3/91 | DATA: mass = 50 kg

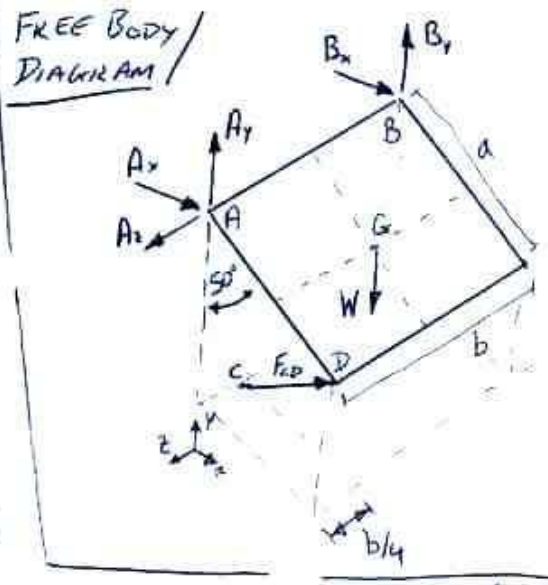
$b = 1.2$ m

we are told $a = 0.8$ m

"Hinge A supports thrust

Hinge B does not"

FREE BODY DIAGRAM



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

& $B = B_x\hat{i} + B_y\hat{j} + 0\hat{k}$

weight force is $-W\hat{j}$; $W = (9.81)(50)$

What about $\vec{F}_{CD}$? assume prop applies force parallel to its length.

need to find unit vector parallel to prop. this is $\dfrac{\vec{CD}}{\|\vec{CD}\|}$

find $\vec{CD}$ from geometry/trigonometry ...

$\vec{CD} = a\sin(50^\circ)\hat{i} + a(1-\cos(50^\circ))\hat{j} + \frac{b}{4}\hat{k}$

So $\Rightarrow$ $\vec{CD} = (0.8)(0.766)\hat{i} + (0.8)(1-0.643)\hat{j} + \frac{1.2}{4}\hat{k}$

$= \underline{0.613\hat{i} + 0.286\hat{j} + 0.3\hat{k}}$

Note: $\sin(50^\circ) = 0.766$
$\cos(50^\circ) = 0.643$

Note: Symbolic version available at http://mconry.ucd.ie

then $\|\vec{CD}\| = \sqrt{(0.613)^2 + (0.286)^2 + (0.3)^2} = \underline{0.740\text{ m}}$

so $\dfrac{\vec{CD}}{\|\vec{CD}\|} = 0.828\hat{i} + 0.386\hat{j} + 0.405\hat{k}$ ... A unit vector

$\vec{F}_{CD} = \underbrace{\|\vec{F}_{CD}\|}_{\text{magnitude (still unknown)}}\underbrace{(0828\hat{i} + 0.386\hat{j} + 0.405\hat{k})}_{\text{direction information, known}}$ **N. B.**

This is a 3-D problem $\Rightarrow$ 6 Equilibrium equations

$\Sigma F_x = 0$, $\Sigma F_y = 0$, $\Sigma F_z = 0$, $\Sigma M_x = 0$, $\Sigma M_y = 0$, $\Sigma M_z = 0$

How many unknowns do we have?

B_x, B_y, A_x, A_y, A_z, $\|\vec{F}_{CD}\| \rightarrow \underline{6}$

this is ok! (if we had more unknowns, problem would be statically indeterminate)