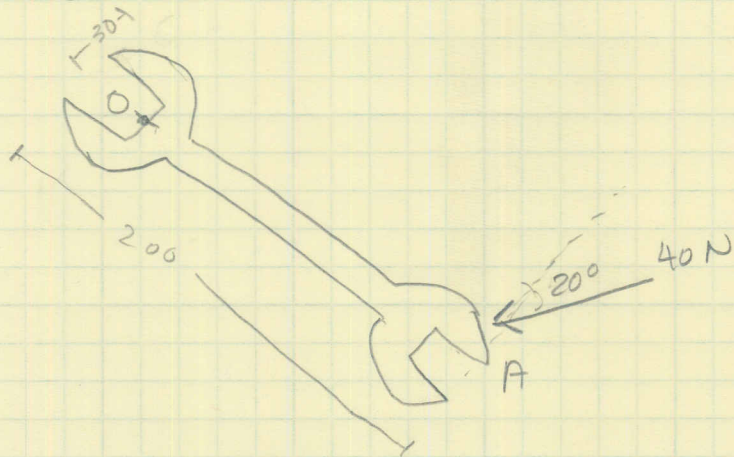


4-10

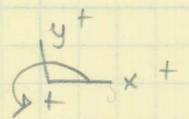


Scalar analysis: $F \cdot d = M$, then decide sign
 cw = - ccw = +

$$\sum M_0 = \overset{\ominus}{\curvearrowright} 40 \cos 20^\circ (0.2 \text{ m}) + 40 \sin 20^\circ (0.03 \text{ m})$$

\curvearrowright cw
 \curvearrowleft ccw

$$= -7.11 \text{ N}\cdot\text{m} \quad \text{so, } \boxed{M_0 = 7.11 \text{ N}\cdot\text{m} \curvearrowright}$$

Vector analysis: use i, j, k and follow 

$$\vec{r}_a = 0.2 \vec{i} + 0.03 \vec{j}$$

$$\vec{F} = -40 \sin 20^\circ \vec{i} - 40 \cos 20^\circ \vec{j}$$

$$\vec{M}_0 = \vec{r}_a \times \vec{F} \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0.2 & 0.03 & 0 \\ -40 \sin 20^\circ & -40 \cos 20^\circ & 0 \end{vmatrix}$$

$$\vec{i}: (0.03)(0) - (-40 \cos 20^\circ)(0) = 0$$

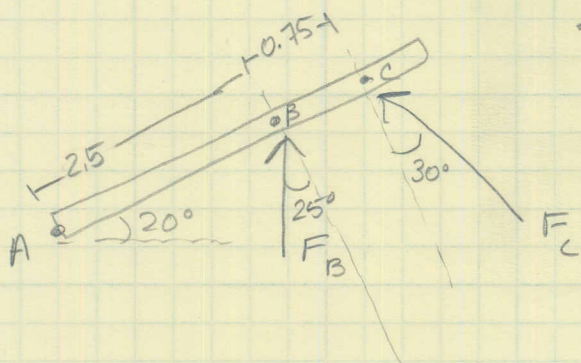
$$-\vec{j}: (0.2)(0) - (-40 \sin 20^\circ)(0) = 0$$

$$\vec{k}: (0.2)(-40 \cos 20^\circ) - (-40 \sin 20^\circ)(0.03) = -7.11 \text{ N}\cdot\text{m}$$

$$\vec{M}_0 = 0 \vec{i} + 0 \vec{j} - 7.11 \vec{k}$$

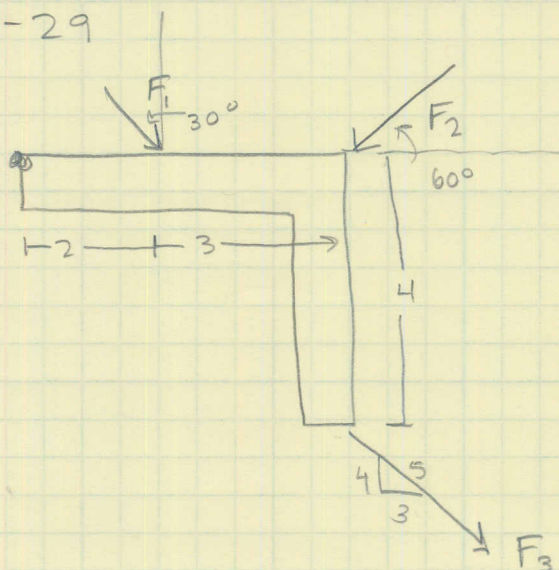
$$\boxed{M_0 = 7.11 \curvearrowright}$$

4-15



$$\begin{aligned}\sum \vec{M}_A &= 30 \cos 25^\circ (2.5 \text{ ft}) \\ &+ 45 \cos 30^\circ (3.25 \text{ ft}) \\ &= 195 \text{ lb}\cdot\text{ft} \quad \uparrow\end{aligned}$$

4-29



$$\begin{aligned}M_{RA} &= 4800 \text{ Nm} \quad \downarrow \\ F_1 &= 300 \text{ N}, \quad F_2 = 400 \text{ N} \\ F_3 &= ?\end{aligned}$$

$$\begin{aligned}(\downarrow +) \sum M_a &= 4800 = 300 \text{ N} (\cos 30^\circ) (2 \text{ m}) + 400 \sin 60^\circ (5 \text{ m}) \\ &+ F_3 \left(\frac{4}{5}\right) (5 \text{ m}) - F_3 \left(\frac{3}{5}\right) (4 \text{ m})\end{aligned}$$

$$F_3 = 1592 \text{ N} = 1.59 \text{ kN}$$