Sem 2 AY 17/18

2a) Longitudinal stress required = 1.0 MPa

$$\sigma_2 = 1.0\,MPa + \frac{mg}{\pi(401^2 - 400^2)\times 10^{-6}}$$

$$= 1.0\times 10^6 + \frac{30\times 9.81}{\pi(401^2-400^2)\times 10^{-6}}$$

$$= 1116952.059\,Pa$$

$$\sigma_2 = \frac{pr}{2t}$$

$$1116952.059 = \frac{p(400\times\cancel{10^{-3}})}{2(1\times\cancel{10^{-3}})}$$

$$p = 5584.760297\,Pa$$

$$\approx 5.585\,kPa$$

Sem 1 AY13/14

1(a) At section H,

Axial force = 400N

Shear force = 300N

Torque = Rb = 30Nm

Moment about the vertical axis

= Sb = 40Nm

1(b) Axial force = 400N

Shear force = 300N

Torque = Rb = 30Nm

Moment about the vertical axis

= Sb = 40Nm

Sem 1 AY 13/14

1c) Area of the circular cross-section $= \pi\left(\frac{20\times10^{-3}}{2}\right)^2$

$= \pi \times 10^{-4} m$

For the top element,

$$\sigma_a = \frac{400}{\pi\times10^{-4}}$$

$$= \frac{4}{\pi} MPa$$

$$\sigma_b = \frac{My}{I}$$

$$= \frac{R(c-a)\times10\times10^{-3}}{\frac{1}{4}\pi(10\times10^{-3})^4}$$

$$= \frac{300(25)\times10\times10^{-6}}{\frac{1}{4}\pi(10)^4\times10^{-12}}$$

$$= \frac{30}{\pi} MPa$$

$$\sigma_{total} = \sigma_a + \sigma_b$$

$$= \frac{4}{\pi} + \frac{30}{\pi}$$

$$= \frac{34}{\pi}$$

$$= 10.8225361 MPa$$

$$\approx 10.8 MPa$$

Sem 1 AY13/14

1c) $\tau_t = \frac{Tc}{J}$

$= \frac{30 \times 10 \times 10^{-3}}{\frac{1}{2}\pi (10^4) \times 10^{-12}}$

$= \frac{60}{\pi}$ MPa

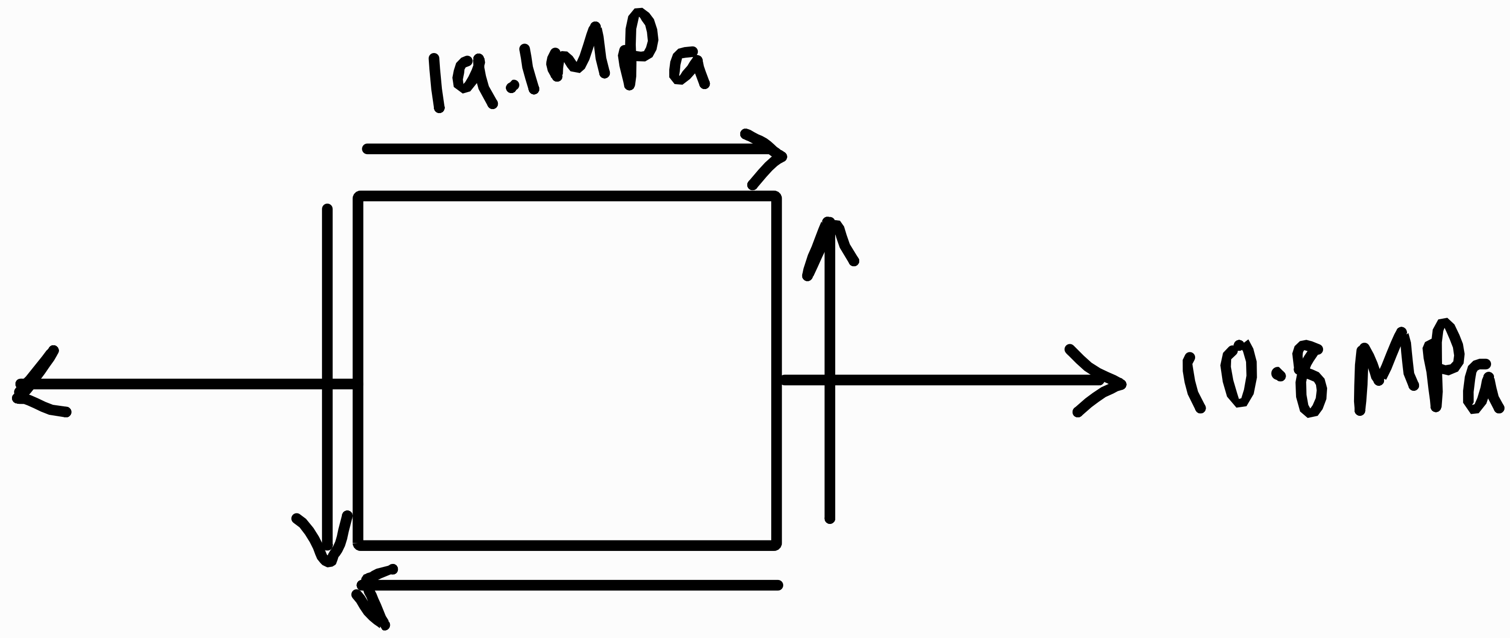
$\tau_b = 0$

$\tau_{total} = \tau_t + \tau_b$

$= \frac{60}{\pi} + 0$

$= 19.09859317$ MPa

$\simeq 19.1$ MPa



Sem 1 AY13/14

1c) For the side element,

$$\sigma_a = \frac{400}{\pi \times 10^{-4}}$$

$$= \frac{4}{\pi} \text{ MPa}$$

$$\sigma_b = \frac{My}{I}$$

$$= \frac{56 \times 10 \times 10^{-3}}{I}$$

$$= \frac{400 \times 100 \times 10^{-3} \times 10 \times 10^{-3}}{\frac{1}{4}\pi(10^4) \times 10^{-12}}$$

$$= \frac{160}{\pi}$$

$$\sigma_{total} = \sigma_a - \sigma_b$$

$$= \frac{4}{\pi} - \frac{160}{\pi}$$

$$= -\frac{156}{\pi} \text{ MPa}$$

$$= -49.65634224 \text{ MPa}$$

$$\approx -49.7 \text{ MPa}$$

Sem 1 AY13/14

1c) $\tau_t = \tau_t$ of the top element

$$= \frac{60}{\pi} \text{ MPa}$$

$$\tau_b = \frac{VQ}{It}$$

$$= \frac{300 \times \frac{2(10 \times 10^{-3})^3}{3}}{\frac{1}{4}\pi(10^4) \times 10^{-12} \times 20 \times 10^{-3}}$$

$$= \frac{4}{\pi} \text{ MPa}$$

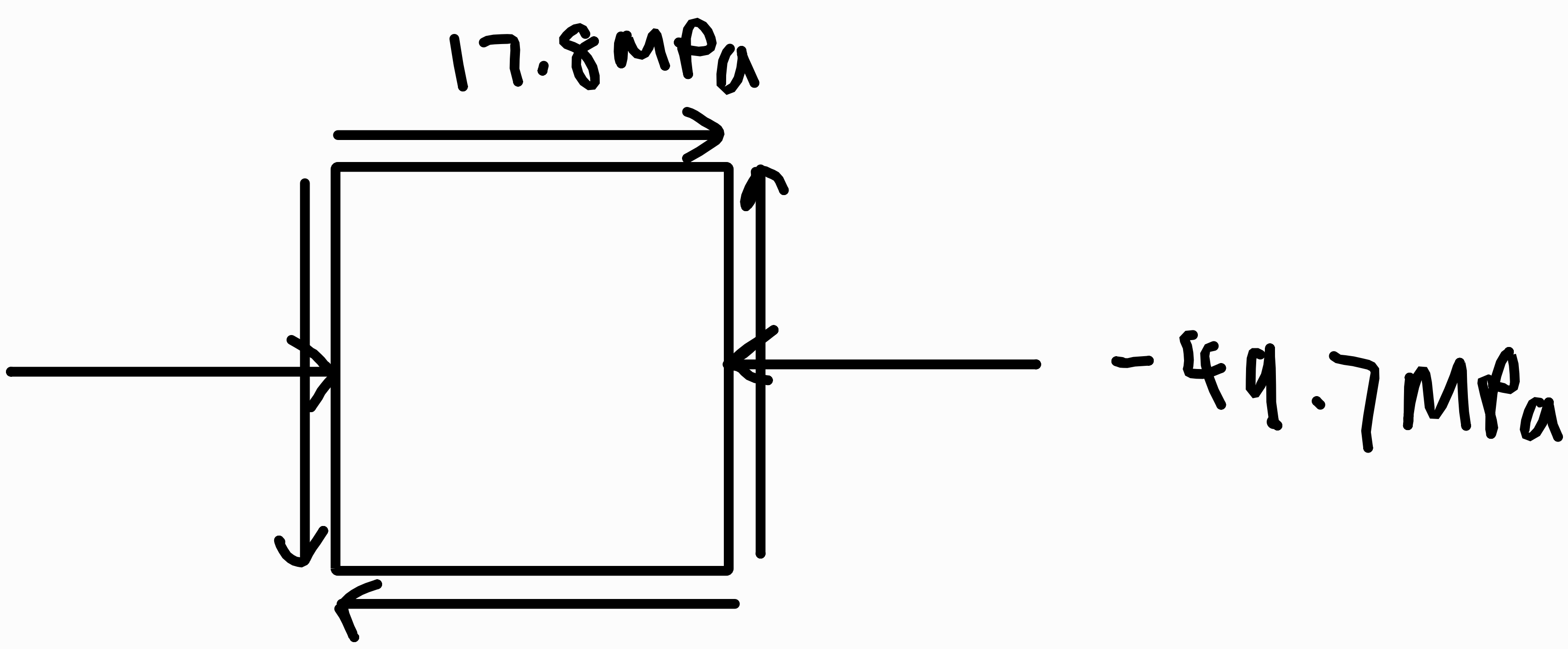
$$\tau_{total} = \tau_t - \tau_b$$

$$= \frac{60}{\pi} - \frac{4}{\pi}$$

$$= \frac{56}{\pi}$$

$$= 17.82535363 \text{ MPa}$$

$$\approx 17.8 \text{ MPa}$$



Sem 1 AY15/16

3a) $P_x = 1.0 \cos 30°$

$= \frac{\sqrt{3}}{2}$ kN

$P_y = 1.0 \sin 30°$

$= \frac{1}{2}$ kN

Anti-clockwise moment due to P_x, $M_p = P_x r_o$

$= \frac{\sqrt{3}}{2} \times 100$

$= 50\sqrt{3}$ Nm

At 0.8L:

Axial load $= -\frac{\sqrt{3}}{2}$ kN

Shear force $= \frac{1}{2}$ kN

Torque $= 200$ Nm

$M_{0.8L} = M - M_p - P_y (0.8)$

$= 500 - 50\sqrt{3} - \frac{1}{2} \times 0.8 \times 10^3$

$= 13.39745962$ Nm

≈ 13.40 Nm.

MP2001 Exam Sem 1 04/05

1a) $F_G = -12\times10^6 \times 4500\times10^{-6}$

$= -54\,kN$

$\sigma_F = 300\times10^{-6} \times 200\times10^9$

$= 60\,MPa$

$F_F = 60000 \times 500\times10^{-6}$

$= 30\,kN$

$P(300) = 54(150) + 450(30)$

$P = \dfrac{21600}{300}$

$= 72\,kN$

1b) $\tau_{ult} = 700\,MPa$

$$\frac{700\times10^6}{2.5} = \frac{30\times10^3 \times \frac{1}{2}}{\pi\left(\frac{d}{2}\right)^2}$$

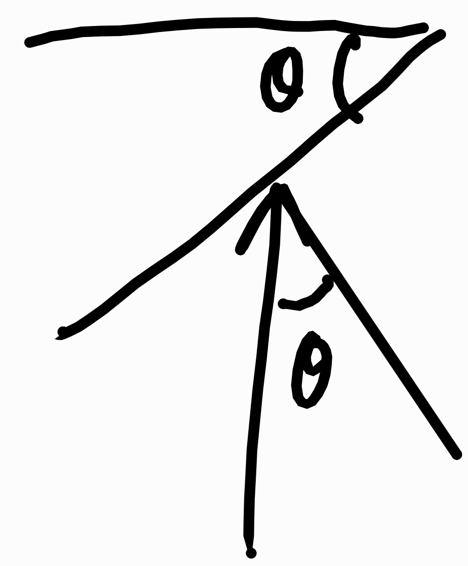
$d = 8.258889836\times10^{-3}\,m$

$\approx 8.26\,mm$

MP2001 exam sem 1 04/05

1c) $F_{shear} = F\sin\theta$

$= 30\sin\theta$



$F_{normal} = 30\cos\theta$

$$\sigma = \frac{30\cos\theta}{\pi\left(\frac{15}{2}\times10^{-3}\right)^2}$$

$$= \frac{1.6\times10^6\cos\theta}{3\pi}\ \text{kPa}$$

$$\tau = \frac{30\sin\theta}{\pi\left(\frac{15}{2}\times10^{-3}\right)^2}$$

$$= \frac{1.6\times10^6\sin\theta}{3\pi}\ \text{kPa}$$

When $\theta = 50^\circ$,

$$\sigma_{50^\circ} = \frac{1.6\times10^6\cos50^\circ}{3\pi}$$

$$= 109123.0138\ \text{kPa}$$

$$\approx 109.1\ \text{MPa}$$

$$\tau_{50^\circ} = \frac{1.6\times10^6\sin50^\circ}{3\pi}$$

$$= 130047.7437\ \text{kPa}$$

$$\approx 130.0\ \text{MPa}$$

M201 99/00 sem 2

(b) $\sigma_b = \dfrac{My}{I}$

$$= \frac{F\left(\frac{1}{2}L\right)\left(\frac{1}{2}\cancel{h}\right)}{\frac{1}{12}bh^{\cancel{3}2}}$$

$$= \frac{3FL}{bh^2}$$

$$\sigma_p = \sigma_b$$

$$\frac{2P}{\cancel{b}\cancel{h}} = \frac{3FL}{\cancel{b}h\cancel{2}}$$

$$2Ph = 3FL$$

$$F = \frac{2}{3}\left(\frac{Ph}{L}\right)$$

G262 03/04 Sem 2

$\sigma_{ult} = -5MPa$

$$\frac{pr}{2t} - \sigma_{max} = \sigma_{ult}$$

$$\sigma_{max} = \frac{pr}{2t} - \sigma_{ult}$$

$$= \frac{200\times10^3 \times 31.9\times10^{-3}}{2(0.1\times10^{-3})} - (-5)\times10^6$$

$$= 36.9MPa$$

$$F_{max} = 36.9\times10^6 \times \pi(32^2 - 31.9^2)\times10^{-6}$$

$$= 740.7592734N$$

$$N_{max} = \frac{F_{max}}{400\times10^{-3}\times9.81}$$

$$= 188.7765732$$

$$\approx 188$$

M201 Exam 99/00 Sem 2

$$\sigma_2 = \frac{pr}{2t}$$

σ_{axial} due to load $= \dfrac{200}{\pi(125^2 - 124^2) \times 10^{-6}}$

$$= 0.2556705913 \text{ MPa}$$

$$\sigma_b = \frac{My}{I}$$

$$= \frac{200(500 \times 10^{-3}) \times 125 \times 10^{-3}}{\frac{1}{4}\pi(125^4 - 124^4) \times 10^{-12}}$$

$$= 2.061793098 \text{ MPa}$$

$$\sigma_2 = \sigma_{axial} + \sigma_b$$

$$\frac{pr}{2t} = (0.2556705913 + 2.061793098) \times 10^6$$

$$\frac{p(248 \times 10^{-3})}{2(2 \times 10^{-3})} = 2317463.689$$

$$p = 37378.4466 \text{ Pa}$$

$$\approx 0.03738 \text{ MPa}$$

M201 Exam 99/00 Sem 2

For element A,

$$\sigma_{vert} = 0$$

$$\sigma_{hori} = \frac{pr}{t}$$

$$= \frac{0.037378446 6\times10^6 \times 248 \cancel{\times 10^{-3}}}{2 \cancel{\times 10^{-3}}}$$

$$= 4.634927378\,MPa$$

$$\simeq 4.635\,MPa$$

For element B,

$\sigma_{hori} = \sigma_{hori}$ of element A

$$\simeq 4.635\,MPa$$

$$\sigma_{vert} = \frac{pr}{2t} + \sigma_b - \sigma_{axial}$$

$$= \frac{0.0373784466\times10^6 \times 248 \cancel{\times 10^{-3}}}{2(2 \cancel{\times 10^{-3}})}$$

$$+ 2.061793098\times10^6 - 0.2556705913\times10^6$$

$$= 4.123586196\,MPa$$

$$\simeq 4.124\,MPa$$

MP2001 Sem 1 05/06

2a) $\varepsilon_x = \dfrac{\sigma_x}{E} - \nu \dfrac{\sigma_y}{E}$

$$3\times10^{-5} = \frac{\sigma_x}{200\times10^{9}} - 0.3\,\frac{\left(\dfrac{1\times10^{6}\times200\times10^{-3}}{2\times10^{-3}}\right)}{200\times10^{9}}$$

$$\sigma_x = 36\,\text{MPa}$$

b) $\sigma_x = \sigma_2 - \sigma_F$

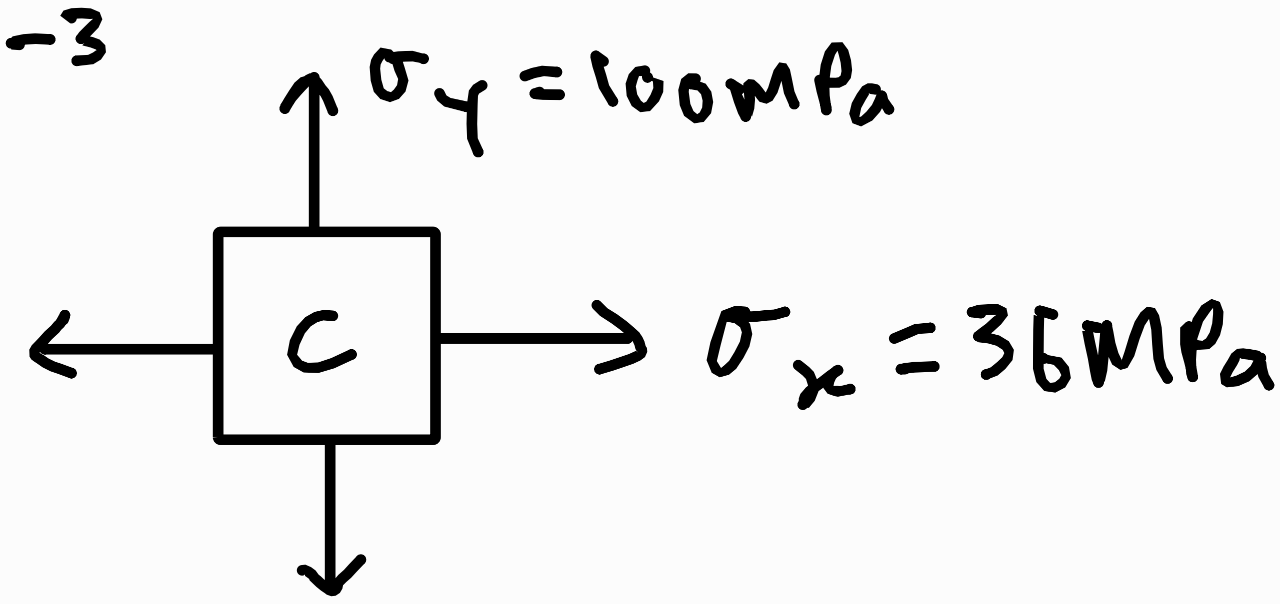
$$\sigma_x = \sigma_2 - \sigma_F$$

$$36\times10^{6} = \frac{1\times10^{6}\times200\times10^{-3}}{2\times2\times10^{-3}} - \frac{F}{\pi(202^2-200^2)\times10^{-6}}$$

$$14\times10^{6} = \frac{F}{804\pi\times10^{-6}}$$

$$F = 35361.7669\,\text{N}$$
$$\approx 35361.8\,\text{N}$$

c) $\sigma_y = \dfrac{1\times10^{6}\times200\times10^{-3}}{2\times10^{-3}} = 100\,\text{MPa}$



MP2001 Sem 1 05/06

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

$$0 = \frac{36 + 100}{2} - \sqrt{\left(\frac{36 - 100}{2}\right)^2 + \tau_{xy}^2}$$

$$68^2 = 1024 + \tau_{xy}^2$$

$$\tau_{xy} = 60\,MPa$$

$$\tau_{xy} = \frac{Tc}{J}$$

$$60 \times 10^6 = \frac{T(202 \times 10^{-3})}{\frac{1}{2}\pi(202^4 - 200^4) \times 10^{-12}}$$

$$T = 30311.58642\,N$$

e) $$\tan^{-1} 2\theta_p = \frac{2\tau_{xy}}{\sigma_x - \sigma_y}$$

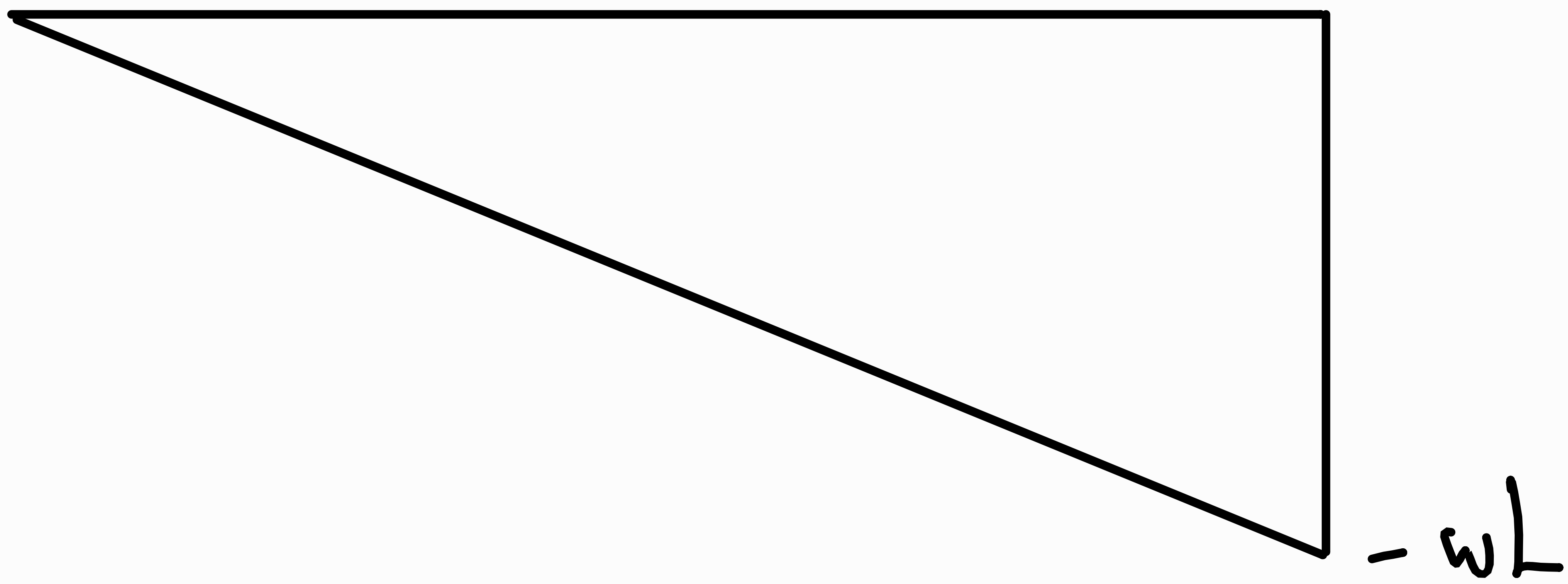
$$\tan^{-1} 2\theta_p = \frac{2(60)}{36 - 100}$$

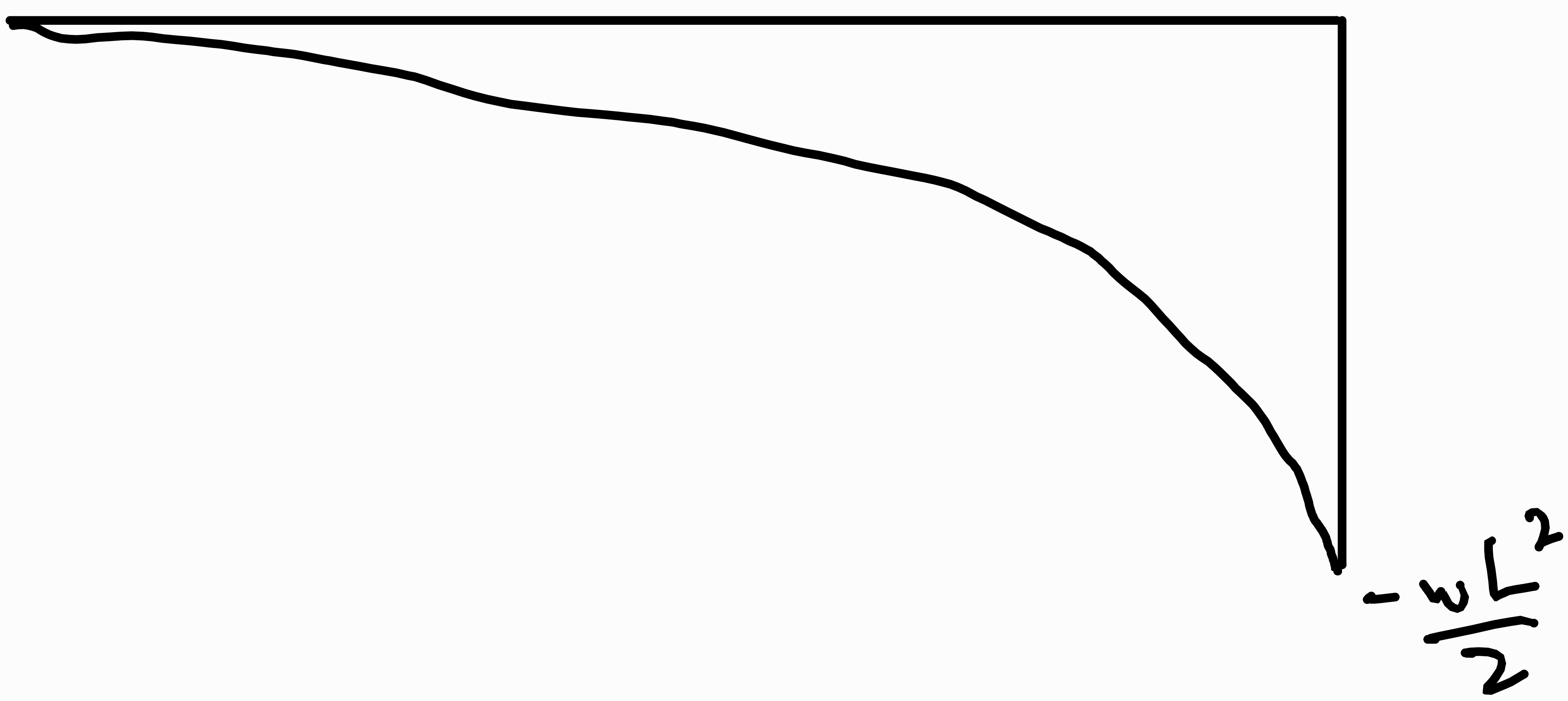
$$\theta_p = -30.96375653°, 59.03624347°$$

$$\approx -30.96°, 59.03°$$

G 262 Sem 2 02/03

2a)





b) $\sigma_b = \frac{-My}{I}$

$$= \frac{-0.3 \times 0.8 \times 1000 \times 0.4 \times 50 \times 10^{-3}}{2 \times 10^5 \times 10^{-12}}$$

$$= -24 \text{MPa}$$

G262 Sem 2 02/03

2c) $I = \frac{1}{4}\pi\left[\left(\frac{d_o}{2}\right)^4 - \left(\frac{d_i}{2}\right)^4\right]$

$$2\times10^5\times10^{-12} = \frac{\pi}{64}\left(d_o^4 - d_i^4\right)$$

$$2\times10^{-7} = \frac{\pi}{64}\left(100^4 - d_i^4\right)\times10^{-12}$$

$$\frac{12.8\times10^6}{\pi} = 100^4 - d_i^4$$

$$d_i = 98.96546486$$

$$\approx 98.97\text{mm}$$

2d) $\sigma_2 = 24\text{MPa}$

$$\frac{pr}{2t} = 24\times10^6$$

$$\frac{p(98.97\times10^{-3})}{2(100-98.97)\times10^{-3}} = 24\times10^6$$

$$p = 0.5017678338\text{MPa}$$

$$\approx 0.5\text{MPa}$$

G262 Sem 2 02/03

2e) $\sigma_B = \sigma_b + \sigma_2$

$= 24\times10^6 + 24\times10^6$

$= 48\,MPa$