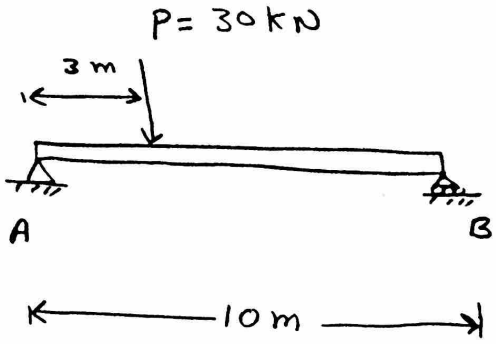
# * Statics review

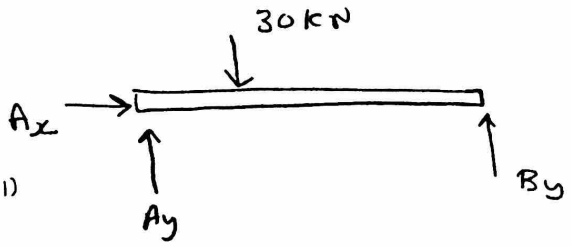
**Example:** For the system shown, Find reactions at A and B




**Solution**

① Draw Free-Body Diagram (F.B.D)

$\overset{+}{\rightarrow} \Sigma F_x = 0 \Rightarrow A_x = 0$




$+\uparrow \Sigma F_y = 0 \Rightarrow \boxed{A_y + B_y = 30\ kN}$ (1)

$+\circlearrowleft \Sigma M_A = 0 \Rightarrow (-30)(3) + B_y(10) = 0$

$\Rightarrow \boxed{B_y = 9\ kN}$

back to eq(1) $\Rightarrow A_y = 30 - B_y$

$= 30 - 21 \Rightarrow A_y = 21\ kN$

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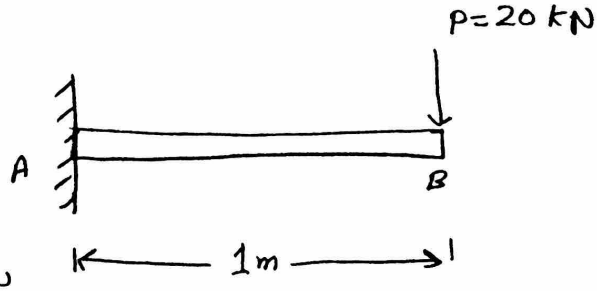
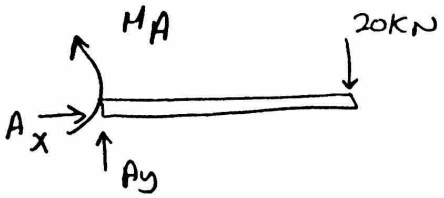
**Example:** Find reaction forces at point (A)




**Solution**

F.B.D $\Rightarrow$




$\overset{+}{\rightarrow} \Sigma F_x = 0 \Rightarrow \boxed{A_x = 0}$

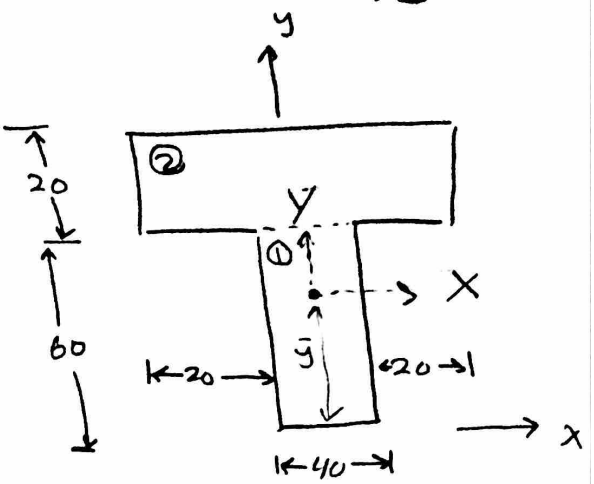
$+\uparrow \Sigma F_y = 0 \Rightarrow A_y - 20 = 0 \Rightarrow \boxed{A_y = 20\ kN}$

$+\circlearrowleft \Sigma M_{at\ A} = 0 \Rightarrow M_A - (20)(1) = 0 \quad \boxed{M_A = 20\ kN \cdot m}$

**Example** For the Following Section, Find

① Centroid location $(\bar{x}, \bar{y})$

② The second moment of Inertia $(I_x)$ "about Centroidal axis"




Dimensions are in (mm)

**Solution**

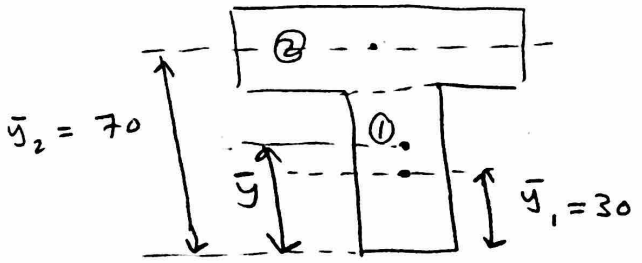
① Centroid

$\bar{x} = 0$ (symmetric)

$$\bar{y} = \frac{\sum A_i \bar{y}_i}{\sum A_i} = \frac{A_1 \bar{y}_1 + A_2 \bar{y}_2}{A_1 + A_2}$$

$$= \frac{(40)(60)(30) + (20)(80)(70)}{(40)(60) + (20)(80)}$$

$$\bar{y} = 46 \text{ mm}$$




② $I = I_1 + I_2$ → remember $I = \frac{1}{12} b h^3$


$I_1 = \frac{1}{12} b h^3 + A_1 d_1^2$ → Parallel axis theorem

$d_1$ = distance between two centroids

$$= \frac{1}{12}(40)(60)^3 + (40)(60)(46-30)^2$$

$$= 1334 \times 10^3 \text{ mm}^4$$

$$I_2 = \frac{1}{12} b h^3 + A_2 d_2^2 = \frac{1}{12}(80)(20)^3 + (80)(20)(70-46)^2$$

$$= 975 \times 10^3 \text{ mm}^4$$

$$\Rightarrow I = I_1 + I_2 = 1334 \times 10^3 + 975 \times 10^3 = 2.31 \times 10^6 \text{ mm}^4$$

Quick notes

① Review $\Sigma F$ and $\Sigma M \Rightarrow$ Find reactions

② Review centroid and moment of Inertia

"Very important"