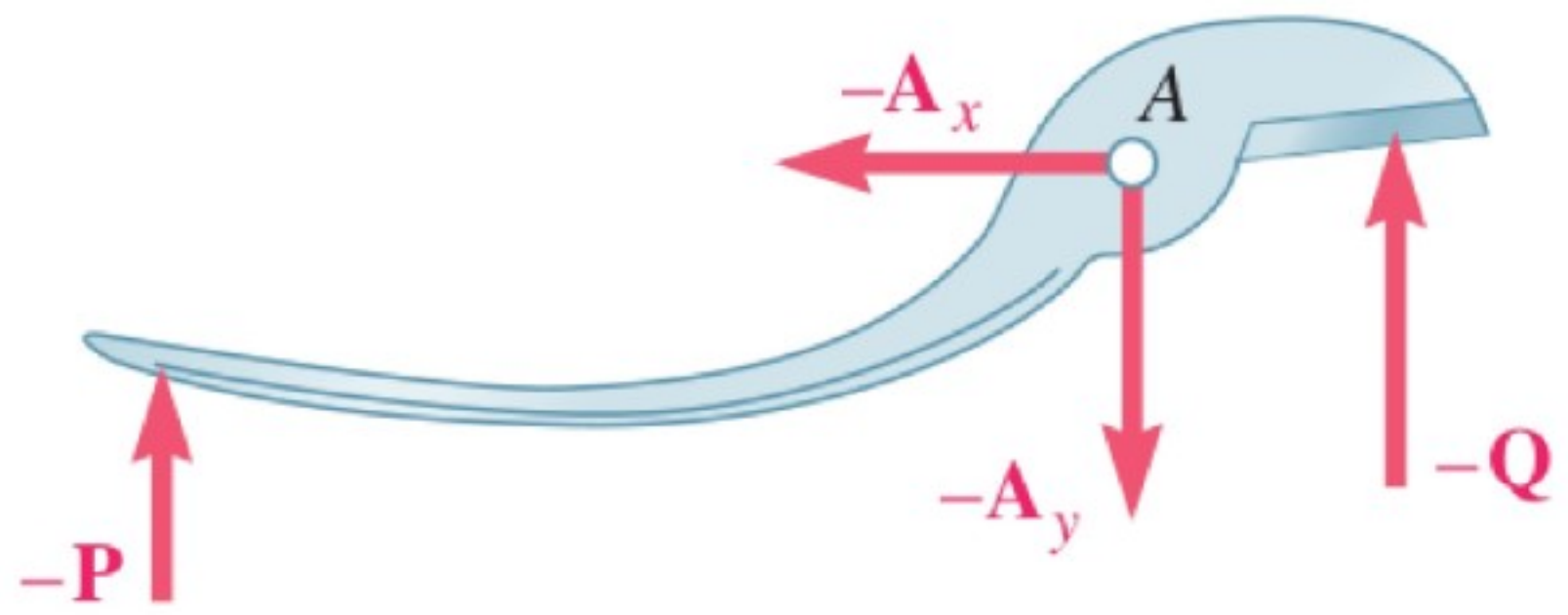


(a)



(b)

6.122 The shear shown is used to cut and trim electronic-circuit-board laminates. For the position shown, determine (a) the vertical component of the force exerted on the shearing blade at D , (b) the reaction at C .

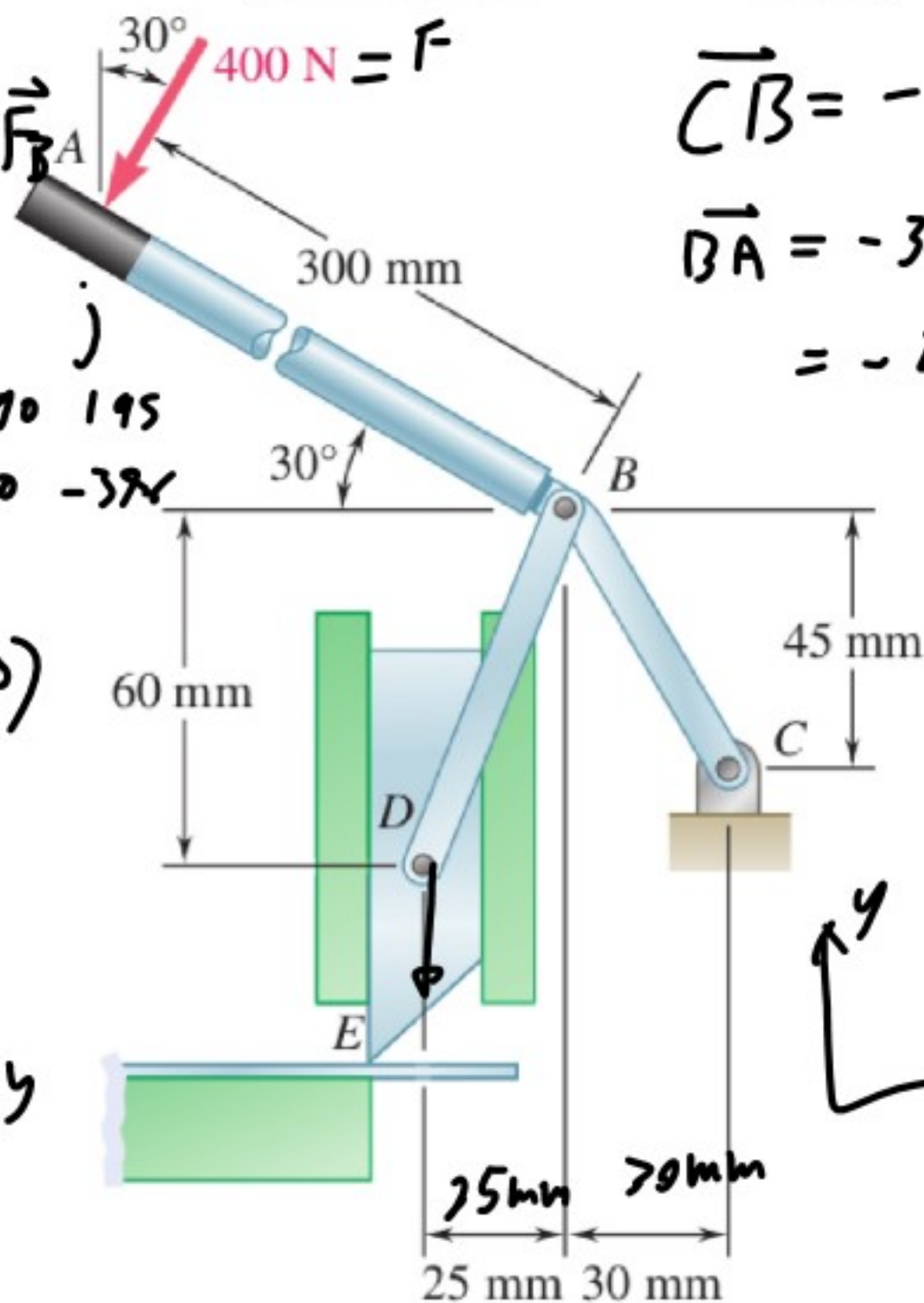
$$\sum M_C = \vec{r}_{CA} \times \vec{F} + \vec{r}_{CB} \times \vec{F}_B$$

$$\vec{r}_{CA} \times \vec{F} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ -290 & 195 & 0 \\ -200 & -396 & 0 \end{vmatrix} \quad \begin{vmatrix} \mathbf{i} & \mathbf{j} \\ -290 & 195 \\ -200 & -396 \end{vmatrix}$$

$$= -290(-396) - 195(-200) \\ = 139 \text{ N}\cdot\text{m}$$

$$\vec{r}_{CB} \times \vec{F}_B = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ -30 & 45 & 0 \\ F_{Bx} & F_{By} & 0 \end{vmatrix} \quad \begin{vmatrix} \mathbf{i} & \mathbf{j} \\ -30 & 45 \\ F_{Bx} & F_{By} \end{vmatrix}$$

$$= -30F_{By} - 45F_{Bx}$$



$$\vec{r}_{CB} = -30\mathbf{i} + 45\mathbf{j} \text{ mm}$$

$$\vec{r}_{BA} = -300 \cos(30^\circ)\mathbf{i} + 300 \sin(30^\circ)\mathbf{j} \text{ mm} \\ = -260\mathbf{i} + 150\mathbf{j} \text{ mm}$$

$$\vec{r}_{CA} = \vec{r}_{CB} + \vec{r}_{BA} \\ = -290\mathbf{i} + 195\mathbf{j}$$

$$\vec{F} = -400 \sin(30^\circ)\mathbf{i} - 400 \cos(30^\circ)\mathbf{j} \\ = -200\mathbf{i} - 346\mathbf{j} \text{ N}$$

$$\vec{BD} = -25i - 60j$$

$$BD = \sqrt{25^2 + 60^2} = 65$$

$$\vec{\lambda} = \frac{-25}{65}i - \frac{60}{65}j$$

$$F_{Bx} = F_B \lambda_x$$

$$F_{By} = F_B \lambda_y$$

$$\sum M_C = 139000 - 30 F_{By} - 45 F_{Bx} = 0$$

$$0 = 139000 - 30 \left(\frac{-60}{65} \right) F_B - 45 \left(\frac{-25}{65} \right) F_B$$

$$-139000 = \frac{30 \cdot 60 + 45 \cdot 25}{65} F_B$$

$$\frac{-139000}{45} = \frac{45 F_B}{45}$$

$$F_B = -3099 \text{ N}$$

$$F_D = 3099 \text{ N}$$

$$F_{Dy} = F_D (-\lambda_y) = 3099 \left(\frac{60}{65} \right)$$

$$= 2861 \text{ N}$$

6.123 A 100-lb force directed vertically downward is applied to the toggle vise at C . Knowing that link BD is 6 in. long and that $a = 4$ in., determine the horizontal force exerted on block E .

