Remarks: See §4.4, pages 168 till 170
See §4.5, pages 171 till 184
See §4.6, pages 184 till 186

Answers:

a. $e_z = 40$ mm
b. $e_z = 80$ mm
c. $e_z = -40$ mm
d. $e_z = -24$ mm

Explanation:

Draw the appropriate stress diagram with, for example, tension at the lower part of the cross-section

Decompose the diagram into $\sigma^{(M)}$ as a result of M_z and $\sigma^{(N)}$ as a result of N.

Take the maximum stress due to M_z as σ:

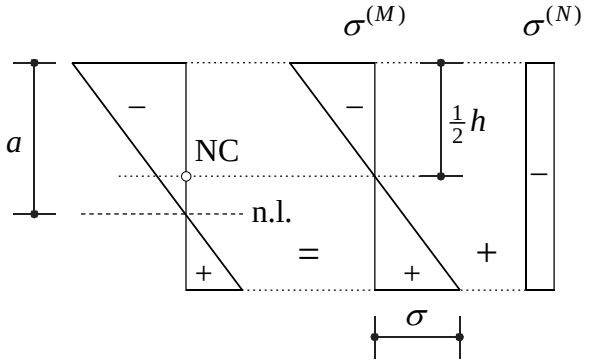
$$M_z = \tfrac{1}{6} b h^2 \sigma$$

At the given value of a one can calculate the stress σ_{NC} in the normal centre:

$$N = bh\sigma_{NC}$$

The centre of force is calculated by:

$$e_z = \frac{M_z}{N}$$



Extra explanation:

If one takes a as a variable then one can, from the stress diagram, derive for the general case that.

$$\sigma_{NC} = -\frac{a - \frac{1}{2}h}{\frac{1}{2}h}\sigma = (1 - \frac{2a}{h})\sigma$$

and $N = b(h - 2a)\sigma$