

Remarks: See §4.4, pages 168 till 170

See §4.5.4, pages 179 till 182

Hint:

Sketch the stress diagram due to N and M. Assume that M causes tension at the bottom and compression at the top. (The opposite is possible).

Answers:

a. $N = -90 \text{ kN}$

b. $\sigma_{\max} = -12 \text{ N/mm}^2$

Explanation:

$$\text{a. } \sigma_{\max}^{(M)} = \frac{M \cdot \frac{1}{2}h}{I} = \frac{(3 \times 10^6 \text{ Nmm})(100 \text{ mm})}{\frac{1}{12}b(200 \text{ mm})^3} = \frac{450 \text{ N/mm}}{b}$$

$$\sigma^{(N)} = -\sigma_{\max}^{(M)} = -\frac{450 \text{ N/mm}}{b}$$

$$N = A\sigma^{(N)} = b \times (200 \text{ mm}) \times \left(-\frac{450 \text{ N/mm}}{b}\right) = -90 \times 10^3 \text{ N}$$

b. $\sigma^{(N)} = -6 \text{ N/mm}^2$

$$\sigma_{\max}^{(M)} = 6 \text{ N/mm}^2$$

$$\sigma_{\text{outermost fibers}} = \sigma^{(N)} \pm \sigma_{\max}^{(M)}$$