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Name: [redacted] Student ID: [redacted] Sec. No.: [redacted]

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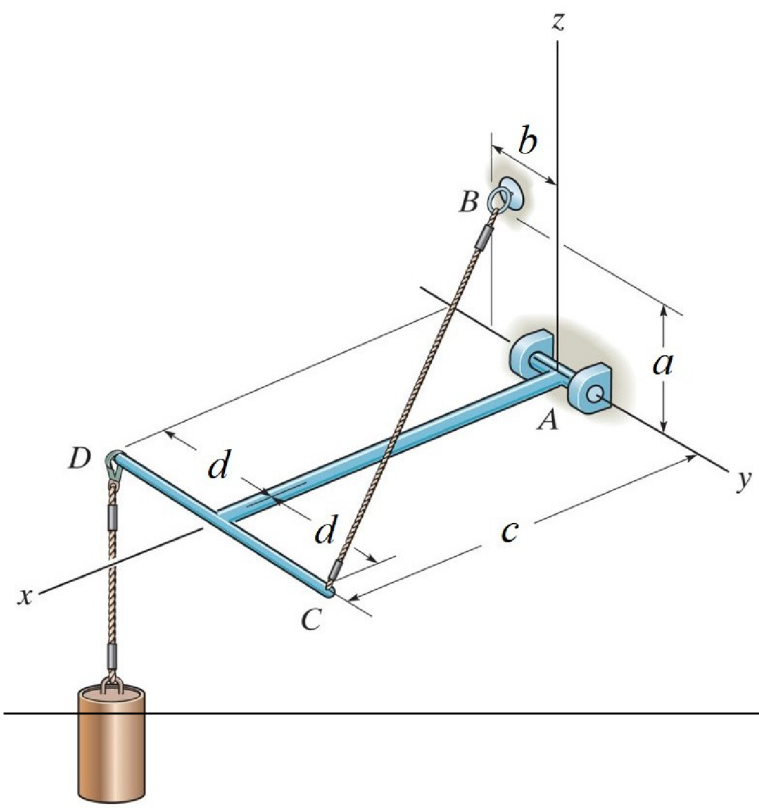
A cylinder of mass 40 kg is suspended from a T-frame as shown in the illustration. The T-frame is attached to the wall at *A* with two bearings that prevents any translation, but allows rotation about the y axis. It is also supported with a cable attached on the wall at *B* and on the frame at *C*. The attachment point *B* is located at $a = 1\ m$ and $b = 0.5\ m$. The frame has dimensions of $c = 3\ m$ and $d = 1\ m$.

Determine the tension in the cable *CB* and the reaction forces and moments at A.



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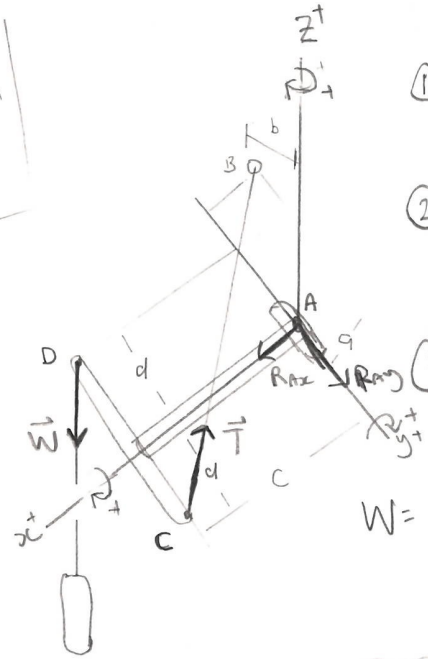
Cylinder mass 40 kg hangs. T-frame attached to wall with 2 bearings prevents translation but allows rotation about y-axis. Has cable to wall at B and on from C.

Determine tension in BC and reaction forces and moments at A

a = 1m
b = 0.5m
c = 3m
d = 1m



① $\Sigma F_x = 0 = T_{CB_x} + R_{Ax}$

② $\Sigma F_y = 0 = T_{CB_y} + R_{Ay}$

③ $\Sigma F_z = 0 = -W + T_{CB_z} + R_{Az}$

+MAx

CW+ $\Sigma M_x = 0 = -Wd - T_{CB_z} d$ ④

CW+ $\Sigma M_y = 0 = -WC + T_{CB_z} C$ ⑤

CW+ $\Sigma M_z = 0 = T_{CB_x} d + M_{Az} - T_{CB_y} C$ ⑥

$W = 40(9.8) = 392\ N$

⑤ $W(C) = T_z(C)$

$392 = T_z$

$392 = T(.2857)$

$T = 1372.07\ N$

$\vec{T}_{CB}$

Point C: (3, 1, 0)

Point B: (0, -.5, 1)

$\vec{CB} : \langle -3, -1.5, 1 \rangle \; ; \; |\vec{CB}| = 3.5$

Unit vector $\vec{CB}$: $\frac{\vec{CB}}{|\vec{CB}|} = \langle -.8571, -.42857, .2857 \rangle$

$\vec{T}_{CB} = T\langle -.8571, -.42857, .2857 \rangle$

$\vec{T} = \langle -1176, -588.03, 392 \rangle$

① $T_x = R_{Ax}$

$1176_N = R_{Ax}$

② $T_y = R_{Ay}$

$588.03_N = R_{Ay}$

④ $-392 - 392 = -M_{Ax}$

$M_{Ax} = 784\ N \cdot m$

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(6) $T_{CB_x} d + M_{A_z} - T_{CB_y} C = 0$

$1176 + M_{AZ} - 3(588) = 0$

$\boxed{M_{AZ} = -582 \text{ N·m}}$

(3) $-392 + 392 + R_z = 0$

$\boxed{R_z = 0 \text{ N}}$

$T_{CB} = 1372 \text{ N}$

$R_{Ax} = 1176 \text{ N}$

$R_{Ay} = 588 \text{ N}$

$R_{Az} = 0 \text{ N}$

$M_{Ax} = 784 \text{ N·m}$

$M_{Ay} = 0 \text{ N·m}$

$M_{Az} = -582 \text{ N·m}$

with Clockwise being positive.