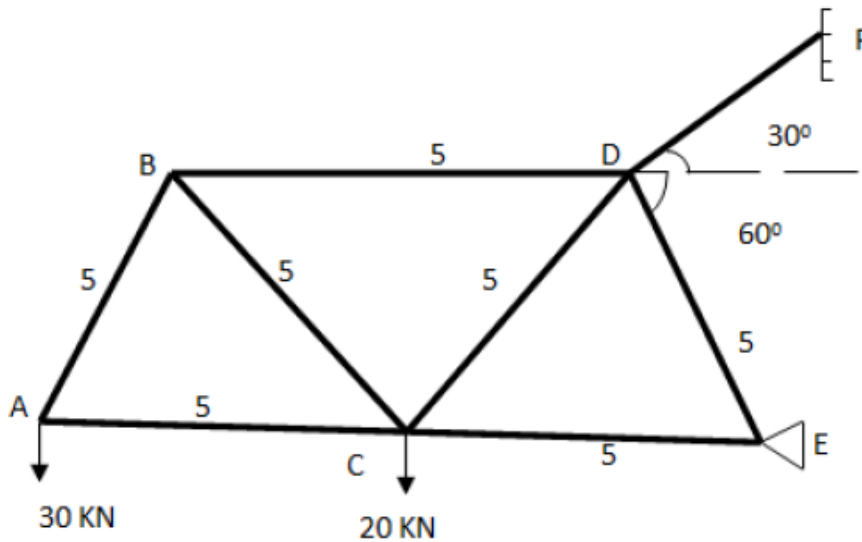


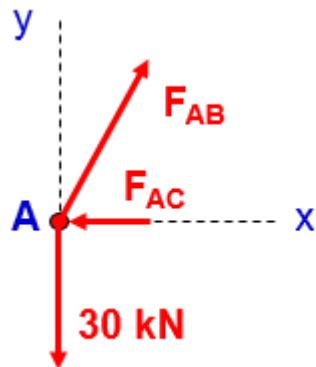
Contrôle 24/04/2018

Exercice 1

a/



Nœud A :



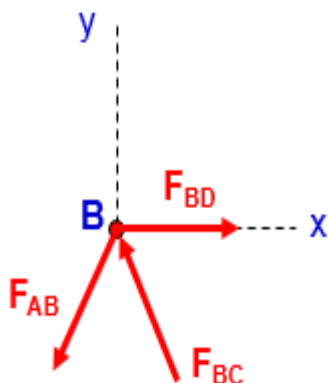
$$\sum F_y = 0 \Leftrightarrow F_{AB} \cos 45 - 30 = 0$$

$$\Rightarrow F_{AB} = 42,42 \text{ kN}$$

$$\sum F_x = 0 \Leftrightarrow F_{AB} \cos 45 - F_{AC} = 0$$

$$\Rightarrow F_{AC} = 30 \text{ kN}$$

Nœud B :



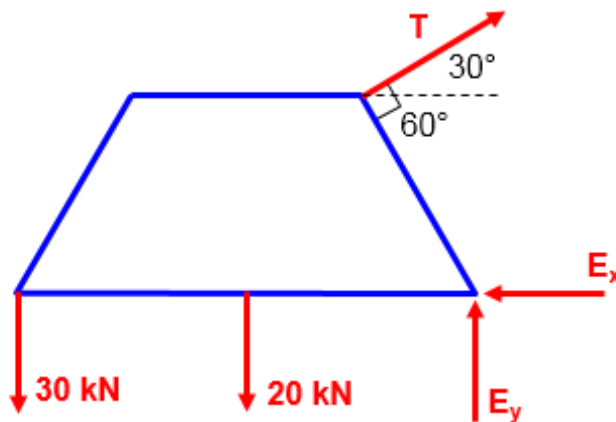
$$\sum F_y = 0 \Leftrightarrow -F_{AB} \cos 45 + F_{BC} \cos 45 = 0$$

$$\Rightarrow F_{BC} = 42,42 \text{ kN}$$

$$\sum F_x = 0 \Leftrightarrow -F_{AB} \cos 45 + F_{BD} - F_{BC} \cos 45 = 0$$

$$\Rightarrow F_{BD} = 60 \text{ kN}$$

Calcul des réactions :



$$\sum M_E = 0 \Leftrightarrow (-T \times 5) + (20 \times 5) + (30 \times 10) = 0$$

$$\Rightarrow T = 80 \text{ kN}$$

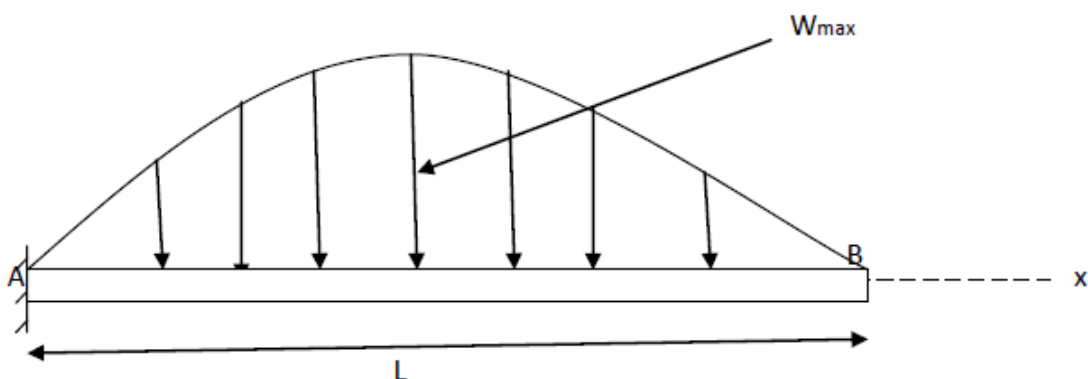
$$\sum F_x = 0 \Leftrightarrow -E_x + T \times \cos 30 = 0$$

$$\Rightarrow E_x = 69,28 \text{ kN}$$

$$\sum F_y = 0 \Leftrightarrow E_y + T \times \sin(30) - 20 - 30 = 0$$

$$\Rightarrow E_y = 10 \text{ kN}$$

b/



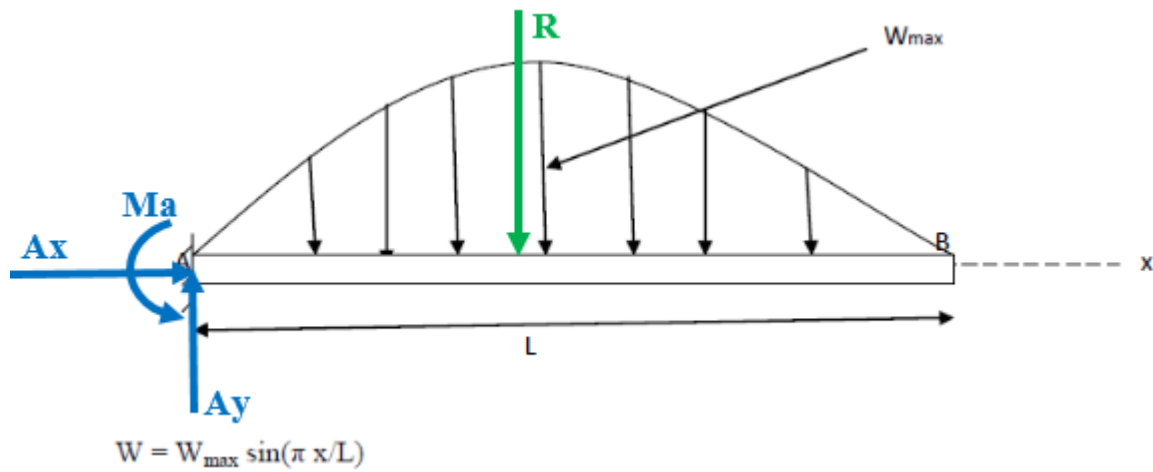
$$W = W_{\max} \sin(\pi x/L)$$

Calcul de la résultante :

$$R = \int_0^L W dx = \int_0^L W_{\max} \sin(\pi \frac{x}{L}) dx$$

$$R = \int_0^L W \max x \cdot \sin\left(\frac{\pi x}{L}\right) dx;$$

$$R = \frac{2 W \max L}{\pi}$$



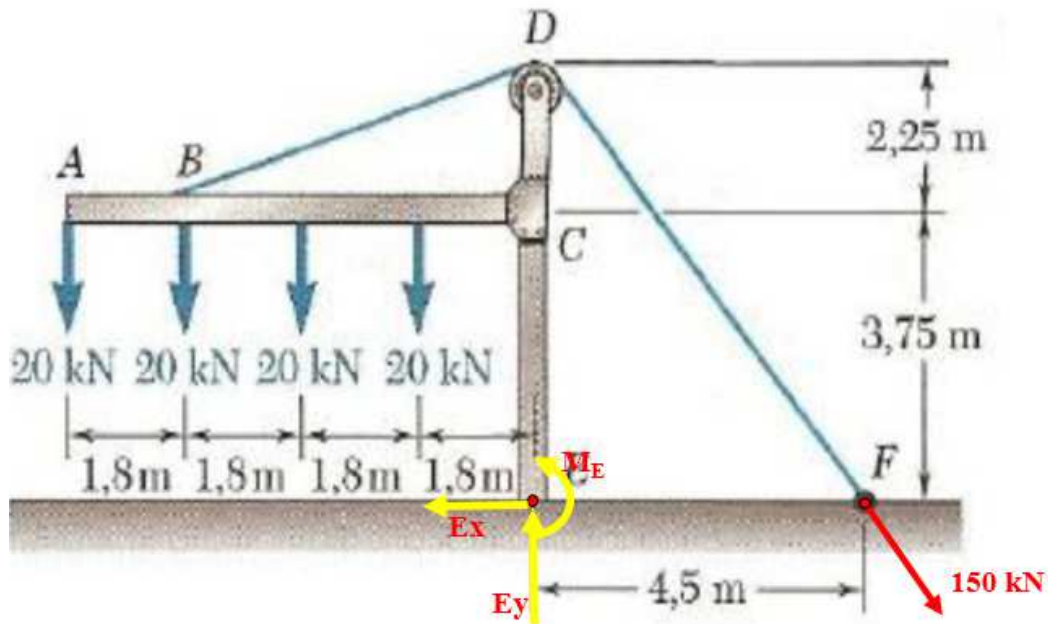
$$\sum F_y = 0 \Leftrightarrow A_y - R = 0$$

$$\Rightarrow A_y = \frac{2LW_{\max}}{\pi}$$

$$Ma = R \times x = \frac{2LW_{\max}}{\pi} \times \frac{L}{2} = \frac{L^2 W_{\max}}{\pi}$$

Exercice 2 :

a/



Cherchons tout d'abord la distance DF :

$$DF = \sqrt{4,5^2 + 6^2} = 7,5 \text{ m}$$

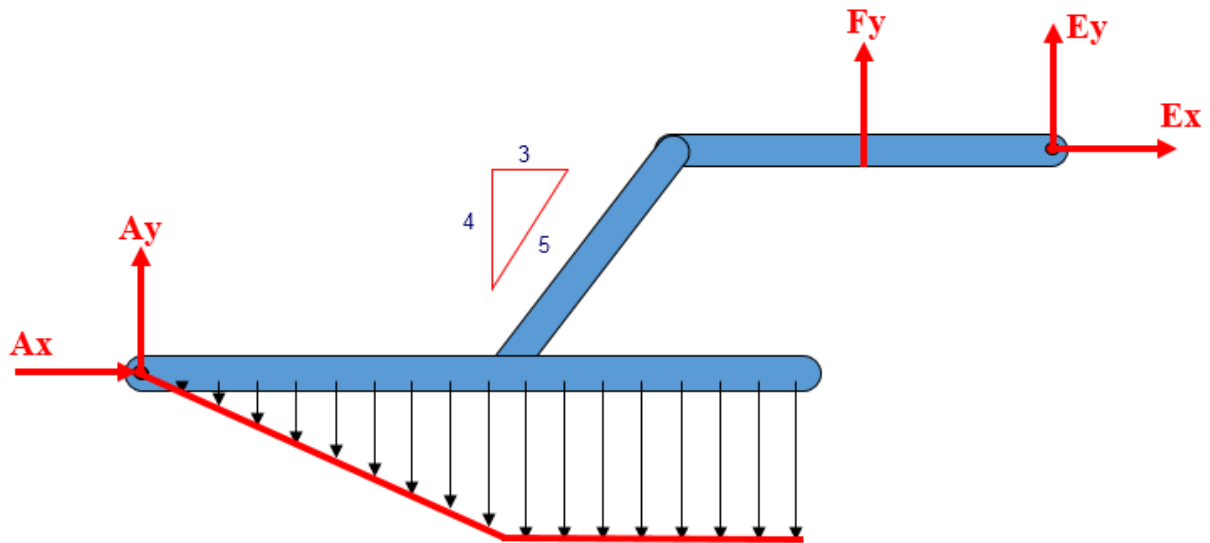
Les réactions :

$$\sum F_x = 0 \Leftrightarrow \left(150 \times \frac{4,5}{7,5}\right) - E_x = 0 \Rightarrow E_x = 90 \text{ kN}$$

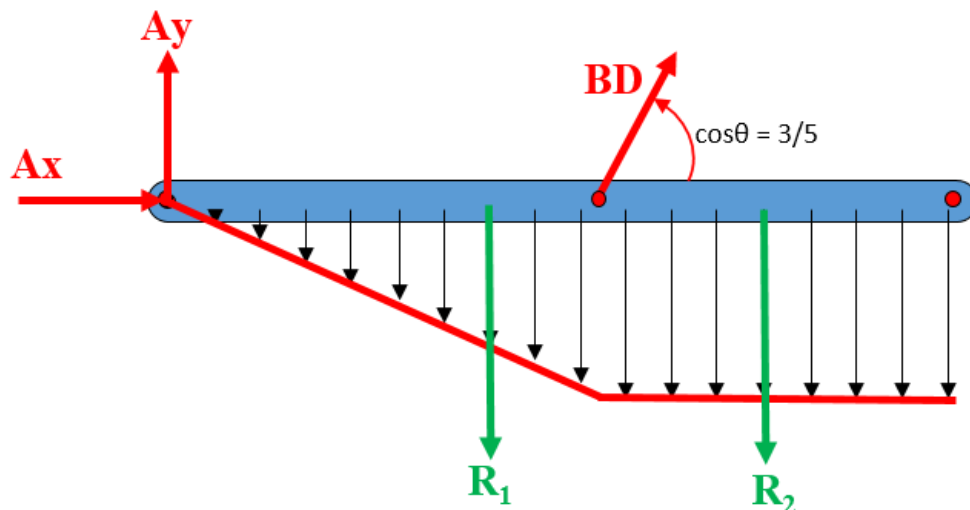
$$\sum F_y = 0 \Leftrightarrow E_y - \left(150 \times \frac{6}{7,5}\right) - (4 \times 20) = 0 \Rightarrow E_y = 200 \text{ kN}$$

$$\begin{aligned} \sum M_E = 0 &\Leftrightarrow M_E - \left(150 \times \frac{6}{7,5} \times 4,5\right) + (20 \times 1,8) + (20 \times 3,6) + (20 \times 5,4) + (20 \times 7,2) = 0 \\ &\Rightarrow M_E = 180 \text{ kN.m} \end{aligned}$$

B/



DCL local de la barre ABC :

Calcul de résultantes R_1 et R_2 :

$$R_1 = \left(300 \frac{N}{m}\right) \times (0,6 m) = 90 N$$

Point d'application :

$$x_1 = \frac{0,6}{3} \times 2 = 0,4 m \text{ de point } A$$

$$R_2 = \left(300 \frac{N}{m}\right) \times (0,4 m) = 120 N$$

Point d'application :

$$x_2 = 0,6 + \frac{0,4}{2} = 0,8 m \text{ de point } A$$

Calcul de l'angle θ :

$$\cos\theta = \frac{3}{5} \Rightarrow \theta = 53,13$$

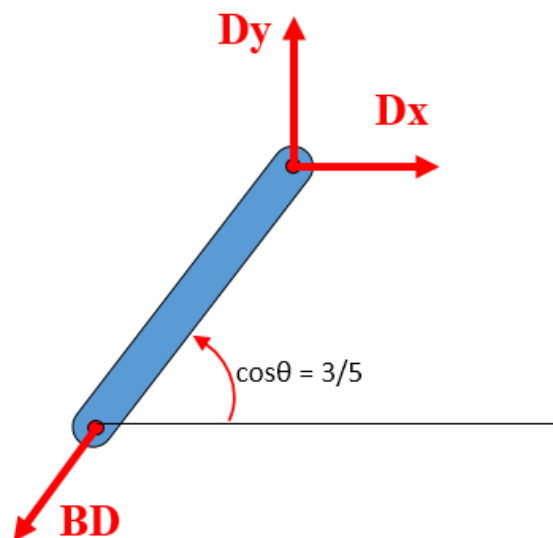
Les réactions :

$$\sum M_A = 0 \Leftrightarrow (BD \times \sin\theta \times 0,6) - (R_1 \times 0,4) - (R_2 \times 0,8) = 0 \Rightarrow BD = 275 \text{ N}$$

$$\sum F_x = 0 \Leftrightarrow A_x + BD \times \cos\theta = 0 \Rightarrow A_x = 165 \text{ N}$$

$$\sum F_y = 0 \Leftrightarrow A_y + BD \times \sin\theta - R_1 - R_2 = 0 \Rightarrow A_y = -10 \text{ N}$$

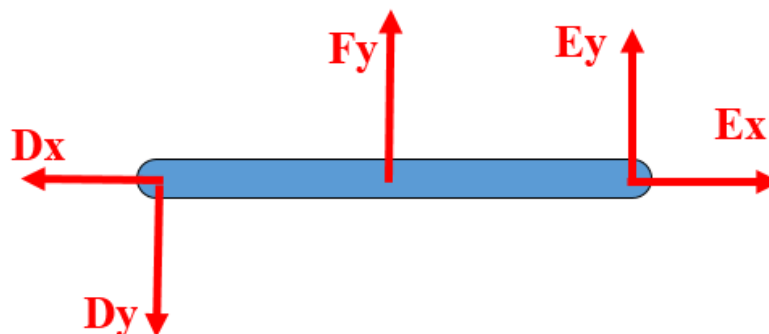
DCL local de la barre BD :



$$\sum F_x = 0 \Leftrightarrow D_x - BD \times \cos\theta = 0 \Rightarrow D_x = 165 \text{ N}$$

$$\sum F_y = 0 \Leftrightarrow D_y - BD \times \sin\theta = 0 \Rightarrow D_y = 220 \text{ N}$$

DCL local de la barre DFE :



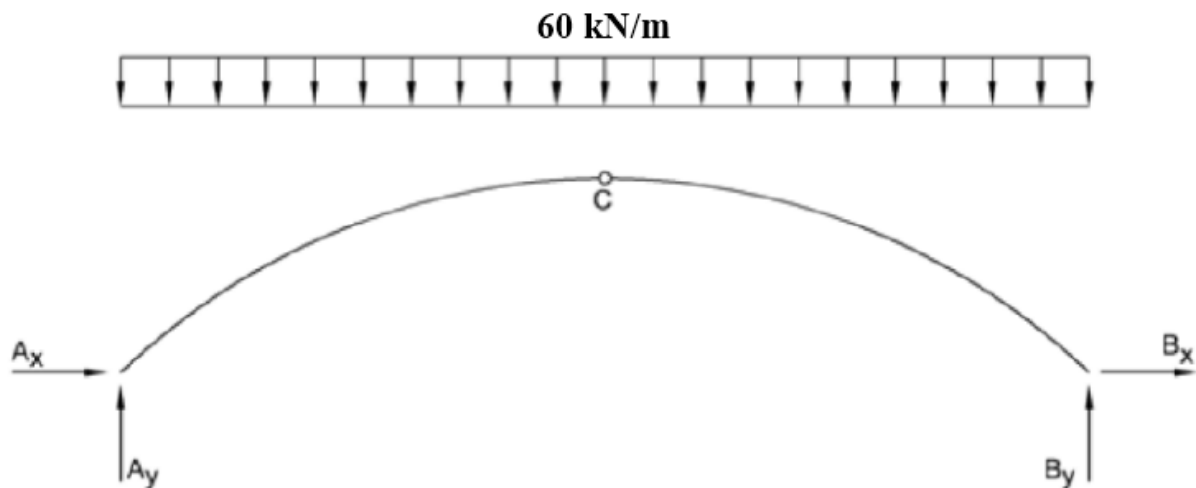
$$\sum M_E = 0 \Leftrightarrow (D_y \times 0,6) - (F_y \times 0,3) = 0 \Rightarrow F_y = 440 \text{ N}$$

$$\sum F_y = 0 \Leftrightarrow F_y - D_y + E_y = 0 \Rightarrow E_y = -220 \text{ N}$$

$$\sum F_x = 0 \Leftrightarrow E_x - D_x = 0 \Rightarrow E_x = 165 \text{ N}$$

Exercice 3 :

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).

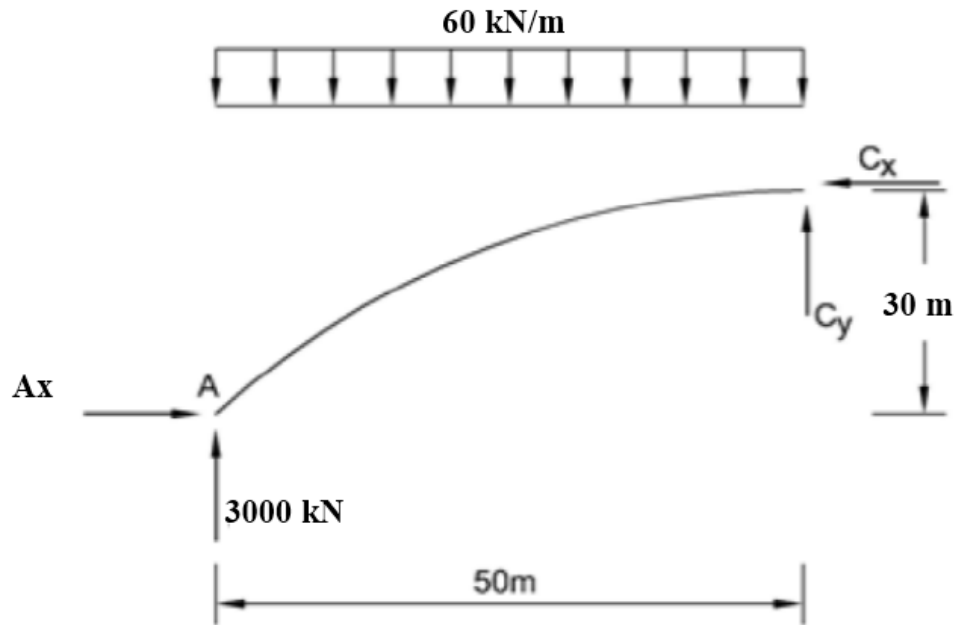
Cherchons les réactions :

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

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

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

DCL du segment AC :



La résultante de la charge répartie :

$$R_2 = 60 \frac{\text{kN}}{\text{m}} \times 50 \text{ m} = 3000 \text{ kN}$$

Point d'application : 25 m de point A.

$$\sum M_C = 0 \Leftrightarrow (R_2 \times 25) - (A_y \times 50) + (A_x \times 30) = 0 \Rightarrow A_x = 2500 \text{ kN}$$

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