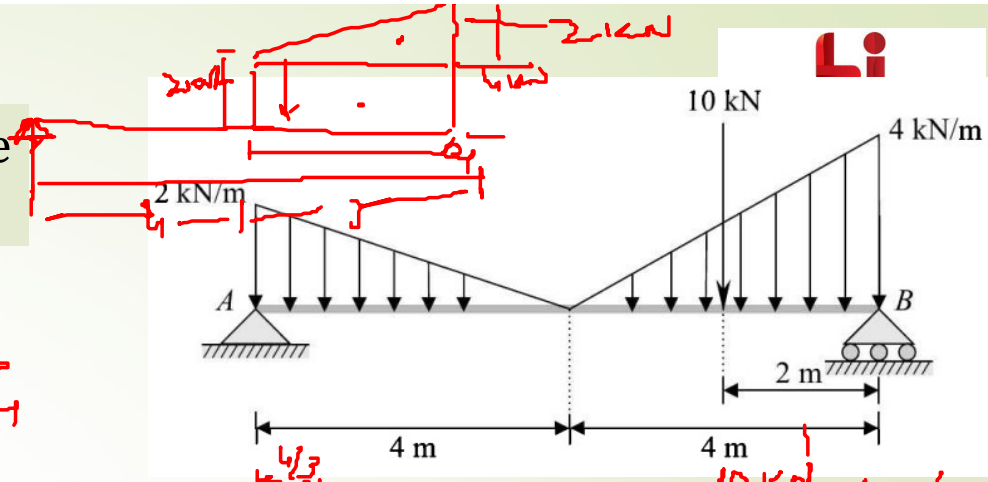
$\sum M_B$ ⟵ $2 \times 3 \times 5.5 + \frac{1}{2} \times 3 \times 2 \times \left(4 + \frac{2}{3} \times 3\right)$

Example: Determine the support reactions in the simply supported beam *AB*.



Solution:

$\sum F_x = 0$

$H_A = 0$

$\sum F_y = 0$

$\frac{1}{2} \times 2 \times 4 + \frac{1}{2} \times 4 \times 4 + 10 - V_A - V_B = 0$

$V_A + V_B = 22 \text{ kN}$ ⟶ (1)

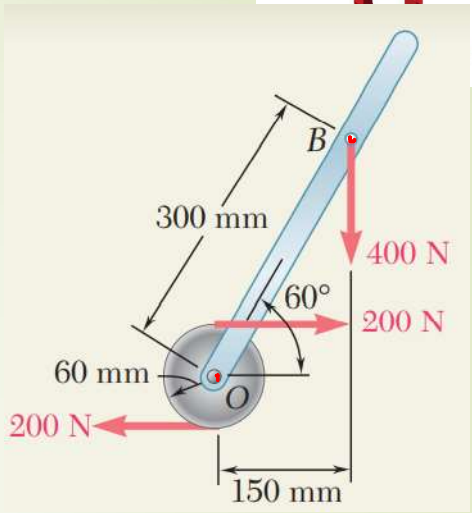
$\sum M_A = 0$

$\frac{1}{2} \times 2 \times 4 \times \left(\frac{4}{3}\right) + 10 \times 6 + \frac{1}{2} \times 4 \times 4 \times \left(4 + \frac{2}{3} \times 4\right) - 8 V_B = 0$

$V_B = 14.8 \text{ kN}$

$V_A = 22 - 14.8 = 7.2 \text{ kN}$

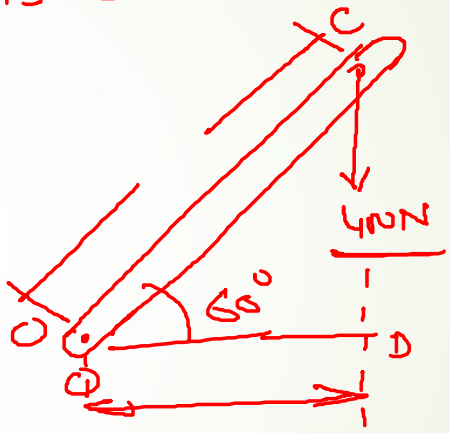
Replace the couple and force shown by an equivalent single force applied to the lever. Determine the distance from the shaft to the point of application of this equivalent force.

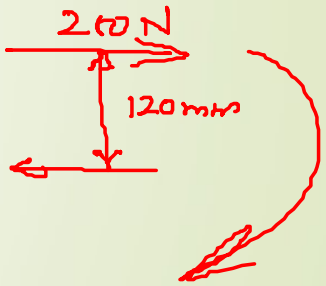


Solution:

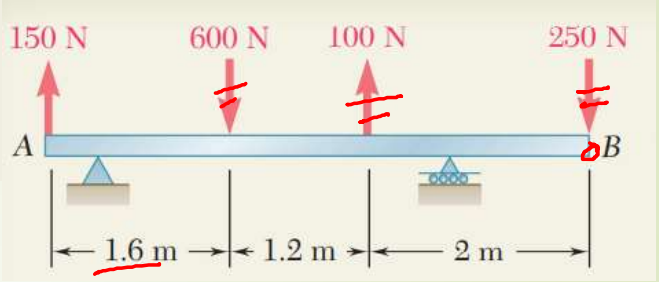
$$M_O = 200 \times 0.12 + 400 \times 0.15 =$$
$$= 24 + 60 = 84 \text{ Nm}$$

$$84 = 400 \times OD$$
$$OD = 0.21 \text{ m}$$
$$OC = 0.42 \text{ m}$$
$$= 420 \text{ mm}$$





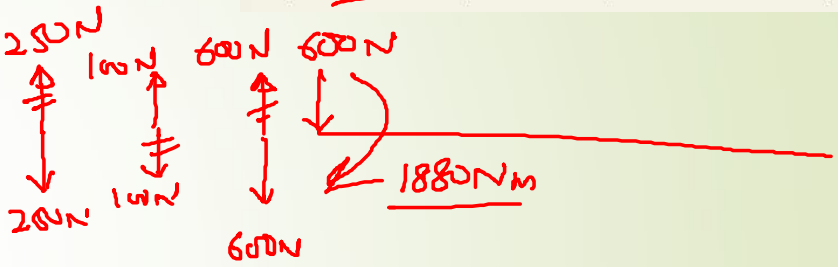
A 4.80-m-long beam is subjected to the forces shown. Reduce the given system of forces to (*a*) an equivalent force-couple system at *A*, (*b*) an equivalent force-couple system at *B*, (*c*) a single force or resultant.



Solution:

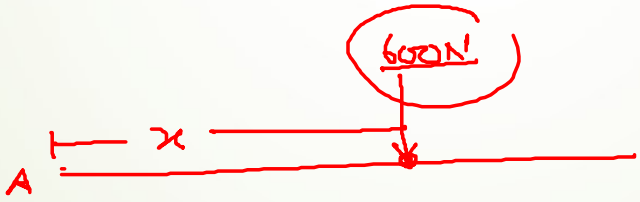
$\Sigma F = 150 - 600 + 100 - 250 = -600\ N$

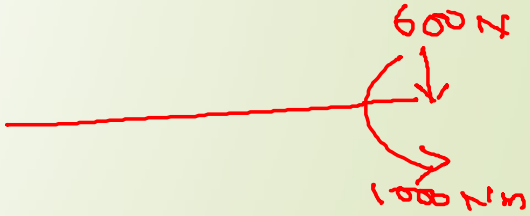
$= 600 \times 1.6$
$- 100 \times 2.8$
$+ 250 \times 4.8$
$=$



$\Sigma M_A = 600 \times 1.6 - 100 \times 2.8 + 250 \times 4.8 = 1880\ Nm$

$\Sigma M_B = 150 \times 4.8 - 600 \times 3.2 + 100 \times 2 = -1000\ Nm$





$600 \cdot x = 1880$

$x = \frac{1880}{600} = 3.13\ m$ from point A

Example: Determine the length of cord *AC*, which will keep the 8 kg lamp, suspended in the position shown. The undeformed length of the spring *AB* is 0.4 m, and the spring has a stiffness $\boldsymbol{k}$ = 300 N/m.

Solution:

$F_s = kx$

$T = 156.90\ N$

$\Delta l = 0.453$

$AC = 1.324\ m$