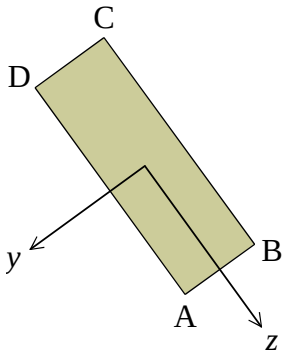
Remarks: See §4.8, pages 198 till 203

Answers:



a. In the middle of the purlin.

b. $\sigma_{max} = 13 \text{ N/mm}^2$

c. $\sigma_A = +13 \text{ N/mm}^2$ $\sigma_B = -5 \text{ N/mm}^2$
$\sigma_C = -13 \text{ N/mm}^2$ $\sigma_D = +5 \text{ N/mm}^2$

e. equation of the neutral axis: $6,75y + z = 0$

Explanation:

Cross-sectional properties:

$I_{yy} = 3,24\times10^6 \text{ mm}^4$ and $I_{zz} = 29,16\times10^6 \text{ mm}^4$
$W_y = 108\times10^3 \text{ mm}^3$ and $W_z = 324\times10^3 \text{ mm}^3$

a. In the middle of the purlin :

$M_y = \frac{1}{8}(0,6 \text{ kN/m})(3,6 \text{ m})^2 = +0,972 \text{ kNm}$
$M_z = \frac{1}{8}(0,8 \text{ kN/m})(3,6 \text{ m})^2 = +1,296 \text{ kNm}$

b. $\sigma_{max}^{(M)} = \left|\frac{M_y}{W_y}\right| + \left|\frac{M_y}{W_y}\right| = \frac{0,972\times10^6 \text{ Nmm}}{108\times10^3 \text{ mm}^3} + \frac{1,296\times10^6 \text{ Nmm}}{324\times10^3 \text{ mm}^3} = 13 \text{ N/mm}^2$

c. Due to M_y :

$\sigma_{max}^{(M)} = \frac{0,972\times10^6 \text{ Nmm}}{108\times10^3 \text{ mm}^3} = 9 \text{ N/mm}^2$;tension in AD and compression in BC

Due to M_z :

$\sigma_{max}^{(M)} = \frac{1,296\times10^6 \text{ Nmm}}{324\times10^3 \text{ mm}^3} = 4 \text{ N/mm}^2$; tension in AB and compression in CD

Total:

$\sigma(y,z) = \frac{(0,972\times10^6 \text{ Nmm})\times y}{3,24\times10^6 \text{ mm}^4} + \frac{(1,296\times10^6 \text{ Nmm})\times z}{29,16\times10^6 \text{ mm}^4}$

e. Equation of the neutral axis: $\sigma(y,z) = 0 \Rightarrow 6,75y + z = 0$