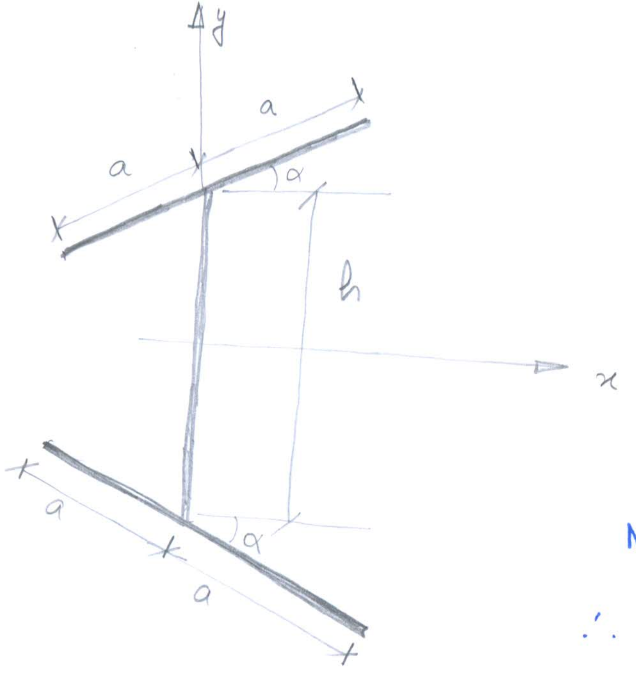

Find the maxm. direct stress in the section for a given M_x and $M_y = 0$

$$\sigma_z = \frac{M_x (I_{yy} y - I_{xy} x)}{I_{xx} I_{yy} - I_{xy}^2} + \frac{M_y (I_{xx} x - I_{xy} y)}{I_{xx} I_{yy} - I_{xy}^2}$$

$M_y = 0$ and $I_{xy} = 0$ (due to symmetry)

$$\therefore \quad \sigma_z = \frac{M_x y}{I_{xx}}$$

$$I_{xx} = \frac{1}{12} h^3 t + 2 \int_0^{2a} y^2 dA = \frac{1}{12} h^3 t + 2t \int_0^{2a} y\, ds$$

$$y = \left(\frac{h}{2} - a \sin\alpha\right) + s \sin\alpha.$$

$$\Rightarrow \quad I_{xx} = \frac{1}{12} h^3 t + 2t \int_0^{2a} \left[\left(\frac{h}{2} - a\sin\alpha\right) + s \sin\alpha\right]^2 ds$$

$$= \frac{1}{12} h^3 t + 2t \int_0^{2a} \left[\left(\frac{h}{2} - a \sin\alpha\right)^2 + 2s \sin\alpha \left(\frac{h}{2} - a\sin\alpha\right) + s^2 \sin^2\alpha\right] ds$$

$$= \frac{1}{12} h^3 t + 2t \left[\left(\frac{h}{2} - a\sin\alpha\right)^2 s + s^2 \sin\alpha \left(\frac{h}{2} - a \sin\alpha\right) + \frac{s^3}{3} \sin^2\alpha\right]_0^{2a}$$

$$= \frac{1}{12} h^3 t + 2t \left[2a\left(\frac{h^2}{4} - ah\sin\alpha + a^2 \sin^2\alpha\right) + 4a^2 \left(\frac{h}{2}\sin\alpha - a\sin^2\alpha\right) + \frac{8a^3}{3}\sin^2\alpha\right]$$

$$- h^3 t + 2t \left[\frac{ah^2}{2} - \cancel{2a^2 h \sin\alpha} + \cancel{2a^3 \sin^2\alpha} + \cancel{2a^2 h \sin\alpha} - 4a^3 \sin^2\alpha + \frac{8a^3}{3} \sin^2\alpha\right]$$

$$\frac{1}{12} h^3 t + 2t \left[\frac{ah^2}{2} + \frac{2a^3}{3} \sin^2\alpha\right] = \left[\frac{1}{12} h^3 t + ah^2 t + \frac{4a^3 t}{3} \sin^2\alpha\right]$$

$$\sigma_z^{max} = \frac{M_x \left(\frac{h}{2} + a \sin\alpha\right)}{\left[\frac{1}{12} h^3 t + ah^2 t + \frac{4a^3 t}{3} \sin^2\alpha\right]}$$