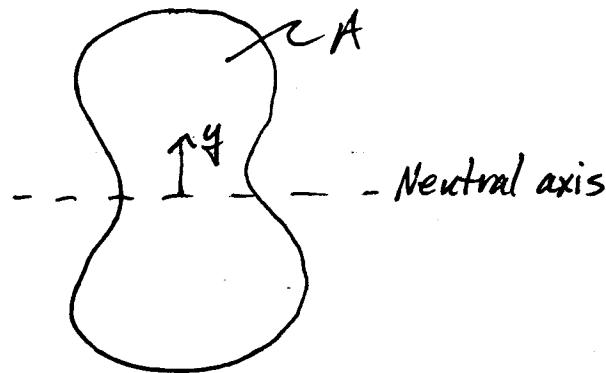


Supplementary Note on Calculating $Q(y)$

Consider an arbitrary shape. Not necessarily symmetric.

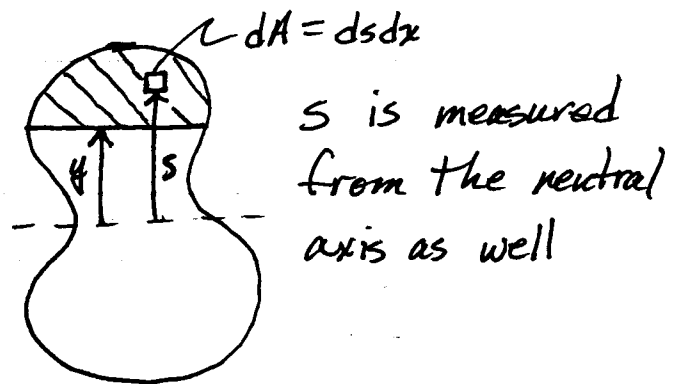


The neutral axis is defined such that

$$\int_A y \, dA = 0$$

Now consider $Q(y)$.

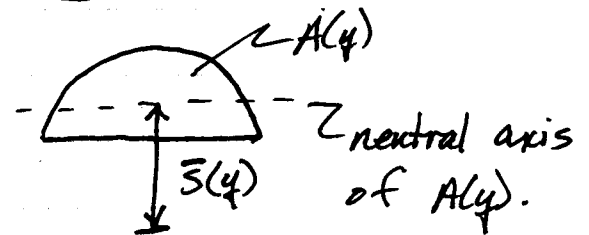
$$Q(y) = \int_{A(y)} s \, dA$$



s is measured from the neutral axis as well

Consider the shaded area.

It has its own neutral axis defined as,



$$\bar{s}(y) = \frac{\int_{A(y)} s \, dA}{\int_{A(y)} dA} = \frac{1}{A(y)} \int_{A(y)} s \, dA = \frac{Q(y)}{A(y)}$$

Therefore, we have shown that,

$$Q(y) = A(y) \bar{s}(y)$$

where $A(y)$ is the area of the cross-section above y , and $\bar{s}(y)$ is the distance to the neutral axis of $A(y)$.

For homework compute $Q(y)$ for 