

$$\textcircled{I} \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{a}{2} \sin(50^\circ) & -\frac{a}{2} \cos(50^\circ) & -\frac{b}{2} \\ 0 & -W & 0 \end{vmatrix} = -\frac{Wb}{2} \hat{i} + 0 \hat{j} - \frac{aW \sin(50^\circ)}{2} \hat{k} = \vec{M}_I$$

$$\textcircled{II} \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -b \\ B_x & B_y & 0 \end{vmatrix} = bB_y \hat{i} - bB_x \hat{j} + 0 \hat{k} = \vec{M}_{II}$$

\textcircled{III} moment is ZERO about A as $\vec{r} = \vec{0} \Rightarrow \vec{M}_{III} = \vec{0}$

$$\textcircled{IV} \vec{M}_{II} = \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a \sin(50^\circ) & -a \cos(50^\circ) & 0 \\ a \sin(50^\circ) & a(1 - \cos(50^\circ)) & b/4 \end{vmatrix} = \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} \left(\begin{aligned} & -\frac{ab \cos(50^\circ)}{4} \hat{i} - \frac{ab \sin(50^\circ)}{4} \hat{j} \\ & + \hat{k} (a^2 \sin(50^\circ)(1 - \cos(50^\circ)) + a^2 \sin(50^\circ) \cos(50^\circ)) \end{aligned} \right)$$

Each component M_x, M_y, M_z must be zero

$$\underline{\underline{\Sigma M_z = 0}} \Rightarrow \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} (a^2 \sin(50^\circ)(1 - \cos(50^\circ)) + a^2 \sin(50^\circ) \cos(50^\circ)) - \frac{aW \sin 50^\circ}{2} = 0 \quad \begin{array}{l} \text{cancel 'a' out} \\ \text{\&cancel{ } \&cancel{ } \sin(50^\circ)} \end{array}$$

$$\Rightarrow \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} (a - a \cos(50^\circ) + a \cos(50^\circ)) = + \frac{W}{2} \Rightarrow \boxed{\|\vec{F}_{CD}\| = \frac{W}{2a} \|\vec{CD}\|}$$

$$\underline{\underline{\Sigma M_y = 0}} \Rightarrow -b B_x - \frac{ab \sin(50^\circ)}{4} \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} = 0, \text{ since } \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} = \frac{W}{2a} \text{ we have}$$

$$\boxed{B_x = -\frac{W \sin(50^\circ)}{8}}$$

$$\underline{\underline{\Sigma M_x = 0}} \Rightarrow -\frac{Wb}{2} + b B_y - \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} \left(\frac{ab \cos(50^\circ)}{4} \right) = 0 \quad \text{cancel 'b'; Substitute } \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} = \frac{W}{2a}$$

$$\Rightarrow B_y = \frac{W}{2} + \frac{W}{2a} \left(\frac{a \cos(50^\circ)}{4} \right) = \boxed{\frac{W}{2} \left(1 + \frac{\cos(50^\circ)}{4} \right)}$$

Still need to get A_x, A_y, A_z ... but still have 3 equilibrium eqns left ...

$$\underline{\underline{\Sigma F_x = 0}} \Rightarrow A_x + B_x + F_{CDx} = 0 \Rightarrow A_x = - \left(-\frac{W \sin(50^\circ)}{8} \right) - \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} (a \sin 50^\circ)$$

$$\text{\& since } \frac{\|\vec{F}_{CD}\|}{\|\vec{CD}\|} = \frac{W}{2a} \dots A_x = \frac{W \sin 50^\circ}{8} - \frac{W}{2a} a \sin(50^\circ) = \boxed{-\frac{3}{8} W \sin(50^\circ)}$$

$$\underline{\underline{\Sigma F_y = 0}} \Rightarrow A_y + B_y + F_{CDy} - W = 0 \text{ or } A_y = -B_y - F_{CDy} + W$$

$$A_y = -\frac{W}{2} \left(1 + \frac{\cos(50^\circ)}{4} \right) - \left(\frac{W}{2a} \right) (a(1 - \cos(50^\circ))) + W$$

$$\text{simplifies to } \boxed{A_y = +\frac{3}{8} W \cos(50^\circ)}$$

$$\underline{\underline{\Sigma F_z = 0}} \quad A_z + F_{CDz} = 0 \quad A_z = -F_{CDz} = \left(-\frac{W}{2a} \right) \left(\frac{b}{4} \right) = \boxed{\frac{Wb}{8a}}$$