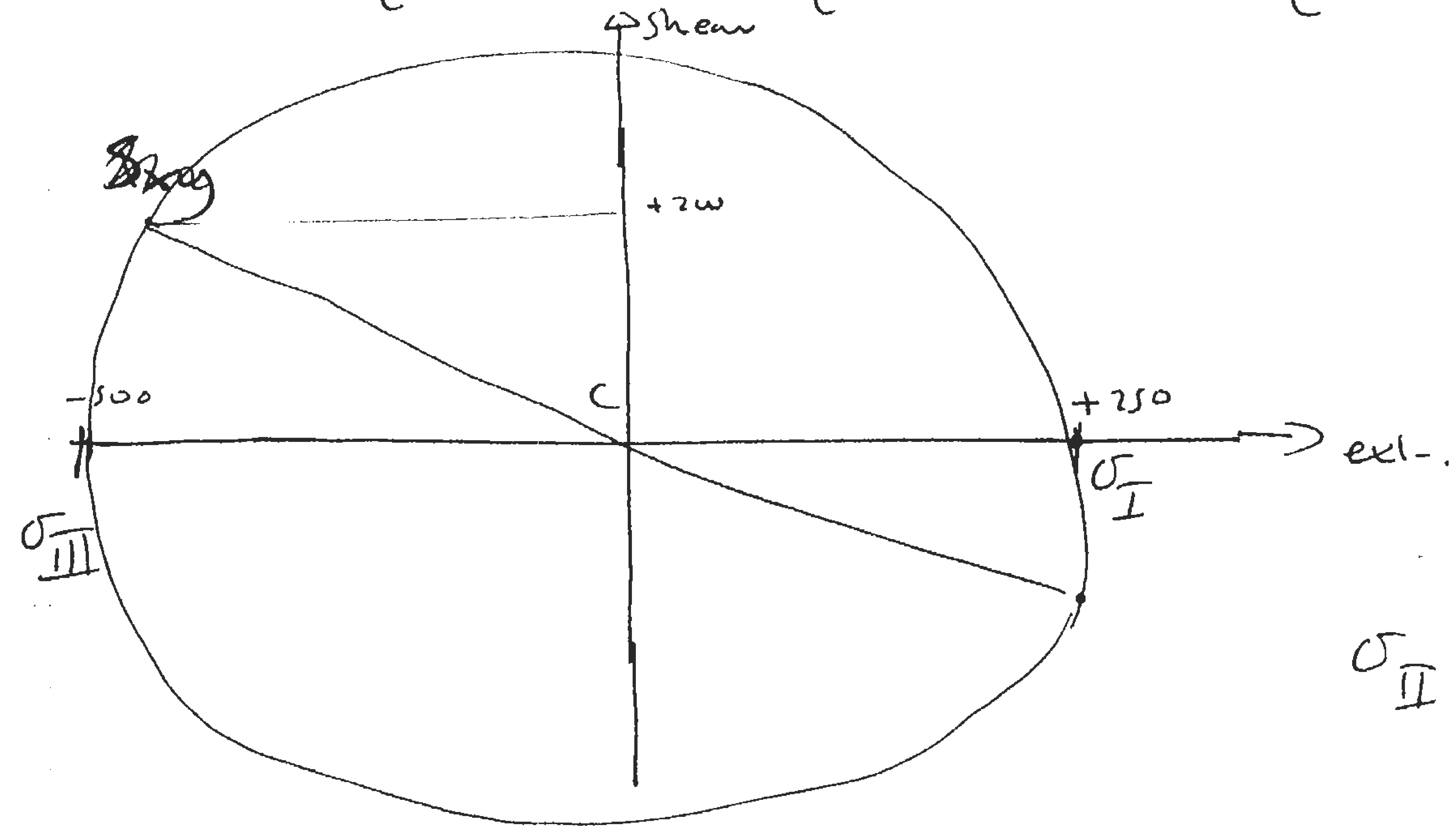
M17

$$\sigma_y = \frac{N_y}{t} \qquad \sigma_x = \frac{N_x}{t} \qquad \sigma_{xy} = \frac{S_{xy}}{t}$$

(1)



$\sigma_{II} = 0$
through thickness

$$C = \frac{+250 - -500}{2} + -500 = -125$$

$$R = \sqrt{(250 - -125)^2 + (200)^2} = 425.$$

$$\therefore \quad \sigma_I = -125 + 425 = +\frac{300}{t} \times 10^3 \text{ Pa}$$

$$\sigma_{III} = -125 - 425 = -\frac{550}{t} \times 10^3 \text{ MPa}$$

Von Mises

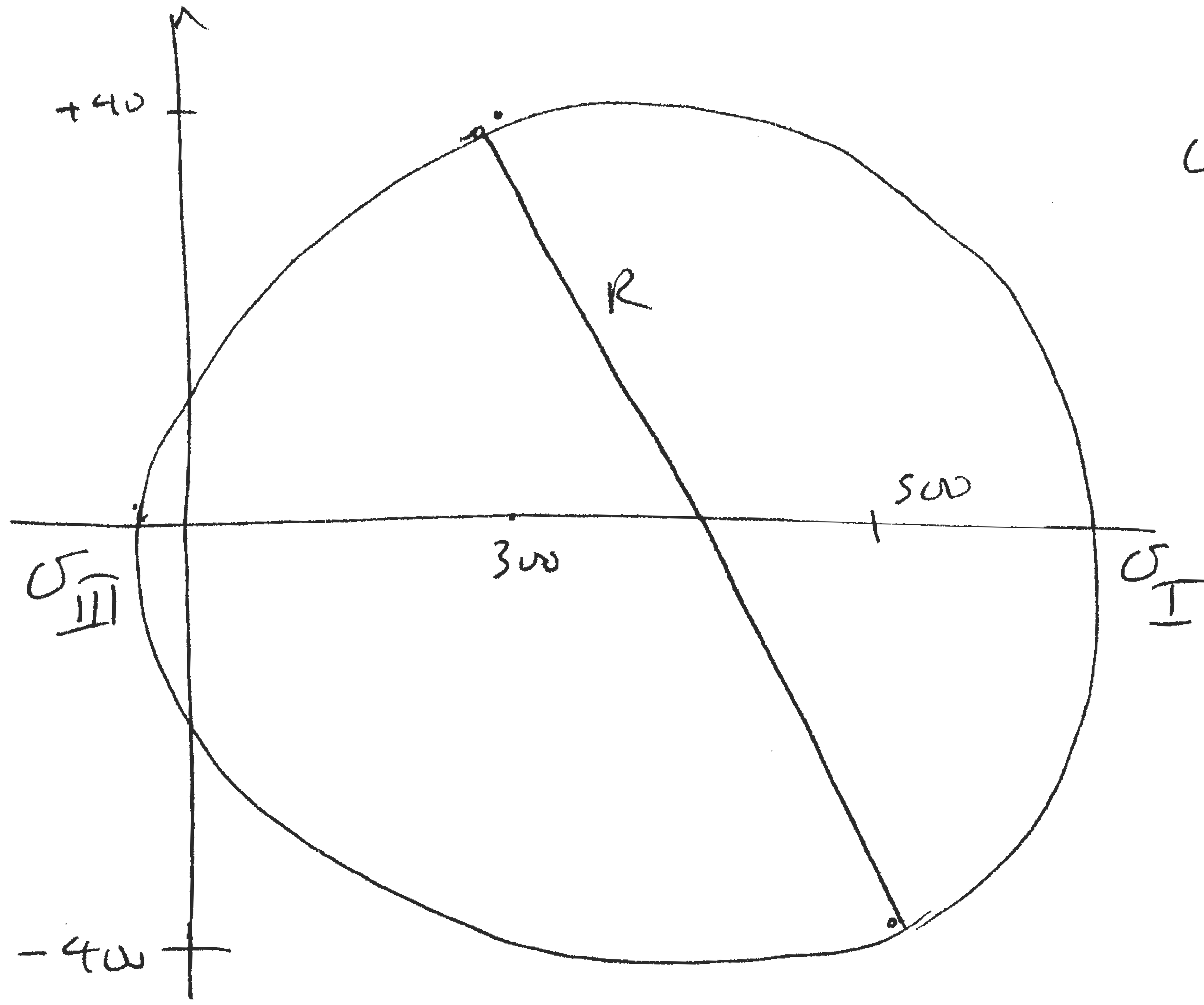
$$(\sigma_I - \sigma_{II})^2 + (\sigma_{II} - \sigma_{III})^2 + (\sigma_{III} - \sigma_I)^2 \geq 2\sigma_y^2$$

$$(300 - 0)^2 + (0 + 550)^2 + (-550 - 300)^2 = \frac{2 \times (500 \times 10^6)^2 t^2}{(10^3)^2 \times (1.5^2)}$$

safety factor

$$t = \sqrt{\frac{1115 \times 10^3 \times (10^3)^2 \times (1.5)^2}{2 \times (500 \times 10^6)^2}} = 2.24\ \text{mm}$$

(2)



$\sigma_{II} = 0$

$C = 400$

$$R = \sqrt{(500-400)^2 + 400^2} = 412.3$$

$$\therefore \sigma_I = 400 + 412.3 = \frac{812.3}{t}$$

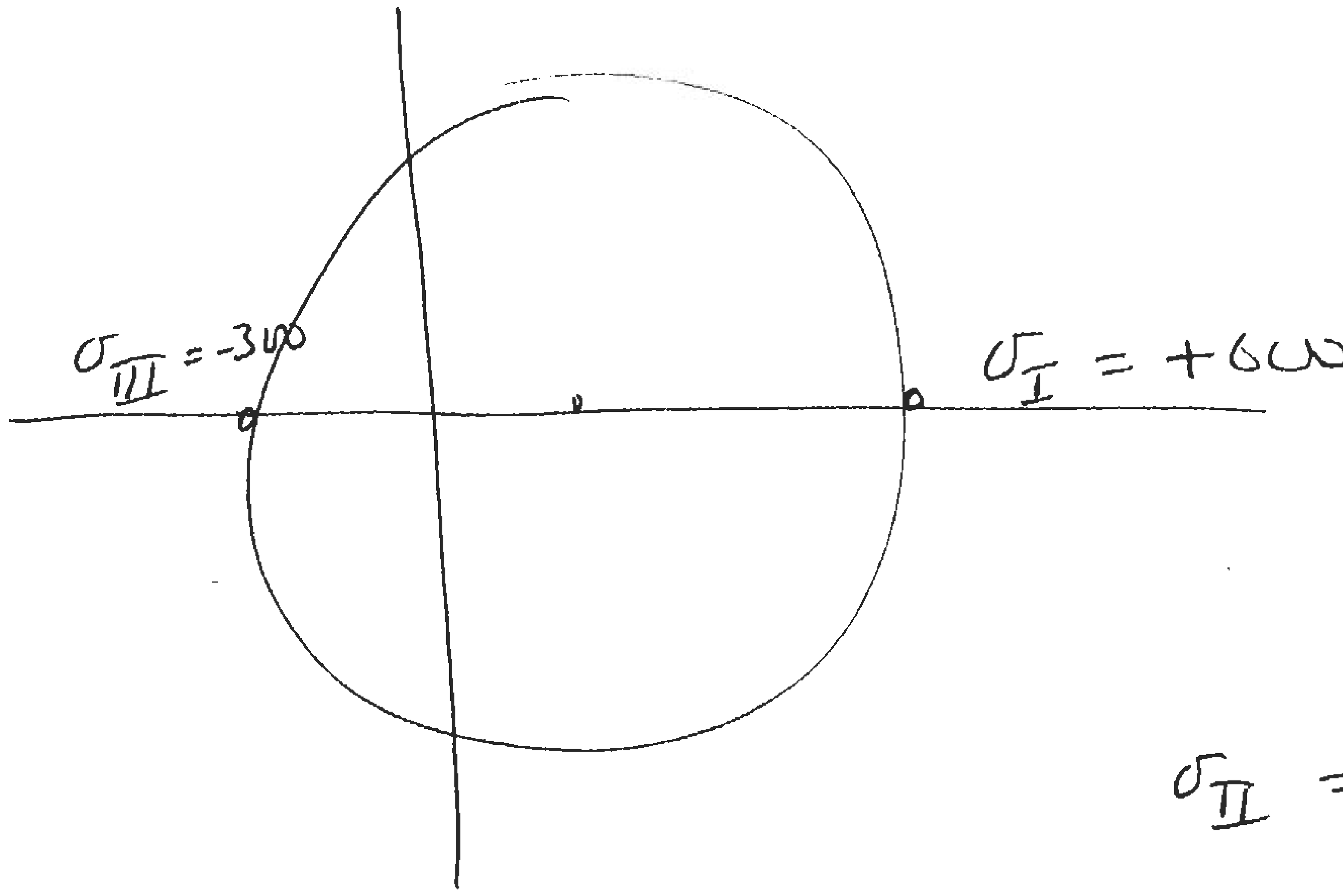
$$\sigma_{II} = 400 - 412.3 = \frac{-12.3}{t}$$

Von Mises $(812-0)^2 + (0+12.3)^2 + (812+12.3)^2 = 2 \times 500 \times 10^6$

$$t = \sqrt{\frac{1.34 \times 10^6 \times (10^3)^2 \times (1.5)^2}{2 \times (500 \times 10^6)^2}} = 2.45 \times 10^{-3}$$

$= 2.45\ \text{mm}$

(3)



$\sigma_{II} = 0$

Von Mises $(600)^2 + (-300)^2 + (600+300)^2 = \dfrac{2 \times (500 \times 10^6)^2 t^2}{(10^3)^2 \times (1.5)^2}$

$t = \sqrt{\dfrac{1.26 \times 10^6 \times (10^3)^2 \times (1.5)^2}{2 \times (500 \times 10^6)^2}} = 2.38$ mm. ⟸

choose thickest required size 2.45 mm ⟸ .