

60b)

$$\rightarrow \sum F_x = 0: H_A = 0$$

$$\uparrow \sum F_y = 0: -100N + R_A + R_B - 300 + 200 = 0$$

$$R_A = 200 - R_B$$

$$\uparrow \sum M_A = 0: 1 \cdot 100 - 3 \cdot 300 + 4 \cdot R_B + 5,5 \cdot 200$$

$$1 \cdot R_A - 4 \cdot 300 + 5 \cdot R_B + 6,5 \cdot 200 = 775$$

$$R_B = -300N \Rightarrow R_A = 500N$$

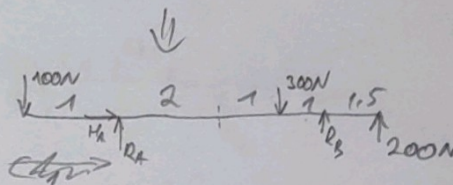
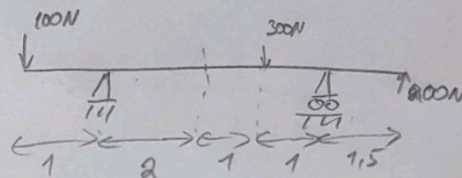
$$R_A = 200 - R_B = 200 - (-300) = 500N$$

$$R_B = 75N$$

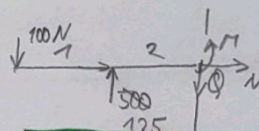
$$\rightarrow \sum F_x = 0: N = 0$$

$$\uparrow \sum F_y = 0: -100 + 500 - \Phi = 0 \Rightarrow \Phi = 400N$$

$$\uparrow \sum M_A = 0: M + 2 \cdot 500 + 3 \cdot 100 = 0 \Rightarrow M = -700Nm$$



$n_{1:1}$



$$\Phi = 175N$$

$$M = 250Nm$$

60c)

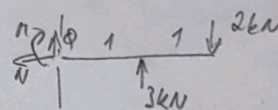
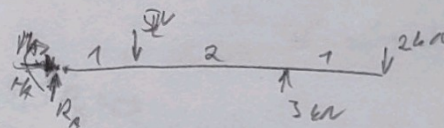
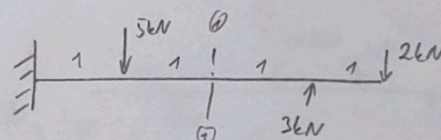
$$\rightarrow \sum F_x = 0: H_A = 0$$

$$\uparrow \sum F_y = 0: R_A - 5kN + 3kN - 2kN = 0$$

$$R_A = 4kN$$

$$\uparrow \sum M_A = 0: -M_A - 5kN \cdot 1 + 3 \cdot 3kN - 4 \cdot 2kN = 0$$

$$M_A = -4kNm$$



$$\rightarrow \sum F_x = 0$$

$$\uparrow \sum F_y = 0: \Phi + 3kN - 2kN = 0 \Rightarrow \Phi = -1kN$$

$$\uparrow \sum M_A = 0: -M + 3 \cdot 1 - 2 \cdot 2 = 0 \Rightarrow M = -1kNm$$

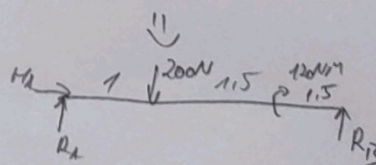
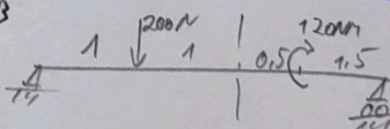
60d)

$$\sum F_x = 0: H_A = 0$$

$$\uparrow \sum F_y = 0: R_A - 200 + R_B = 0 \Rightarrow R_A = 200 - R_B$$

$$\uparrow \sum M_A = 0: -1 \cdot 200 - 120 + 4 \cdot R_B = 0$$

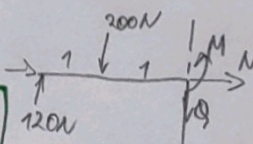
$$R_B = 80N \Rightarrow R_A = 120N$$



$$\sum F_x = 0: N = 0$$

$$\uparrow \sum F_y = 0: 120 - 200 - \Phi = 0 \Rightarrow \Phi = -80N$$

$$\uparrow \sum M_A = 0: M + 200 \cdot 1 - 2 \cdot 120 = 0 \Rightarrow M = 40Nm$$



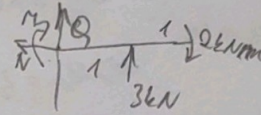
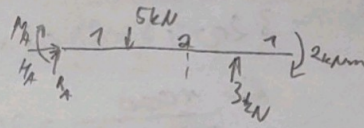
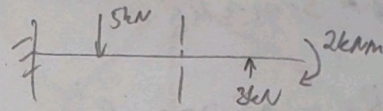
60 f) $\rightarrow \sum F_x = 0: H_A = 0$

$\uparrow \sum F_y = 0: R_A - 5 \text{ kN} + 3 \text{ kN} = 0$

$R_A = 2 \text{ kN}$

$\uparrow \sum M_A = 0: -M_A - 5 \cdot 1 + 3 \cdot 3 - 2 = 0$

$M_A = 2 \text{ kNm}$



$\rightarrow \sum F_x = 0: N = 0$

$\uparrow \sum F_y = 0: Q + 3 \text{ kN} = 0 \Rightarrow Q = -3 \text{ kN}$

$\uparrow \sum M_A = 0: -M + 3 \cdot 1 - 2 = 0 \Rightarrow M = 1 \text{ kNm}$

60 g)

$\sum F_x = 0: H_A = 0$

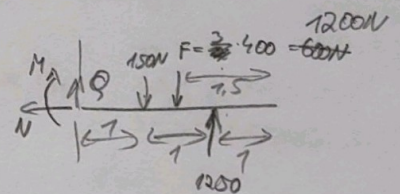
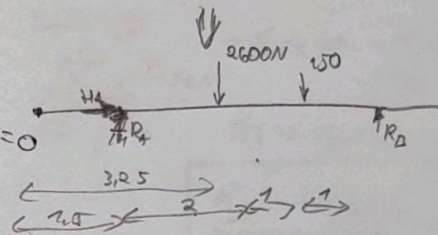
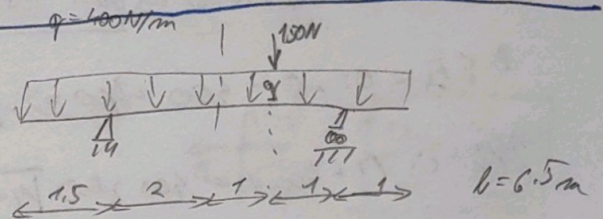
$\sum F_y = 0: R_A - 2600 - 150 + R_B = 0$

$R_A = 2750 - R_B$

$\uparrow \sum M_A = R_A \cdot 1.5 - 2600 \cdot 3.25 - 150 \cdot 5.150 + 5.5 R_B = 0$

$4125 - 1.5 R_B - 8450 - 675 + 5.5 R_B = 0$

$R_B = 7250 \text{ N} \Rightarrow R_A = 1500 \text{ N}$



$\rightarrow \sum F_x = 0: N = 0$

$\uparrow \sum F_y = 0: Q - 150 - 1200 + 1200 = 0 \Rightarrow Q = 100 \text{ N}$

$\uparrow \sum M_A = 0: -M - 150 \cdot 1 - 1.5 \cdot 1200 + 2 \cdot 1200 = 0$

$M = 500 \text{ Nm}$

$$60c) \rightarrow \sum F_x = H_A - \sin \alpha R'_B = 0$$

$$\uparrow \sum F_y = R_A - 400 - 200 + R'_B \cos \alpha = 0$$

$$\uparrow \sum M_A = 0: 400 \cdot 1 - 3 \cdot 200 + 5 \cdot R'_B \cos \alpha = 0$$

$$R'_B = \frac{1000}{5 \cdot \cos 26^\circ} = 222.5$$

$$R_B = 200 \text{ N}$$

$$\Rightarrow R_A = 300 \text{ N}$$

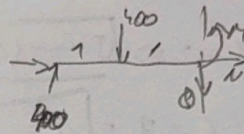
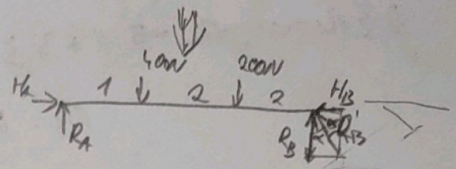
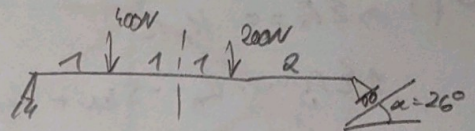
$$H_B = 97.5 \text{ N}$$

$$H_A = 97.5 \text{ N}$$

$$\rightarrow \sum F_x = 0: H_A + N = 0 \Rightarrow \boxed{N = -97.5 \text{ N}}$$

$$\uparrow \sum F_y = 0: -Q - 400 + 400 = 0 \Rightarrow \boxed{Q = 0 \text{ N}}$$

$$\sum M_A = 0: M + 400 \cdot 1 - 400 \cdot 2 = 0 \Rightarrow \boxed{M = 400 \text{ Nm}}$$



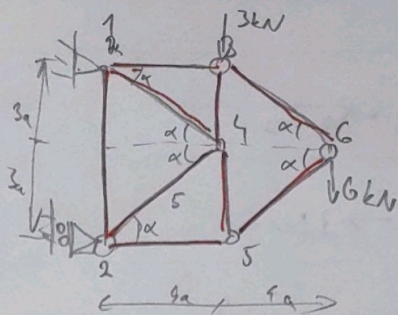
eg 68b)

$$\rightarrow \sum F_x = 0: R_A + R_B = 0$$

$$\uparrow \sum F_y = 0: -6 - 3 + H_A = 0 \Rightarrow H_A = 9 \text{ kN}$$

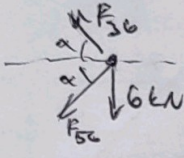
$$\circlearrowleft \sum M_A = 0: 6 \cdot 2a - 8a \cdot 6 - 4a \cdot 3 = 0$$

$$\boxed{\begin{aligned} R_B &= 10 \text{ kN} \\ H_A &= 9 \text{ kN} \\ R_A &= -10 \text{ kN} \end{aligned}}$$



$$\alpha = 36.87^\circ$$

Joint ②

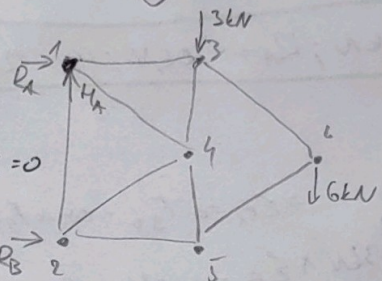


$$\sum F_x = 0: -F_{36} \cos \alpha - F_{56} \cos \alpha = 0$$

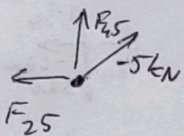
$$F_{36} = -F_{56}$$

$$\sum F_y = 0: -6 - \sin \alpha F_{56} + \sin \alpha F_{36} = 0$$

$$\boxed{F_{36} = -5 \text{ kN}; F_{56} = 5 \text{ kN}}$$



Joint ⑤

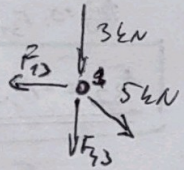


$$\sum F_x = 0: -5 \cos \alpha - F_{25} = 0$$

$$\sum F_y = 0: -5 \sin \alpha + F_{45} = 0$$

$$\boxed{F_{45} = 3 \text{ kN}; F_{25} = -4 \text{ kN}}$$

Joint ③

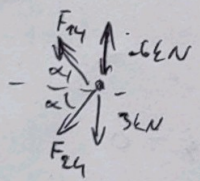


$$\sum F_x = 0: 5 \cos \alpha - F_{13} = 0$$

$$\sum F_y = 0: -3 - F_{43} + 5 \sin \alpha = 0$$

$$\boxed{F_{13} = 4 \text{ kN}; F_{43} = -6 \text{ kN}}$$

Joint ④



$$\sum F_x = 0: F_{14} \cos \alpha - F_{24} \cos \alpha = 0$$

$$F_{14} = F_{24}$$

$$\sum F_y = 0: F_{14} \sin \alpha - F_{24} \sin \alpha - 6 - 3 = 0$$

$$\boxed{F_{24} = -7.5 \text{ kN}; F_{14} = 7.5 \text{ kN}}$$

$$\boxed{F_{12} = 9.5 \text{ kN}}$$

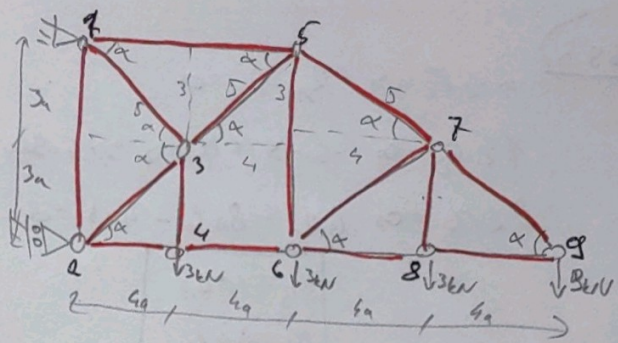
eg 68)

$$\rightarrow \sum F_x = 0: R_A + R_B = 0$$

$$\uparrow \sum F_y = 0: H_A - 4 \cdot 3 \text{ kN} = 0$$

$$\uparrow \sum M_A = 0: -3(4a + 4a + 4a + 4a) + 6R_B = 0$$

$$R_B = 20 \text{ kN}; R_A = -20 \text{ kN}; H_A = 12 \text{ kN}$$



$$\alpha = 36,87^\circ$$

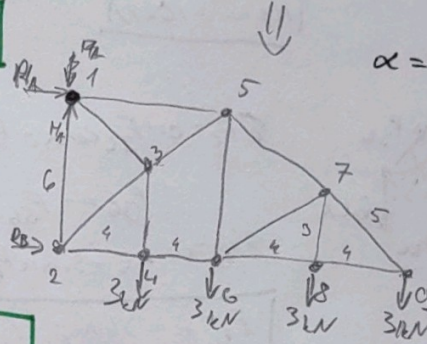
Joint 9

$$\rightarrow \sum F_x = 0: F_{98} - \cos \alpha F_{97} = 0$$

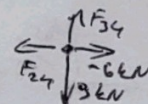
$$\uparrow \sum F_y = 0: -3 \text{ kN} + F_{97} \sin \alpha = 0$$

$$F_{98} = -\cos \alpha F_{97}; F_{97} = 3 \text{ kN} / \sin \alpha$$

$$F_{97} = 5 \text{ kN}; F_{98} = -4 \text{ kN}$$



Joint 8



$$F_{84} = 3 \text{ kN}$$

$$F_{87} = 6 \text{ kN}$$

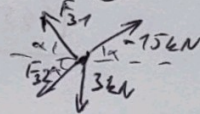
Joint 8

$$\rightarrow \sum F_x = 0: -4 \text{ kN} - F_{86} = 0$$

$$\uparrow \sum F_y = 0: F_{87} - 3 \text{ kN} = 0$$

$$F_{86} = -4 \text{ kN}; F_{87} = 3 \text{ kN}$$

Joint 3

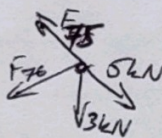


$$\rightarrow \sum F_x = 0: -15 \cos \alpha - F_{31} \cos \alpha - F_{32} \cos \alpha = 0$$

$$\uparrow \sum F_y = 0: F_{31} \sin \alpha + 15 \sin \alpha - F_{32} \sin \alpha = 0$$

$$F_{32} = -17,5 \text{ kN}; F_{31} = 2,5 \text{ kN}$$

Joint 7



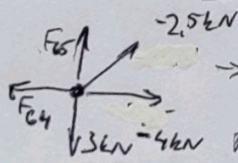
$$\rightarrow \sum F_x = 0: -\cos \alpha F_{76} - \cos \alpha F_{75} + \cos \alpha F_{97} = 0$$

$$\uparrow \sum F_y = 0: -3 \text{ kN} - \sin \alpha F_{76} + \sin \alpha F_{75} = 0$$

$$F_{75} = 7,5 \text{ kN}; F_{76} = -2,5 \text{ kN}$$

$$F_{12} = 10,5 \text{ kN}$$

Joint 6

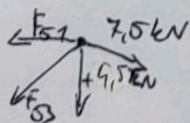


$$\rightarrow \sum F_x = 0: -2,5 - \cos \alpha F_{64} - F_{68} = 0$$

$$\uparrow \sum F_y = 0: -2,5 + F_{65} - F_{68} \sin \alpha = 0$$

$$F_{65} = 4 \text{ kN}; F_{64} = -6 \text{ kN}$$

Joint 5



$$\rightarrow \sum F_x = 0: -F_{51} + \cos \alpha F_{57} - \cos \alpha F_{53} = 0$$

$$\uparrow \sum F_y = 0: -4,5 - 7,5 \sin \alpha - F_{53} \sin \alpha = 0$$

$$F_{53} = 15 \text{ kN}; F_{51} = 10 \text{ kN}$$