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

Answers:

a. $W = 58\times10^{3}\ \text{mm}^3$

b. $N = -112,5\ \text{kN}$

c. $M = 2,175\ \text{kNm}\ (\smile)$

Explanation:

a. $I = \frac{1}{12}(60\ \text{mm})(80\ \text{mm})^3 - \frac{1}{12}(45\ \text{mm})(40\ \text{mm})^3 = 2,32\times10^{6}\ \text{mm}^4$

$$W = \frac{2,32\times10^{6}\ \text{mm}^4}{40\ \text{mm}} = 58\times10^{3}\ \text{mm}^3$$

b. $A = 3000\ \text{mm}^2$

$\sigma_{NC} = -37,5\ \text{N/mm}^2$

$N = (-37,5\ \text{N/mm}^2)(3000\ \text{mm}^2) = 112,5\times10^{3}\ \text{N}$

c. $\sigma_b^{(M)} = \sigma_b - \sigma_{NC} = 37,5\ \text{N/mm}^2$ (tension at the bottom)

$\sigma_t^{(M)} = \sigma_t - \sigma_{NC} = -37,5\ \text{N/mm}^2$ (compression at the top)

Thus: $\sigma_{max}^{(M)} = 37,5\ \text{N/mm}^2$

$M = \sigma_{max}^{(M)} \times W = (37,5\ \text{N/mm}^2)(58\times10^{3}\ \text{mm}^3) = 2,175\times10^{6}\ \text{Nmm}\ \ (\smile)$

(because tension at the bottom and compression n at the top)