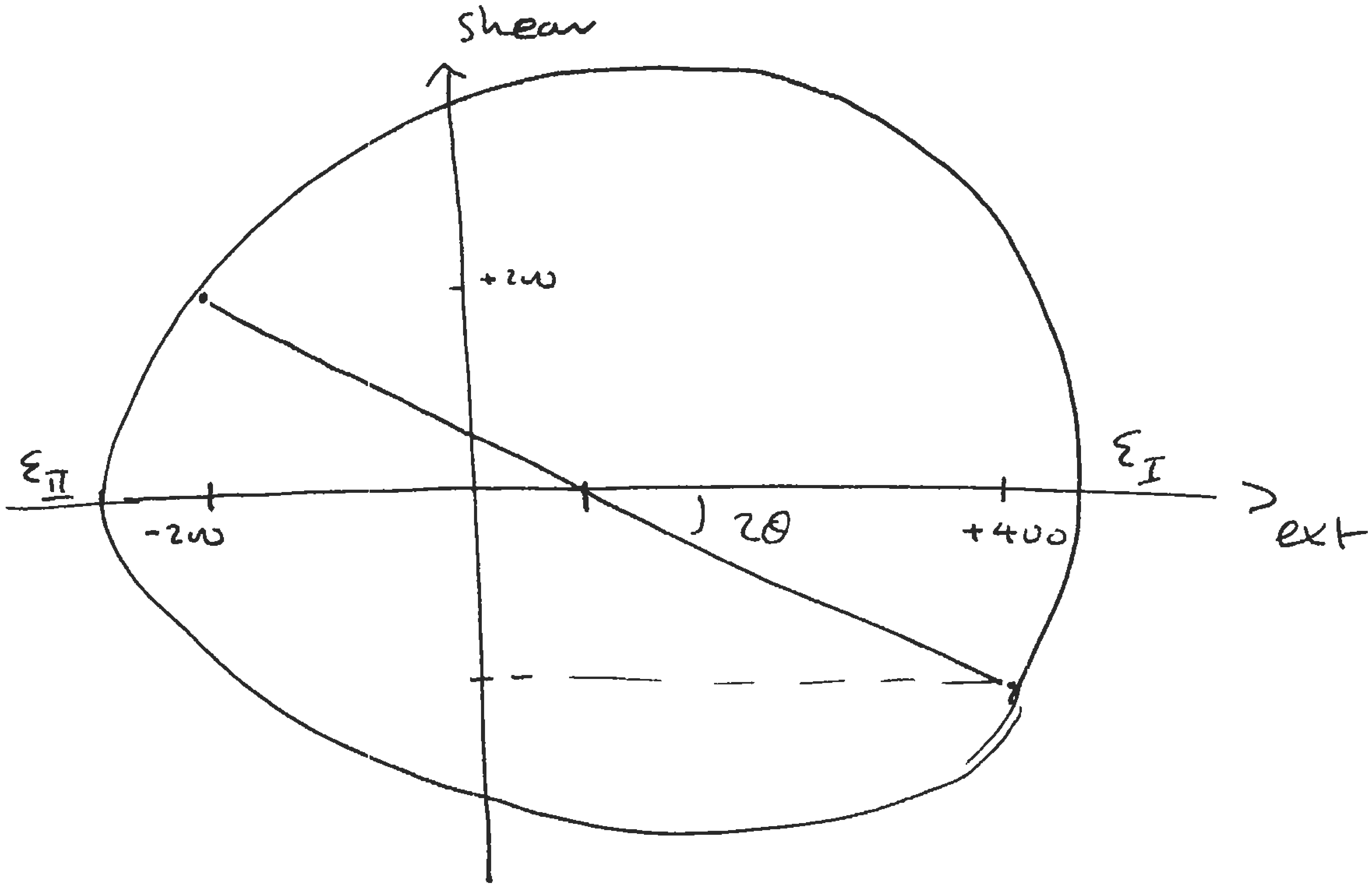
M16

a)



Center @ $+100\,\mu\varepsilon$.

Radius $= \sqrt{300^2 + 200^2} = 36\cancel{0}\,\mu\varepsilon$.

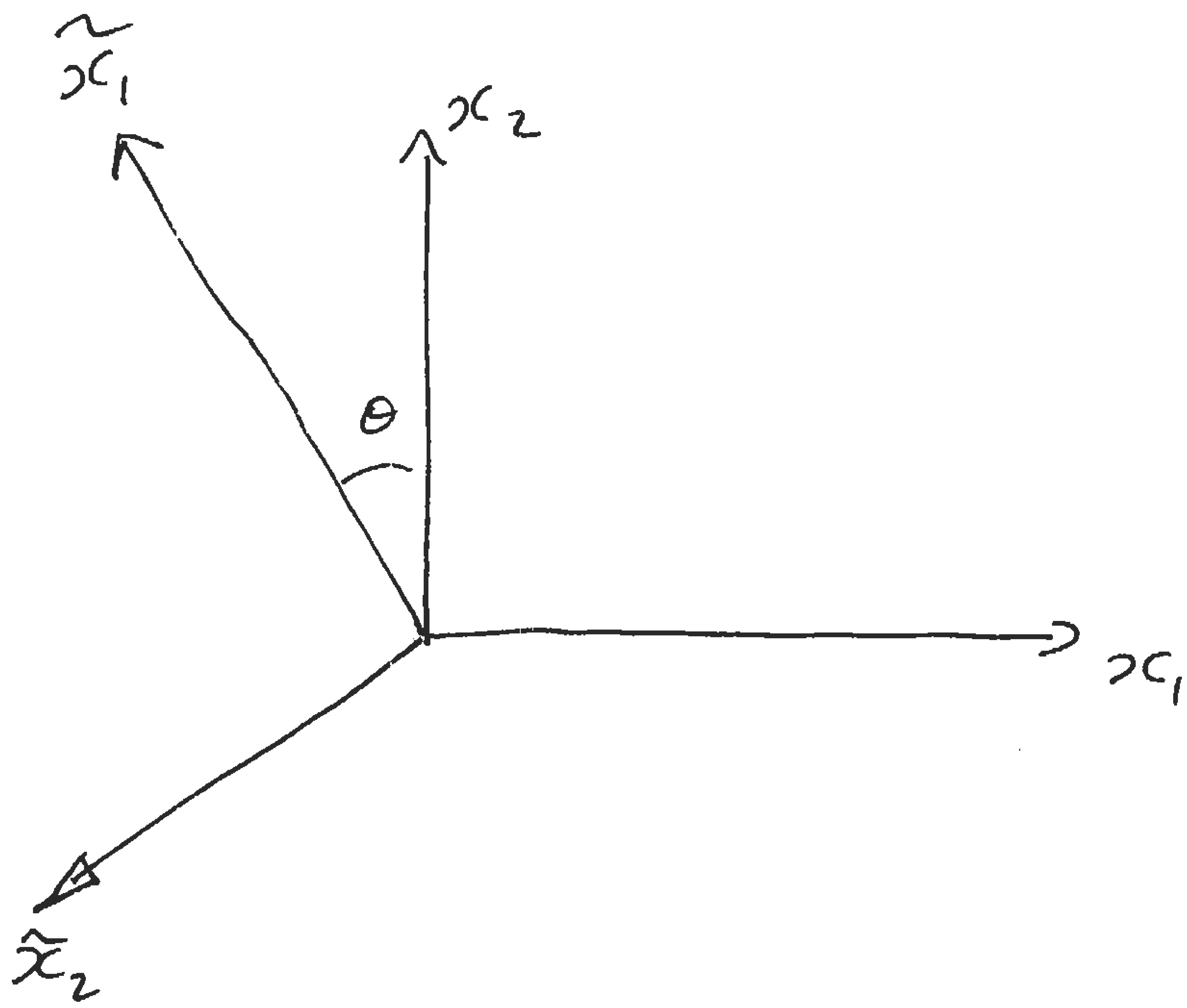
b) $\varepsilon_I = 100 + 361 = 461\,\mu\varepsilon$

$\varepsilon_{II} = 100 - 361 = -261\,\mu\varepsilon$.

$\cancel{2}\theta = \frac{1}{2}\tan^{-1}\left(\frac{200}{300}\right) = 16.85^\circ$

$\therefore\ \hat{x}_1 = 90 + \theta = 1\cancel{0}6.85^\circ$ ccw from x_1

$\hat{x}_2 = \theta = 16.85^\circ$ ccw from x_1 $(10\cancel{6}.85^\circ$ ccw from $x_2)$



$$l_{\tilde{1}1} = \cos(106.8) = -0.290 \Leftarrow$$

$$l_{\tilde{1}2} = \cos(16.85) = 0.957 \Leftarrow$$

$$l_{\tilde{2}2} = \cos(106.8) = -0.290 \Leftarrow$$

$$l_{\tilde{2}1} = \cos(180+16.85) = -0.957 \Leftarrow$$

$$l_{\tilde{3}3} = 1, \quad l_{\tilde{1}3} = l_{\tilde{2}3} = l_{\tilde{3}1} = l_{\tilde{3}2} = 0. \Leftarrow$$

d) $\tilde{\varepsilon}_{mn} = l_{\tilde{m}p}\, l_{\tilde{n}q}\, \varepsilon_{pq}$

$$\tilde{\varepsilon}_{11} = l_{\tilde{1}1}\, l_{\tilde{1}1}\, \varepsilon_{11} + l_{\tilde{1}1}\, l_{\tilde{1}2}\, \varepsilon_{12} + l_{\tilde{1}2}\, l_{\tilde{1}1}\, \varepsilon_{21}$$

$$(-0.290)^2(-200) + (-0.290)(0.957)(-200) + (-0.290)(0.957)(-200)$$

$$+ l_{\tilde{1}2}\, l_{\tilde{1}2}\, \varepsilon_{22} + 0 + 0 + 0$$

$$+ (0.957)^2(400)$$

$$= 460.5\, \mu\varepsilon \Leftarrow$$

$$\tilde{\varepsilon}_{22} = l_{\tilde{2}1}\, l_{\tilde{2}1}\, \varepsilon_{11} + l_{\tilde{2}1}\, l_{\tilde{2}2}\, \varepsilon_{12} + l_{\tilde{2}2}\, l_{\tilde{2}1}\, \varepsilon_{21} + l_{\tilde{2}2}\, l_{\tilde{2}2}\, \varepsilon_{22}$$

$$(-0.957)^2(-200) + (-0.957)(-0.290)(-200) + (-0.290)(-0.957)(-200) + (-0.290)^2(+400)$$

$$= -261\, \mu\varepsilon.$$

$$\tilde{\varepsilon}_{12} = l_{\tilde{1}1}\, l_{\tilde{2}1}\, \varepsilon_{11} + l_{\tilde{1}2}\, l_{\tilde{2}1}\, \varepsilon_{21} + l_{\tilde{1}1}\, l_{\tilde{2}2}\, \varepsilon_{12} + l_{\tilde{1}2}\, l_{\tilde{2}2}\, \varepsilon_{22} + 0\text{'s}$$

$$= (-0.290)(-0.957)(-200) + (0.957)(-0.957)(-200) + (-0.290)(-0.290)(-200) +$$

$$+ (0.957)(-0.290)(400)$$

$$= -0.2 \simeq 0 \Leftarrow.$$

$$\tilde{\varepsilon}_{11} = +460, \quad \tilde{\varepsilon}_{22} = -261, \quad \tilde{\varepsilon}_{12} = 0$$

$\therefore$ agrees with Mohr's circle.