Calculate the principal stresses and the maximum and minimum shearing stresses for the state of plane stress shown. Show these stresses properly oriented sketches. Use Mohr's Circle.

Plane 2

This is positive because it would rotate element CW

This is negative because the element rotate CCW

Determine the proper signs of \( \tau_x, \tau_y, \) and \( \tau_{xy} \)

\( \tau_x = 3 \)
\( \tau_y = -6 \)
\( \tau_{xy} = 4 \)

Determine the center of the circle

\( \tau_{\text{center}} = \frac{\tau_x + \tau_y}{2} \)
\( \tau_{\text{center}} = \frac{3 + (-6)}{2} = -\frac{3}{2} = 1.5 \)
Determine the radius of the circle.

\[ R = \sqrt{\left(\frac{y_{max}}{2}\right)^2 + x_{max}^2} \]

\[ R = \sqrt{\left(\frac{3}{2}\right)^2 + (4)^2} \]

\[ R = 6.021 \]

\[ \left(1.5, 6.021\right) \]

\[ \theta_{p_1} = 41.63^\circ \]

\[ \theta_{p_2} = 138.37^\circ \]

\[ \theta_{p_1} = 5 \sin^{-1} \left(\frac{4}{6.021}\right) \]

\[ \theta_{p_2} = 150^\circ - 41.63^\circ \]

\[ \theta_{p_2} = 90^\circ - 41.63^\circ \]

\[ \theta_{p_2} = 48.37^\circ \]
As shown on the circle

16) \( T_{\text{max}} = 4.521 \) \( \theta_{\text{p}} = 41.63^\circ \text{ CCW} \)

17) \( T_{\text{min}} = -7.521 \) \( \theta_{\text{p}_2} = 138.37^\circ \text{ CW} \)

18) \( T_{\text{max}} = 6.021 \) \( \theta_{\text{p}_1} = 131.63^\circ \text{ CCW} \)

19) \( T_{\text{min}} = -6.021 \) \( \theta_{\text{p}_2} = 48.37^\circ \text{ CW} \)

20) \( T_{\text{center}} = -1.5 \)

Show the principal stresses on a properly oriented sketch.

Maximum and Minimum Normal Stresses or Principal Stresses
Show the maximum and minimum shearing stresses on a properly oriented sketch.