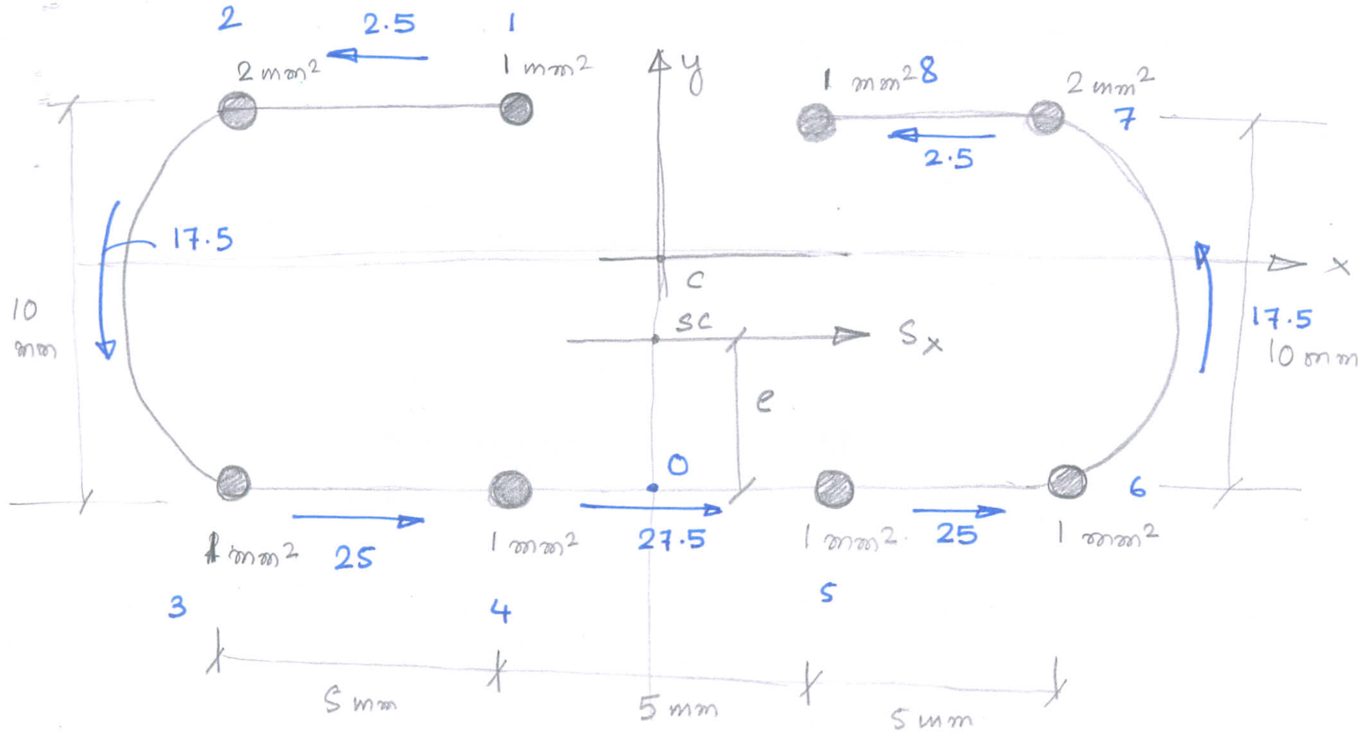

The section is symmetrical about y-axis, therefore the shear centre will lie on y-axis

∴ We need find y-coordinate of the shear centre and calculating the shear flow due to S_x will suffice.

$$q_s - q_0 = -\left[\frac{S_x I_{xx} - S_y I_{xy}}{I_{xx} I_{yy} - I_{xy}^2}\right] B_r x_r - \left[\frac{S_y I_{yy} - S_x I_{xy}}{I_{xx} I_{yy} - I_{xy}^2}\right] B_r y_r$$

$I_{xy} = 0$ due to symmetry and $S_y = 0$

$$\therefore \quad q_s - q_0 = \frac{-S_x}{I_{yy}} B_r x_r .$$

$$I_{yy} = 2\times1\times(2.5)^2 + 2\times2\times(7.5)^2 + 2\times1\times(2.5)^2 + 2\times1\times(7.5)^2$$

$$= 4\times(2.5)^2 + 6\times(7.5)^2 = 25 + 337.5 = 362.5\ mm^4$$

$$q_{12} = \frac{-S_x}{I_{yy}} \cdot 1\times(-2.5) = \frac{2.5 S_x}{I_{yy}} .$$

$$q_{23} = \frac{-S_x}{I_{yy}} \cdot 2\times(-7.5) + \frac{2.5 S_x}{I_{yy}} = \frac{17.5 S_x}{I_{yy}} .$$

$$q_{34} = \frac{-S_x}{I_{yy}} \times 1\times(-7.5) + \frac{17.5 S_x}{I_{yy}} = \frac{25 S_x}{I_{yy}} .$$

$$q_{45} = \frac{-S_x}{I_{yy}} \times 1 \times (-2.5) + \frac{25 S_x}{I_{yy}} = \frac{27.5\, S_x}{I_{yy}}.$$

$$q_{56} = \frac{-S_x}{I_{yy}} \times 1 \times (2.5) + \frac{27.5\, S_x}{I_{yy}} = \frac{25 S_x}{I_{yy}}. \quad \text{(by symmetry)}$$

$$q_{67} = D \quad \frac{-S_x}{I_{yy}} \times 1 \times 7.5 + \frac{25 S_x}{I_{yy}} = \frac{17.5\, S_x}{I_{yy}} \quad ''$$

$$q_{78} = \frac{2.5\, S_x}{I_{yy}}.$$

Balancing moment about O,

$$S_x e = \frac{S_x}{I_{yy}} \left[2 \times 2.5 \times 5 \times 10 + 2 \times 2 \times 17.5 \times \left(\frac{\pi 5^2}{2} + \frac{1}{2} \times 7.5 \times 10 \right) \right]$$

$$\Rightarrow \quad e = \frac{1}{362.5} \left[250 + 2 \times 35 \left(39.26 + 37.5 \right) \right]$$

$$= \cancel{8.1\,mm} \quad \underline{15.51\ mm.}$$