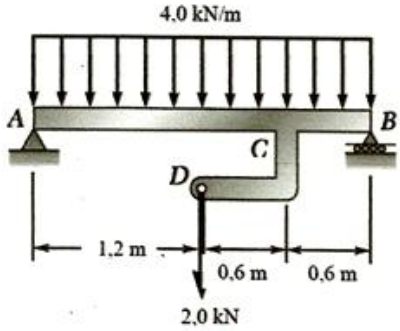
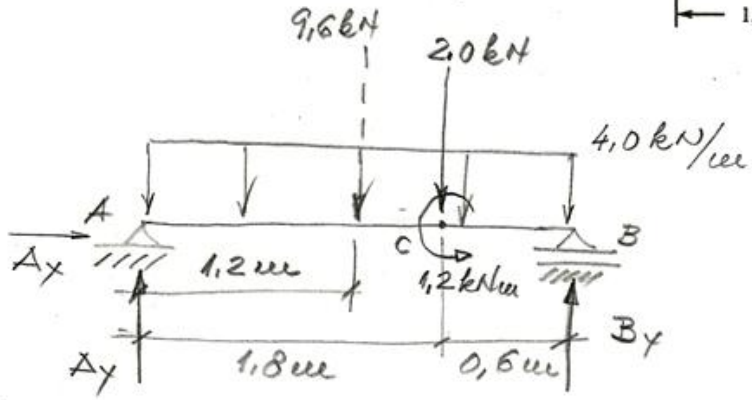
UFF – INSTITUTO DE FÍSICA
Mecânica Geral V – GFI 04.104
Prof. Cary Cassiano
2ª VE – 04/07/2013 – Turma A1

Nome: GABARITO

1. (2,5p) Para a viga e carregamento mostrados, pede-se:
   (a) traçar os diagramas de esforço cortante e momento de flexão;
   (b) determinar a localização e a intensidade do momento de flexão de máximo valor absoluto.





$\xrightarrow{+}$ $\Sigma F_x = 0$

$A_x = 0$

$\circlearrowleft + \; \Sigma M_B = 0$

$A_y \times 2{,}4 - 9{,}6 \times 1{,}2 - 2 \times 0{,}6 - 1{,}2 = 0$

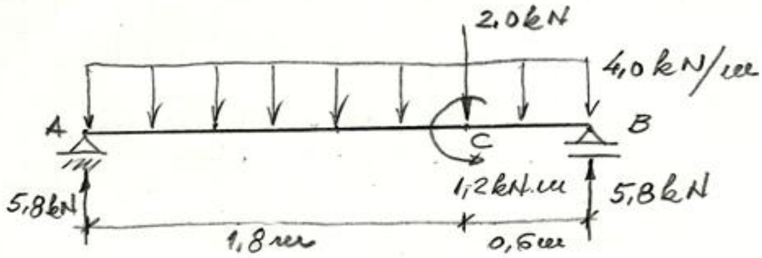
$A_y = 5{,}8\ kN \uparrow$ 0,35

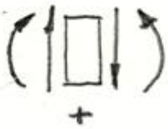
$+\uparrow \; \Sigma F_y = 0$

$A_y - 9{,}6 - 2 + B_y = 0$

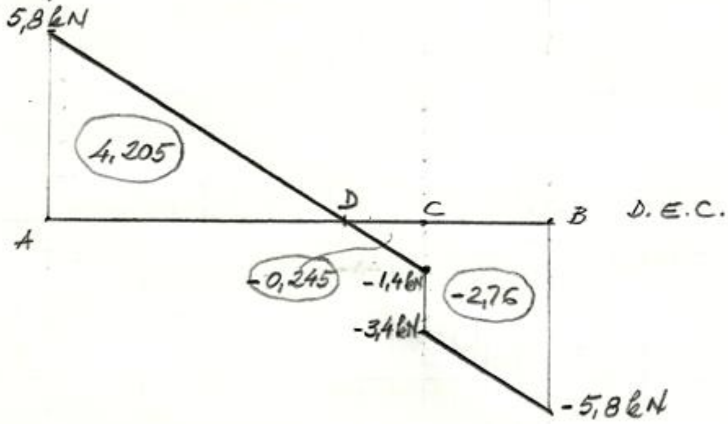
$B_y = 5{,}8\ kN \uparrow$ 0,35

a)





0,7

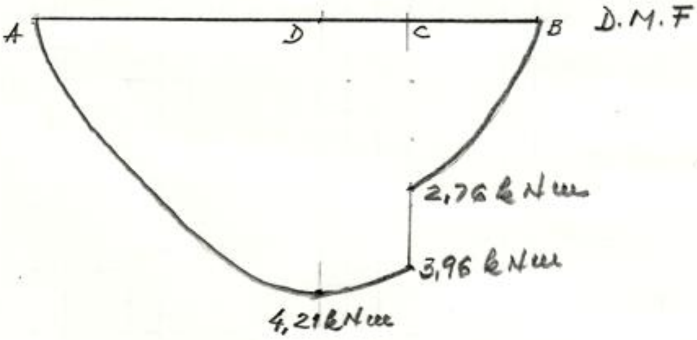


$$\frac{\overline{AD}}{5{,}8} = \frac{\overline{AC}}{1{,}4} = \frac{1{,}8}{7{,}2}$$

$\overline{AD} = 1{,}45\,m$

$\overline{AC} = 0{,}35\,m$

0,7



$M_A = 0$

$M_D - M_A = 4{,}205$

$M_D = 4{,}205\ kNm$

$M_C - M_D = -0{,}245$

$M_C = 3{,}96\ kNm$

$M_C' = M_C - 1{,}2$

$M_C' = 2{,}76\ kNm$

$M_B - M_C' = -2{,}76$

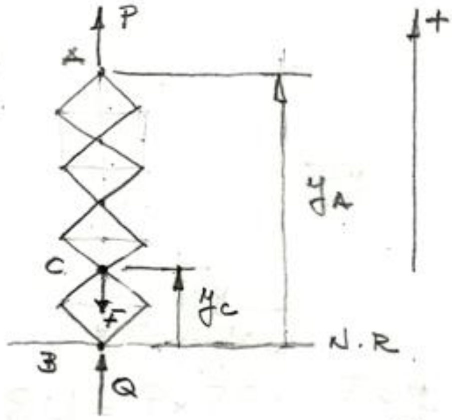
$M_B = 0$

b) $M_{máx} = 4{,}21\ kNm$

0,4 localizado a 1,45 m de A.

2. (2,5p) Sabendo que a máxima força de atrito exercida pela garrafa na rolha é de 267 N, determine:
   (a) a força **P** que deve ser aplicada no saca-rolhas para abrir a garrafa;
   (b) a força máxima exercida pela base do saca-rolhas no topo da garrafa.

a)



$y_A = 4y_C \Rightarrow \delta y_A = 4\delta y_C$

$\delta U = P\delta y_A - F\delta y_C$

$\delta U = (4P - F)\delta y_C$

EQUILÍBRIO $\Rightarrow \delta U = 0$

$\delta y_C \neq 0$

$4P - F = 0 \qquad P = \frac{F}{4} \qquad P = \frac{267}{4}$

$\boxed{P = 66{,}75\,N} \uparrow$ 1,5

b) $+\uparrow \Sigma F_y = 0$

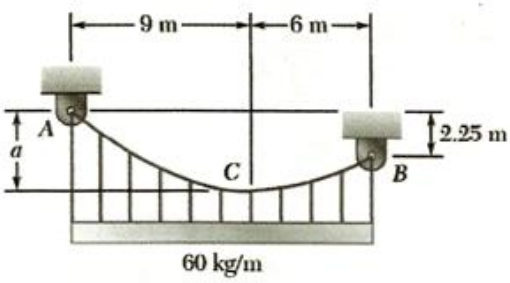
$P + Q - F = 0 \qquad Q = F - P \Rightarrow Q = \frac{3}{4}F$

$Q = 267 - 66{,}75$

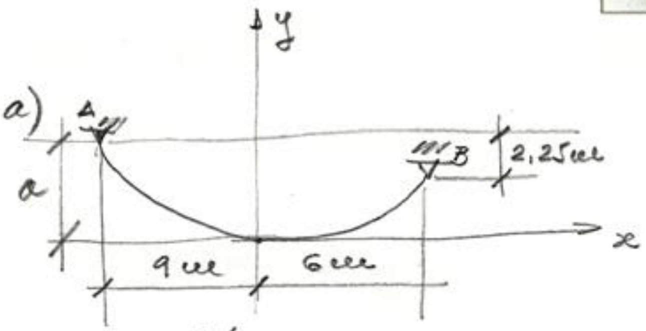
$Q = 200{,}25\,N \uparrow$

A força exercida pelo saca-rolhas na garrafa é $\boxed{Q = 200{,}25\,N \downarrow}$ 1,0

3. (2,5p) O cabo *ACB* suporta uma carga uniformemente distribuída ao longo da direção horizontal. O ponto mais baixo do cabo *C* está localizado 9 m à direita de *A*. Determine:
   (*a*) a distância vertical *a*;
   (*b*) o comprimento do cabo;
   (*c*) as componentes da reação em *A*.



a)



$\omega = 60g \ N/m$

$x_A = 9m \qquad y_A = a$

$x_B = 6m \qquad y_B = (a - 2,25)$

$$y = \frac{\omega}{2T_0} x^2$$

$$\frac{y_B}{x_B^2} = \frac{y_A}{x_A^2} = \frac{\omega}{2T_0}$$

$$\frac{y_B}{y_A} = \left(\frac{x_B}{x_A}\right)^2 \qquad \frac{a - 2,25}{a} = \left(\frac{6}{9}\right)^2$$

$$\frac{a - 2,25}{a} = 0,44 \qquad a - 2,25 = 0,44a$$

$$\boxed{a = 4,05\,m}$$

0,85

b) $s_A = x_A\left[1 + \frac{2}{3}\left(\frac{y_A}{x_A}\right)^2\right]$

$s_A = 9\left[1 + \frac{2}{3}\left(\frac{4,05}{9}\right)^2\right] \qquad s_A = 10,22\,m$

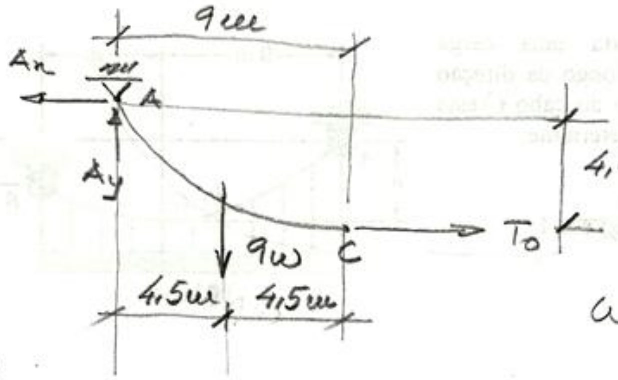
$s_B = x_B\left[1 + \frac{2}{3}\left(\frac{y_B}{x_B}\right)^2\right]$

$s_B = 6\left[1 + \frac{2}{3}\left(\frac{1,8}{6}\right)^2\right] \qquad s_B = 6,36\,m$

$s = s_A + s_B$ 0,85

$$\boxed{s = 16,58\,m}$$

c)



$w = 60g \ N/m$

$+\uparrow \Sigma F_y = 0$

$A_y - 9w = 0$

$A_y = 9w \longrightarrow A_y = 9 \times 60 \times g$

$A_y = 5297.4 N$

$\boxed{A_y = 5,30 \ kN \uparrow}$ 0,4

$\circlearrowleft + \ \Sigma M_C = 0$

$A_x \times 4,05 - A_y \times 9 + 9w \times 4,5 = 0$

$A_x = \dfrac{9 \times (9w) - 9w \times 4,5}{4,05} \qquad A_x = 10w$

$A_x = 10 \times 60 \times g$

$A_x = 5886 \ N$

$\boxed{A_x = 5.89 \ kN \leftarrow}$ 0,4

4. (2,5p) O painel representado constitui a extremidade de uma gamela que se encontra cheia de água até a linha *AA'*. Determine a profundidade do ponto de aplicação da resultante das forças hidrostáticas que atuam no painel (centro de pressão).

$$y_{CP} = \frac{I}{\bar{y}A}$$

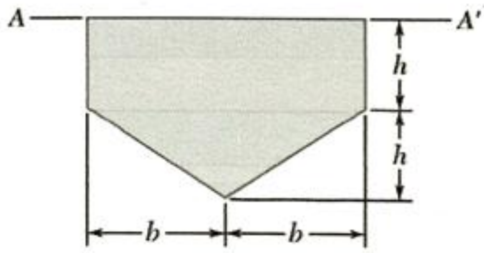
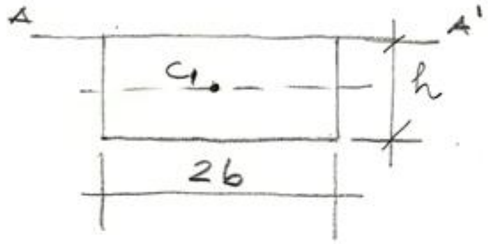


FIGURA ①



$$(I_{AA'})_1 = \frac{2b \cdot h^3}{12} + \left(\frac{h}{2}\right)^2 \times h \cdot 2b$$

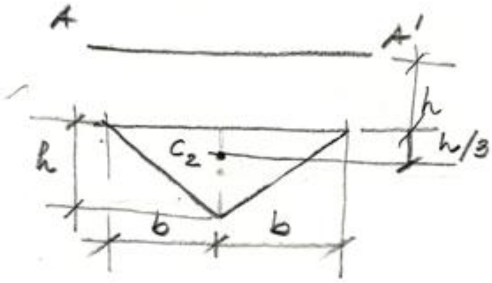
$$(I_{AA'})_1 = \frac{bh^3}{6} + \frac{bh^3}{2} = \frac{4}{6} bh^3$$

$$(I_{AA'})_1 = \frac{2}{3} bh^3 \quad 0{,}5$$

$$\bar{y}_1 = \frac{h}{2}$$

$$A_1 = 2b \cdot h$$

FIGURA ②



$$(I_{AA'})_2 = \frac{2bh^3}{36} + \left(\frac{h}{3} + h\right)^2 \times \frac{2b \times h}{2}$$

$$(I_{AA'})_2 = \frac{bh^3}{18} + \frac{16}{9} h^2 \times \frac{2bh}{2}$$

$$(I_{AA'})_2 = \frac{bh^3}{18} + \frac{32}{18} bh^3 \quad 0{,}5$$

$$(I_{AA'})_2 = \frac{33}{18} bh^3 = \frac{11}{6} bh^3$$

$$\bar{y}_2 = \frac{4}{3} h$$

$$A_2 = bh$$

$$I_{AA'} = (I_{AA'})_1 + (I_{AA'})_2 = \frac{2}{3} bh^3 + \frac{11}{6} bh^3 = \frac{15}{6} bh^3$$

$$I_{AA'} = \frac{5}{2} bh^3 \quad 0{,}5$$

$$\bar{y}A = \bar{y}_1 A_1 + \bar{y}_2 A_2 = \frac{h}{\cancel{2}} \cdot \cancel{2}bh + \frac{4}{3} h\, bh = \frac{7}{3} bh^2 \quad 0{,}5$$

$$y_{CP} = \frac{I_{AA'}}{\bar{y}A} \qquad y_{CP} = \frac{\frac{5}{2} \cancel{b} h^{\cancel{3}}}{\frac{7}{3} \cancel{b} h^{\cancel{2}}} = \frac{15}{14} h$$

$$\boxed{y_{CP} = 1{,}07\, h} \quad 0{,}5$$