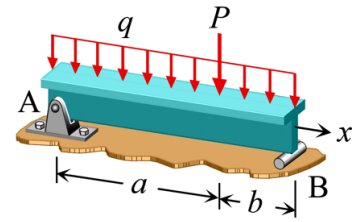


STATICS

Internal Forces

Dr. Umit N. ARIBAS

Question : Determine the functions of the internal forces.
 ($a = 2\text{ m}$, $b = 1\text{ m}$, $P = 21\text{ kN}$, $q = 2\text{ kN/m}$).

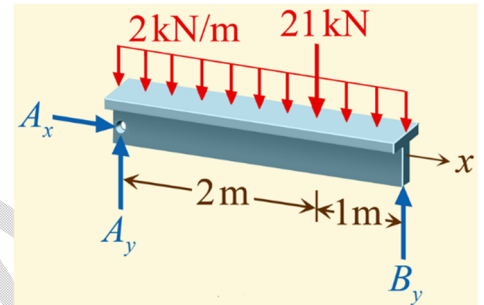


Solution :

The support reactions are obtained using the equilibrium equations,

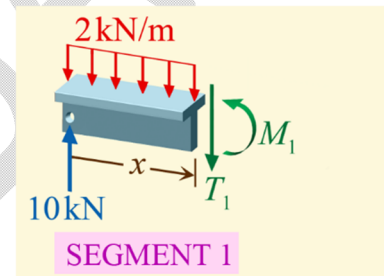
$$\begin{aligned} \sum F_x = 0; & \quad \Rightarrow A_x = 0 \\ \sum M_A = 0; & \quad 3B_y - 1.5(3 \times 2) - 2 \times 21 = 0 \Rightarrow B_y = 17\text{ kN} \uparrow \\ \sum F_y = 0; & \quad A_y + 17 - 3 \times 2 - 21 = 0 \Rightarrow A_y = 10\text{ kN} \uparrow \end{aligned}$$

Since there is a singularity acting on the beam at $x = 2\text{ m}$, the beam will be investigated in two segments.



Segment 1:

$$\begin{aligned} \sum F_y = 0; & \quad T_1 - 10 + 2x = 0 \quad \Rightarrow T_1 = 10 - 2x \\ \sum M = 0; & \quad M_1 + \left(\frac{1}{2}x\right)(2x) - 10x = 0 \Rightarrow M_1 = 10x - x^2 \end{aligned}$$



Segment 2:

$$\begin{aligned} \sum F_y = 0; & \quad T_2 - 10 + 2x + 21 = 0 \\ & \quad T_2 = -11 - 2x \\ \sum M = 0; & \quad M_2 + \left(\frac{1}{2}x\right)(2x) + 21(x - 2) - 10x = 0 \\ & \quad M_2 = -x^2 - 11x + 42 \end{aligned}$$

