

3/91 | DATA: MASS = 50 kg

$$b = 1.2 \text{ m}$$

$$a = 0.8 \text{ m}$$

we are told

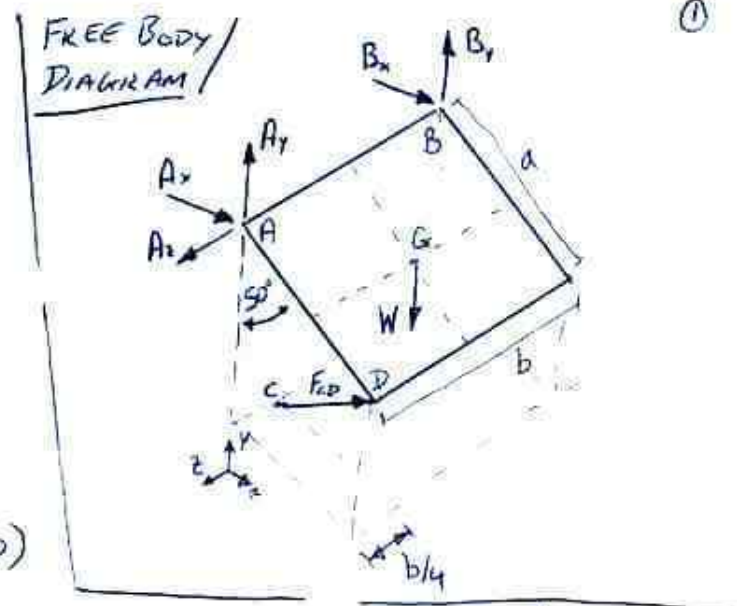
"Hinge A supports thrust

Hinge B does not"

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

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

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 $\frac{\vec{CD}}{\|\vec{CD}\|}$

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

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

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

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

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

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

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

$$\text{so } \frac{\vec{CD}}{\|\vec{CD}\|} = 0.828 \hat{i} + 0.386 \hat{j} + 0.405 \hat{k} \quad \dots \text{ A unit vector}$$

$$\vec{F}_{cd} = \underbrace{\|\vec{F}_{cd}\|}_{\text{magnitude (still unknown)}} \left(0.828 \hat{i} + 0.386 \hat{j} + 0.405 \hat{k} \right) \quad \text{N.B.}$$

magnitude (still unknown)

direction information, known



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)