

CAP III.- TENSIONES COMBINADAS

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TENSIONES COMBINADAS

Tensiones combinadas:

Traction simple



$$\sigma = \frac{F}{A} \leq \bar{\sigma}$$

σ_{max}

Corte simple



$$\tau = \frac{F}{A} \leq \bar{\tau}$$

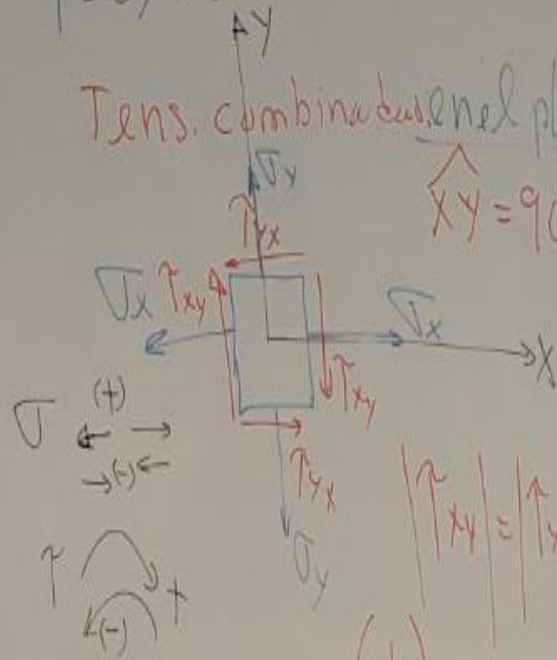
τ_{max}

$$\bar{\sigma} = \frac{\sigma_f}{n}$$

$$\bar{\tau} = 0,5 \bar{\sigma}$$

Tens. combinadas en el plano:

$$xy = 90^\circ$$



$$|\tau_{xy}| = |\tau_{yx}| \text{ Siempre!}$$

(d)

Objetivos

1) Tensiones principales

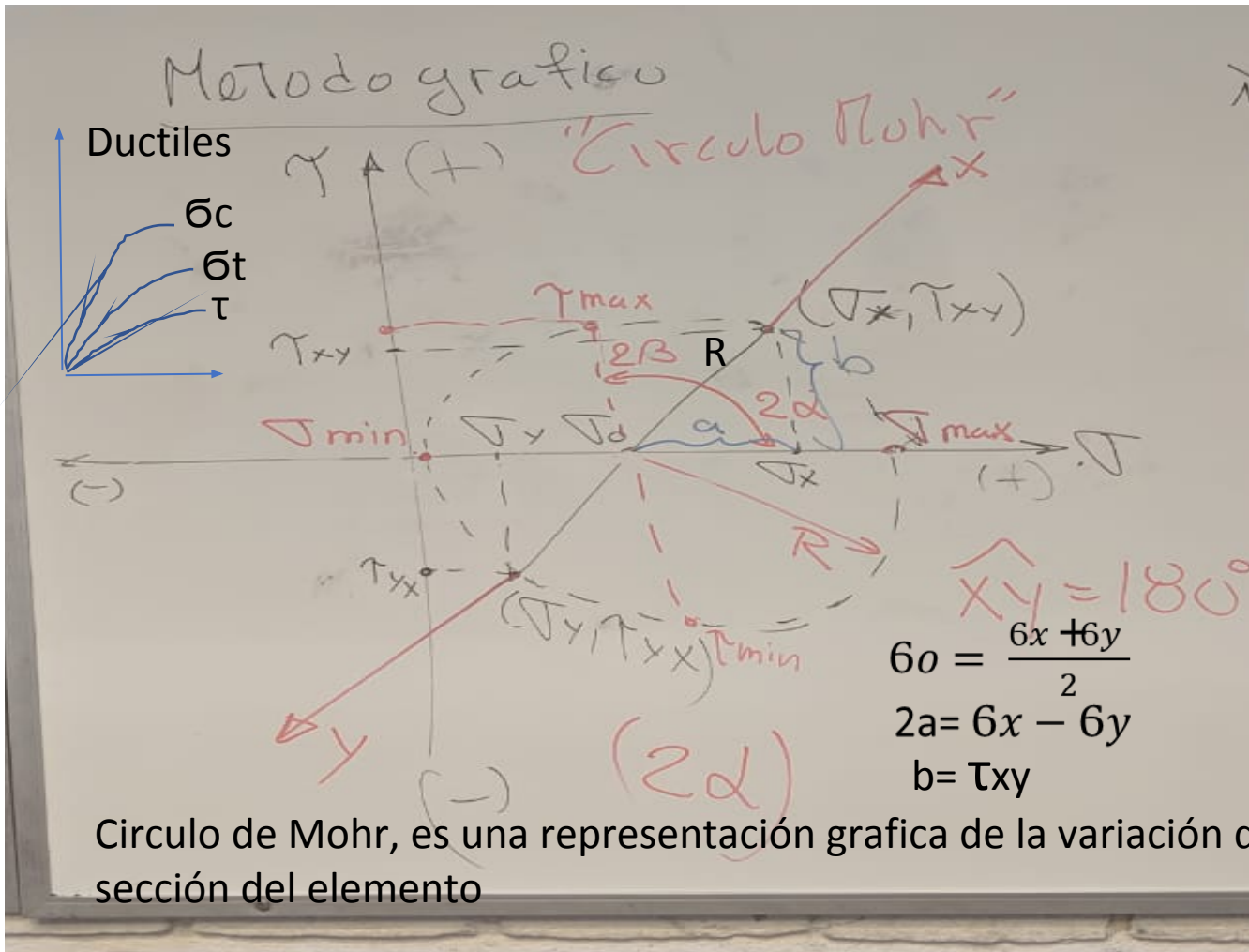
$$\sigma_{max} = ?$$

$$\sigma_{min} = ?$$

$$\tau_{max} = ?$$

2) Secciones Principales donde son Secciones Principales de falla?

TENSIONES COMBINADAS



λ Pasos:

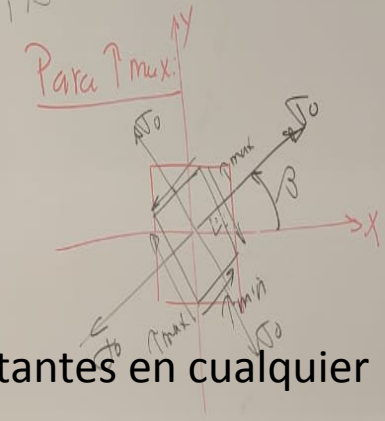
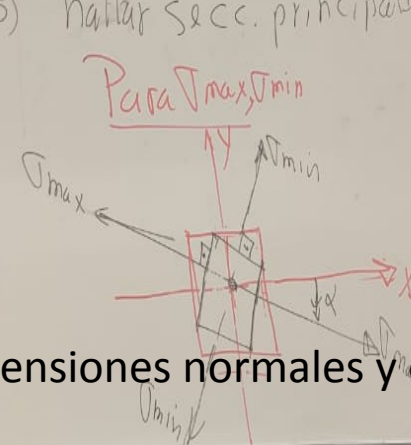
- 1) hallar (σ_x, τ_{xy}) (σ_y, τ_{yx})
- 2) unir los p'tos y hallar σ_o
- 3) Trazar circulo Mohr
- 4) hallar $\sigma_{max}, \sigma_{min}, \tau_{max}$ (Tensiones principales)
- 5) hallar secc. principales α, β

b) Dimensionamiento:

$$\sigma_{max} \leq \bar{\sigma} \Rightarrow \phi_1 \checkmark$$

$$\tau_{max} \leq \bar{\tau} \Rightarrow \phi_2 \checkmark$$

$$\phi_{final} = \text{Mayor}(\phi_1, \phi_2)$$



TENSIONES COMBINADAS

Método analítico:

Datos ($\sigma_x, \sigma_y, \tau_{xy}$)

Ecuaciones de Mohr

$$\sigma_{\max} = \sigma_o + R$$

$$\sigma_{\min} = \sigma_o - R$$

$$\tau_{\max} = R$$

$$\sigma_o = \frac{\sigma_x + \sigma_y}{2}$$

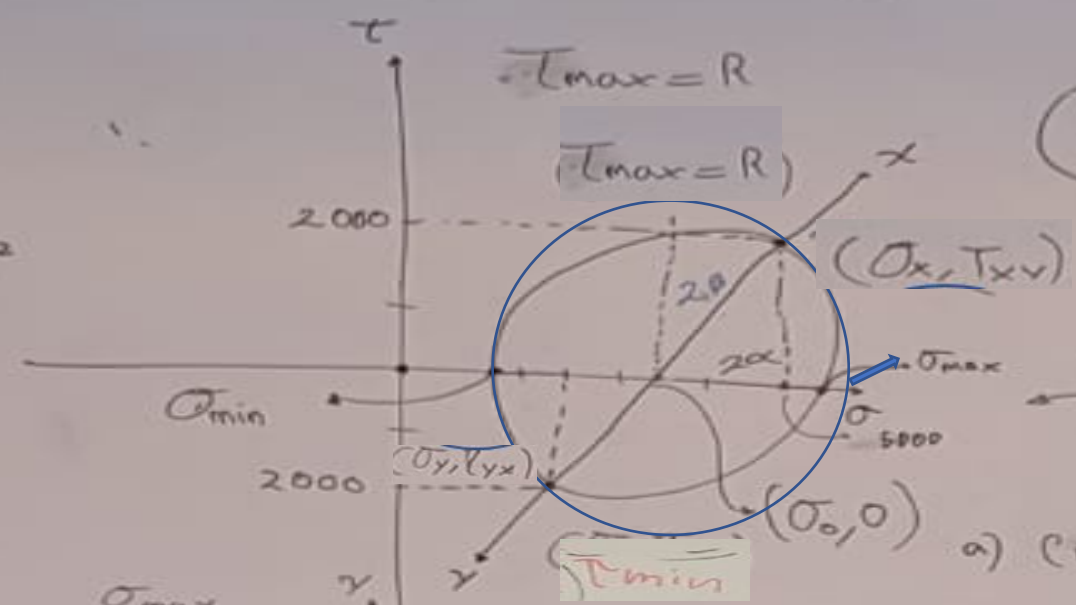
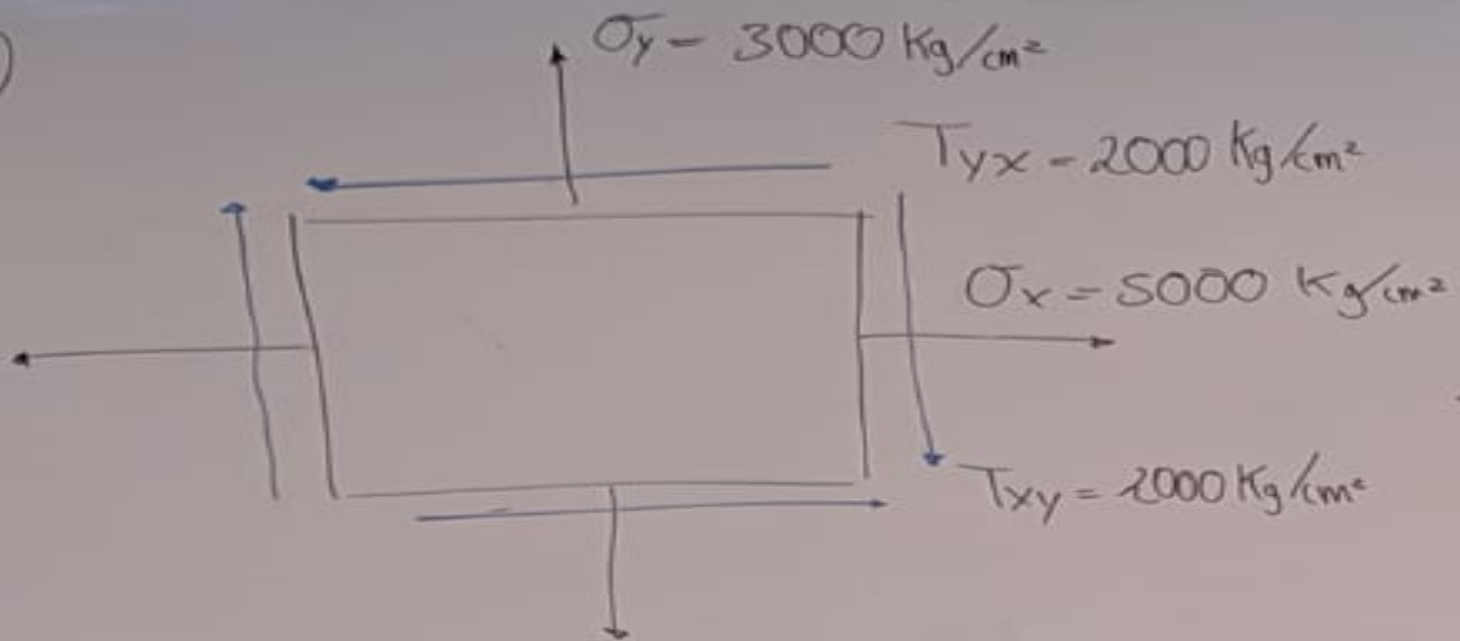
$$R = \sqrt{a^2 + b^2} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$\sigma_{\max/\min} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2} \leq \bar{\sigma}$$

$$\tau_{\max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2} \leq \bar{\tau}$$

$$\operatorname{Tg} 2\alpha = \frac{b}{a} = \frac{\tau_{xy}}{\frac{\sigma_x - \sigma_y}{2}}$$

$$2\alpha + 2\beta = 90^\circ$$



$$\sigma_{max} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + (\tau_{xy})^2}$$

$$\sigma_{max} = \frac{5000 + 3000}{2} + \sqrt{\left(\frac{5000 - 3000}{2}\right)^2 + (2000)^2}$$

$$\sigma_{max} = 4000 + 2236.07$$

$$\sigma_{max} = 6236.07 \text{ Kg/cm}^2$$

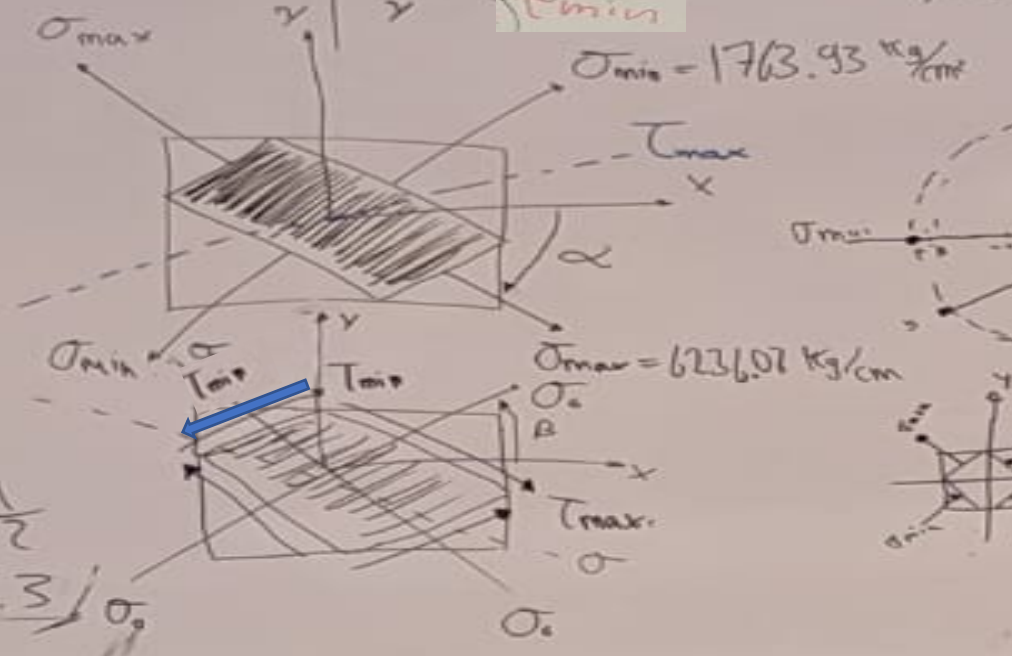
$$\sigma_{min} = 1763.93 \text{ Kg/cm}^2$$

$$\tau_{max} = 2236.07 \text{ Kg/cm}^2$$

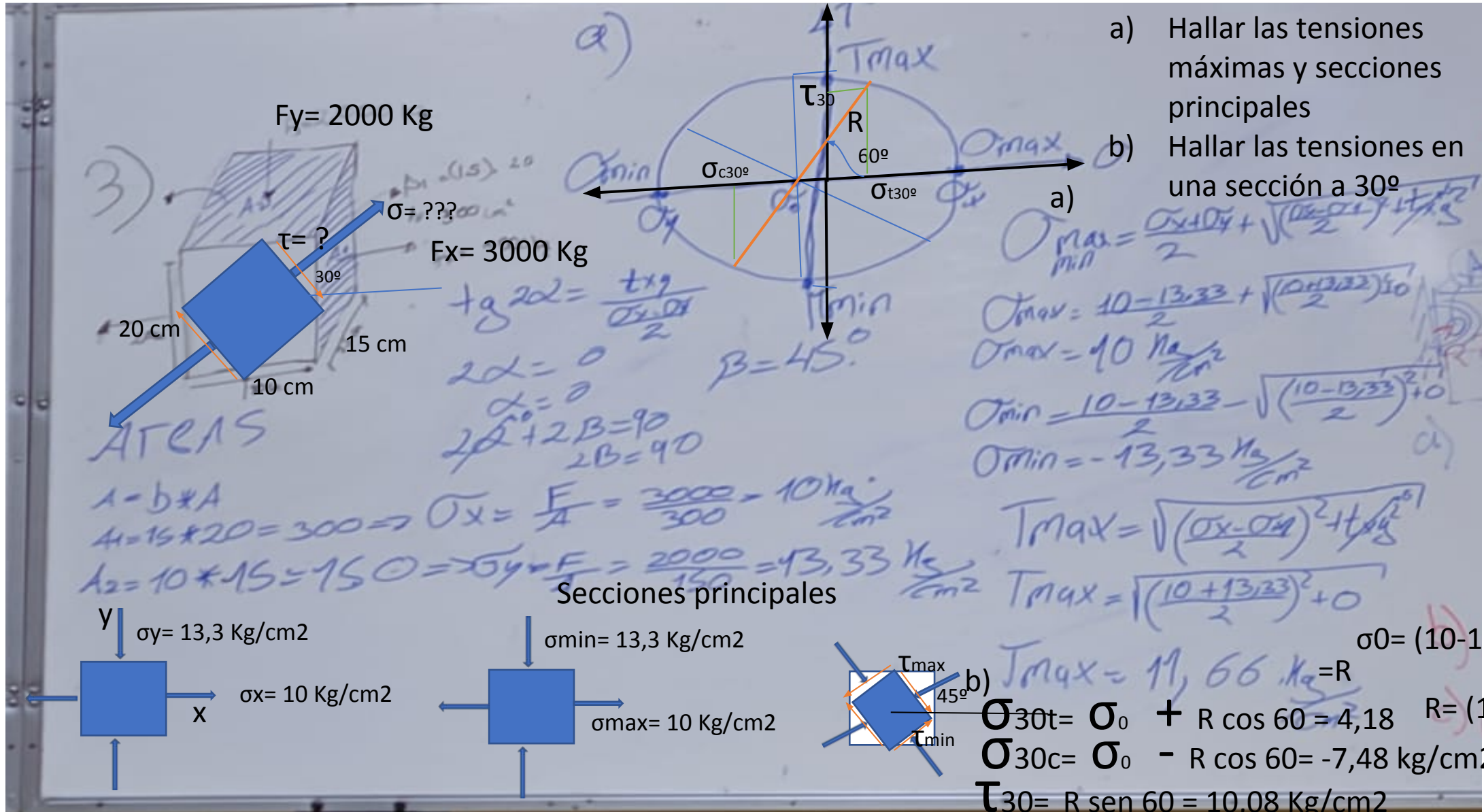
$$\tan 2\alpha = \frac{2\tau_{xy}}{\sigma_x - \sigma_y}$$

$$\alpha = \arctan\left(\frac{2(2000)}{5000 - 3000}\right)^{\frac{1}{2}}$$

$$\alpha = 31.7^\circ \quad \beta = 13.3^\circ$$



EJERCICIOS RESUELTOS

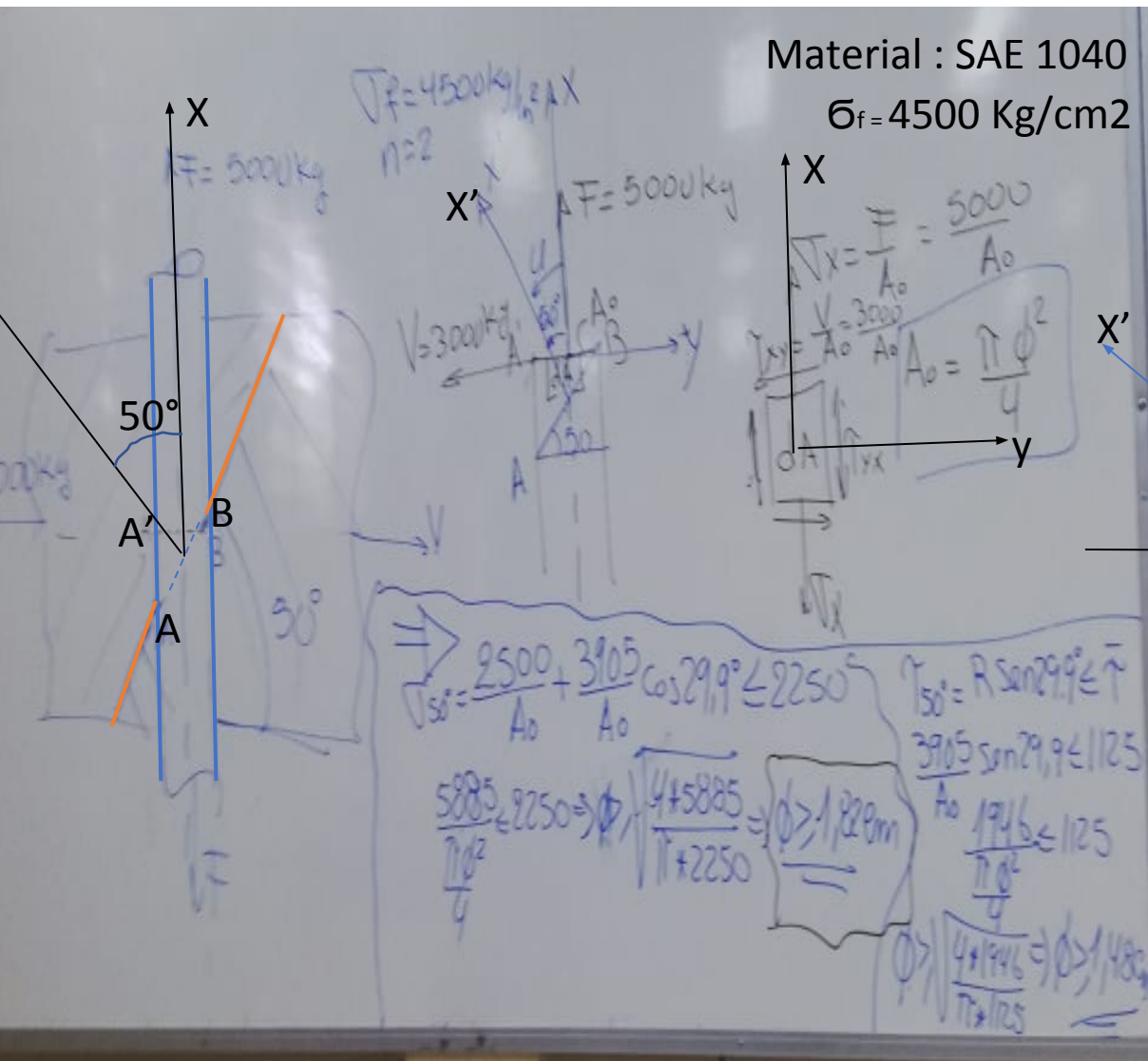


EJERCICIOS RESUELTOS

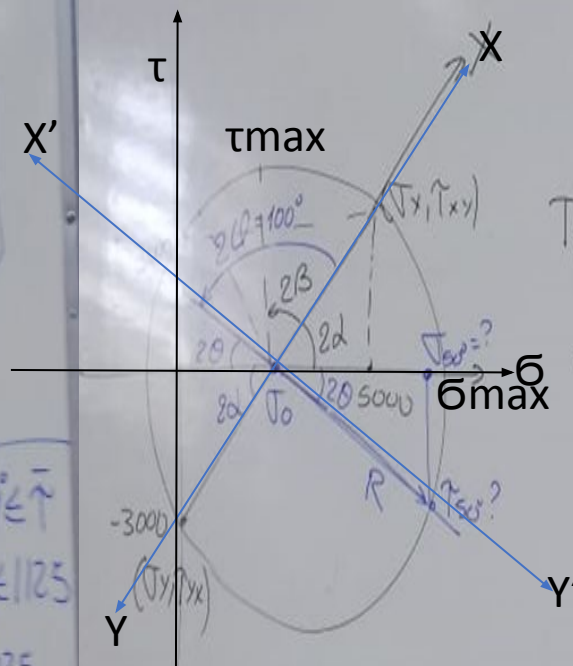
Dimensionar el diametro del perno en la sección AB

Material : SAE 1040 n=2

$\sigma_f = 4500 \text{ Kg/cm}^2$

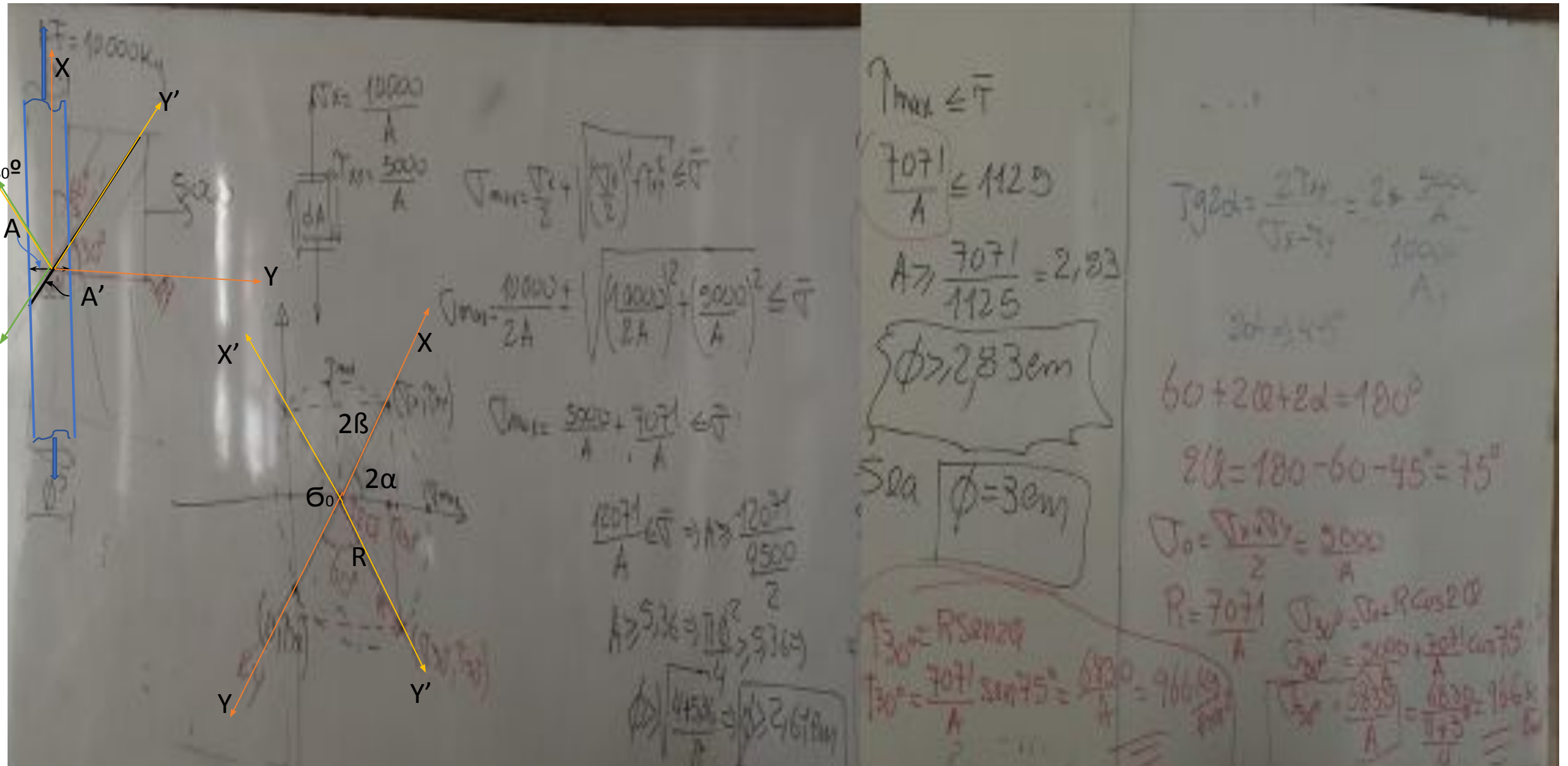


$$\begin{aligned}\sigma_{max} &= \sigma_0 + R \\ \sigma_{min} &= \sigma_0 - R \\ \tau_{max} &= R \\ \sigma_0 &= \frac{\sigma_x + \sigma_y}{2} \\ R &= \sqrt{a^2 + b^2} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}\end{aligned}$$



$$\begin{aligned}\sigma_{50^\circ} &= \sigma_0 + R \cos 2\theta \leq \bar{\sigma} \\ R &= \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2} \\ R &= \sqrt{\left(\frac{5000}{2A_0}\right)^2 + \left(\frac{3000}{A_0}\right)^2} \\ R &= \frac{3905}{A_0} \\ \sigma_{50^\circ} &= \frac{2500}{A_0} + \frac{3905}{A_0} \cos 2\theta \leq 2250 \\ \tau_{50^\circ} &= R \sin 2\theta \leq \bar{\tau} \\ \frac{3905}{A_0} \sin 2\theta &\leq 1125 \\ \frac{1946}{\frac{\pi \phi^2}{4}} &\leq 1125 \\ \phi &> 1.82 \text{ cm}\end{aligned}$$

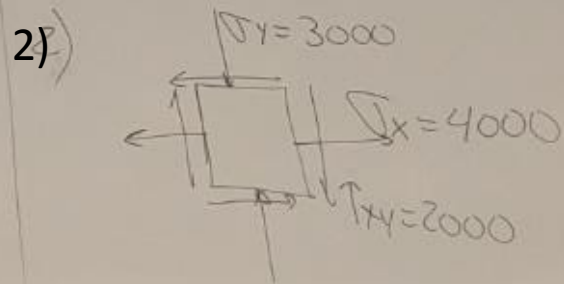
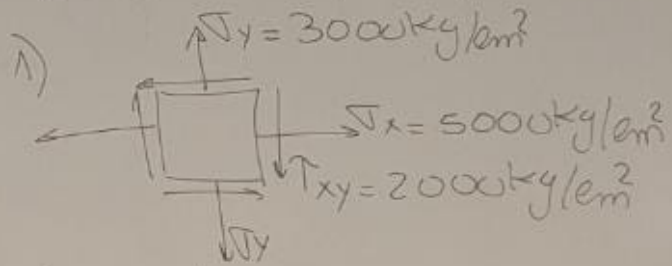
EJERCICIOS RESUELTOS



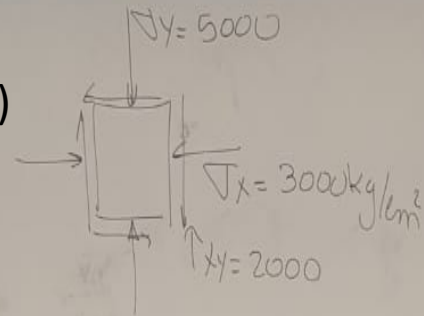
PRACTICA 3

1) practica # - -

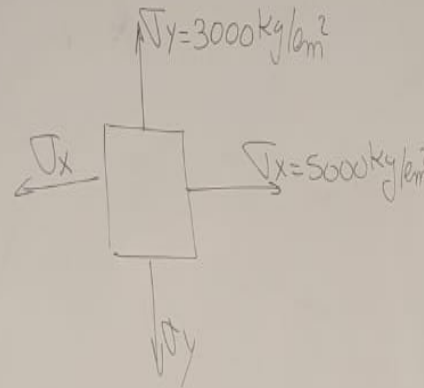
- * Circulo de Mohr
- * $\sigma_{max}, \sigma_{min}, \alpha, \beta$
- * Secciones principales



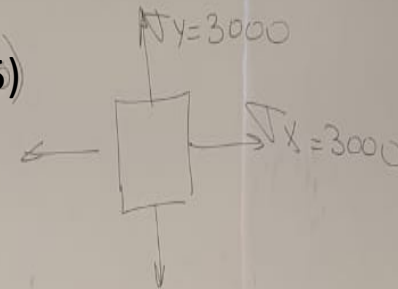
3)



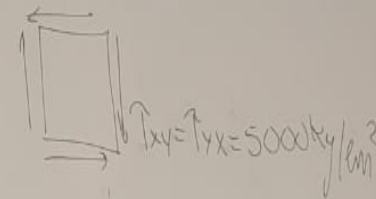
4)



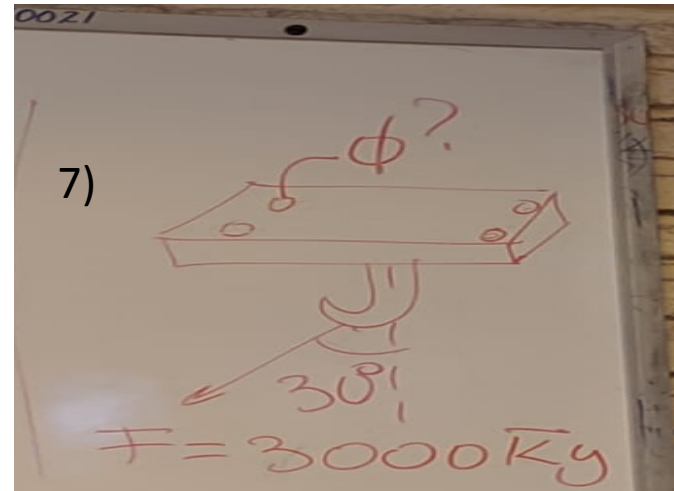
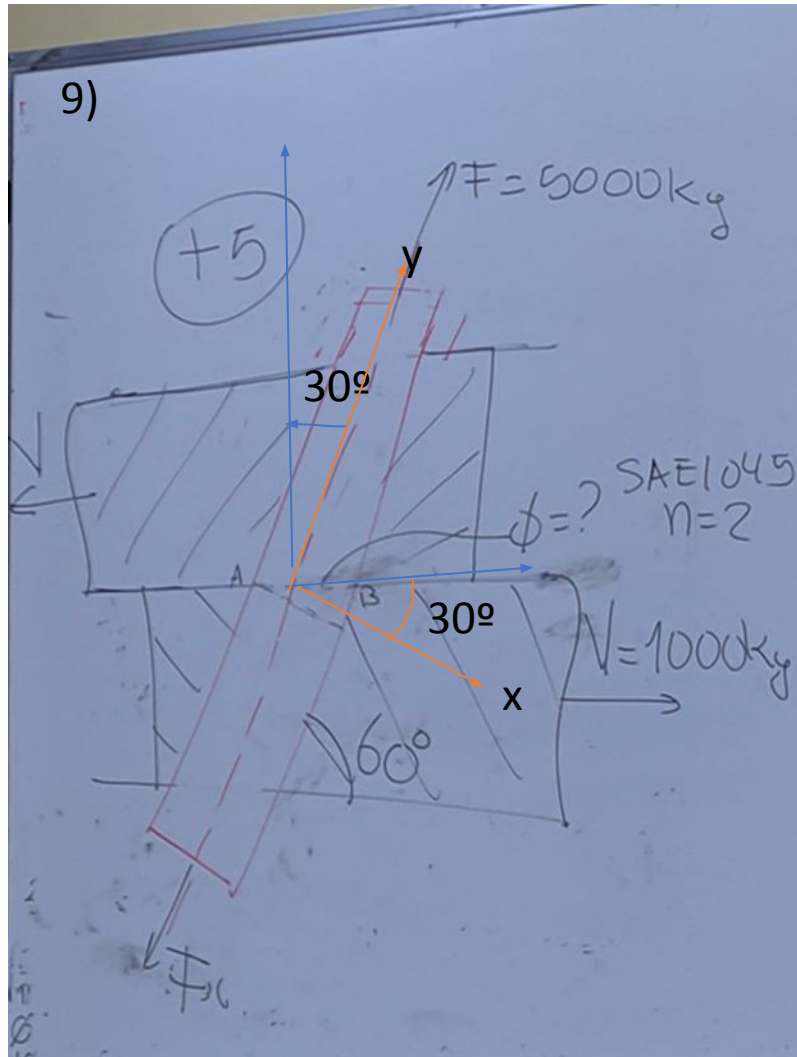
5)



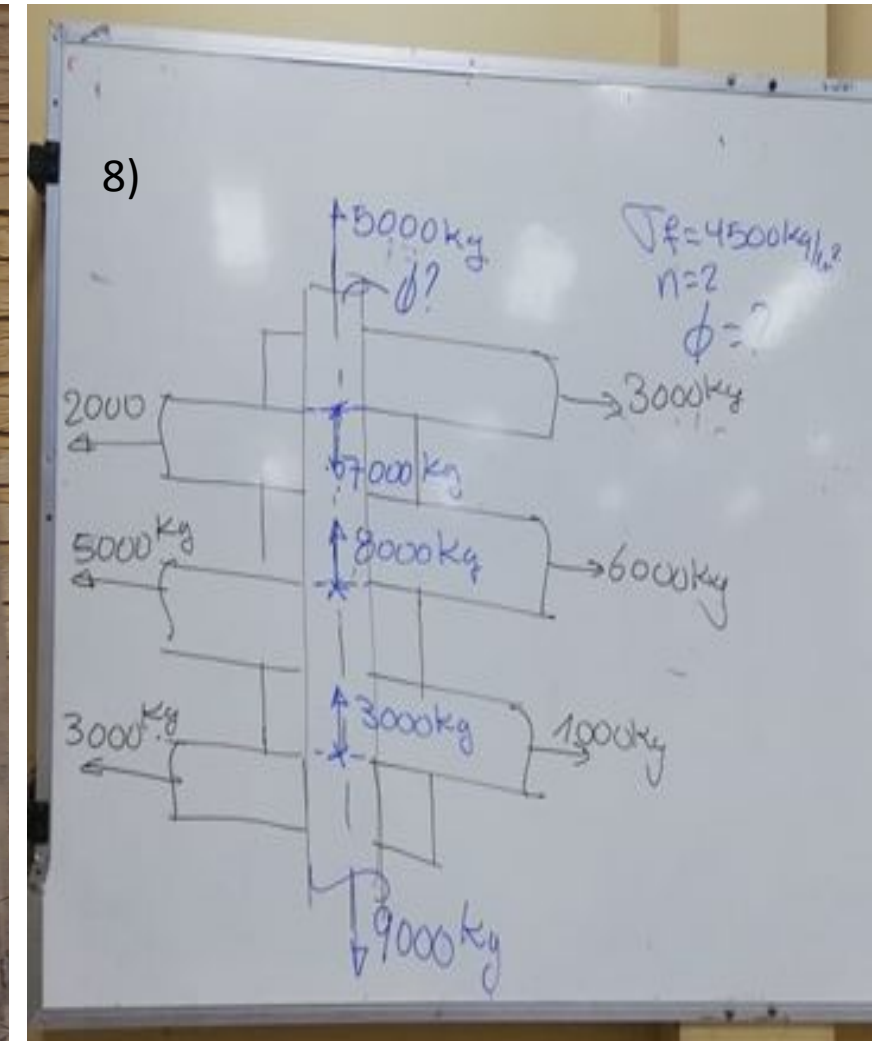
6)



PRACTICA 3



- Hallar diametro del gancho para una SAE 1020 con $n=2$
- Hallar el diametro de los pernos para una SAE 1010 con $n=2$





GRACIAS.....