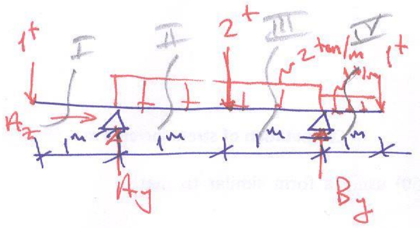
1



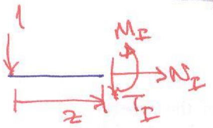
$\xrightarrow{+} \sum F_z = 0$ $\boxed{A_z = 0}$

$\circlearrowleft + \sum M_B = 0 \quad 2A_y - 1\times 3 - 2\times 1 - (2\times 2)1 + (1\times 1)0.5 + 1\times 1 = 0$ 5

$\boxed{A_y = 3.75^t \uparrow}$

$+\uparrow \sum F_y = 0 \quad A_y + B_y - 1 - 2 - 1 - 2\times 2 = 0$

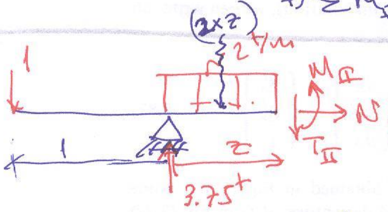
$\boxed{B_y = 5.25^t \uparrow}$



$\rightarrow \sum F_z = 0$ $\boxed{N_I = 0}$

$\downarrow \sum F_y = 0$ $\boxed{T_I = -1^t}$ 5

$\circlearrowleft \sum M_I = 0$ $\boxed{M_I = -z}$

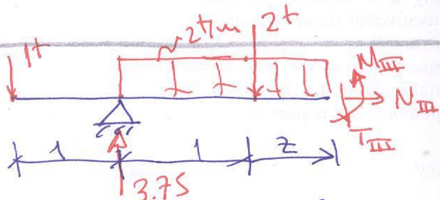


$\xrightarrow{+} \sum F_z = 0$ $\boxed{N_{II} = 0}$ 7

$+\downarrow \sum F_y = 0 \quad -1 - 2z + 3.75 - T_{II} = 0$

$\boxed{T_{II} = 2.75 - 2z}$

$\circlearrowleft \sum M_{II} = 0 \quad M_{II} + \frac{2z^2}{2} - 3.75z + (1+z)\times 1 = 0$ $\boxed{M_{II} = -z^2 + 2.75z - 1}$



$\boxed{N_{III} = 0}$ 7

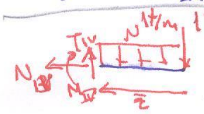
$\xrightarrow{+} \sum F_z = 0$

$+\downarrow \sum F_y = 0 \quad -1 - 2\times 1 - 2 + 3.75 - 2z - T_{III} = 0$

$\boxed{T_{III} = -1.25 - 2z}$

$\circlearrowleft \sum M_{III} = 0 \quad M_{III} + \frac{2z^2}{2} + (2\times z) + (2\times 1)(z+0.5) - 3.75(1+z) + 1(2+z) = 0$

$\boxed{M_{III} = -z^2 - 1.25z + 0.75}$



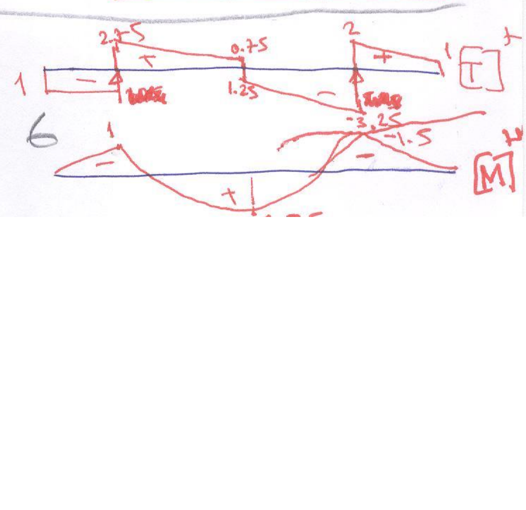
$\xrightarrow{+} \sum F_z = 0$ $\boxed{N_{IV} = 0}$

$+\uparrow \sum F_y = 0$ $\boxed{T_{IV} = 1 + z}$

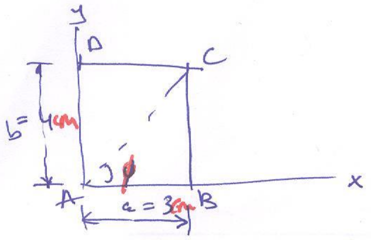
$\circlearrowleft + \sum M_{IV} = 0$ $\boxed{M_{IV} = -z - \frac{z^2}{2}}$

5

6



2



$\Delta L_x = -6\times10^{-3}$ cm

$\Delta L_y = 4\times10^{-3}$ cm $\quad \phi = \tan^{-1}\left(\frac{4}{3}\right) = 53.13^\circ$

$\gamma_{xy} = 1.2\times10^{-3}$ rad $\quad 2\phi = 106.26^\circ$

$\cos 2\phi = -0.28 \quad \sin 2\phi = 0.96$

$$\varepsilon_x = \frac{\Delta L_x}{L_x} = \frac{-6\times10^{-3}}{3} = -2\times10^{-3}$$

10

$$\varepsilon_y = \frac{\Delta L_y}{L_y} = \frac{4\times10^{-3}}{4} = 1\times10^{-3}$$

$$e_{xy} = \frac{\gamma_{xy}}{2} = 0.6\times10^{-3}$$

$$\varepsilon_{AC} = \frac{\varepsilon_x+\varepsilon_y}{2} + \frac{\varepsilon_x-\varepsilon_y}{2}\cos2\phi + e_{xy}\sin2\phi$$

10

$$= \left[\left(\frac{-2+1}{2}\right) + \left(\frac{-2-1}{2}\right)(-0.28) + 0.6(0.96)\right]\times10^{-3}$$

$$\varepsilon_{AC} = 0.496\times10^{-3}$$

$$\varepsilon_{1,2} = \frac{\varepsilon_x+\varepsilon_y}{2} \pm \sqrt{\left(\frac{\varepsilon_x-\varepsilon_y}{2}\right)^2 + e_{xy}^2}$$

10

$$= \left[\left(\frac{-2+1}{2}\right) \pm \sqrt{\left(\frac{-2-1}{2}\right)^2 + (0.6)^2}\right]\times10^{-3}$$

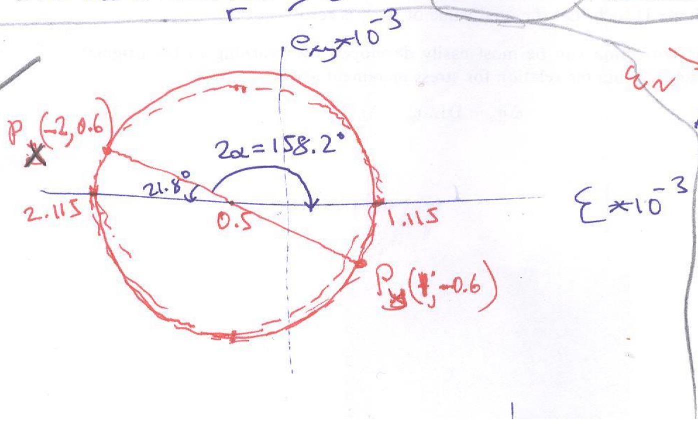
$$\varepsilon_1 = 1.115\times10^{-3}$$

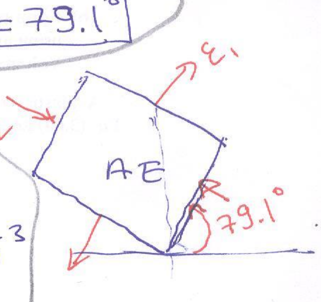
$$\varepsilon_2 = -2.115\times10^{-3}$$

$$\tan 2\alpha = \frac{2e_{xy}}{\varepsilon_x-\varepsilon_y} = \frac{1.2}{-2-1} = -0.4 \qquad 2\alpha = -21.8^\circ + \pi = 158.2^\circ$$

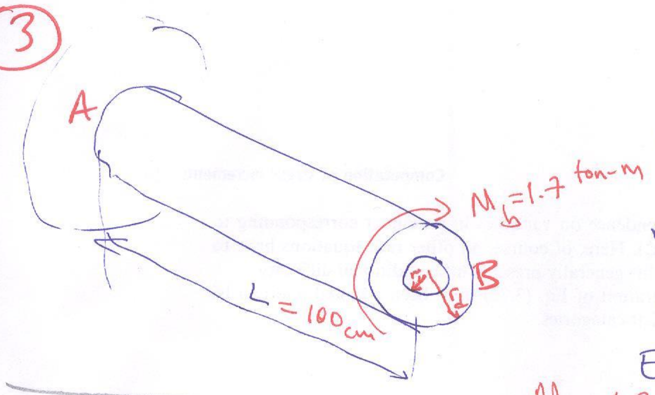
$$\sin 2\alpha = \frac{e_{xy}}{r} > 0 \qquad 2. \text{ Bölge} \quad \boxed{\alpha = 79.1^\circ}$$

5





3



$r_d = \frac{D_d}{2} = \frac{10}{2} = 5\ cm$

$r_i = \frac{D_i}{2} = \frac{7}{2} = 3.5\ cm$

$\nu = 0.3$

$E = 2\times10^6\ kgf/cm^2$

$M_b = 1.7\times10^5\ kgf\text{-}cm$

$\tau_{min} = \frac{M_b}{I_o} r_i$ (iç yarıçaptaki kayma gerilmesi)

5 $I_o = \frac{\pi(5^4 - 3.5^4)}{2} = 746.03\ cm^4$

10 $\tau_{min} = \frac{(\overset{kgf\text{-}cm}{1.7\times10^5})\,3.5}{746.03} = 797.55\ kgf/cm^2$

$\phi_{BA} = \phi_B - \underbrace{\phi_A}_{0} = \frac{M_b L}{G I_o}$

5 $G = \frac{E}{2(1+\nu)} = \frac{2\times10^6}{2(1+0.3)} = 769230.77\ kgf/cm^2$

10 $\phi_{BA} = \frac{1.7\times10^5 \times 100}{(769230.77)(746.03)} = 0.0296\ rad \cong 0.03\ rad$

$\phi = 1.699^\circ \cong 1.7^\circ$