$$\uparrow 90 \text{ MPa}$$

$$\rightarrow 60 \text{ MPa}$$

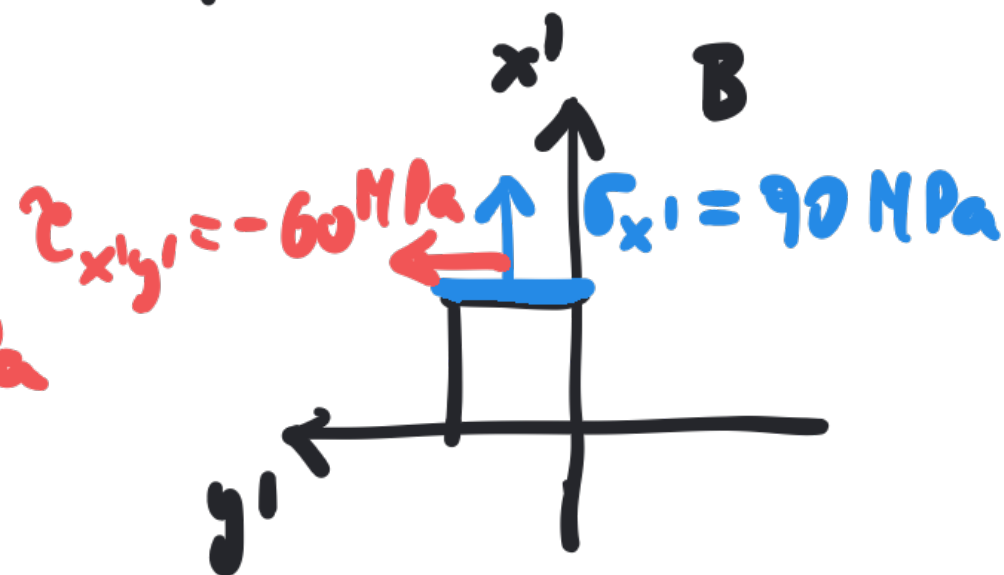$$\leftarrow 20 \text{ MPa}$$
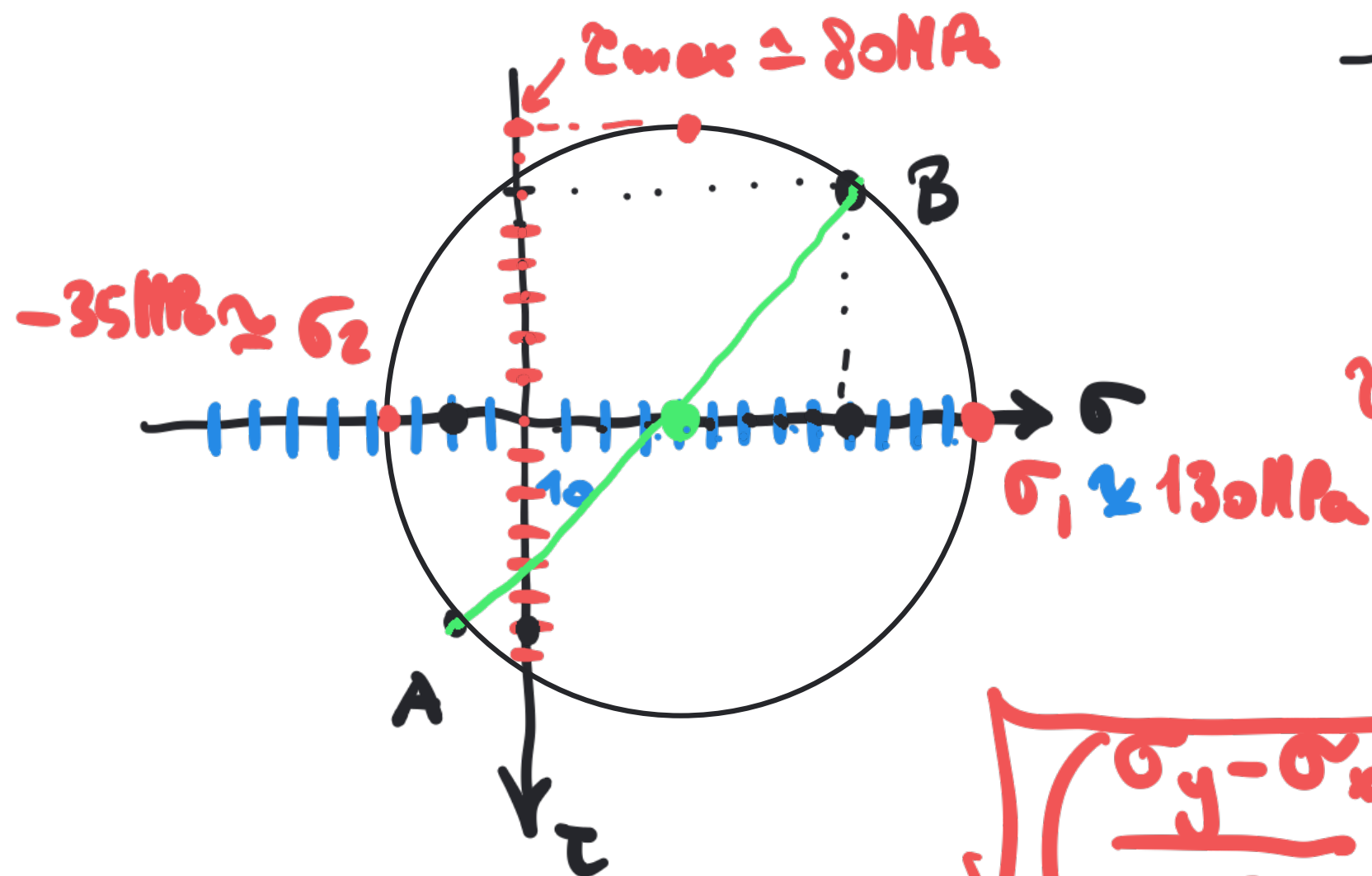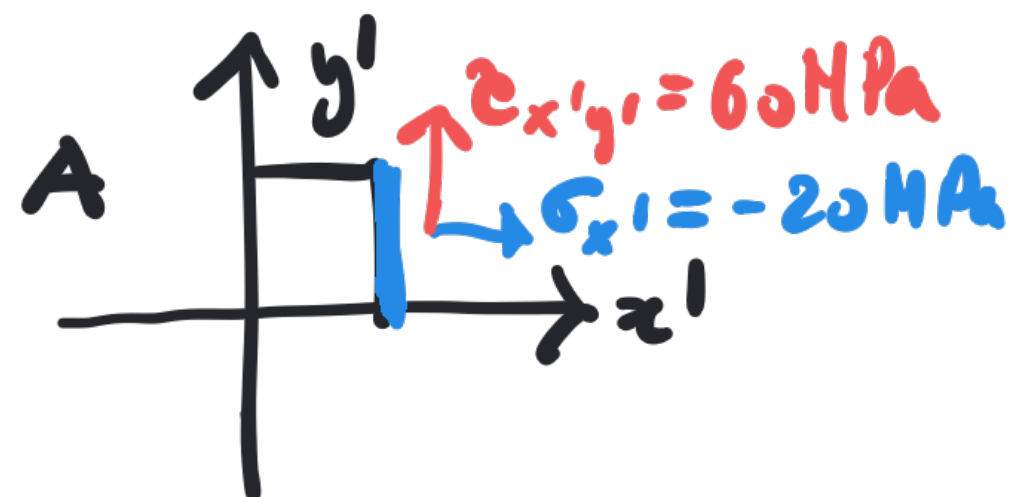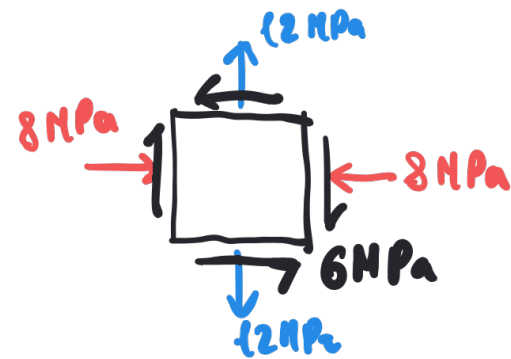
$$\begin{bmatrix} -20 & 60 \\ 60 & 90 \end{bmatrix} = \begin{bmatrix} \sigma_x & \tau_{xy} \\ \tau_{xy} & \sigma_y \end{bmatrix}$$

A

$$\tau_{x'y'} = 60 \text{ MPa}$$

$$\sigma_{x'} = -20 \text{ MPa}$$

y' z'

$$\tau_{max} \simeq 80 \text{ MPa}$$

$$-35 \text{ MPa} \simeq \sigma_2$$

B

$$\sigma_1 \simeq 130 \text{ MPa}$$

A τ σ

$$10$$

B

$$\tau_{x'y'} = -60 \text{ MPa}$$

$$\sigma_{x'} = 90 \text{ MPa}$$

x'

y'

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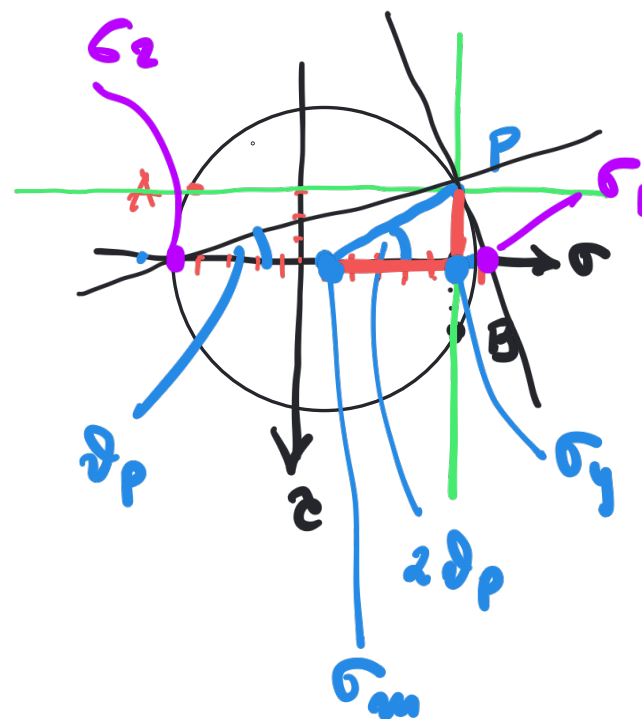
12 MPa ↑

8 MPa → ←8 MPa

6 MPa ↗

12 MPa ↓

$$\begin{bmatrix} \sigma_x & \tau_{xy} \\ \tau_{xy} & \sigma_y \end{bmatrix} = \begin{bmatrix} -8 & -6 \\ -6 & 12 \end{bmatrix}$$

$$\sigma_m = \frac{\sigma_x + \sigma_y}{2} = \frac{-8 + 12}{2} = 2 \text{ MPa}$$

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

$$= \sqrt{10^2 + 6^2} = 11.66 \text{ MPa}$$

$$\tan 2\vartheta_p = \frac{6 \text{ MPa}}{(12-2) \text{ MPa}} = \frac{6}{10} = \frac{3}{5}$$

$$2\vartheta_p = 31° \Rightarrow \vartheta_p = 15.5°$$
↑ arctan 3/5

$\sigma_1 = 2 + 11.66 = 13.66 \text{ MPa}$

$\sigma_2 = 2 - 11.66 = -9.66 \text{ MPa}$

σ_2 σ_1 P σ ϑ_p $2\vartheta_p$ σ_y σ_m z