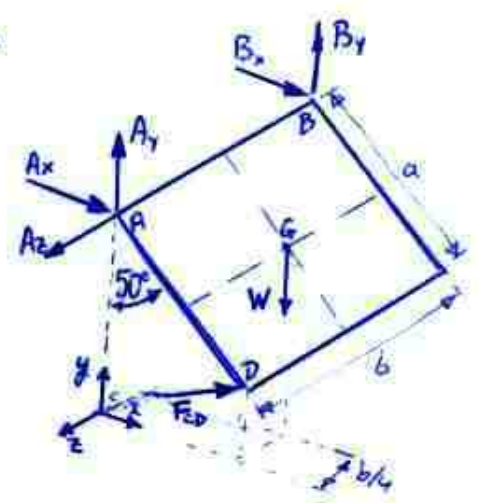


Q 3/91 Data, mass = 50kg; b=1.2m; a=0.8m

NOTE 3 components for \vec{A} (force @ pt. A)
 2 components for \vec{B} (force @ pt. B)
 Because we are told hinge A supports thrust while hinge B does not



$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$; $\vec{B} = B_x \hat{i} + B_y \hat{j}$

weight force is $-W\hat{j}$... minus because arrow drawn along neg dir'n of y-axis

\vec{F}_{cd} is force from prop CD \Rightarrow parallel to \vec{CD}

find unit vector in this direction ... $\frac{\vec{CD}}{\|\vec{CD}\|}$

$$\frac{\vec{CD}}{\|\vec{CD}\|} = \frac{a \sin(50^\circ) \hat{i} + a(1 - \cos(50^\circ)) \hat{j} + b/4 \hat{k}}{\sqrt{a^2 \sin^2(50^\circ) + a^2(1 - \cos(50^\circ))^2 + b^2/16}}$$

Then \vec{F}_{cd} is $\|\vec{F}_{cd}\| \left(\frac{\vec{CD}}{\|\vec{CD}\|} \right) = \|\vec{F}_{cd}\| \left(\frac{a \sin(50^\circ) \hat{i} + a(1 - \cos(50^\circ)) \hat{j} + b/4 \hat{k}}{\sqrt{a^2 \sin^2(50^\circ) + a^2(1 - \cos(50^\circ))^2 + b^2/16}} \right)$ (1)

$\|\vec{F}_{cd}\|$ is unknown, rest is ok.



Now - look at equilibrium equations; look at moments first: $\sum \vec{M} = 0$

USE A as reference point since a lot of components pass through it B would be ok too; G or D would be trickier.

for each force, write down force vector & vector from pt. A to a pt on line of action of the force; then $\vec{M} = \vec{r} \times \vec{F}$ gives moment.

Weight force: $\vec{F} = \vec{W} = -W\hat{j}$ $\vec{r}_{AG} = \frac{1}{2} a \sin(50^\circ) \hat{i} - \frac{1}{2} a \cos(50^\circ) \hat{j} - \frac{1}{2} b \hat{k}$ | (I)

Re @ hinge B: $\vec{F} = \vec{B} = B_x \hat{i} + B_y \hat{j}$ $\vec{r}_{AB} = -1.2 \hat{k} = -b \hat{k}$ | (II)

Re @ hinge A: $\vec{F} = \vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$ $\vec{r}_{AA} = \vec{0}$ | (III)

Prop force @ D: $\vec{F} = \vec{F}_{cd} = \|\vec{F}_{cd}\| \left[\frac{a \sin(50^\circ) \hat{i} + a(1 - \cos(50^\circ)) \hat{j} + b/4 \hat{k}}{\|\vec{CD}\|} \right]$

Note ... $\|\vec{CD}\|$ is bottom line of (1) above ... $\|\vec{CD}\| = 0.740$ however, it is sometimes convenient to leave calculation with numbers until the end. (IV)

$\vec{r}_{AD} = a \sin(50^\circ) \hat{i} - a \cos(50^\circ) \hat{j}$

for each of (I), (II), (III), (IV) calculate $\vec{M} = \vec{r} \times \vec{F}$

Note 6 unknowns ... $A_x, A_y, A_z, \|\vec{F}_{cd}\|, B_x, B_y$
 6 Equations $\sum F_x = 0, \sum F_y = 0, \sum F_z = 0, \sum M_x = 0, \sum M_y = 0, \sum M_z = 0$ } so it is OK! DETERMINATE