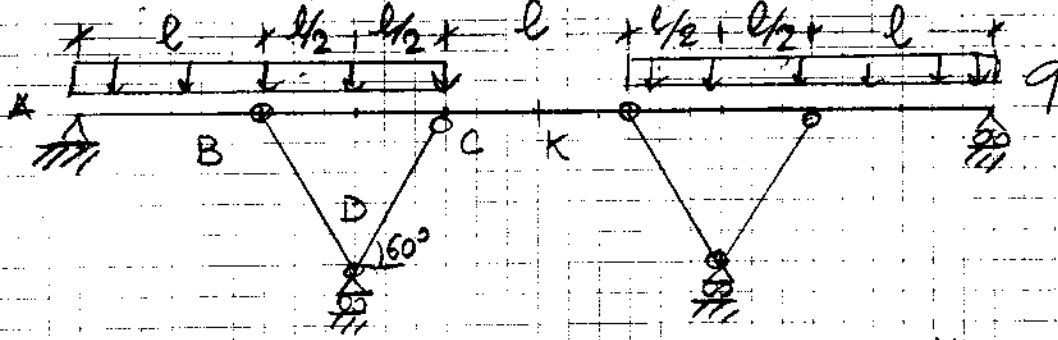
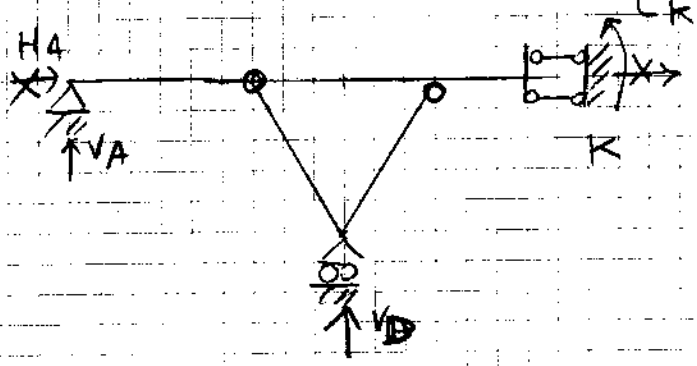
COMPITO SdC I 16/4/02

1)



$l = 1\,m$

$q = 1\,t/m$



$H_A = 0$

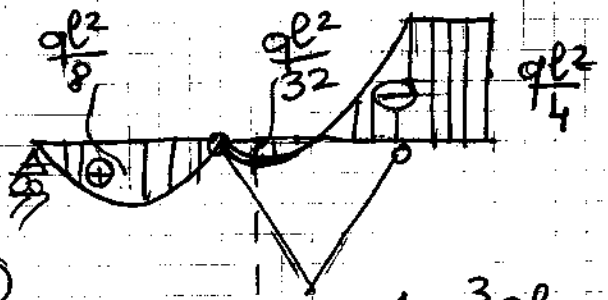
$$\begin{cases} B\curvearrowleft & -V_A l + q\frac{l^2}{2} = 0 \\ \uparrow & V_D = 2ql - \frac{ql}{2} \\ D\curvearrowleft & -V_A \cdot \frac{3}{2}l + 2q\frac{l^2}{2} + C_K = 0 \end{cases}$$

$V_A = \frac{ql}{2}$;

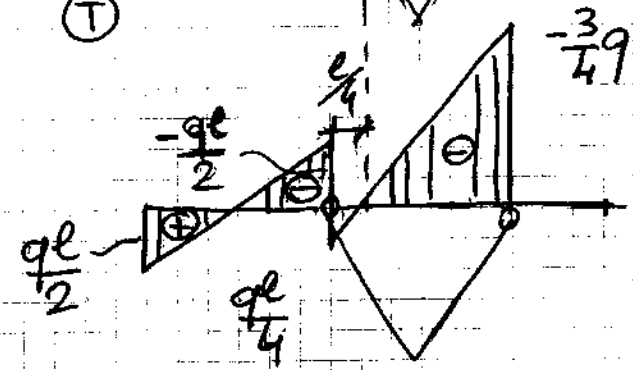
$V_D = \frac{3}{2}ql$

$C_K = -\frac{ql^2}{4}$

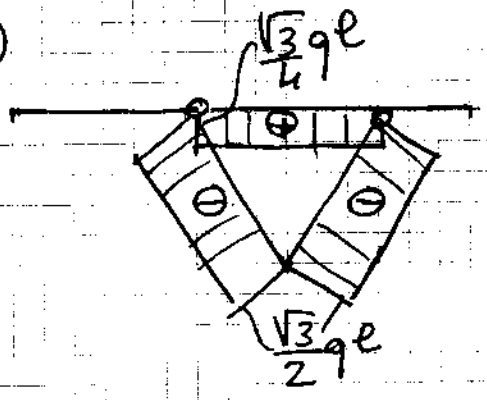
(H)

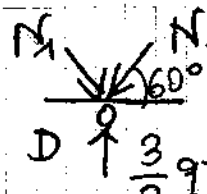


(T)



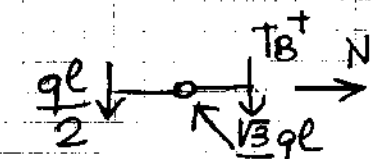
(N)





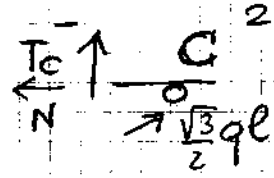
$2N_1\frac{\sqrt{3}}{2} = \frac{3}{2}ql$

$N_1 = \frac{\sqrt{3}}{2}ql$



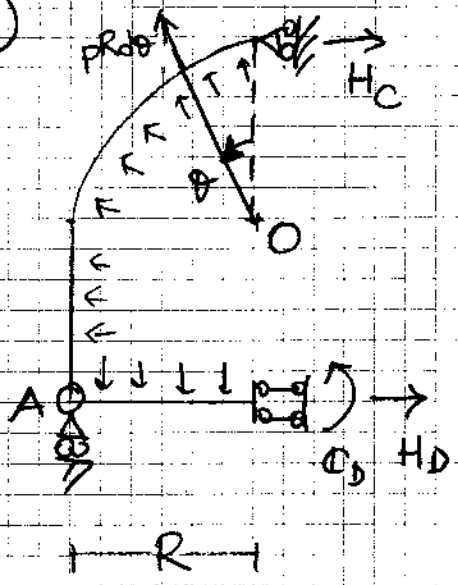
$T_B^+ = \frac{ql}{4}$

$N = \frac{\sqrt{3}}{2}\frac{ql}{2}$



$T_C^- = -\frac{3}{4}ql$

2)



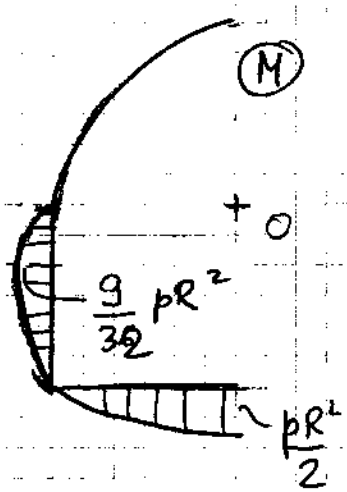
$$\begin{cases} V_A - pR + \int_0^{\pi/2} \cos\theta\, pR\, d\theta = 0 \\ H_D + H_C - pR - \int_0^{\pi/2} \sin\theta\, pR\, d\theta = 0 \end{cases}$$

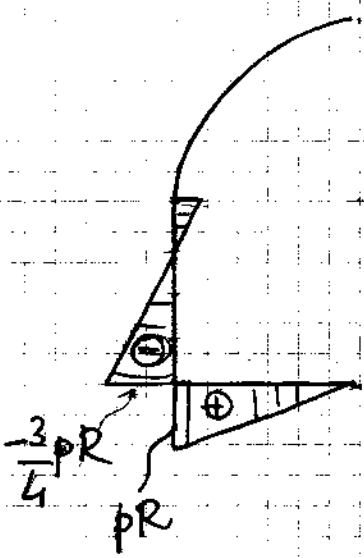
$$\begin{cases} V_A = 0 \\ H_D + H_C = pR - [\cos\theta]_0^{\pi/2} = 2pR \end{cases}$$

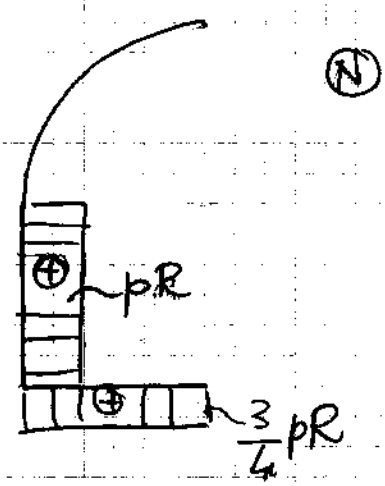
$$\begin{cases} A) \quad C_D - \frac{pR^2}{2} = 0 \rightarrow C_D = \frac{pR^2}{2} \\ O) \quad \frac{pR^2}{2} + (H_D - H_C)R - \frac{pR^2}{2} + \frac{pR^2}{2} = 0 \end{cases}$$

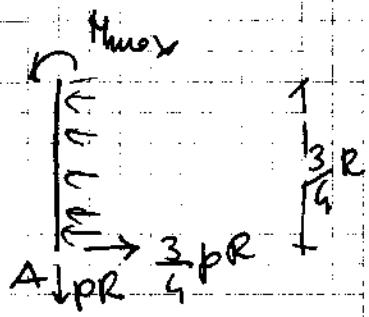
$$\begin{cases} O) \quad H_C - H_D = \frac{pR}{2} \\ H_D + H_C = 2pR \end{cases}$$

$$\boxed{H_D = \frac{3}{4}pR} \; ; \; \boxed{H_C = \frac{5}{4}pR}$$



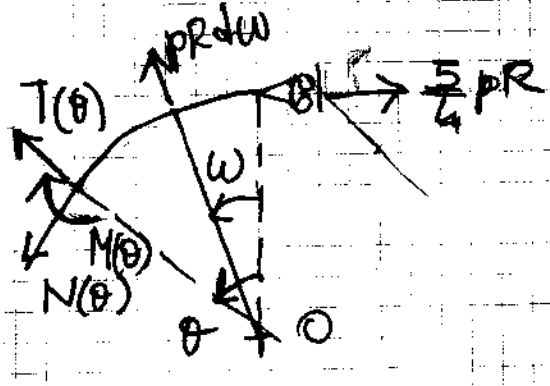






$$M_{max} = -\frac{9}{16}pR^2 + \frac{1}{2}\,\frac{9}{16}pR^2 = -\frac{9}{32}pR^2$$

2)



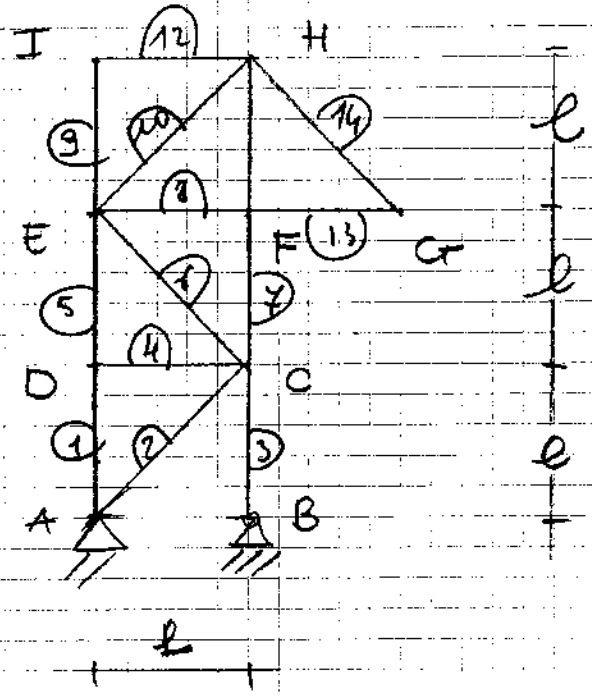
$$N(\theta) = \int_0^\theta \sin(\theta-\omega)\, pR\, d\omega + \frac{5}{4} pR\cos\theta =$$

$$= \left[\cos(\theta-\omega)\right]_0^\theta pR + \frac{5}{4} pR\cos\theta = pR + \frac{pR}{4}\cos\theta$$

$$T(\theta) = -\int_0^\theta \cos(\theta-\omega)\, pR\, d\omega + \frac{5}{4} pR\sin\theta = \frac{pR}{4}\sin\theta$$

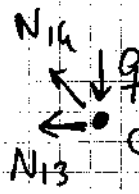
$$O\circlearrowleft \quad -M(\theta) + N(\theta)R - \frac{5}{4} pR^2 = 0 \Rightarrow M(\theta) = \frac{pR^2}{4}(\cos\theta - 1)$$

3)



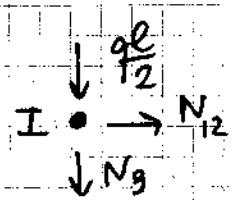
1	0	12	0
2	0	13	$-9\ell/2$
3	$-2q\ell$	14	$q\ell\sqrt{2}$
4	0		
5	0		
6	0		
7	$-2q\ell$		
8	$-q\ell/2$		
9	$-q\ell/2$		
10	$q\ell/\sqrt{2}$		
11	$-2q\ell$		

STATO PRIMARIO



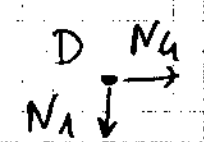
$\frac{\sqrt{2}}{2} N_{14} = \frac{q\ell}{2}$

$N_{13} = -N_{14}\frac{\sqrt{2}}{2} = -\frac{q\ell}{2}$



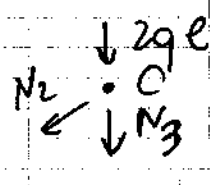
$N_{12} = 0$

$N_9 = \frac{q\ell}{2}$



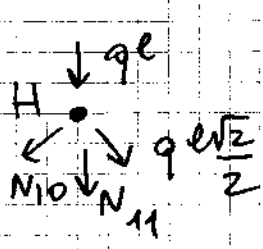
$N_1 = 0$

$N_4 = 0$



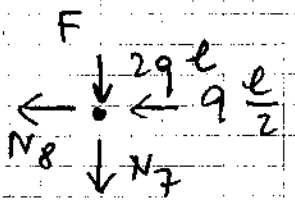
$N_2 = 0$

$N_3 = -2q\ell$



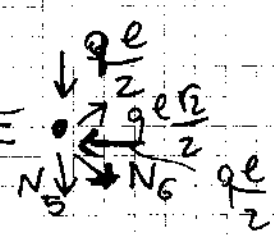
$N_{10}\frac{\sqrt{2}}{2} = q\ell\frac{\sqrt{2}}{2}\frac{\sqrt{2}}{2}$

$N_{11} = -q\ell - 2q\ell\frac{\sqrt{2}}{2}\frac{\sqrt{2}}{2} = -2q\ell$



$N_7 = -2q\ell$

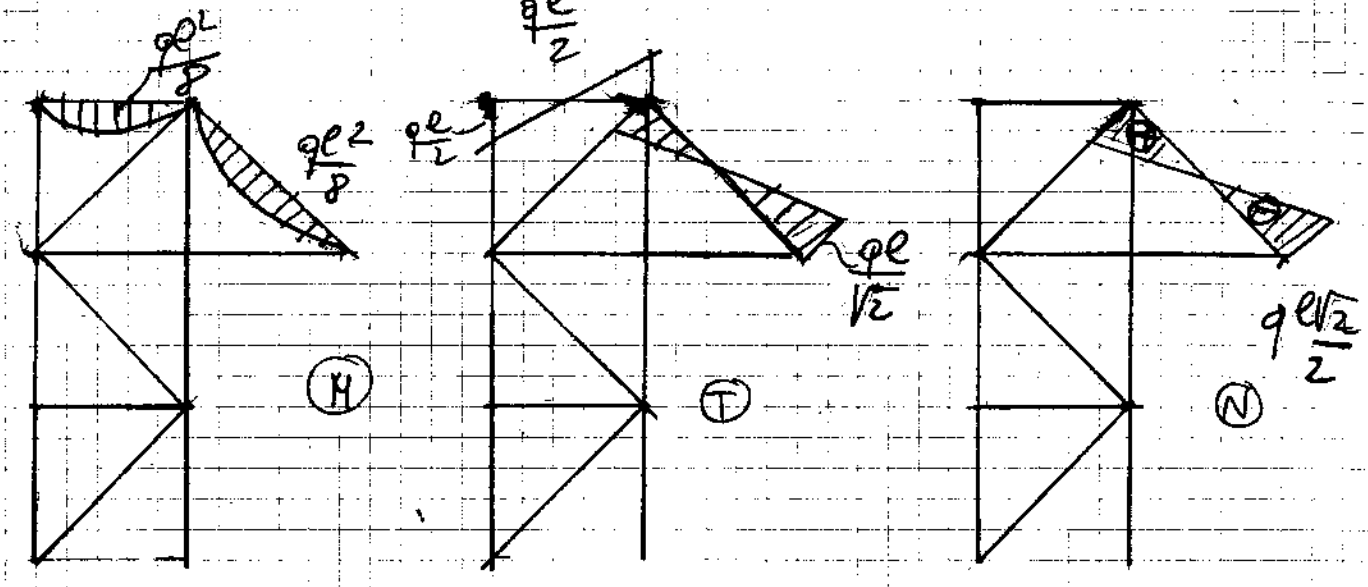
$N_8 = -\frac{q\ell}{2}$

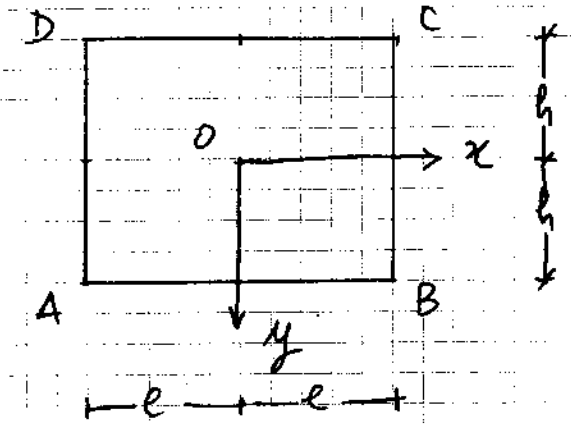


$N_6 - \frac{q\ell}{2} + q\ell\frac{\sqrt{2}}{2}\frac{\sqrt{2}}{2} = 0 \Rightarrow N_6 = 0$

$N_5 + \frac{q\ell}{2} - q\ell\frac{\sqrt{2}}{2}\frac{\sqrt{2}}{2} = 0 \Rightarrow N_5 = 0$

3)


$\frac{ql^2}{8}$
$\frac{ql^2}{8}$
(M)
$\frac{ql}{2}$
$\frac{ql}{2}$
$\frac{ql}{\sqrt{2}}$
(T)
(N)
$\frac{ql\sqrt{2}}{2}$



$$T = \begin{vmatrix} 0 & -ax \\ -ax & ay \end{vmatrix}$$

a) $\operatorname{div} T + b = 0$

$$\operatorname{div} T = \begin{vmatrix} 0+0 \\ -a+a \end{vmatrix} = \begin{vmatrix} 0 \\ 0 \end{vmatrix} \Rightarrow \underset{\sim}{b} = \underset{\sim}{0}$$

forze di volume nulle

lato AB) $T\underset{\sim}{n} = \begin{vmatrix} 0 & -ax \\ -ax & ay \end{vmatrix} \begin{vmatrix} 0 \\ 1 \end{vmatrix} = \begin{vmatrix} -ax \\ ah \end{vmatrix}$

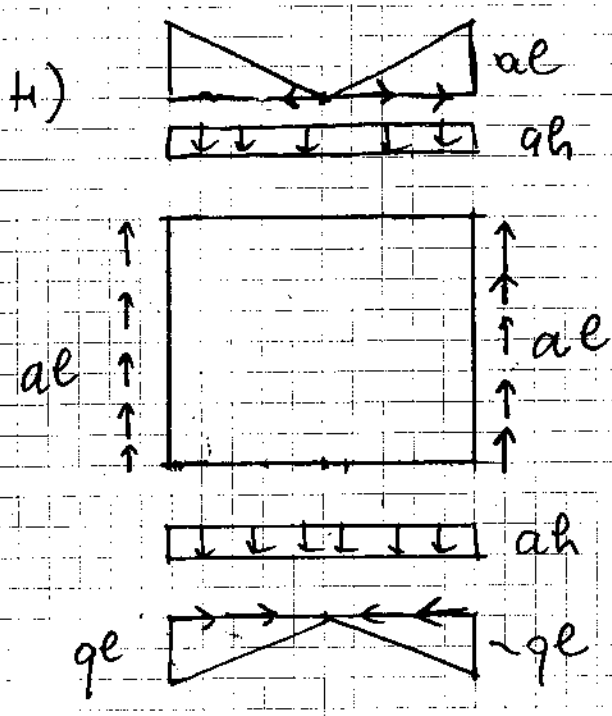
$T\underset{\sim}{n} \cdot \underset{\sim}{n} = ah$

lato CD) $T\underset{\sim}{n} = \begin{vmatrix} 0 & -ax \\ -ax & -ah \end{vmatrix} \begin{vmatrix} 0 \\ -1 \end{vmatrix} = \begin{vmatrix} ax \\ ah \end{vmatrix}$ $\quad T\underset{\sim}{n} \cdot \underset{\sim}{n} = ah$

lato BC) $T\underset{\sim}{n} = \begin{vmatrix} \cancel{0} & -al \\ -al & -ay \end{vmatrix} \begin{vmatrix} 1 \\ 0 \end{vmatrix} = \begin{vmatrix} 0 \\ -al \end{vmatrix}$ $\quad T\underset{\sim}{n} \cdot \underset{\sim}{n} = 0$

lato DA) $T\underset{\sim}{n} = \begin{vmatrix} 0 & al \\ al & ay \end{vmatrix} \begin{vmatrix} -1 \\ 0 \end{vmatrix} = \begin{vmatrix} 0 \\ -al \end{vmatrix}$ $\quad T\underset{\sim}{n} \cdot \underset{\sim}{n} = 0$

4)

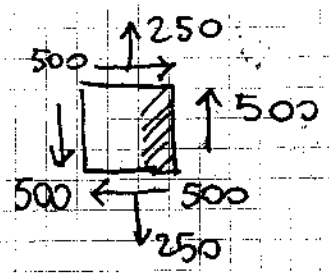


NB $a_h \cdot 2\ell = a_\ell \cdot 2h$

le trazioni superficiali costituiscono un sistema di forze autoequilibrato

b) $P \equiv (5, \frac{5}{2})$

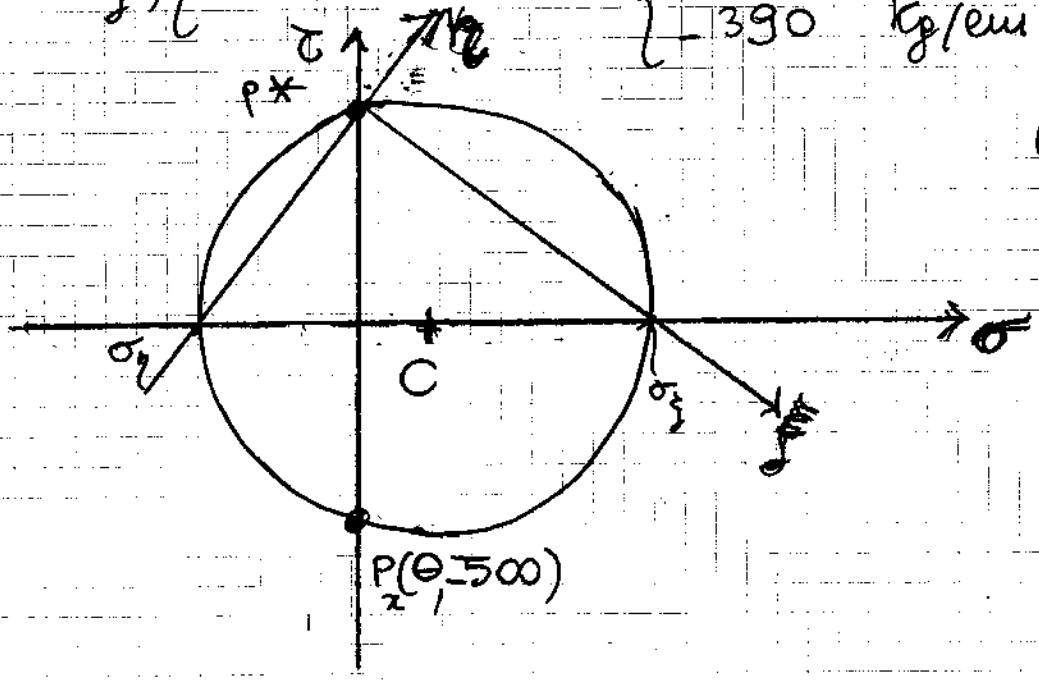
$$T = \begin{bmatrix} 0 & -500 \\ -500 & 250 \end{bmatrix} \quad kg/cm^2$$



$$C = \frac{250}{2} = 125$$

$$R = \sqrt{\left(\frac{250}{2}\right)^2 + 500^2} = 515$$

$$\sigma_{\xi,\eta} = 125 \pm 515 = \begin{cases} 640 & kg/cm^2 \\ -390 & kg/cm^2 \end{cases}$$



$P_x \equiv (0, -500)$

$P^*(0, 500)$