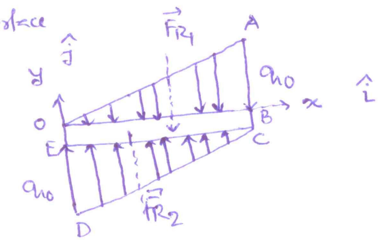
Q 2.4 (e) pg. 227



The resultant of the parallel forces distributions of the upper surface makes the loading surface (a triangle OBA).

$\therefore \vec{F}_{R_1} = \frac{1}{2} q_o L (-\hat{j})$ acting through the centre of mass of the triangle, whose distance from the point O is $\vec{OR_1} = \frac{2L}{3}\hat{i}$

Similarly, the resultant of the parallel force distributions of the lower surface makes the loading surface (a triangle ECD)

$\therefore \vec{F}_{R_2} = \frac{1}{2} q_o L (\hat{j})$, acting at a distance $\frac{L}{3}\hat{i} + (-b\hat{j})$ from O

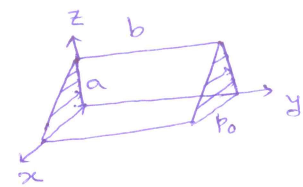
$\therefore$ Total Resultant $\vec{F}_R = \vec{F}_{R_1} + \vec{F}_{R_2} = 0$

The force distributions $\vec{F}_{R_1}$ and $\vec{F}_{R_2}$ makes a couple because they are parallel to itself.

$\therefore$ Couple $= M_o = F_{R_1} d = F_{R_1}\left(\frac{2L}{3} - \frac{L}{3}\right) = \frac{L}{3} \frac{1}{2} q_o L = \frac{q_o L^2}{6}$

acting perpendicular to xy plane.

Q 2.4 (b) pg. 227



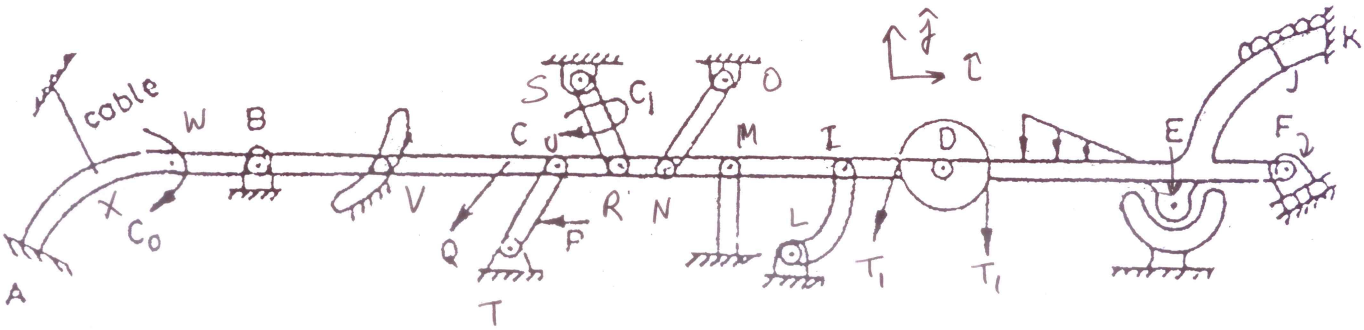
The parallel force distributions makes triangular shape (loading surface) through out the length b.

$\therefore$ The resultant of the force distribution is given by $\vec{F}_R = \left(\frac{1}{2} p_o a\right) b (-\hat{i}) = \frac{1}{2} p_o ab (-\hat{i})$.

As the resultant acting at the centre of mass of the loading surface, then the centre of the parallel force distribution would be

$$\vec{r}_R = \frac{b}{2}\hat{j} + \frac{a}{3}\hat{k}$$

Q 2.7 (a) pg. 229



given: i) coplanar loading   ii) All members are light
iii) All contacts are smooth (i.e. frictionless).

The reactions at any support are determined by the types of motion constrained by the support. Coplanar loading ⇒ forces in the x-y plane and moments are all in the $\hat{k}$ direction.

A – Fixed end ⇒ Force in the x-y plane (direction not known) + Moment

X – Cable → Tension along the cable.

W – Concentrated couple C_0

B – Hinge ⇒ Force in the x-y plane (direction unknown).

V – no friction ⇒ Force normal to the slot.

C – concentrated force Q.

U – UT is not a 2 force member; Hinge at U ⇒ Force in the x-y plane (direction not known)

R → SR is not a 2 force member → the couple C_1 can be viewed as 2 forces ⇒ Similar to U.

N – NO is a 2 force member ⇒ Force along NO.

M – Extended hinge ⇒ similar to B.

I – IL is a 2 force member ⇒ Force along IL.

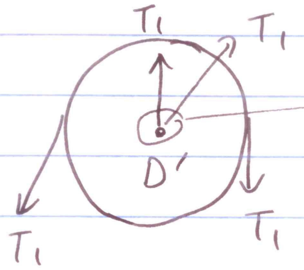
D → No friction in the bearing ⇒ forces T_1 can be shifted to D.

E → Ball + socket ≡ hinge for coplanar loading

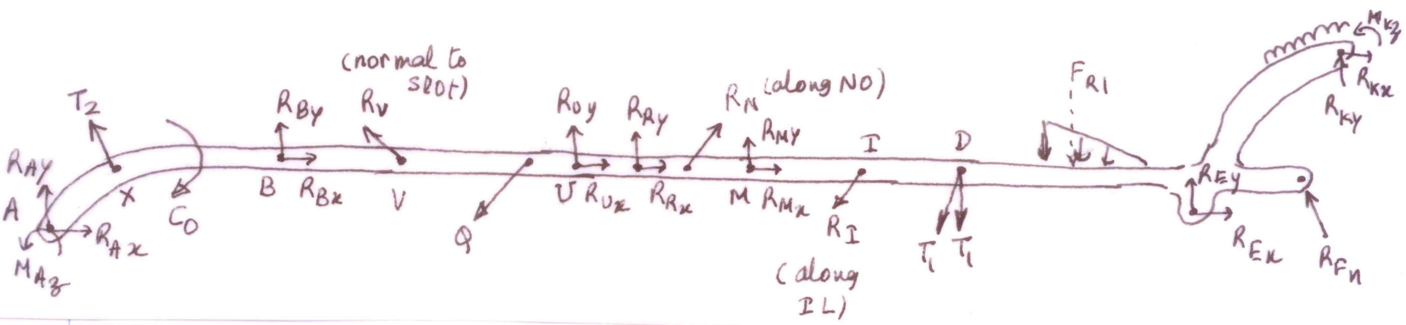
F – Roller ⇒ no constraint along the roller ⇒ force perpendicular to roller

K – fixed end → similar to A.

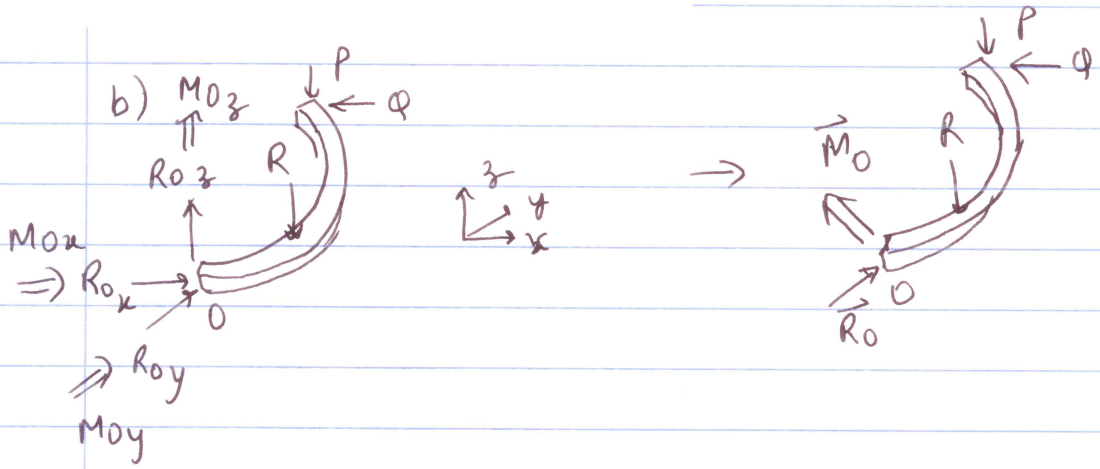
Consider the disc at D. No friction ⇒ to keep the disc in equilibrium we need two forces at the centre to counter act the 2 tensions T_1



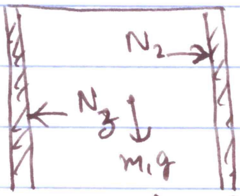
reactions to these two forces appear at D on the rod.



Q 2.13 (b) and (g) pg. 236-237



d) Body ① appears to be a hollow cylinder (no bottom surface).



↑N (somewhere on the rim.)

Q 2.16 (a) pg. 284

Since the body is translating all points have the same acceleration. $\Rightarrow \vec{a}_{C/I} = \vec{a}_{A/I}$

$\Rightarrow \vec{F}_R$ acts at C along CF.

Hence the valid points for $\vec{M}_O = \dot{\vec{H}}_{O/I}$ are:

N, H, J, C, E, F, M, D and L.

$\vec{M}_O = 0$ for: E, C, F, K, N, and L.