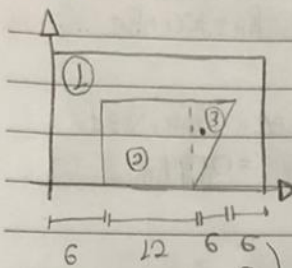
Daniel Augusto Müller. RA: 203934

Prova

1)

a)



	x	y	A (cm²)	Ax	Ay	dx	dy	$\bar{I}_x$	$\bar{I}_y$
+ ①	15	9	540	8100	4860	0,70	1,30	11580	40500
- ②	12	6	144	1728	864	3,70	4,30	4320	27000
- ③	20	8	36	720	288	4,70	2,30	288	72

$\Sigma A = 360 cm^2$ $\Sigma Ax = 5652 cm^2$

$\Sigma Ay = 3708 cm^2$

a) $\bar{x} = \frac{\Sigma Ax}{\Sigma A} = 15,70 cm$

$\bar{y} = \frac{\Sigma Ay}{\Sigma A} = 10,30 cm$

b)

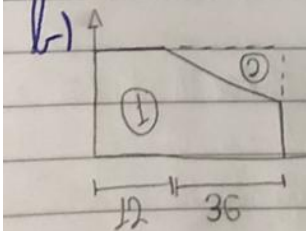
$I_x = I_{x1} - I_{x2} - I_{x3} = (\bar{I}_{x1} + A_1 dy_1^2) - (\bar{I}_{x2} + A_2 dy_2^2) - (\bar{I}_{x3} + A_3 dy_3^2)$

$I_x = 8031,60 cm^4$

$I_y = I_{y1} - I_{y2} - I_{y3} = (\bar{I}_{y1} + A_1 dx_1^2) - (\bar{I}_{y2} + A_2 dx_2^2) - (\bar{I}_{y3} + A_3 dx_3^2)$

$I_y = 10926 cm^4$

b)



	x	y	A (mm²)	Ax	Ay	dx	dy	$\bar{I}_x$	$\bar{I}_y$
+ ①	24	12	1152	27648	13824	2,77	1,85	55296	221184
- ②	36	20	216	7776	4320	14,77	9,85	1728	15552

$\Sigma A = 936 mm^2$

a) $\Sigma Ax = 19872 mm^2$ $\bar{x} = 21,23 mm$

$\Sigma Ay = 9504 mm^2$ $\bar{y} = 10,15 mm$

b) $I_x = I_{x1} - I_{x2}$

$= (\bar{I}_{x1} + A_1 dy_1^2) - (\bar{I}_{x2} + A_2 dy_2^2)$

$I_x = 36553,86 mm^4$

$I_y = I_{y1} - I_{y2}$

$= (\bar{I}_{y1} + A_1 dx_1^2) - (\bar{I}_{y2} + A_2 dx_2^2)$

$I_y = 167350,15 mm^4$

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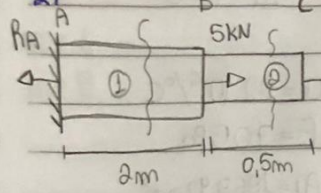
2)



$\phi_1 = 14mm$ $\phi_2 = 8mm$ $E_1 = E_2 = 70GPa$

$\sum F_x = 0$

$+R_A - 5KN - 3KN = 0$

$R_A = 8KN$

$A_1 = 153,94\ mm^2$

$A_2 = 50,26\ mm^2$

a) $\sigma_{AB} = \frac{P_{AB}}{A_1} = \frac{8.10^3}{153,94} = 51,97MPa\ (T)$ (0)

$\sigma_{BC} = \frac{P_{BC}}{A_2} = \frac{(8-5)10^3}{50,26} = 59,69MPa\ (T)$

b)

$\Delta l = \frac{P.l}{E.A}$

$\Delta l_{AB} = \frac{P_{AB}.l_1}{E_1.A_1} = \frac{(8.10^3)(2.10^3mm)}{(70.10^3)(153,94mm^2)} = 1,48mm \rightarrow$

$\Delta l_{BC} = \frac{(3.10^3)(0,5.10^3mm)}{(70.10^3)(50,26mm^2)} + \Delta l_{AB} = 0,42 + 1,48 = 1,9mm \rightarrow$

Deformação Total = 1,9mm

Tamanho Total 2,5019 m (1)

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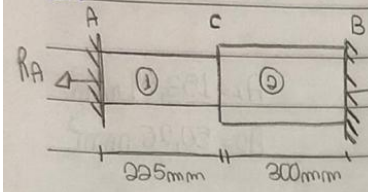
31 $\phi_1 = 50mm$ $\phi_2 = 75mm$ $\Delta T = 40°C$



$\Delta l = \alpha . l . \Delta T$

$\alpha = 22.10^{-6}/°C$

$E = 70GPa$

$A_1 = 1963,42mm^2$

$A_2 = 4417,86mm^2$

$R_A = R_B$

a) $\Delta l = 0$

$\Delta l_{AC} + \Delta l_{BC} = 0$

$$\left[\left(\frac{+R_A.225}{70.10^3.1963,42}\right) + 22.10^{-6}.225.40\right] + \left[\left(\frac{R_B.300}{70.10^3.4417,86}\right) + 22.10^{-6}.300.40\right] = 0$$

$$\left(+1,63R_A.10^{-6} + 0,198\right) + \left(9,70R_B.10^{-7} + 0,264\right) = 0$$

Como $R_A = R_B$

$2,6R_B.10^{-6} = 0,462$

$R_B = -177,7KN$ (C)

$\sigma_{AB} = \frac{F}{A_1} = 90,25MPa$ $\sigma_{BC} = \frac{F}{A_2} = 40,11MPa$

b) $\Delta L_{AC} = \Delta L_C = \alpha . l_{AC} . \Delta T + \frac{R_A . l_{AC}}{E . \pi (\frac{d^2}{4})} = -0,0921mm$

deformação para esquerda

c) $\Delta L = \Delta L_{AC} + \Delta L_{CB} = 0$ $\Delta L_{AC} = -0,0921mm$

$\Delta L_{CB} = -\Delta L_{AC}$

$\Delta L_{CB} = 0,0921mm$

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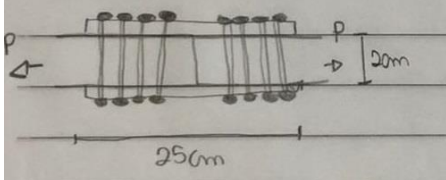
4)



$\phi = 2,2cm$ $P = 700KN$

$\phi = 22mm$

a) $\bar{\sigma} = \frac{P}{A'}$ $A' = m.m.A_0 = 2.8.\left(\pi.\frac{22^2}{4}\right) = 6082,12\,mm^2$

$\bar{\sigma} = \frac{700.10^3}{6082,12} = 115,09\,MPa$

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5) $F = 200KN$ $\bar{\sigma} = 95N/m^2 = 9,5.10^{-5}MPa$

$m = 1$

$m = 8$

$\bar{\sigma} = \frac{F}{A'}$ $A' = m.m.A_0$

$A' = 8A_0$

$8A_0 = \frac{F}{\bar{\sigma}}$

$A_0 = \frac{F}{8\bar{\sigma}}$ $R = \sqrt{\frac{F}{8\pi\bar{\sigma}}} = 9,15mm$ $\phi = 18,30mm$

Diâmetro Comercial 19mm