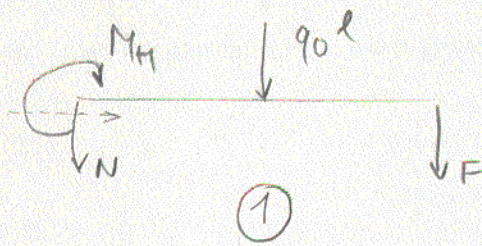


1) a)

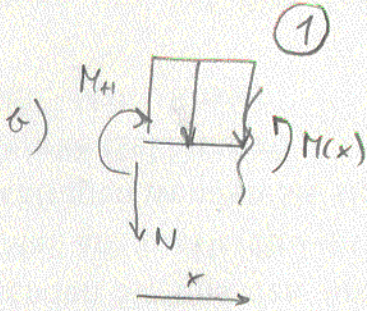


$$F \cdot l = -\frac{1}{2} q_0 l^2 - M_H$$

$$F = -\frac{1}{2} q_0 l - \frac{M_H}{l} \quad (1)$$

$$N \cdot l = -\frac{1}{2} q_0 l^2 + M_H$$

$$N = -\frac{1}{2} q_0 l + \frac{M_H}{l} \quad (1)$$



$$M(x) = M_H - \frac{1}{2} q_0 x^2 - N x = M_H - \frac{1}{2} q_0 x^2 - \frac{M_H}{l} x + \frac{1}{2} q_0 l x \quad (1)$$

$$N(x) = \text{const} = -\frac{1}{2} q_0 l + \frac{M_H}{l} \quad (2)$$

$$W = \frac{1}{2EJ} \int_0^l M(x)^2 dx + \frac{1}{2EA} \int_0^{\frac{l}{2}} N(x)^2 dz + \frac{1}{2c} F^2 \quad (1)$$

$$c) \quad \frac{\partial W}{\partial M_H} = 1 - \frac{x}{l} \quad \frac{\partial N}{\partial M_H} = \frac{1}{l} \quad \frac{\partial F}{\partial M_H} = -\frac{1}{l} \quad (1)$$

$$\varphi = \frac{\partial W}{\partial M_H} \Big|_{M_H=0} = \frac{1}{EJ} \int_0^l \left(-\frac{1}{2} q_0 x^2 + \frac{1}{2} q_0 l x \right) dx + \frac{1}{EA} \int_0^{\frac{l}{2}} \left(-\frac{1}{2} q_0 l \right) dz + \frac{1}{2c} \cdot \frac{1}{2} \cdot \left(\frac{1}{2} q_0 l \right)^2$$

$$= \frac{1}{EJ} \left\{ -\frac{1}{6} q_0 l^3 + \frac{1}{4} q_0 l^3 + \frac{1}{8} q_0 l^3 - \frac{1}{6} q_0 l^3 \right\} - \frac{1}{EA} \cdot \frac{1}{2} q_0 \frac{l}{2} + \frac{1}{2c} q_0$$

$$= \frac{1}{24EJ} \left\{ -4+6+3-4 \right\} q_0 l^3 - \frac{1}{4EA} q_0 l + \frac{1}{2c} q_0 = \frac{1}{24EJ} q_0 l^3 - \frac{1}{4EA} q_0 l + \frac{1}{2c} q_0$$

$$\varphi = \frac{1}{24EJ} q_0 l^3 - \frac{1}{4EA} q_0 l + \frac{1}{2c} q_0 \quad (1)$$