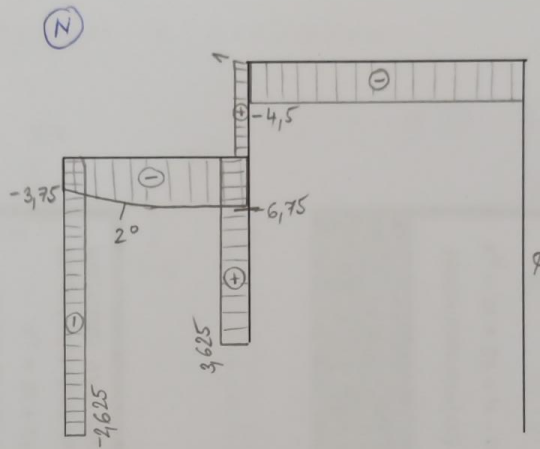
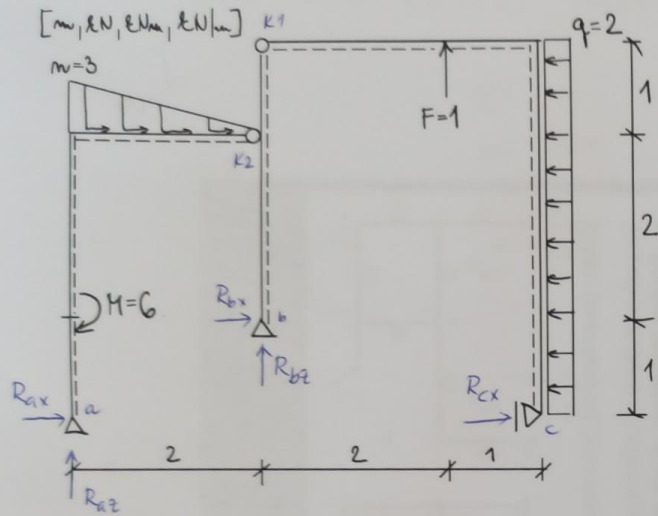




$$\sum M_{i,k1}^P = 0: F \cdot 2 - q \cdot 4 \cdot 2 + R_{cx} \cdot 4 = 0$$

$$R_{cx} = \frac{-1,2 + 2 \cdot 4 \cdot 2}{4}$$

$$R_{cx} = 3,5 \text{ kN} (\rightarrow)$$

$$\sum M_{i,k2}^P = 0: F \cdot 2 - q \cdot 4 \cdot 1 + R_{cx} \cdot 3 + R_{bx} \cdot 2 = 0$$

$$R_{bx} = \frac{-1,2 + 2 \cdot 4 \cdot 1 - 3,5 \cdot 3}{2}$$

$$R_{bx} = -2,25 \text{ kN} (\leftarrow)$$

$$\sum M_{i,a} = 0:$$

$$-M - \frac{1}{2} \cdot m \cdot 2 \cdot 3 - R_{bx} \cdot 1 + R_{bz} \cdot 2 + F \cdot 4 + q \cdot 4 \cdot 2 = 0$$

$$R_{bz} = \frac{6 + \frac{1}{2} \cdot 3 \cdot 2 \cdot 3 + (-2,25 \cdot 1) - 1 \cdot 4 - 2 \cdot 4 \cdot 2}{2}$$

$$R_{bz} = -3,625 \text{ kN} (\downarrow)$$

$$\sum M_{i,c} = 0: q \cdot 4 \cdot 2 - F \cdot 1 - \frac{1}{2} \cdot m \cdot 2 \cdot 3 - M - R_{bx} \cdot 1 - R_{bz} \cdot 3 - R_{az} \cdot 5 = 0$$

$$R_{az} = \frac{+2 \cdot 4 \cdot 2 - 1 \cdot 1 - \frac{1}{2} \cdot 3 \cdot 2 \cdot 3 - 6 - (-2,25) \cdot 1 - (-3,625) \cdot 3}{5}$$

$$R_{az} = 2,625 \text{ kN} (\uparrow)$$

$$\sum M_{i,k2}^L = 0: -M + R_{ax} \cdot 3 - R_{az} \cdot 2 = 0$$

$$R_{ax} = \frac{6 + 2,625 \cdot 2}{3}$$

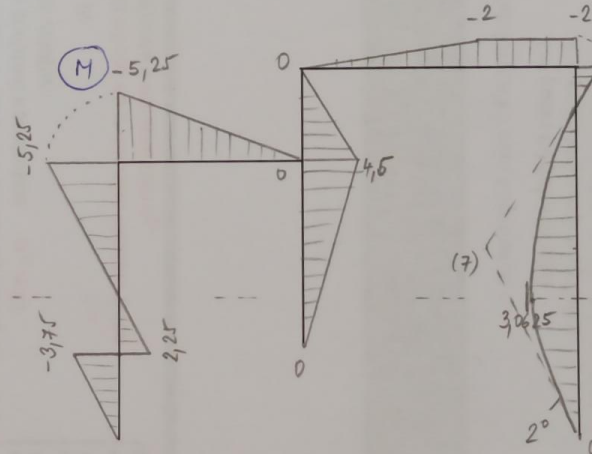
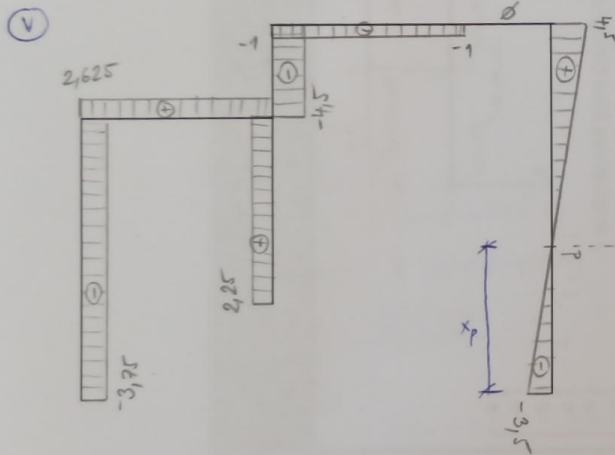
$$R_{ax} = 3,75 \text{ kN} (\rightarrow)$$

$$\sum F_{ix} = 0: R_{ax} + R_{bx} + R_{cx} + \frac{1}{2} \cdot m \cdot 2 - q \cdot 4 = 0$$

$$3,75 - 2,25 + 3,5 + \frac{1}{2} \cdot 3 \cdot 2 - 2 \cdot 4 = 0 \quad \checkmark$$

$$\sum F_{iz} = 0: R_{az} + R_{bz} + F = 0$$

$$2,625 + (-3,625) + 1 = 0 \quad \checkmark$$



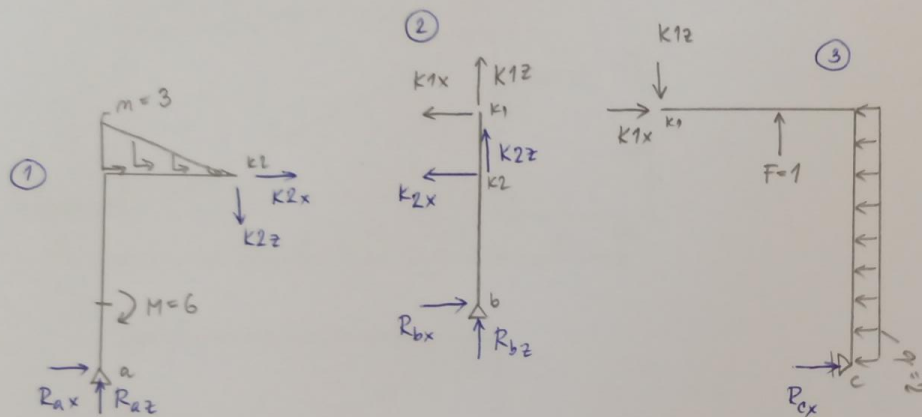
$$V_p^P = 0: -R_{cx} + q \cdot x_p = 0$$

$$x_p = \frac{R_{cx}}{q} = \frac{3,5}{2} = 1,75 \text{ m}$$

$$M_p^P = R_{cx} \cdot x_p - q \cdot x_p \cdot \frac{x_p}{2}$$

$$= 3,5 \cdot 1,75 - 2 \cdot \frac{1,75^2}{2} = 3,0625 \text{ kNm}$$

VÝPOČET VNĚJŠÍCH REAKCÍ ROZDĚLENÍM V KLOUBECH:



5) ① $\sum F_{ix} = 0$:

$$R_{ax} + \frac{1}{2} \cdot m \cdot 2 + K_{2x} = 0$$

$$R_{ax} = -\frac{1}{2} \cdot 3 \cdot 2 - (-6,75)$$

$$\underline{R_{ax} = 3,75 \text{ kN}}$$

$\sum F_{iz} = 0$:

$$R_{az} - K_{2z} = 0$$

$$\underline{R_{az} = 2,625 \text{ kN} \quad (\uparrow)}$$

ko: $\sum M_{i,k2} = 0 \quad \odot \oplus$:

$$R_{ax} \cdot 3 - R_{az} \cdot 2 - M = 0$$

$$3,75 \cdot 3 - 2,625 \cdot 2 - 6 = 0 \quad \checkmark$$

1) ③ $\sum M_{i,k1} = 0 \quad \odot \oplus$

$$F \cdot 2 - q \cdot 4 \cdot 2 + R_{cx} \cdot 4 = 0$$

$$\underline{R_{cx} = \frac{-1 \cdot 2 + 2 \cdot 4 \cdot 2}{4} = 3,5 \text{ kN} \quad (\rightarrow)}$$

$\sum F_{ix} = 0$: $K_{1x} - q \cdot 4 + R_{cx} = 0$

$$\underline{K_{1x} = -3,5 + 2 \cdot 4 = 4,5 \text{ kN}}$$

$\sum F_{iz} = 0$: $-K_{1z} + F = 0 \rightarrow \underline{K_{1z} = 1 \text{ kN}}$

ko: $\sum M_{i,c} = 0 \quad \odot \oplus$:

$$K_{1z} \cdot 3 - K_{1x} \cdot 4 - F \cdot 1 + q \cdot 4 \cdot 2 = 0$$

$$1 \cdot 3 - 4,5 \cdot 4 - 1 \cdot 1 + 2 \cdot 4 \cdot 2 = 0 \quad \checkmark$$

2) ② $\sum M_{i,k2} = 0 \quad \odot \oplus$

$$K_{1x} \cdot 1 + R_{bx} \cdot 2 = 0$$

$$\underline{R_{bx} = \frac{-4,5 \cdot 1}{2} = -2,25 \text{ kN} \quad (\leftarrow)}$$

$\sum F_{ix} = 0$:

$$-K_{1x} - K_{2x} + R_{bx} = 0$$

$$\underline{K_{2x} = R_{bx} - K_{1x} = -2,25 - 4,5 = -6,75 \text{ kN}}$$

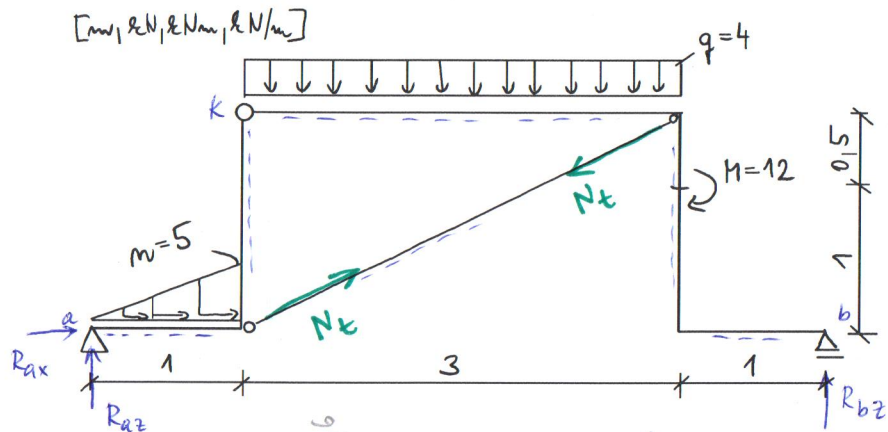
3) ④ $\sum M_{i,a} = 0 \quad \odot \oplus$:

$$-M - \frac{1}{2} \cdot m \cdot 2 \cdot 3 - K_{2z} \cdot 2 - K_{2x} \cdot 3 = 0$$

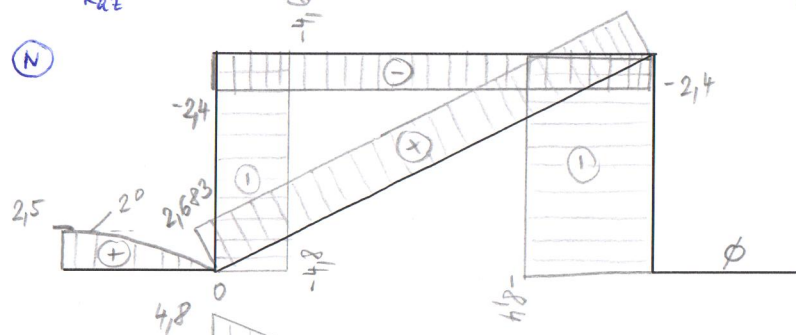
$$\underline{K_{2z} = \frac{-6 - \frac{1}{2} \cdot 3 \cdot 2 \cdot 3 - (-6,75) \cdot 3}{2} = 2,625 \text{ kN}}$$

4) ② $\sum F_{iz} = 0$: $K_{1z} + K_{2z} + R_{bz} = 0$

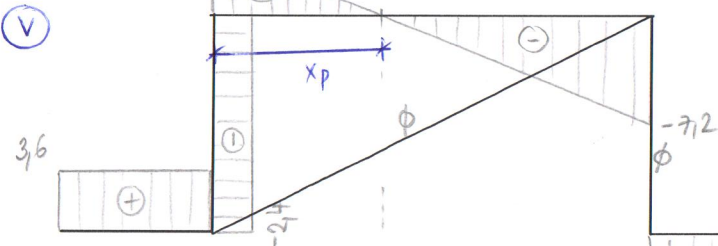
$$\underline{R_{bz} = -1 - 2,625 = -3,625 \text{ kN} \quad (\downarrow)}$$



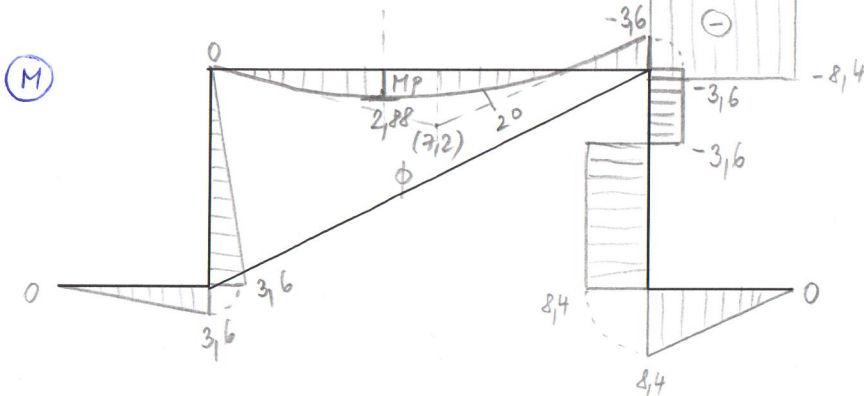
(N)



(V)



(M)



$$x_p = \frac{4.8}{4} = 1.2 \text{ m}$$

$$M_p = 0 + \frac{1}{2} \cdot 4.8 \cdot 1.2 = 2.88 \text{ kNm}$$

$$\oplus \sum M_{ia} = 0: -q \cdot 3 \cdot 2.5 - M + R_{bz} \cdot 5 = 0$$

$$R_{bz} = \frac{4 \cdot 3 \cdot 2.5 + 12}{5} = 8.4 \text{ kN} \quad (\uparrow)$$

$$\oplus \sum F_{ix} = 0: R_{ax} + \frac{1}{2} \cdot m \cdot 1 = 0$$

$$R_{ax} = -\frac{1}{2} \cdot 5 \cdot 1 = -2.5 \text{ kN} \quad (\leftarrow)$$

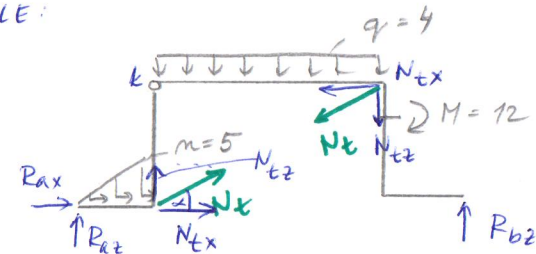
$$\oplus \sum M_{ib} = 0: q \cdot 3 \cdot 2.5 - M - R_{az} \cdot 5 = 0$$

$$R_{az} = \frac{4 \cdot 3 \cdot 2.5 - 12}{5} = 3.6 \text{ kN} \quad (\uparrow)$$

$$KO: \sum F_{iz} = 0: R_{az} + R_{bz} - q \cdot 3 = 0$$

$$3.6 + 8.4 - 4 \cdot 3 = 0 \quad \checkmark$$

SILA V TAHLE:



$$\oplus \sum M_{ik}^L = 0: N_{tx} \cdot 1.5 + \frac{1}{2} \cdot m \cdot 1 \cdot 1.5 + R_{ax} \cdot 1.5 - R_{az} \cdot 1 = 0$$

$$N_{tx} = \frac{-\frac{1}{2} \cdot 5 \cdot 1 \cdot 1.5 - (-2.5) \cdot 1.5 + 3.6 \cdot 1}{1.5}$$

$$N_{tx} = 2.4 \text{ kN}$$

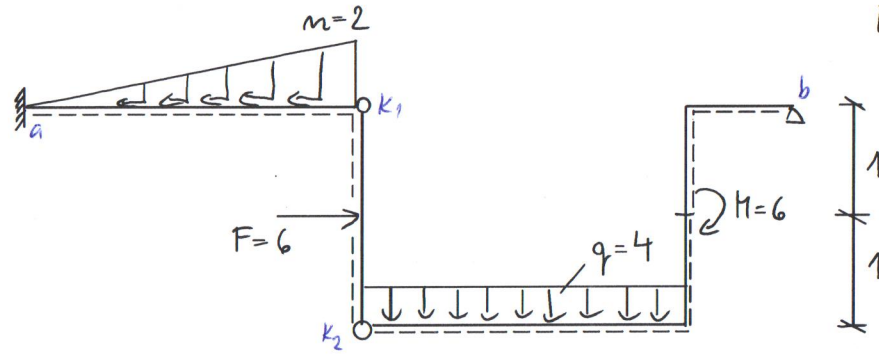
$$\oplus \sum M_{ik}^P = 0: R_{bz} \cdot 4 - M - q \cdot 3 \cdot 1.5 - N_{tz} \cdot 3 = 0$$

$$N_{tz} = \frac{8.4 \cdot 4 - 12 - 4 \cdot 3 \cdot 1.5}{3}$$

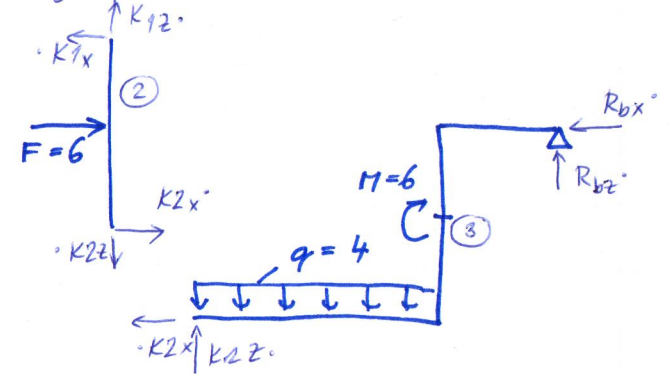
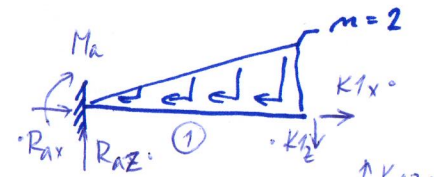
$$N_{tz} = 1.2 \text{ kN}$$

$$N_t = \sqrt{1.2^2 + 2.4^2} = \sqrt{7.2} = 2.683 \text{ kN}$$

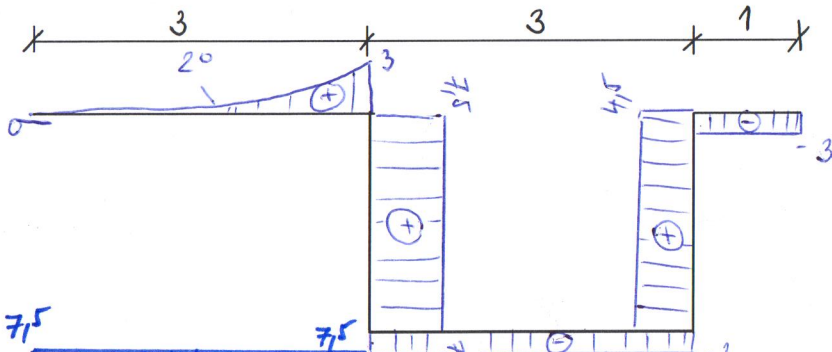
$$KO: N_t = \frac{N_{tx}}{\cos \alpha} = \frac{2.4}{(3/\sqrt{3^2 + 1.5^2})} = 2.683 \text{ kN}$$



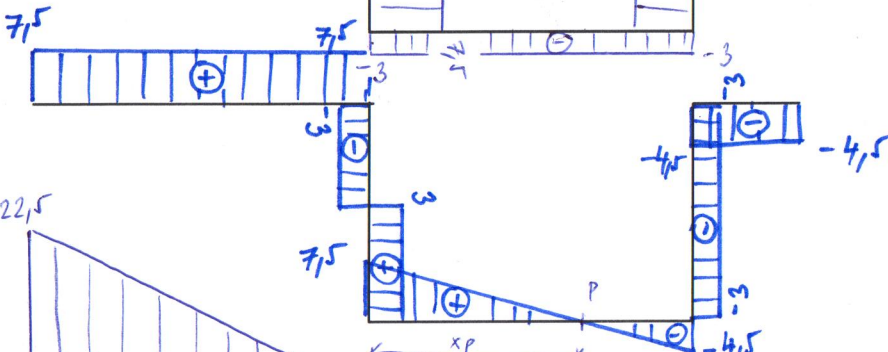
[mm, kN, kNm, kN/m]



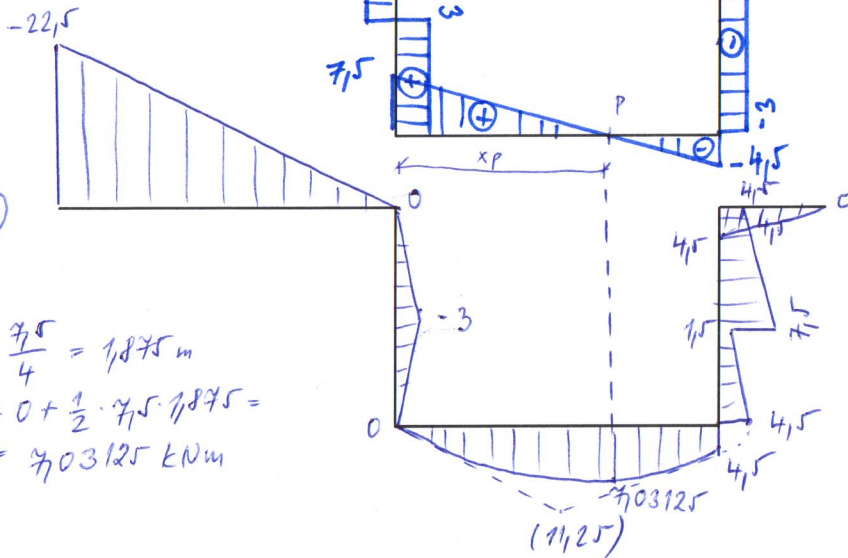
(N)



(V)



(M)



$$x_p = \frac{7.5}{4} = 1.875 \text{ m}$$

$$M_p = 0 + \frac{1}{2} \cdot 7.5 \cdot 1.875 = 7.03125 \text{ kNm}$$

(2) $\circledast$

$$\sum M_{iK1} = 0 : F \cdot 1 + K2x \cdot 2 = 0$$

$$K2x = \frac{-6 \cdot 1}{2} = -3 \text{ kN}$$

(2)

$$\sum F_{ix} = 0 : -K1x + F + K2x = 0$$

$$K1x = 6 + (-3) = 3 \text{ kN}$$

(3) $\circledast$

$$\sum M_{ib} = 0 : -K2x \cdot 2 - K2z \cdot 4 + q \cdot 3 \cdot 2.5 - M = 0$$

$$K2z = \frac{-(-3) \cdot 2 + 4 \cdot 3 \cdot 2.5 - 6}{4} = 7.5 \text{ kN}$$

(2)

$$\sum F_{iz} = 0 : K1z - K2z = 0 \rightarrow K1z = 7.5 \text{ kN}$$

(3)

$$\sum F_{ix} = 0 : -K2x - R_{bx} = 0 \rightarrow R_{bx} = -(-3) = 3 \text{ kN}$$

(3)

$$\sum M_{ik2} = 0 : -q \cdot 3 \cdot 1.5 - M + R_{bx} \cdot 2 + R_{bz} \cdot 4 = 0$$

$$R_{bz} = \frac{4 \cdot 3 \cdot 1.5 + 6 - 3 \cdot 2}{4} = 4.5 \text{ kN}$$

(1)

$$\sum F_{ix} = 0 : R_{ax} - \frac{1}{2} m \cdot 3 + K1x = 0 \rightarrow R_{ax} = \frac{1}{2} \cdot 2 \cdot 3 - 3 = 0$$

(1)

$$\sum F_{iz} = 0 : R_{az} - K1z = 0 \rightarrow R_{az} = K1z = 7.5 \text{ kN}$$

(1)

$$\sum M_{ia} = 0 : -M_a - K1z \cdot 3 = 0 \rightarrow M_a = -7.5 \cdot 3 = -22.5 \text{ kNm}$$