Remarks: See §3.2.4, pages 109 till 113,example 5

Answers 3.33-1:

a. The NC is located on the intersection of the lines of symmetry
b. $I_{zz} = 67500 \text{ mm}^4$
c. $I_{yy} = 67500 \text{ mm}^4$
d. $I_{yz} = 0$

Explanation 3.33-1:

Take the cross-section as the combination of two triangles.
Dimensions in mm:

b. $I_{zz} = 2\times\left\{I_{zz(\text{basis})}\right\} = 2\times\left\{\frac{1}{12}\times 30\sqrt{2}\times(15\sqrt{2})^3\right\} = 67500 \text{ mm}^4$

c. The cross-section is rotation-symmetric:

$$I_{yy} = I_{zz} \text{ en } I_{yz} = I_{zy} = 0$$

Answers 3.33-2:

a. The NC is located at the centre of rotational symmetry.
b. $I_{zz} = 540\times10^3 \text{ mm}^4$
c. $I_{yy} = 6,2208 \text{ m}^4$
d. $I_{yz} = -180\times10^3 \text{ mm}^4$

Explanation 3.33-2:

Take the cross-section as the combination of two triangles.
Dimensions in mm:

b. $I_{zz} = 2\times\left\{\frac{1}{36}\times 30\times 60^3 + \frac{1}{2}\times 30\times 60\times 10^2\right\} = 540\times10^3 \text{ mm}^4$

c. $I_{yy} = 2\times\left\{I_{zz(\text{basis})}\right\} = 2\times\left\{\frac{1}{12}\times 60\times 30^3\right\} = 270\times10^3 \text{ mm}^4$

d. $I_{yz} = 2\times\left\{\frac{1}{2}\times 60\times 30\times(+10)\times(-10)\right\} = -180\times10^3 \text{ mm}^4$

Answers 3.33-3:

a. The NC is located on the line of symmetry and 35 mm above the bottom edge of the cross-section

b. $I_{zz} = 1873 \times 10^3 \text{ mm}^4$

c. $I_{yy} = 1350 \times 10^3 \text{ mm}^4$

d. $I_{yz} = 0$

Explanation 3.33-3:

Take the cross-section as the combination of two triangles.
Dimensions in mm:

b. $I_{zz} = \left\{\tfrac{1}{12} \times 60 \times 90^3 + 60 \times 90 \times 10^2\right\} - \left\{\tfrac{1}{36} \times 60 \times 45^3 + \tfrac{1}{2} \times 60 \times 45 \times 40^2\right\}$

c. $I_{yy} = \left\{\tfrac{1}{12} \times 90 \times 60^3\right\} - \left\{\tfrac{1}{36} \times 45 \times 60^3\right\} = 1350 \times 10^3 \text{ mm}^4$

d. The cross-section is symmetric: $I_{yz} = I_{zy} = 0$

Answers 3.33-4:

a. The NC is located at the centre of rotational symmetry.

b. $I_{zz} = 405 \times 10^3 \text{ mm}^4$

c. $I_{yy} = 303{,}75 \times 10^3 \text{ mm}^4$

d. $I_{yz} = 157{,}5 \times 10^3 \text{ mm}^4$

Explanation 3.33-4:

Take the cross-section as the combination of two triangles.
Dimensions in mm:

b. $I_{zz} = 2 \times \left\{\tfrac{1}{36} \times 45 \times 40^3 + \tfrac{1}{2} \times 45 \times 40 \times (11\tfrac{2}{3})^2\right\} = 405 \times 10^3 \text{ mm}^4$

c. $I_{yy} = \tfrac{1}{12} \times 40 \times 45^3 = 303{,}75 \times 10^3 \text{ mm}^4$.

d. $I_{yz} = \left\{\tfrac{1}{2} \times 45 \times 40 \times (+11\tfrac{2}{3}) \times (+7\tfrac{1}{2})\right\} + \left\{\tfrac{1}{2} \times 45 \times 40 \times (-11\tfrac{2}{3}) \times (-7\tfrac{1}{2})\right\} =$
$= 157{,}5 \times 10^3 \text{ mm}^4$