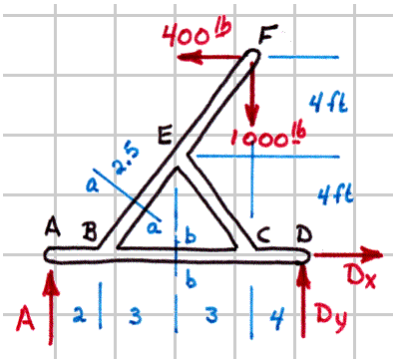
1-79*

(a) First, from a free-body diagram of the entire frame, the equations of equilibrium give



$$\rightarrow \Sigma F_x = 0: \qquad D_x - 400 = 0$$

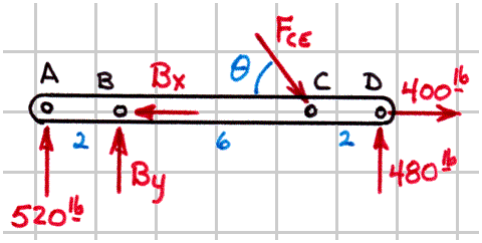
$$\uparrow \Sigma F_y = 0: \qquad A + D_y - 1000 = 0$$

$$\circlearrowleft \Sigma M_D = 0: \quad 8(400) + 2(1000) - 10A = 0$$

$$A = 520 \text{ lb}$$

$$D_x = 400 \text{ lb} \qquad D_y = 480 \text{ lb}$$

Next, from a free-body diagram of bar *ABCD*, the equations of equilibrium give



$$\rightarrow \Sigma F_x = 0: \qquad (400) - B_x + F_{CE}\cos\theta = 0$$

$$\uparrow \Sigma F_y = 0: \qquad (520) + B_y - F_{CE}\sin\theta + 480 = 0$$

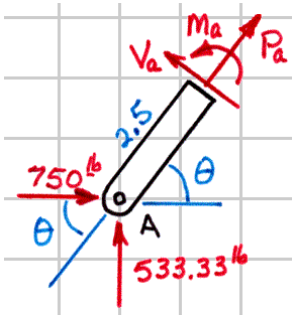
$$\circlearrowleft \Sigma M_B = 0: \quad 8(480) - 2(520) - 6(F_{CE}\sin\theta) = 0$$

$$\sin\theta = 4/5 \qquad \cos\theta = 3/5$$

$$F_{CE} = 583.333 \text{ lb}$$

$$B_x = 750 \text{ lb} \qquad B_y = -533.333 \text{ lb}$$

Next, from a free-body diagram of the lower end of bar *BEF*, the equations of equilibrium give



$$\text{Z}\ \Sigma F_x = 0: \qquad P_a + 750\cos\theta + 533.333\sin\theta = 0$$

$$\text{^}\ \Sigma F_y = 0: \qquad V_a - 750\sin\theta + 533.333\cos\theta = 0$$

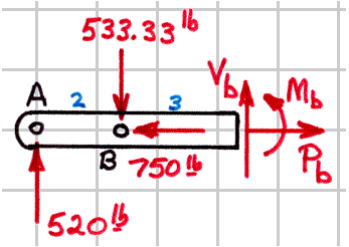
$$\circlearrowleft \Sigma M_B = 0: \quad M_a + 2.5(750\sin\theta) - 2.5(533.333\cos\theta) = 0$$

$P_a = -876.667 \text{ lb} \cong 877 \text{ lb (C)}$ ..... **Ans.**

$V_a = 280 \text{ lb}$ ..... **Ans.**

$M_a = -700 \text{ lb}\cdot\text{ft}$ ..... **Ans.**

(b) Finally, from a free-body diagram of the left end of bar *ABCD*, the equations of equilibrium give



$$\text{Z}\ \Sigma F_x = 0: \qquad P_b - 750 = 0$$

$$\text{^}\ \Sigma F_y = 0: \qquad V_b + 520 - 533.333 = 0$$

$$\circlearrowleft \Sigma M_B = 0: \quad M_b + 3(533.333) - 5(520) = 0$$

$P_b = 750 \text{ lb (T)}$ ..... **Ans.**

$V_b = 13.33 \text{ lb}$ ..... **Ans.**

$M_b = 1000 \text{ lb}\cdot\text{ft}$ ..... **Ans.**