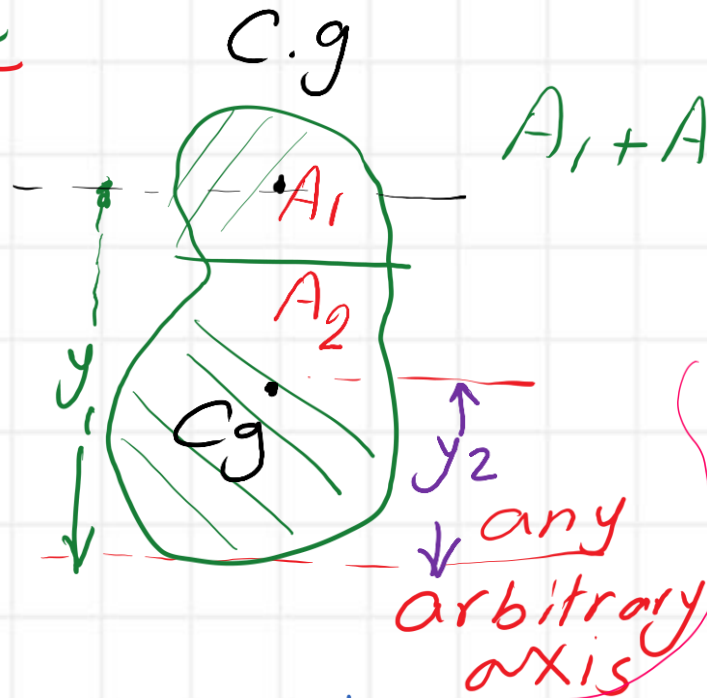
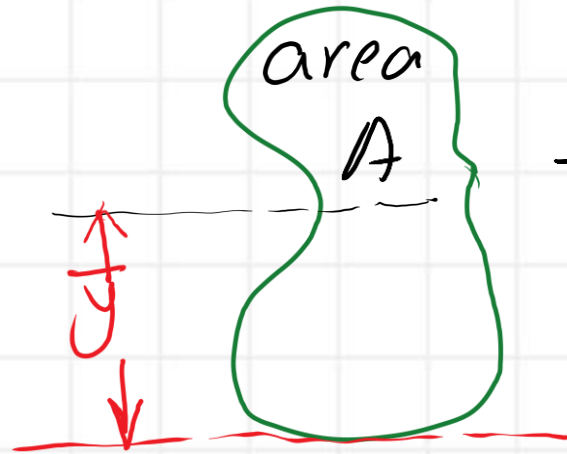


Any Shape



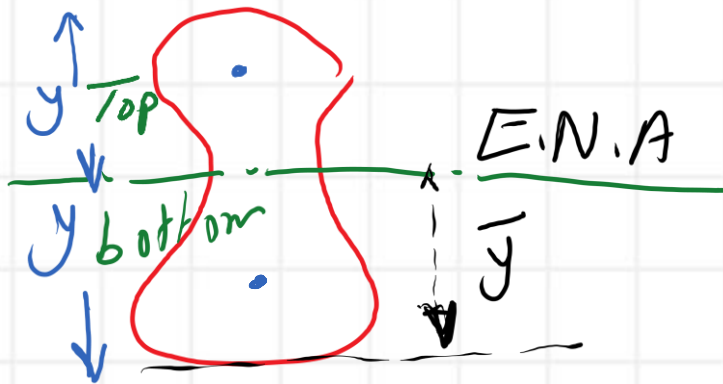
S_x : Section modulus.

$$A_1 + A_2 = A \quad (1)$$

$$\bar{y}_{bar} = \frac{A_1 y_1 + A_2 y_2}{A_1 + A_2}$$

Sum of First moment of Areas
 $\frac{A_1 + A_2}{\sum Areas}$

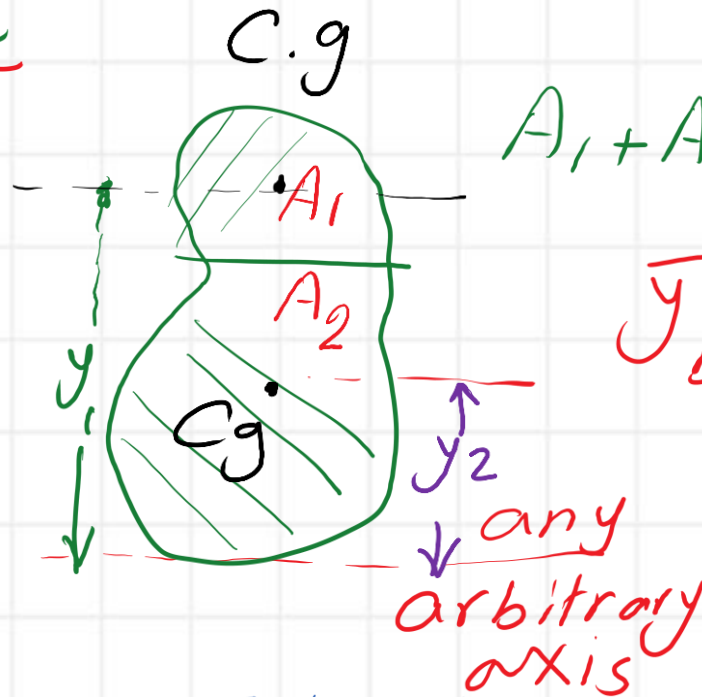
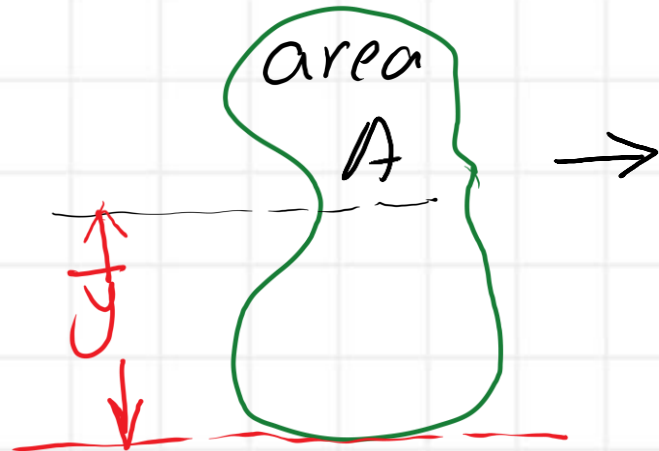
Then the Elastic neutral axis Can be Located



get y_1 Top, the distance to upper most edge
 get y_2 bottom, the distance to Lower most edge

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Any Shape



S_x : Section modulus.
Contd.

$$A_1 + A_2 = A$$

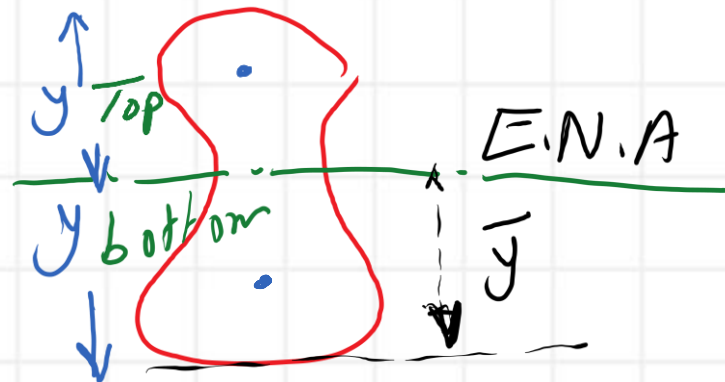
$$\bar{y}_{bar} = \frac{A_1 y_1 + A_2 y_2}{A_1 + A_2}$$

Which value to select?

Estimate I_x about the E.N.A

$$y_{max} = y_{max}(y_{1, top}, y_{2, bottom})$$

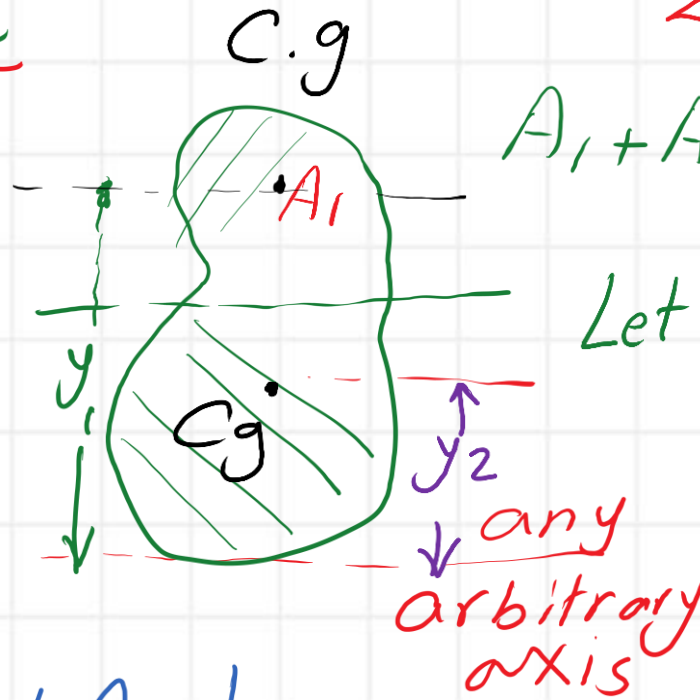
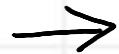
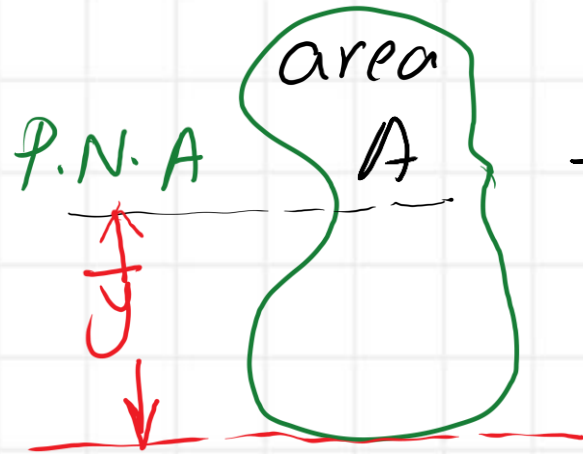
$$S_x = \frac{I_x}{y_{max}}$$



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Any Shape

Z_x Plastic section modulus



$$A_1 + A_2 = A$$

$$\text{Let } A_1 = A_2 = \frac{A}{2}$$

always ←

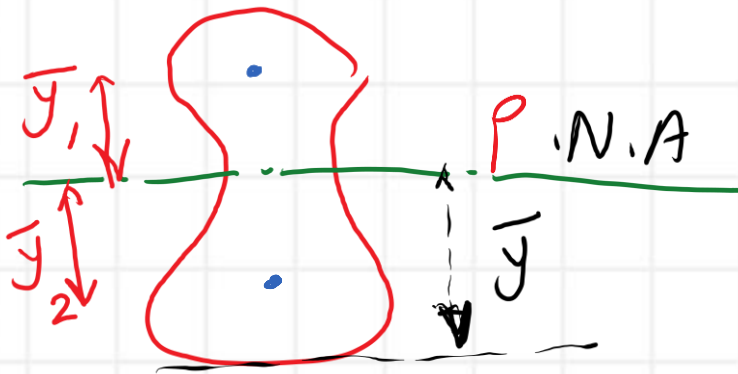
get the P.N.A by

$$\bar{y} = \frac{A_1 y_1 + A_2 y_2}{A_1 + A_2} = \frac{A}{2} \left(\frac{1}{A} \right) (y_1 + y_2)$$

get $\bar{y}_1$
 $\bar{y}_2$

distance From C.g of A_1
to P.N.A

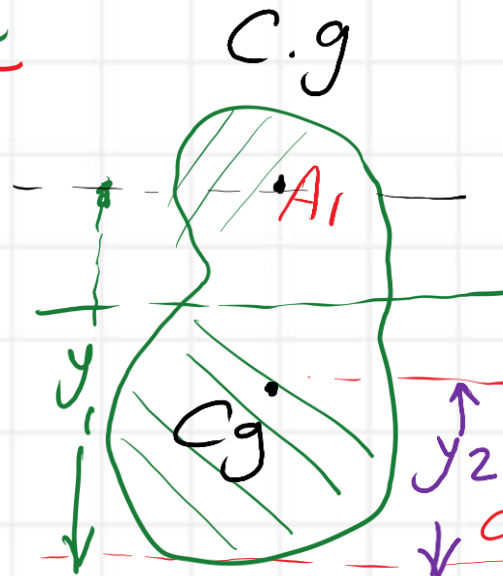
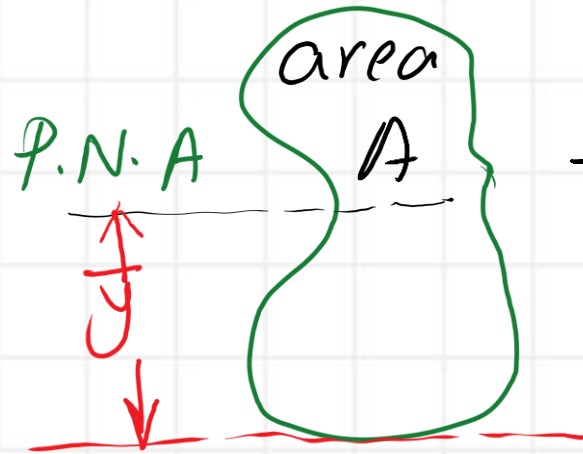
distance From C.g of A_2
to P.N.A.



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Any Shape

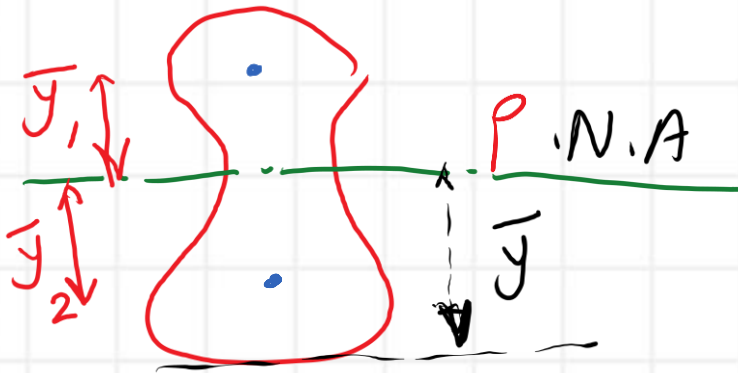
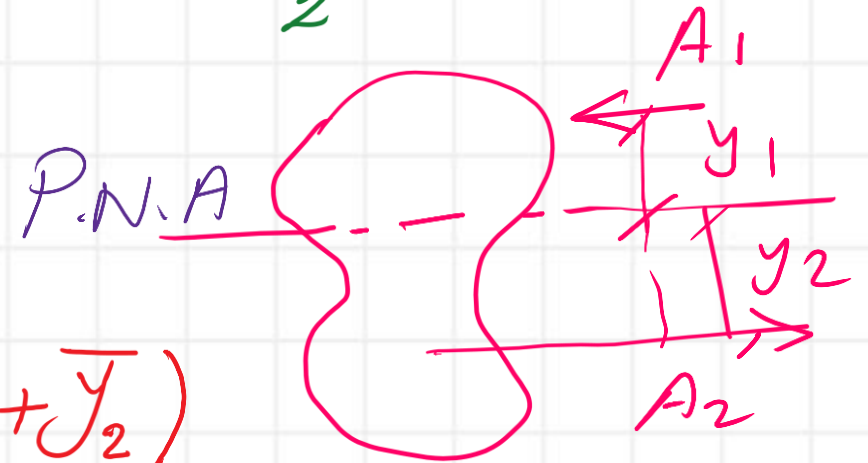
Z_x Plastic section modulus



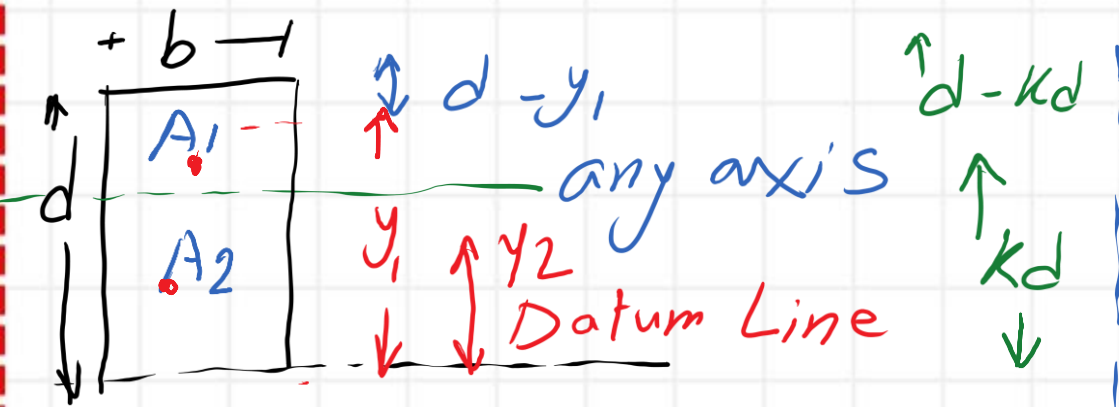
Let $A_1 = A_2 = \frac{A}{2}$

any arbitrary axis

$$Z_x = \frac{A}{2} (\bar{y}_1 + \bar{y}_2)$$



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① Take any axis with distance kd From the datum

② $A_1 = (d - kd)b = d(b)(1 - k)$

③ $A_2 = bkd$

④ Let $A_1 = A_2$

$db(1 - k) = bkd \Rightarrow db = bkd(2)$

⑤ $K = \frac{bd}{2bd} = \frac{1}{2}$

⑥ $\bar{y}_1 c.g = \frac{d}{4}$

$\bar{y}_2 c.g = \frac{d}{4}$

⑦ $Z_x = \frac{A}{2} (\bar{y}_1 + \bar{y}_2)$

$= \frac{bd}{2} \left(\frac{d}{4} + \frac{d}{4} \right)$

$Z_x = \frac{bd}{2} \left(\frac{d}{2} \right) = \left(\frac{bd^2}{4} \right)$

