STATICS

Equilibrium of a Rigid Body

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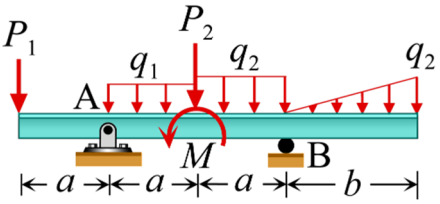
Question : Determine the support reactions of the overhanging beam. $M = 3\,\text{Nm}$, $P_1 = 2\,\text{kN}$, $P_2 = 3\,\text{kN}$, $q_1 = 2\,\text{kN/m}$, $q_2 = 3\,\text{kN/m}$, $a = 2\,\text{m}$ and $b = 3\,\text{m}$.



Solution :

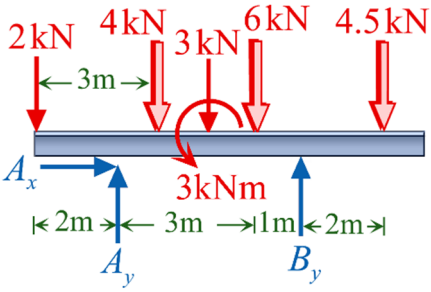
The equivalent single forces of distributed loads are as follows,

$R_1 = (2\,\text{kN/m})(2\,\text{m}) = 4\,\text{kN}$

$R_2 = (3\,\text{kN/m})(2\,\text{m}) = 6\,\text{kN}$

$R_3 = \frac{1}{2}(3\,\text{kN/m})(3\,\text{m}) = 4.5\,\text{kN}$

The coordinates of application points for each equivalent single force are the center of its loading type.



The support reactions are obtained using the equilibrium equations,

$\sum M_A = 0 \quad ; \quad 4\times1 - 2\times2 + 3\times2 + 6\times3 - 4\times B_y + 4.5\times6 - 3 = 0 \quad \Rightarrow \quad B_y = 12\,\text{kN}\uparrow$

$\sum F_y = 0 \quad ; \quad A_y - 2 - 4 - 3 - 6 - 4.5 + B_y = 0 \quad \Rightarrow \quad A_y = 7.5\,\text{kN}\uparrow$

$\sum F_x = 0 \quad ; \quad A_x = 0$