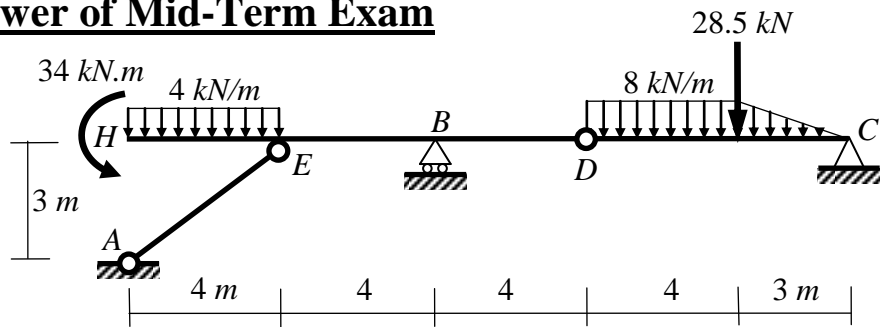


Answer of Mid-Term Exam

Question (1): (9 Marks)

For the shown structure, determine the reactions at the supports **A**, **B** and **C** and the force in the link member **AE**.



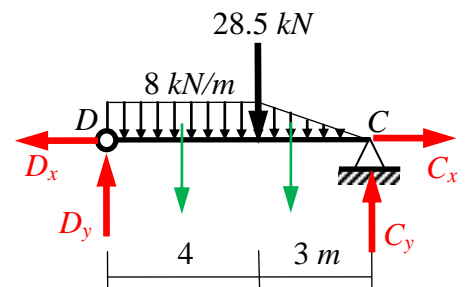
Part DC:

$$+\circlearrowleft \sum M_D = 0: \quad (8 \times 4)(2) + (28.5)(4) + (\frac{1}{2} \times 8 \times 3)(5) - C_y(7) = 0$$

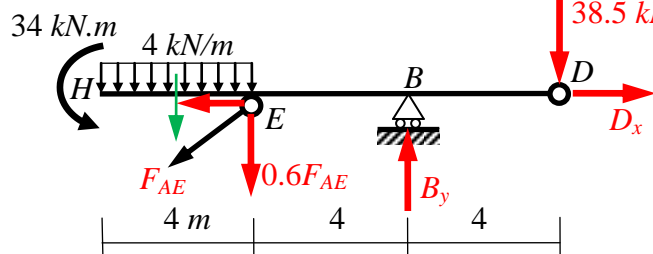
$$\rightarrow \quad \boxed{C_y = 34 \text{ kN } \uparrow}$$

$$+\uparrow \sum F_y = 0: \quad D_y + C_y - 32 - 28.5 - 12 = 0$$

$$\rightarrow \quad \boxed{D_y = 38.5 \text{ kN } \uparrow}$$



Part HD



$$+\circlearrowleft \sum M_B = 0: \quad -34 - (4 \times 4)(6) - (0.6F_{AE})(4) + (38.5)(4) = 0 \rightarrow F_{AE} = +10 \text{ kN} \rightarrow \quad \boxed{F_{AE} = 10 \text{ kN } \checkmark}$$

$$+\uparrow \sum F_y = 0: \quad -16 - 0.6(10) + B_y - 38.5 = 0 \rightarrow B_y = +60.5 \text{ kN} \rightarrow \quad \boxed{B_y = 60.5 \text{ kN } \uparrow}$$

$$+\rightarrow \sum F_x = 0: \quad -0.8(10) + D_x = 0 \rightarrow D_x = +8 \text{ kN} \rightarrow \quad \boxed{D_x = 8 \text{ kN } \rightarrow}$$

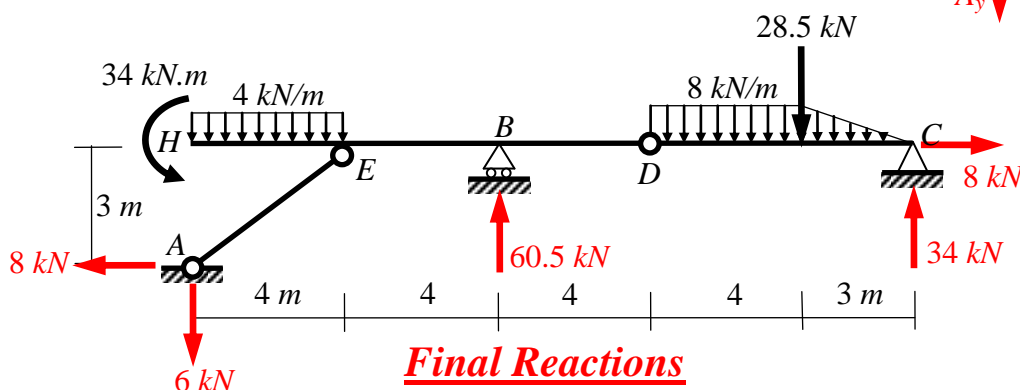
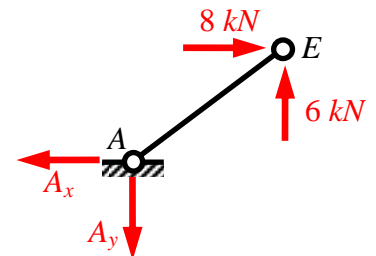
Part DC:

$$+\rightarrow \sum F_x = 0: \quad -8 + C_x = 0 \rightarrow C_x = +8 \text{ kN} \rightarrow \quad \boxed{C_x = 8 \text{ kN } \rightarrow}$$

Part AE:

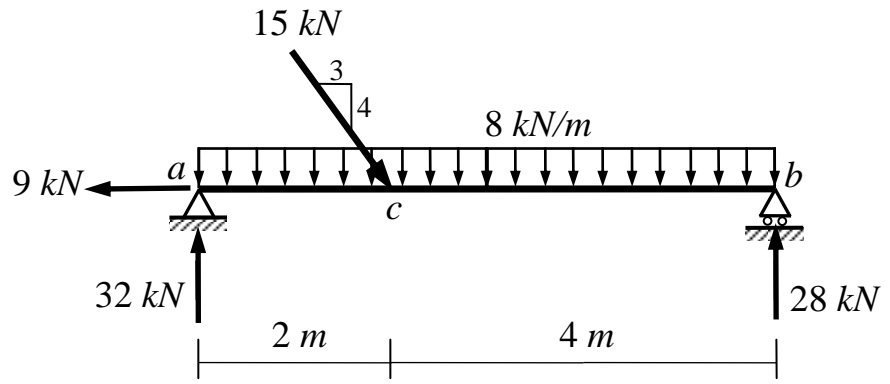
$$+\rightarrow \sum F_x = 0: \quad 8 - A_x = 0 \rightarrow A_x = +8 \text{ kN} \rightarrow \quad \boxed{A_x = 8 \text{ kN } \leftarrow}$$

$$+\uparrow \sum F_y = 0: \quad 6 - A_y = 0 \rightarrow A_y = +6 \text{ kN} \rightarrow \quad \boxed{A_y = 6 \text{ kN } \downarrow}$$

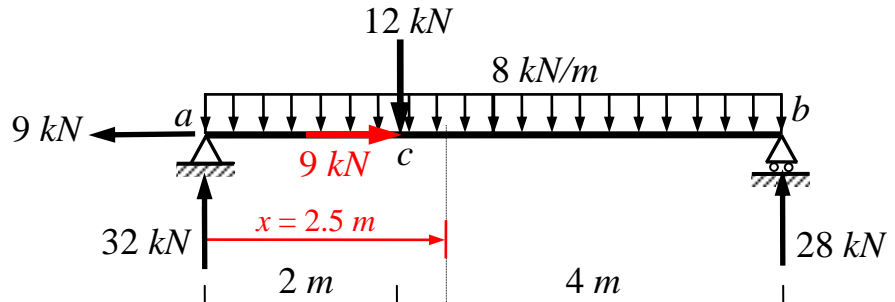


The force in the link member AE = 10 kN (Tension)

Question (2): (8 Marks)



(a)



(b) Location and value of $M_{\max +ve}$

Zero shear at: $\sum F_y \text{ left} = 0$

$$32 - 12 - 8x = 0 \rightarrow \boxed{x = 2.5 \text{ m}}$$

$$M_{\max +ve} = 32(2.5) - 12(0.5) - 8(2.5)^2/2 = 49 \text{ kN.m}$$

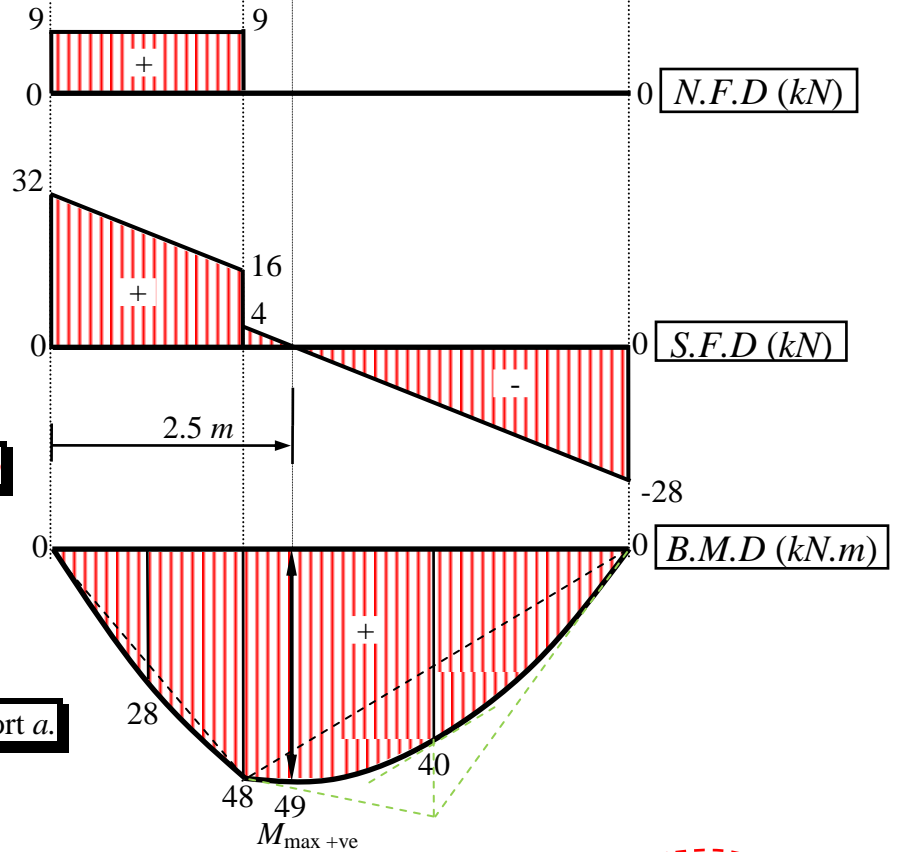
Or

Zero shear at: $\sum F_y \text{ right} = 0$

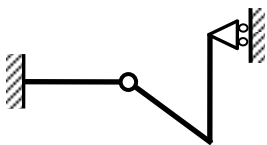
$$8x - 28 = 0 \rightarrow \boxed{x = 3.5 \text{ m from support b}}$$

$$M_{\max +ve} = 28(3.5) - 8(3.5)^2/2 = 49 \text{ kN.m}$$

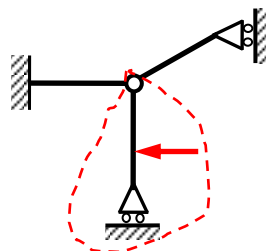
$$\boxed{M_{\max +ve} = 49 \text{ kN.m at } 2.5 \text{ m from the support a.}}$$



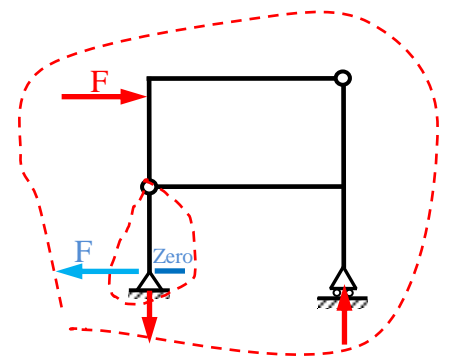
Question (3): (3 Marks)



(1) **Stable + Determinate.**



(2) **Unstable.**



(3) **Unstable.**