College of Technological Studies

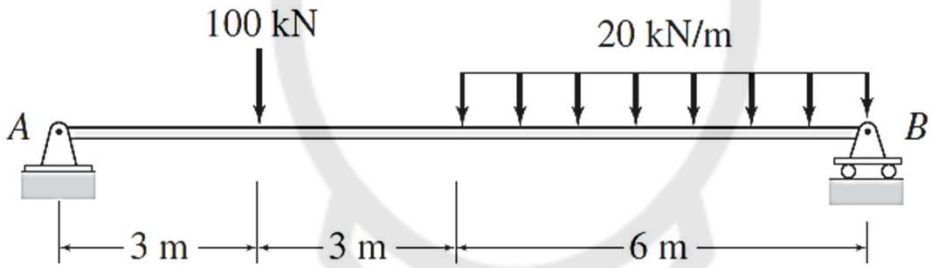
Department of Civil Engineering Technology

CE 278 Structural Analysis

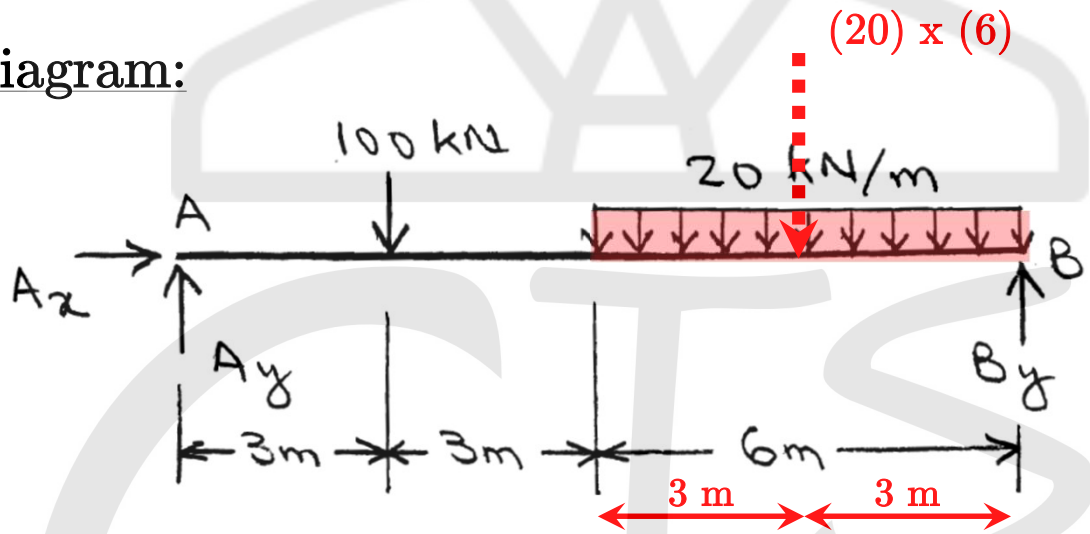
Tutorial (1)

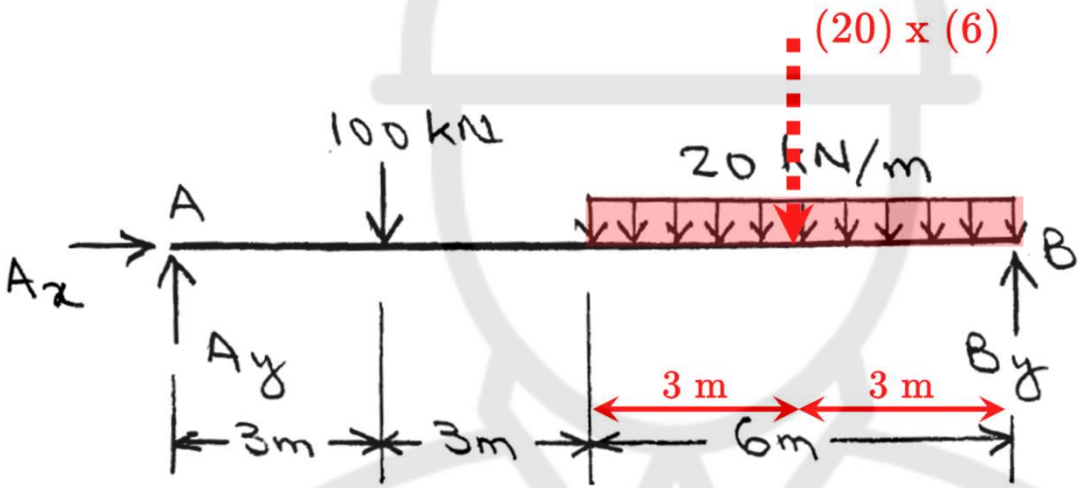
Beams and Frames Reactions

Example (1): Determine the reactions at the supports for the beam shown.



Free Body Diagram:





$\Sigma F_x = 0$ $\qquad A_x = 0$

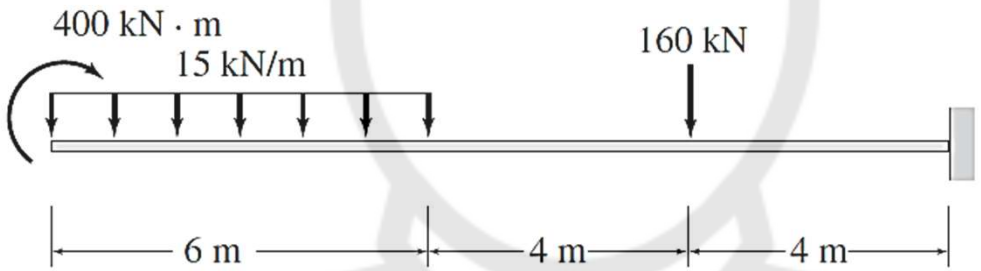
$+\circlearrowleft \Sigma M_B = 0 \qquad -A_y(12) + 100(9) + 20(6)3 = 0$

$A_y = 105\,kN \uparrow$

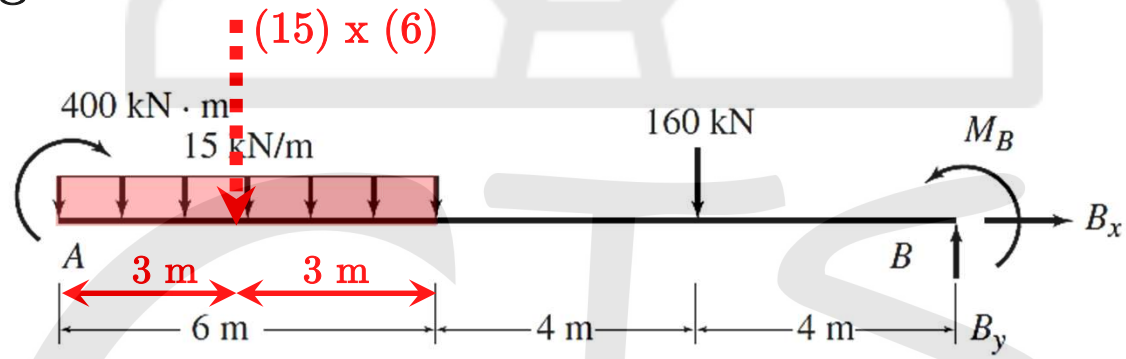
$+\uparrow \Sigma F_y = 0 \qquad 105 - 100 - 20(6) + B_y = 0$

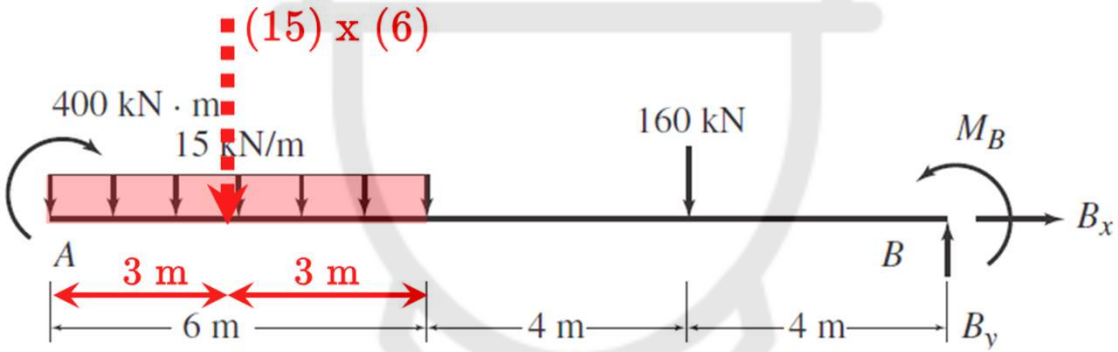
$B_y = 115\,kN \uparrow$

Example (2): Determine the reactions at the support for the beam shown.



Free Body Diagram:





$$+\uparrow \sum F_y = 0$$

$$-15(6) - 160 + B_y = 0$$

$$B_y = 250 \text{ kN}$$

$$B_y = 250 \text{ kN} \uparrow$$

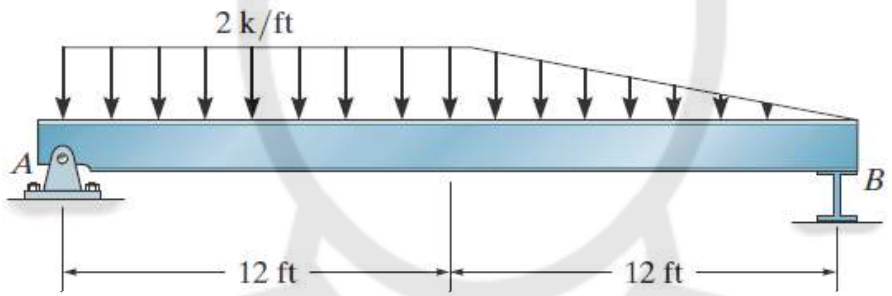
$$+\circlearrowleft \sum M_B = 0$$

$$-400 + 15(6)(3 + 8) + 160(4) + M_B = 0$$

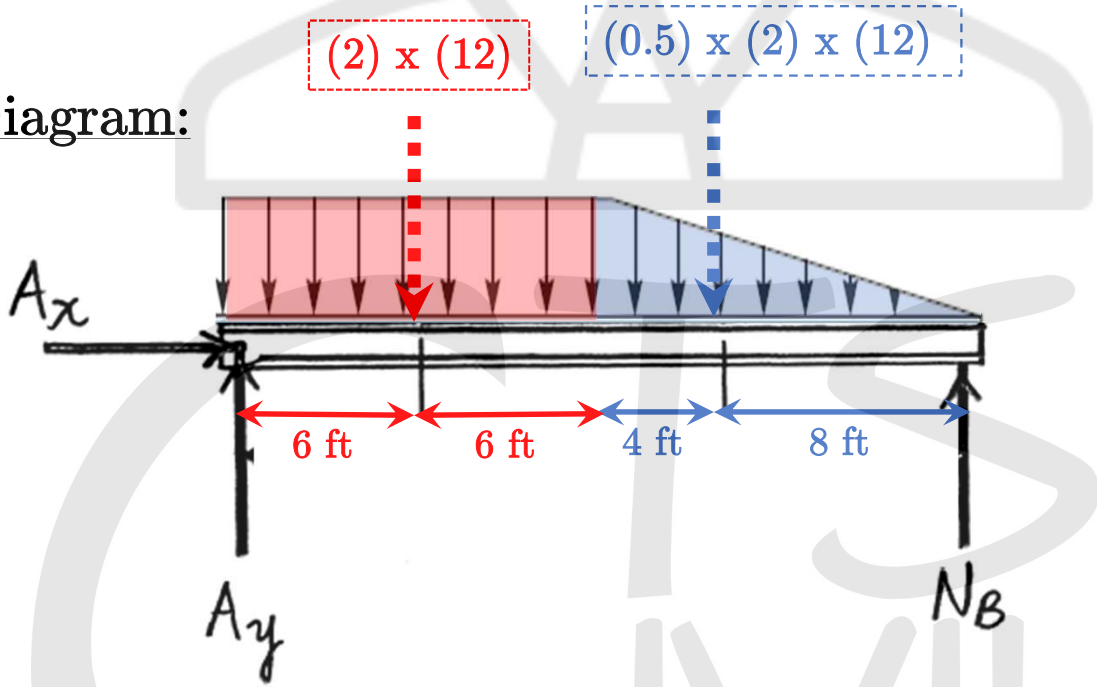
$$M_B = -1230 \text{ kN} \cdot \text{m}$$

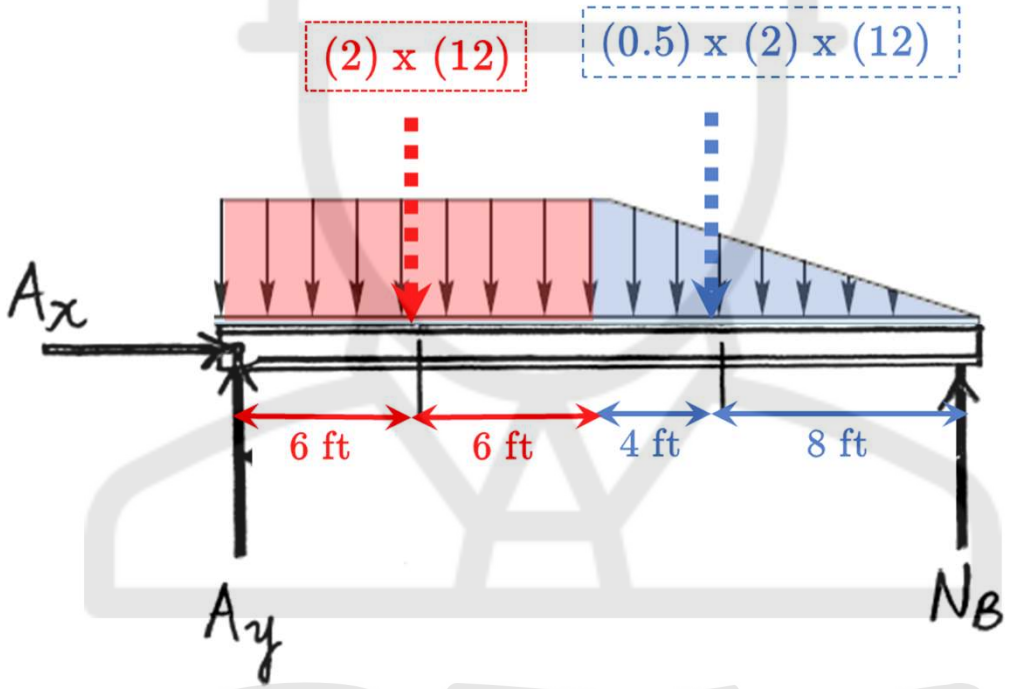
$$M_B = 1230 \text{ kN} \cdot \text{m} \circlearrowright$$

Example (3): Determine the reactions at the support for the beam shown.



Free Body Diagram:



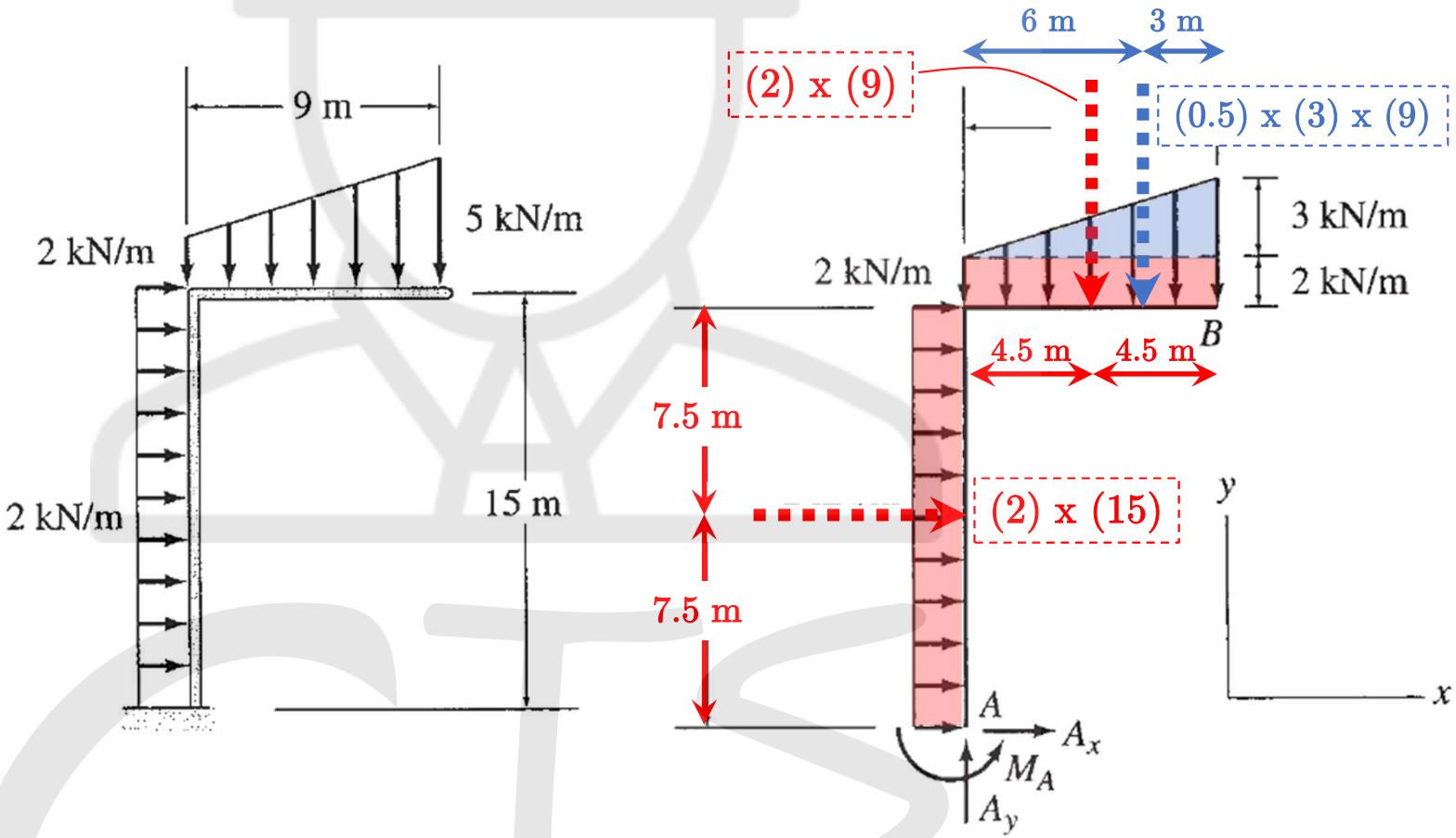


$$\overset{+}{\rightarrow} \sum F_x = 0; \quad A_x = 0$$

$$\zeta + \sum M_B = 0; \quad \frac{1}{2}(2)(12)(8) + 2(12)(18) - A_y(24) = 0 \qquad A_y = 22.0\ \text{k}$$

$$\zeta + \sum M_A = 0; \quad N_B(24) - 2(12)(6) - \frac{1}{2}(2)(12)(16) = 0 \qquad N_B = 14.0\ \text{k}$$

Example (4):
Determine the reactions at the support for the frame shown.



Free Body Diagram

$$+\rightarrow \sum F_x = 0$$

$$A_x + 2(15) = 0$$

$$A_x = -30 \text{ kN}$$

$$A_x = 30 \text{ kN}$$

$$+\uparrow \sum F_y = 0$$

$$A_y - 2(9) - \frac{1}{2}(3)(9) = 0$$

$$A_y = 31.5 \text{ kN}$$

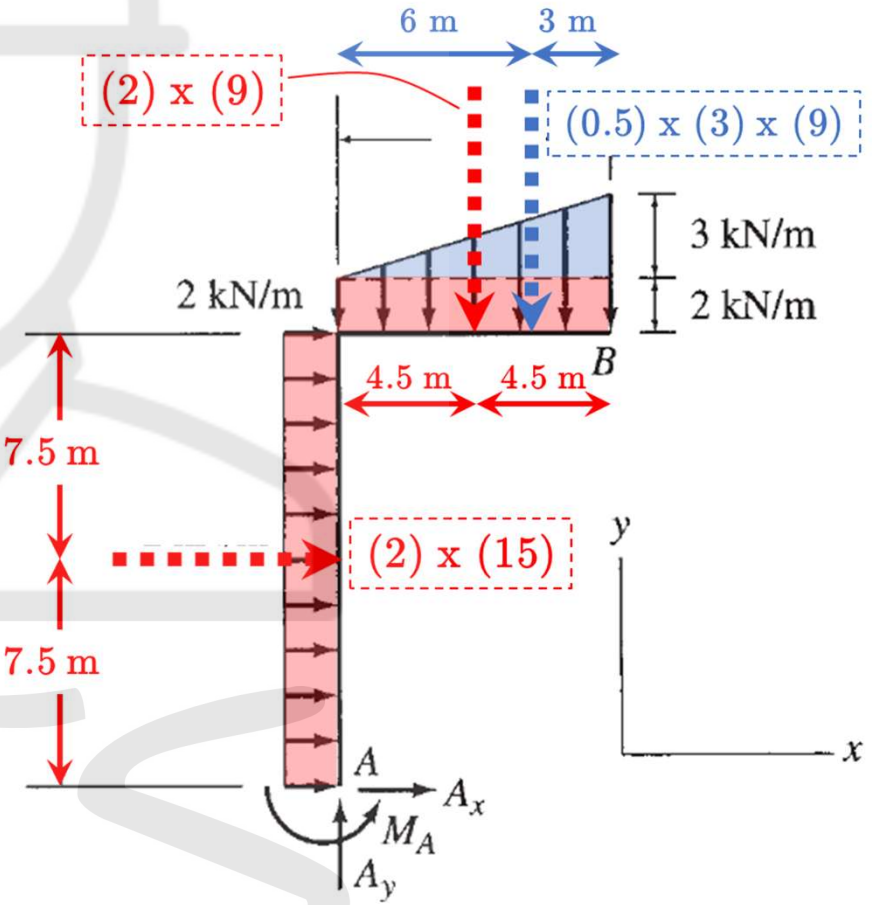
$$A_y = 31.5 \text{ kN} \uparrow$$

$$+\circlearrowleft \sum M_A = 0$$

$$M_A - [2(15)]\left(\frac{15}{2}\right) - [2(9)]\left(\frac{9}{2}\right) - \left[\frac{1}{2}(3)(9)\right]\frac{2}{3}(9) = 0$$

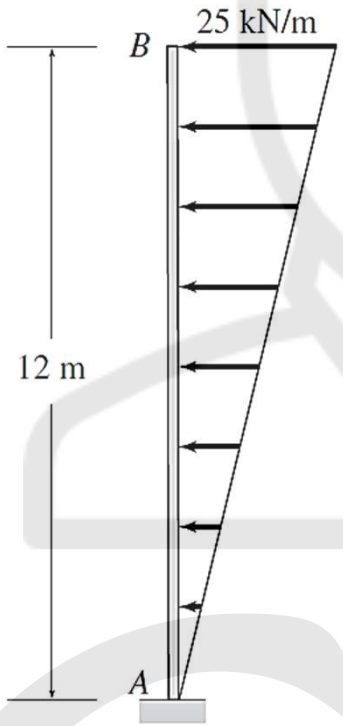
$$M_A = 387 \text{ kN-m}$$

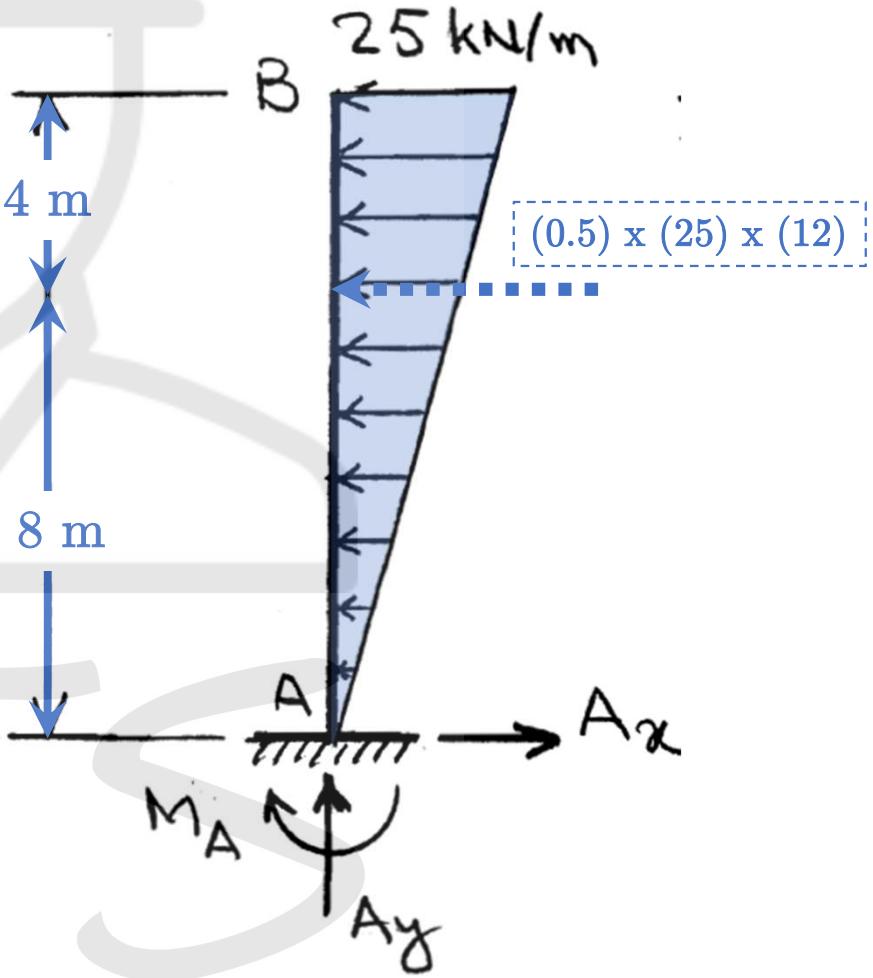
$$M_A = 387 \text{ kN-m} \circlearrowleft$$



Free Body Diagram

Example (5):
Determine the reactions at the support for the frame shown.





Free Body Diagram

$\xrightarrow{+} \Sigma F_x = 0$

$-\frac{1}{2}(25)(12) + A_x = 0$

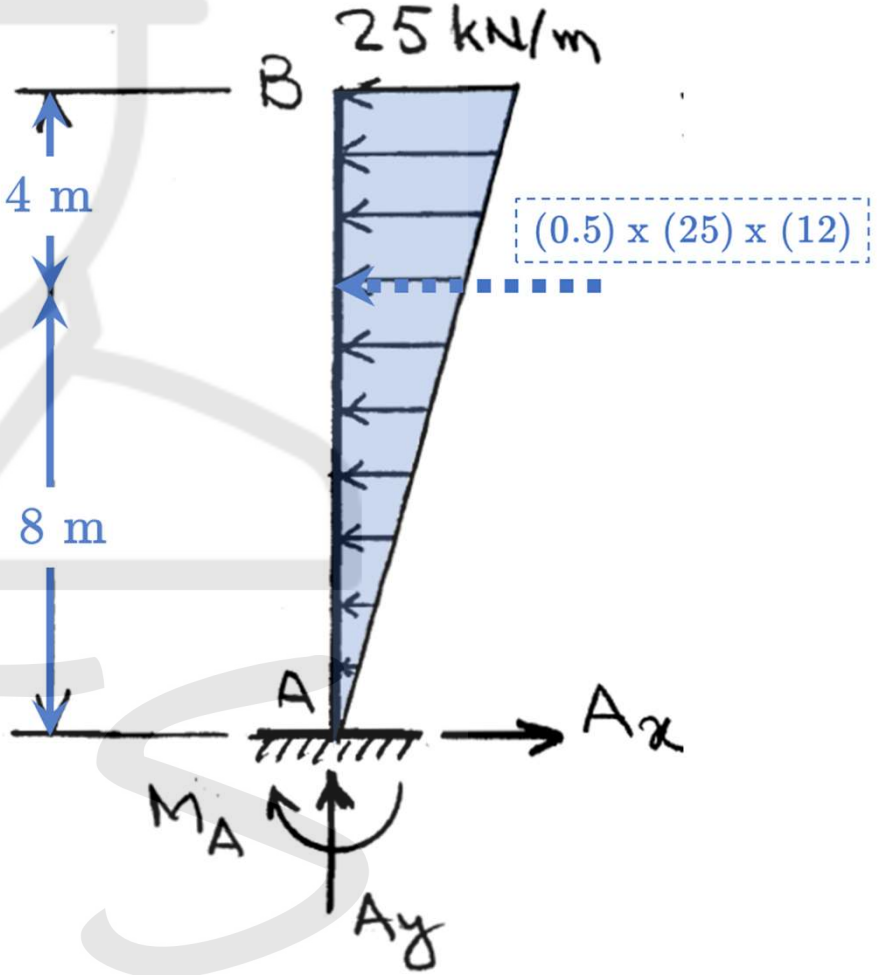
$A_x = 150 \text{ kN} \rightarrow$

$\Sigma F_y = 0 \qquad A_y = 0$

$+\circlearrowleft \Sigma M_A = 0$

$-M_A + \frac{1}{2}(25)(12)(8) = 0$

$M_A = 1200 \text{ kN.m} \circlearrowleft$



Free Body Diagram

Questions?