3–1.

The members of a truss are pin connected at joint O. Determine the magnitudes of $\mathbf{F}_1$ and $\mathbf{F}_2$ for equilibrium. Set $\theta = 60°$.
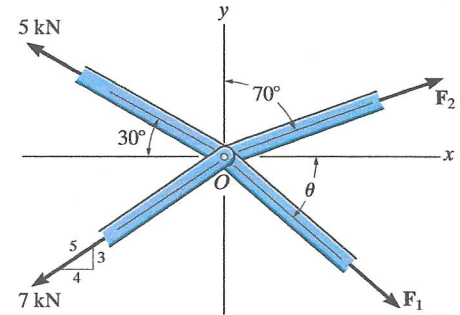
SOLUTION

$\xrightarrow{+} \Sigma F_x = 0;$ $F_2 \sin 70° + F_1 \cos 60° - 5 \cos 30° - \dfrac{4}{5}(7) = 0$

$\underline{0.9397F_2 + 0.5F_1 = 9.930}$

$+\uparrow \Sigma F_y = 0;$ $F_2 \cos 70° + 5 \sin 30° - F_1 \sin 60° - \dfrac{3}{5}(7) = 0$
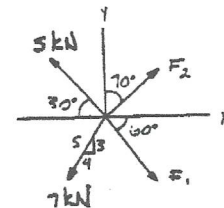
$\underline{0.3420F_2 - 0.8660F_1 = 1.7}$

Solving:

$F_2 = 9.60 \text{ kN}$ **Ans.**

$F_1 = 1.83 \text{ kN}$ **Ans.**

$$\begin{bmatrix} 0.9397 & 0.5 \\ 0.3420 & -0.866 \end{bmatrix} \begin{Bmatrix} F_2 \\ F_1 \end{Bmatrix} = \begin{Bmatrix} 9.93 \\ 1.7 \end{Bmatrix}$$

$$\begin{Bmatrix} F_2 \\ F_1 \end{Bmatrix} = \begin{bmatrix} 0.9397 & 0.5 \\ 0.3420 & -0.866 \end{bmatrix}^{-1} \begin{Bmatrix} 9.93 \\ 1.7 \end{Bmatrix}$$

$$\begin{Bmatrix} F_2 \\ F_1 \end{Bmatrix} = \begin{Bmatrix} 9.595 \\ 1.826 \end{Bmatrix}$$

$\boxed{\begin{aligned} F_1 &= 1.83 \text{ kN} \\ F_2 &= 9.6 \text{ kN} \end{aligned}}$

Ans:
$F_2 = 9.60 \text{ kN}$
$F_1 = 1.83 \text{ kN}$