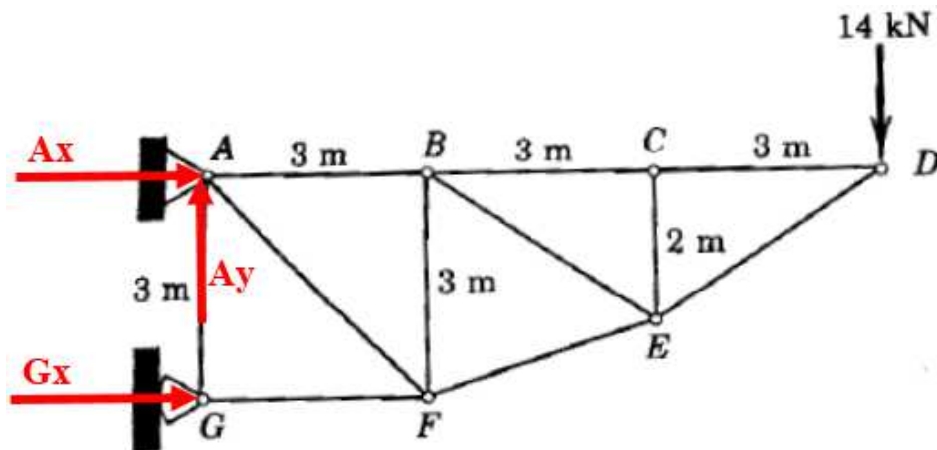


Contrôle 24/05/2014

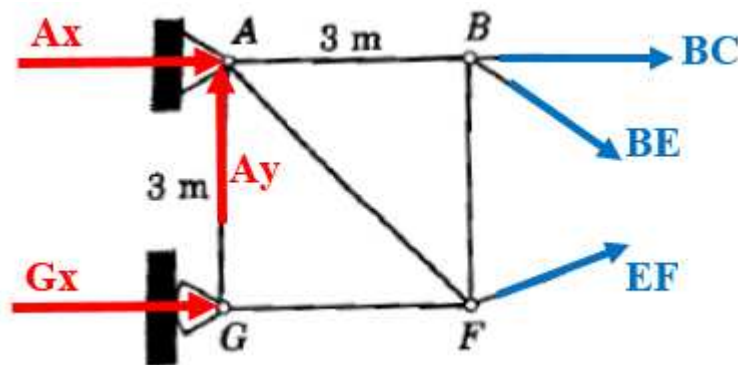
Exercice 1 :

Partie i :

$$\sum F_y = 0 \Rightarrow A_y - 14 = 0 \Rightarrow A_y = 14 \text{ kN}$$

$$\sum M_A = 0 \Rightarrow (G_x \times 3) - (14 \times 9) = 0 \Rightarrow G_x = 42 \text{ kN}$$

$$\sum F_x = 0 \Rightarrow A_x + G_x = 0 \Rightarrow A_x = -42 \text{ kN} (\leftarrow)$$



$$\sum F_y = 0 \Rightarrow A_y + EF \times \sin(18,43) - BE \times \sin(33,7) = 0$$

$$\Rightarrow BE = 14 + EF \times \sin(18,43) \quad (A)$$

$$B : \sum M_A = 0$$

$$\Rightarrow G_x \times 3 + EF \times 3 \times \cos(18,43) + EF \times 3 \times \sin(18,43)$$

$$- BE \times 3 \times \sin(33,7) = 0$$

Remplaçons A dans B :

$$\Rightarrow G_x \times 3 + EF \times 3 \times \cos(18,43) + EF \times 3 \times \sin(18,43) - 14 \times 3 \times \sin(33,7) - EF \times \sin(18,43) \times 3 \times \sin(33,7) = 0$$

$$\Rightarrow EF = -31,42 \text{ kN } (\leftarrow)$$

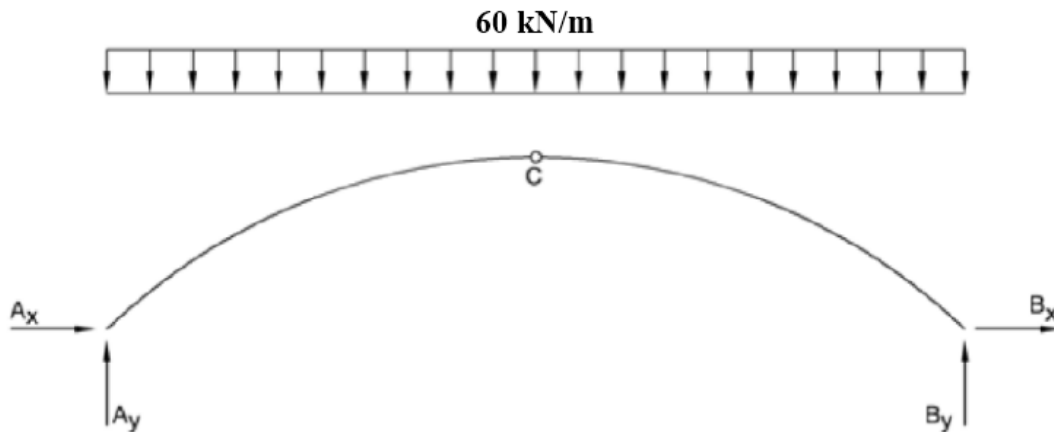
$$\text{donc : } BE = 14 - 31,42 \times \sin(18,43) = 4,06 \text{ kN}$$

$$\sum F_x = 0 \Rightarrow A_x + G_x + BC + BE \times \cos(33,7) + EF \times \cos(18,43) = 0$$

$$\Rightarrow BC = 42 - 42 - 4,06 \times \cos(33,7) + 31,42 \times \cos(18,43) = 26,43 \text{ kN}$$

Partie ii :

DCL global



La résultante de la charge répartie :

$$R = \left(60 \frac{\text{kN}}{\text{m}}\right) \times (100 \text{ m}) = 6000 \text{ kN}$$

Point d'application : 50 m de point A (Point C).

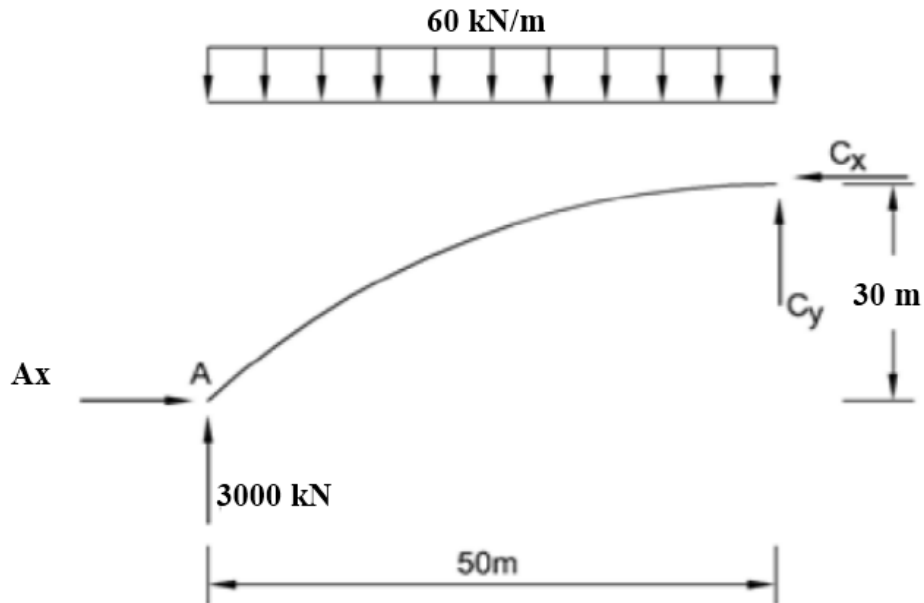
Cherchons les réactions :

$$\sum M_B = 0 \Leftrightarrow (R \times 50) - (A_y \times 100) = 0 \Rightarrow A_y = 3000 \text{ kN}$$

$$\sum F_y = 0 \Leftrightarrow A_y + B_y - R = 0 \Rightarrow B_y = 3000 \text{ kN}$$

$$(A) : \sum F_x = 0 \Leftrightarrow A_x + B_x = 0$$

DCL du segment AC :



La résultante de la charge répartie :

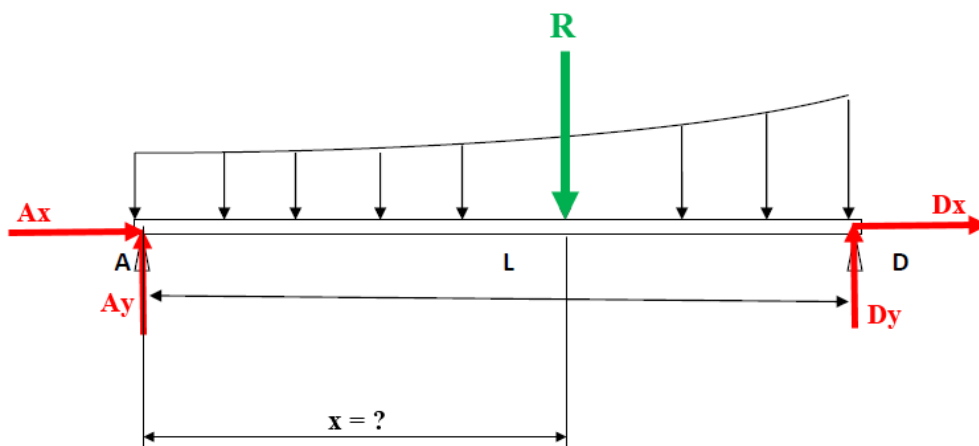
$$R2 = 60 \frac{kN}{m} \times 50 m = 3000 kN$$

Point d'application : 25 m de point A.

$$\sum M_C = 0 \Leftrightarrow (R2 \times 25) - (A_y \times 50) + (A_x \times 30) = 0 \Rightarrow A_x = 2500 kN$$

$$(A) \Rightarrow B_x = -A_x = -2500 kN$$

Exercice 3 :



Calculons les constantes W_0 et K :

$$\text{on a : } W(x) = W_0 + Kx^2$$

$$W(0) = 1 \Rightarrow 1 = W_0$$

$$\text{et } W(L) = 2 \Rightarrow 2 = 1 + KL^2 \Rightarrow K = \frac{1}{L^2}$$

$$\text{Or : } L = 8 \text{ donc } K = \frac{1}{64}$$

La fonction de la charge répartie devient :

$$W(x) = 1 + \frac{1}{64}x^2$$

Calcul de la résultante :

$$R = \int_0^L W(x) dx = \int_0^8 \left(1 + \frac{1}{64}x^2\right) dx$$

$$R = \text{int}\left(1 + \left(\frac{1}{64}\right) \cdot x^2, x=0..8\right);$$

$$R = \frac{32}{3}$$

Cette charge est située au centroïde de l'air envisagé. L'abscisse x de ce centroïde est obtenue en appliquant le principe des moments $x \cdot R = \int_0^L x \cdot W(x) \cdot dx$:

$$\Rightarrow x = \frac{\int_0^L x \cdot W(x) \cdot dx}{R} = \frac{\int_0^8 x \cdot \left(1 + \frac{1}{64}x^2\right) \cdot dx}{R}$$

$$X := \frac{\text{int}\left(\left(1 + \left(\frac{1}{64}\right) \cdot x^2\right) \cdot x, x=0..8\right)}{Ra};$$

$$X := \frac{9}{2}$$

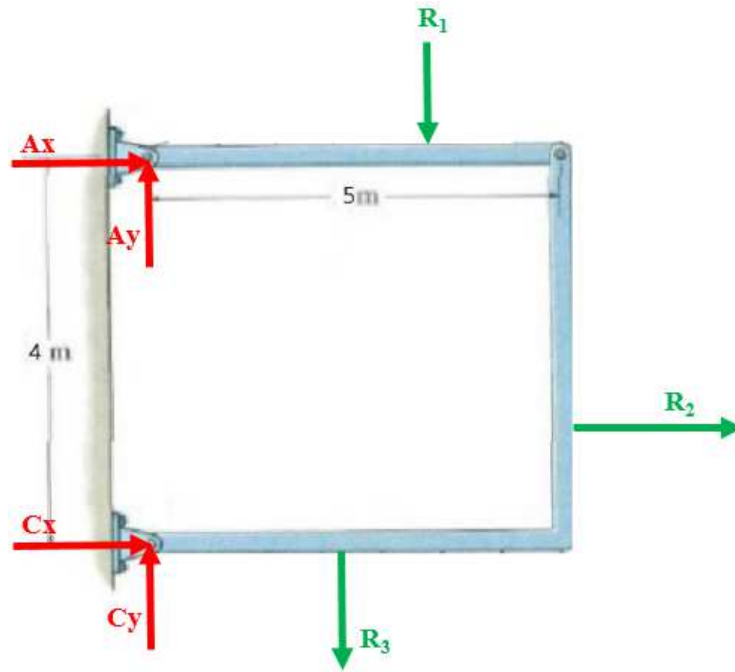
Les réactions :

$$\sum M_A = 0 \Leftrightarrow (D_y \times 8) - (R \times 4,5) = 0 \Rightarrow D_y = 6 \text{ kN}$$

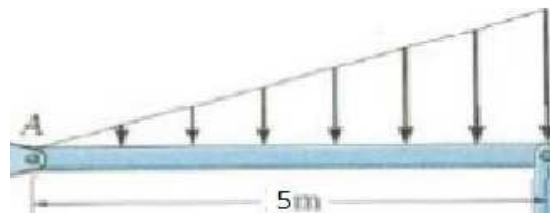
$$\sum F_y = 0 \Leftrightarrow D_y + A_y - R = 0 \Rightarrow A_y = 4,66 \text{ kN}$$

$$A_x = D_x = 0$$

Exercice 4 :

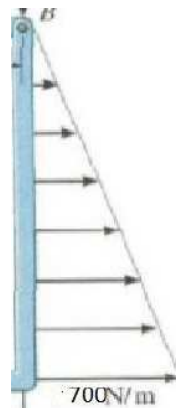


Calcul de résultantes :



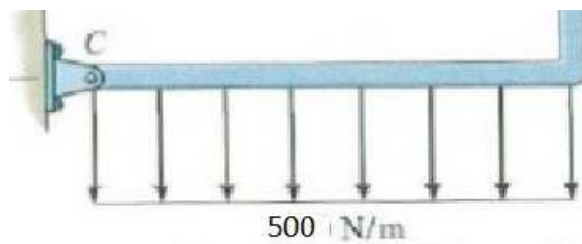
$$R_1 = 700 \times 5 \times \frac{1}{2} = 1750 \text{ N}$$

Point d'application : $x_1 = 2 \times \frac{5}{3} = \frac{10}{3} \text{ m de point A}$



$$R_2 = 700 \times 4 \times \frac{1}{2} = 1400 \text{ N}$$

Point d'application : $x_2 = 2 \times \frac{4}{3} = \frac{8}{3} \text{ m de point B}$



$$R_3 = 500 \times 5 = 2500 \text{ N}$$

Point d'application : $x_3 = \frac{5}{2} = 2,5 \text{ m de point C}$

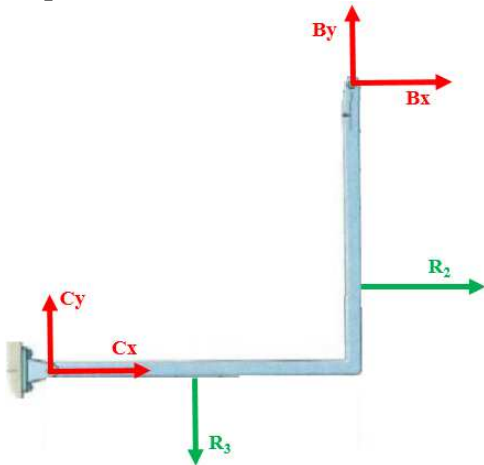
Les réactions :

$$\sum M_C = 0 \Leftrightarrow -(A_x \times 4) - (R_1 \times 3,33) - (R_2 \times 1,33) - (R_3 \times 2,5) = 0$$

$$\Rightarrow A_x = -3484,87 \text{ N}$$

$$\sum F_x = 0 \Leftrightarrow A_x + C_x + R_2 = 0 \Rightarrow C_x = 2084,87 \text{ N}$$

La partie BC :



$$\sum M_B = 0 \Leftrightarrow (C_x \times 4) - (C_y \times 5)$$

$$+ (R_3 \times 2,5)$$

$$+ (R_2 \times 2,66) = 0$$

$$\Rightarrow C_y = 3662,67 \text{ N}$$

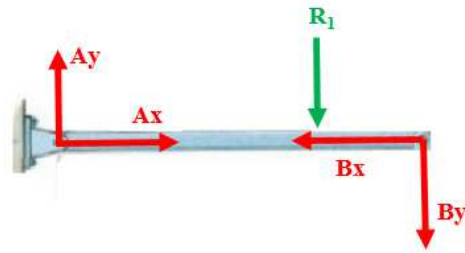
$$\sum F_x = 0 \Leftrightarrow B_x + C_x + R_2 = 0$$

$$\Rightarrow B_x = 3484,87 \text{ N}$$

$$\sum F_y = 0 \Leftrightarrow B_y + C_y - R_3 = 0$$

$$\Rightarrow B_y = -1162,67 \text{ N}$$

La barre AB :



$$\sum F_y = 0 \Leftrightarrow A_y - B_y - R_1 = 0 \Rightarrow A_y = 587,33 \text{ N}$$