{7\sqrt{17}}\right)+\left(-32-24\right)\left(\frac{99}{\sqrt{17}}\right)=0$$

or

$$T_{BE}=588.00\text{ lb}$$

or $T_{BE}=588\text{ lb}$ ◀

$$\Sigma F_x=0:\quad C_x-\left(T_{AD}\right)_x-\left(T_{BE}\right)_x=0$$

$$C_x-\left(\frac{8}{9}\right)425.25-\left(\frac{6}{7}\right)588.00=0$$

$$\therefore\quad C_x=882\text{ lb}$$

$$\Sigma F_y=0:\quad C_y+\left(T_{AD}\right)_y+\left(T_{BE}\right)_y-99-99=0$$

$$C_y+\left(\frac{1}{9}\right)425.25+\left(\frac{2}{7}\right)588.00-198=0$$

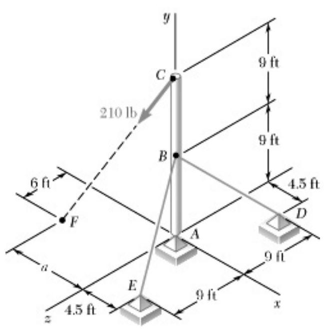
$$\therefore\quad C_y=-17.25\text{ lb}$$

$$\Sigma F_z=0:\quad C_z+\left(T_{AD}\right)_z-\left(T_{BE}\right)_z=0$$

$$C_z+\left(\frac{4}{9}\right)425.25-\left(\frac{3}{7}\right)588.00=0$$

$$\therefore\quad C_z=63.0\text{ lb}$$

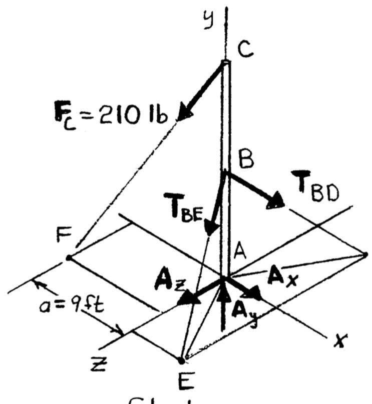
or $\mathbf{C}=(882\text{ lb})\mathbf{i}-(17.25\text{ lb})\mathbf{j}+(63.0\text{ lb})\mathbf{k}$ ◀



PROBLEM 4.116

The 18-ft pole *ABC* is acted upon by a 210-lb force as shown. The pole is held by a ball-and-socket joint at *A* and by two cables *BD* and *BE*. For $a = 9$ ft, determine the tension in each cable and the reaction at *A*.

SOLUTION



f.b.d.

From f.b.d. of pole *ABC*

$$\Sigma M_{AE} = 0: \quad \lambda_{AE} \cdot \left(\mathbf{r}_{B/A} \times \mathbf{T}_{BD}\right) + \lambda_{AE} \cdot \left(\mathbf{r}_{C/A} \times \mathbf{F}_C\right) = 0$$

where $$\lambda_{AE} = \frac{(4.5\text{ ft})\mathbf{i} + (9\text{ ft})\mathbf{k}}{\sqrt{(4.5)^2 + (9)^2}\text{ ft}} = \frac{1}{\sqrt{101.25}}(4.5\mathbf{i} + 9\mathbf{k})$$

$$\mathbf{r}_{B/A} = (9\text{ ft})\mathbf{j}$$

$$\mathbf{r}_{C/A} = (18\text{ ft})\mathbf{j}$$

$$\mathbf{T}_{BD} = \lambda_{BD} T_{BD} = \frac{(4.5\text{ ft})\mathbf{i} - (9\text{ ft})\mathbf{j} - (9\text{ ft})\mathbf{k}}{\sqrt{(4.5)^2 + (9)^2 + (9)^2}\text{ ft}} T_{BD}$$

$$= \left(\frac{T_{BD}}{13.5}\right)(4.5\mathbf{i} - 9\mathbf{j} - 9\mathbf{k})$$

$$\mathbf{F}_C = \lambda_{CF}(210\text{ lb}) = \frac{-9\mathbf{i} - 18\mathbf{j} + 6\mathbf{k}}{\sqrt{(9)^2 + (18)^2 + (6)^2}}(210\text{ lb}) = 10\text{ lb}(-9\mathbf{i} - 18\mathbf{j} + 6\mathbf{k})$$

$$\therefore \quad \begin{vmatrix} 4.5 & 0 & 9 \\ 0 & 9 & 0 \\ 4.5 & -9 & -9 \end{vmatrix} \left(\frac{T_{BD}}{13.5\sqrt{101.25}}\right) + \begin{vmatrix} 4.5 & 0 & 9 \\ 0 & 18 & 0 \\ -9 & -18 & 6 \end{vmatrix} \left(\frac{10\text{ lb}}{\sqrt{101.25}}\right) = 0$$

PROBLEM 4.116 CONTINUED

$$\frac{(-364.5 - 364.5)}{13.5\sqrt{101.25}}T_{BD} + \frac{(486 + 1458)}{\sqrt{101.25}}(10 \text{ lb}) = 0$$

and $$T_{BD} = 360.00 \text{ lb}$$

or $T_{BD} = 360$ lb ◀

$$\Sigma M_{AD} = 0: \quad \boldsymbol{\lambda}_{AD} \cdot (\mathbf{r}_{B/A} \times \mathbf{T}_{BE}) + \boldsymbol{\lambda}_{AD} \cdot (\mathbf{r}_{C/A} \times \mathbf{F}_C) = 0$$

where $$\boldsymbol{\lambda}_{AD} = \frac{(4.5 \text{ ft})\mathbf{i} - (9 \text{ ft})\mathbf{k}}{\sqrt{(4.5)^2 + (9)^2} \text{ ft}} = \frac{1}{\sqrt{101.25}}(4.5\mathbf{i} - 9\mathbf{k})$$

$$\mathbf{r}_{B/A} = (9 \text{ ft})\mathbf{j}$$

$$\mathbf{r}_{C/A} = (18 \text{ ft})\mathbf{j}$$

$$\mathbf{T}_{BE} = \boldsymbol{\lambda}_{BE}T_{BE} = \frac{(4.5 \text{ ft})\mathbf{i} - (9 \text{ ft})\mathbf{j} + (9 \text{ ft})\mathbf{k}}{\sqrt{(4.5)^2 + (9)^2 + (9)^2} \text{ ft}}T_{BE} = \frac{T_{BE}}{13.5}(4.5\mathbf{i} - 9\mathbf{j} + 9\mathbf{k})$$

$$\therefore \quad \begin{vmatrix} 4.5 & 0 & -9 \\ 0 & 9 & 0 \\ 4.5 & -9 & 9 \end{vmatrix}\left(\frac{T_{BE}}{13.5\sqrt{101.25}}\right) + \begin{vmatrix} 4.5 & 0 & -9 \\ 0 & 18 & 0 \\ -9 & -18 & 6 \end{vmatrix}\left(\frac{10 \text{ lb}}{\sqrt{101.25}}\right) = 0$$

$$\frac{(364.5 + 364.5)}{13.5\sqrt{101.25}}T_{BE} + \frac{(486 - 1458)10 \text{ lb}}{\sqrt{101.25}} = 0$$

or $$T_{BE} = 180.0 \text{ lb}$$

or $T_{BE} = 180.0$ lb ◀

$$\Sigma F_x = 0: \quad A_x + (T_{BD})_x + (T_{BE})_x - (F_C)_x = 0$$

$$A_x + \left(\frac{4.5}{13.5}\right)360 + \left(\frac{4.5}{13.5}\right)180 - \left(\frac{9}{21}\right)210 = 0$$

$$\therefore \quad A_x = -90.0 \text{ lb}$$

$$\Sigma F_y = 0: \quad A_y - (T_{BD})_y - (T_{BE})_y - (F_C)_y = 0$$

$$A_y - \left(\frac{9}{13.5}\right)360 - \left(\frac{9}{13.5}\right)180 - \left(\frac{18}{21}\right)210 = 0$$

$$\therefore \quad A_y = 540 \text{ lb}$$

$$\Sigma F_z = 0: \quad A_z - (T_{BD})_z + (T_{BE})_z + (F_C)_z = 0$$

$$A_z - \left(\frac{9}{13.5}\right)360 + \left(\frac{9}{13.5}\right)180 + \left(\frac{6}{21}\right)210 = 0$$

$$\therefore \quad A_z = 60.0 \text{ lb}$$

or $\mathbf{A} = -(90.0 \text{ lb})\mathbf{i} + (540 \text{ lb})\mathbf{j} + (60.0 \text{ lb})\mathbf{k}$ ◀