

We will start with Equilib eqn  $\Sigma \vec{M} = \vec{0}$  first. ②

Use point A as Reference (Why? because many (3) force components pass through it so simplifies problem)

for each force write down force vector and vector from A to a point on line of action of force.

for weight:  $\vec{W} = -W\hat{j}$  (note sign) =  $-490.5\hat{j}$  N (I)

$\vec{W}$  goes thru point G

$$\begin{aligned}\vec{AG} &= \left(\frac{1}{2}\right)a \sin(50^\circ)\hat{i} - \frac{1}{2}a \cos(50^\circ)\hat{j} - \frac{1}{2}b\hat{k} \\ &= \left(\frac{1}{2}\right)(0.8)(0.766)\hat{i} - \frac{1}{2}(0.8)(0.643)\hat{j} - \frac{1}{2}(1.2)\hat{k} \\ &= 0.306\hat{i} - 0.257\hat{j} - 0.6\hat{k}\end{aligned}$$

Hinge B

$$\vec{B} = B_x\hat{i} + B_y\hat{j}$$

$\vec{B}$  goes thru point B

$$\vec{AB} = -b\hat{k} = -1.2\hat{k}$$

Hinge A

$$\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$$

$\vec{A}$  passes thru pt. A

$$\vec{AA} = \vec{0}$$

Prop CD

$$\vec{F}_{CD} = \|\vec{F}_{CD}\|(0.828\hat{i} + 0.386\hat{j} + 0.405\hat{k})$$

$\vec{F}_{CD}$  passes thru pt. D

$$\begin{aligned}\vec{AD} &= a \sin(50^\circ)\hat{i} - a \cos(50^\circ)\hat{j} \\ &= (0.8)(0.766)\hat{i} - (0.8)(0.643)\hat{j} \\ &= 0.613\hat{i} - 0.514\hat{j}\end{aligned}$$

NOW WE ARE READY TO CALCULATE MOMENTS  $\vec{M} = \vec{r} \times \vec{F}$

$$\begin{aligned}\text{(I)} \quad \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0.306 & -0.257 & -0.6 \\ 0 & -490.5 & 0 \end{vmatrix} &= -(0.6)(490.5)\hat{i} + 0\hat{j} - (0.306)(490.5)\hat{k} \\ &= -294.3\hat{i} - 150.1\hat{k} \quad \text{Nm}\end{aligned}$$

$$\text{(II)} \quad \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -1.2 \\ B_x & B_y & 0 \end{vmatrix} = +(1.2)B_y\hat{i} - (1.2)B_x\hat{j}$$

$$\text{(III)} \quad \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 0 \\ A_x & A_y & A_z \end{vmatrix} = \vec{0} \quad (\text{naturally})$$

(this was obvious, but is included for completeness INDEED, we use pt. A as a ref so as to produce this result)