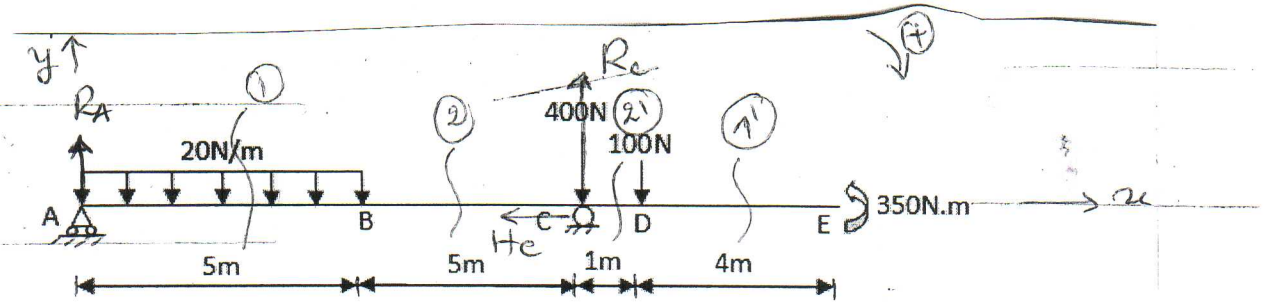
~~L2~~

Corrigé de l'examen de RDM du 16/06/2022

Exo 1 (10 pts)



1- Réactions d'appuis

$\Sigma F_{/x} = 0 \rightarrow$ $\boxed{H_c = 0\,N}$ (0,5 pt)

$\Sigma F_{/y} = 0 \rightarrow R_A + R_c - 20\times 5 - 400 - 100 = 0$

$R_A + R_c = 600$

$\Sigma M_{/A} = 0 \rightarrow 20\times 5\times 2{,}5 + 400\times 10 - R_c\times 10 + 100\times 11 - 350 =$

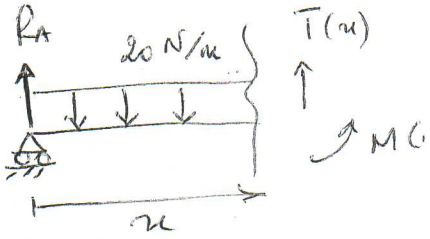
$\boxed{R_c = 500\,N}$ (0,75 pt)

$\boxed{R_A = 100\,N}$ (0,75 pt)

2- Expressions de T(x) et M(x)

~~T(x) et M(x)~~

Coupe ① entre A et B : $0 \le x \le 5m$



T(x) : $T(x) + R_A - 20x = 0$

$\boxed{T(x) = 20x - 100}$ (0,5 pt)

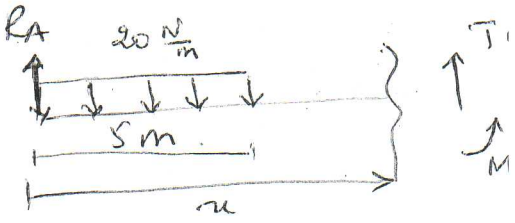
M(x) : $M(x) - R_A \cdot x + 20\,\frac{x^2}{2} = 0$

$M(x) = -10x^2 + R_A x \Rightarrow$ $\boxed{M(x) = -10x^2 + 100x}$ (1 pt)

pour $x = 0 \rightarrow M(A) = 0$

$x = 5m \rightarrow M(B) = 250\,N.m$

Coupe ② entre B et C : $5 \leq x \leq 10m$



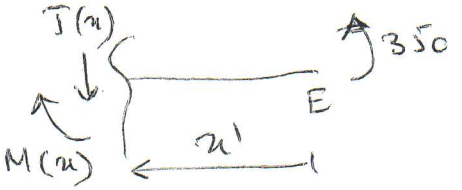
$T(x)$: $T(x) + R_A - 20 \times 5 = 0$

$\boxed{T(x) = 0\,N}$ (0,5pt)

$M(x)$: $M(x) - R_A x + 20 \times 5\,(x - 2,5) = 0$

$\boxed{M(x) = 250\ N.m}$ (1pt)

* Coupe ① entre E et D : $0 \leq x' \leq 4m$

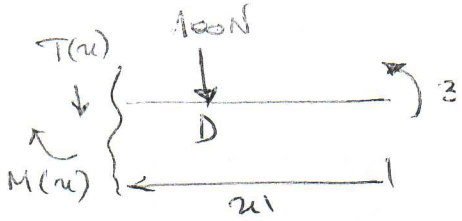


$T(x)$: $\boxed{T(x) = 0\ N}$ (0,5pt)

$M(x)$: $M(x) - 350 = 0$

$\boxed{M(x) = 350\ N.m}$ (1pt)

* Coupe ② entre D et C $4 \leq x' \leq 5m$



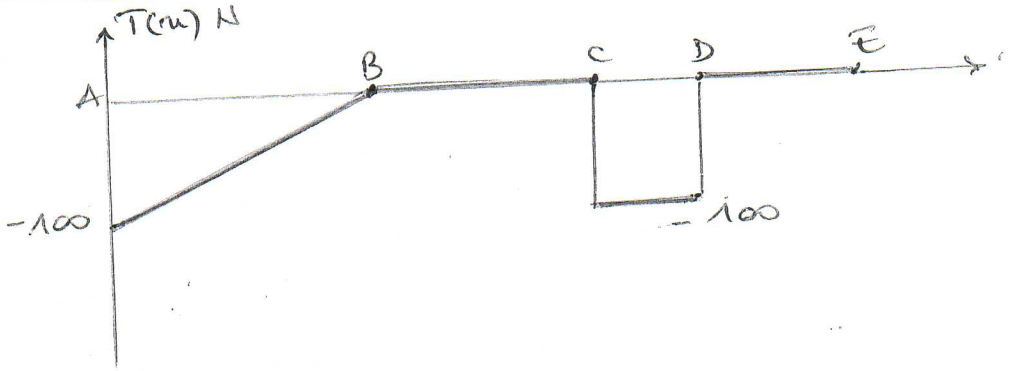
$T(x)$: $T(x) + 100 = 0$

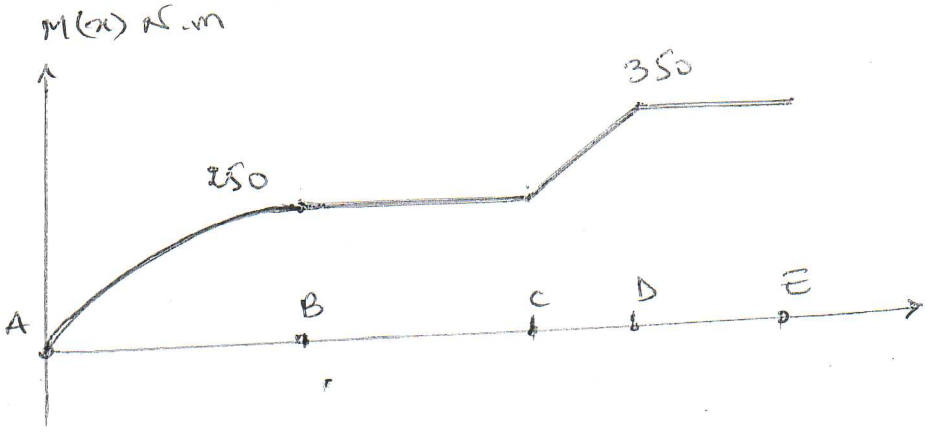
$\boxed{T(x) = -100\,N}$ (0,5pt)

$M(x)$: $M(x) - 350 + 100\,(x - 4) = 0$

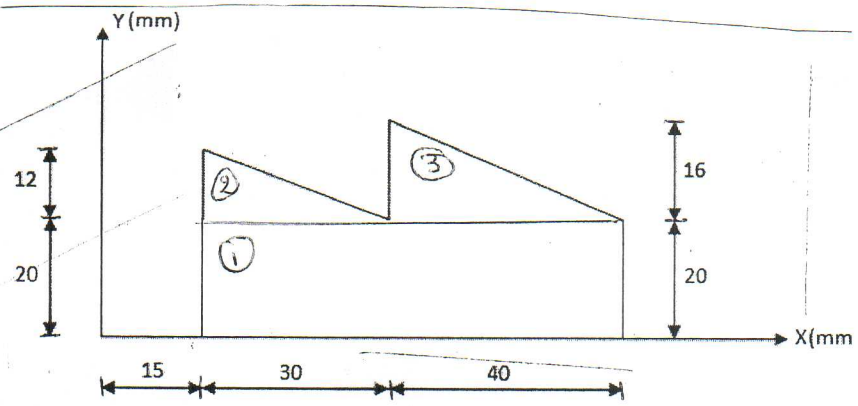
$\boxed{M(x) = -100x + 750}$ (1pt)

Diagrammes :





Exo2 : (10 pts)



Section	Surface	x_i (mm)	y_i (mm)
①	$20 \times 70 = 1400$	50	10
②	$\frac{12 \times 30}{2} = 180$	25	24
③	$\frac{16 \times 40}{2} = 320$	58,33	25,33
Total	1900		

1- Coordonnées du CDG :

$$X_G = \frac{\sum x_i S_i}{\sum S_i} \text{ (0,5pt)}, \quad Y_G = \frac{\sum y_i S_i}{\sum S_i} \text{ (0,5pt)}$$

$$X_G = \frac{50 \times 1400 + 25 \times 180 + 58,33 \times 320}{1900} = \frac{93165,6}{1900}$$

$$\boxed{X_G = 49,03 \text{ mm}} \text{ (1pt)}$$

$$Y_G = \frac{10 \times 1400 + 24 \times 180 + 25,33 \times 320}{1900} = \frac{26425,6}{1900}$$

$$\boxed{Y_G = 13,91 \text{ mm}} \text{ (1pt)}$$

2- Calcul des moments d'inertie I_x et I_y :

I_x : $I_x = I_x^{①} + I_x^{②} + I_x^{③}$ (0,5pt) Théorème de Huy (0,5)

$$I_x^{①} = \frac{70 (20)^3}{3} = 186666,66 \text{ mm}^4$$

ou $I_x^{①} = \frac{70 (20)^3}{12} + 1400 (10)^2 = 46666,66 + 140000$ (0,5)

$= 186666,66 \text{ mm}^4$ (0,5).

$$I_x^{(2)} = \frac{30(12)^3}{36} + 180(24)^2 = 1440 + 103680$$

(0,5)

$$\boxed{I_x^{(2)} = 105120\ mm^4}$$

(0,5)

(0,5)

$$I_x^{(3)} = \frac{40(16)^3}{36} + 320(25,33)^2 = 4551,11 + 205314,85$$

$$\boxed{I_x^{(3)} = 209865,96\ mm^4}$$

(0,5)

$$I_x = 501652,62\ mm^4$$

I_y:

$$I_y = I_y^{(1)} + I_y^{(2)} + I_y^{(3)}$$

(0,5)

$$I_y^{(1)} = \frac{20(70)^3}{12} + 1400(50)^2 = 571666,66 + 3500000$$

$$\boxed{I_y^{(1)} = 4071666,66\ mm^4}$$ (0,5)

(0,5)

$$I_y^{(2)} = \frac{12(30)^3}{36} + 180(25)^2 = 9000 + 112500$$

$$\boxed{I_y^{(2)} = 121500\ mm^4}$$ (0,5)

(0,5)

$$I_y^{(3)} = \frac{16(40)^3}{36} + 320(58,33)^2 = 28444,44 + 1088761$$

$$\boxed{I_y^{(3)} = 1117208,88\ mm^4}$$

(0,5)

$$\boxed{I_y = 5310375,54\ mm^4}$$