

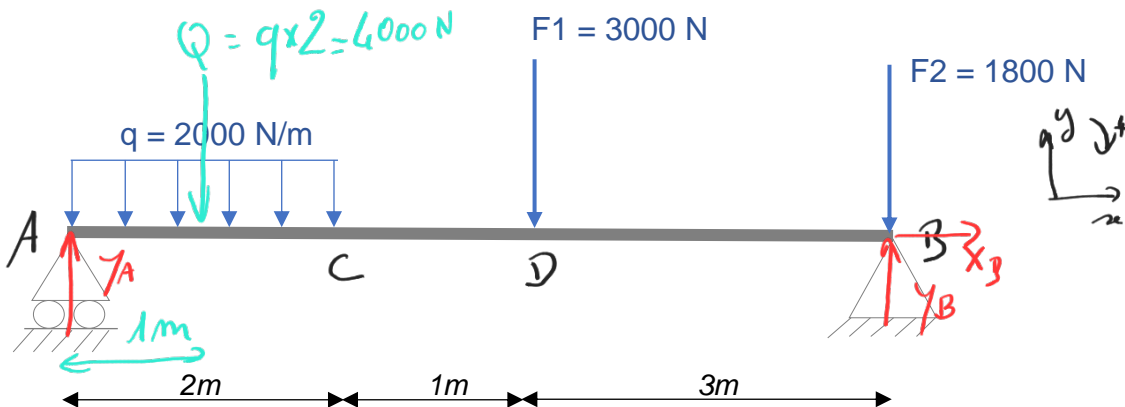
**BTS Bât 1 – Devoir en autonomie U41**

**Diagramme des efforts internes**

**Groupe 1**

/ 20

Tracer les diagrammes des efforts internes de la structure suivante.



Réactions aux appuis :

$$\sum F_y = 0 \quad Y_A - Q - F_1 - F_2 + Y_B = 0$$

$$Y_A + Y_B = 4000 + 3000 + 1800 = 8800 \text{ N}$$

$$\sum M_A = 0 \quad Q \times 1 + F_1 \times 3 + F_2 \times 6 - Y_B \times 6 = 0$$

$$Y_B = \frac{4000 + 9000 + 10800}{6} \approx \underline{3967 \text{ N}}$$

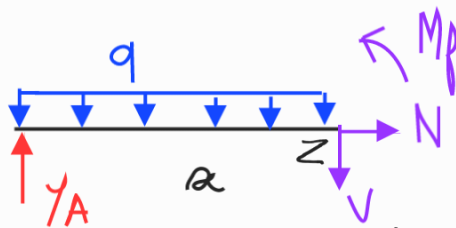
$$Y_A = 8800 - Y_B \approx \underline{4833 \text{ N}}$$

$$\sum F_x = 0 \quad X_B = 0 \text{ N}$$

# Méthode des coupures:

Singularités en A, C, D et B = 3 coupures.

1) entre A et C

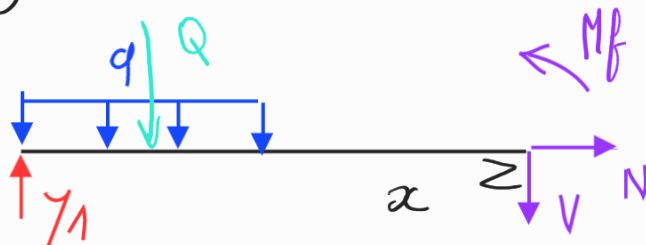


$$\sum F_x = 0 \quad N = 0 \text{ (sur toute la poutre)}$$

$$\sum F_y = 0 \quad Y_A - q\alpha - V = 0$$
$$V(\alpha) = 4833 - 2000\alpha$$

$$\sum M_{1/2} = 0 \quad Y_A \alpha - q\alpha \times \frac{\alpha}{2} - M_f = 0$$
$$M_f(\alpha) = 4833\alpha - 1000\alpha^2 \text{ N.m}$$

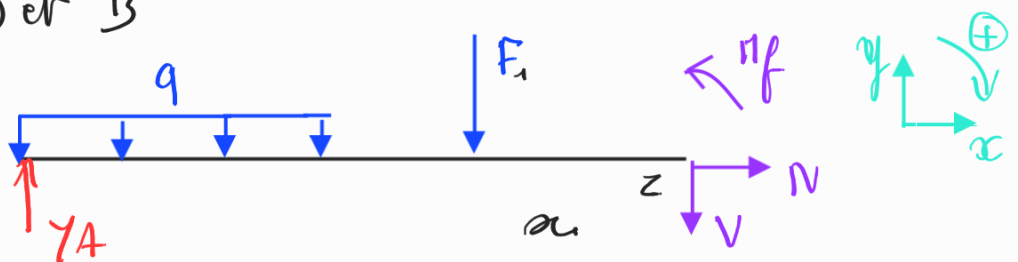
2) entre C et D



$$\sum F_y = 0 \quad Y_A - q \times 2 - V = 0$$
$$V(\alpha) = 4833 - 4000 = 833 \text{ N}$$

$$\sum M_{1/2} = 0 \quad Y_A \alpha - Q(\alpha - 1) - M_f = 0$$
$$M_f(\alpha) = 4833\alpha - 4000\alpha + 4000 \text{ N.m}$$
$$= 833\alpha + 4000 \text{ N.m}$$

3) entre D et B



$$\sum F_y = 0 \quad Y_A - q \times 2 - F_1 - V = 0$$
$$V(\alpha) = 4833 - 4000 - 3000$$
$$= -2167 \text{ N}$$

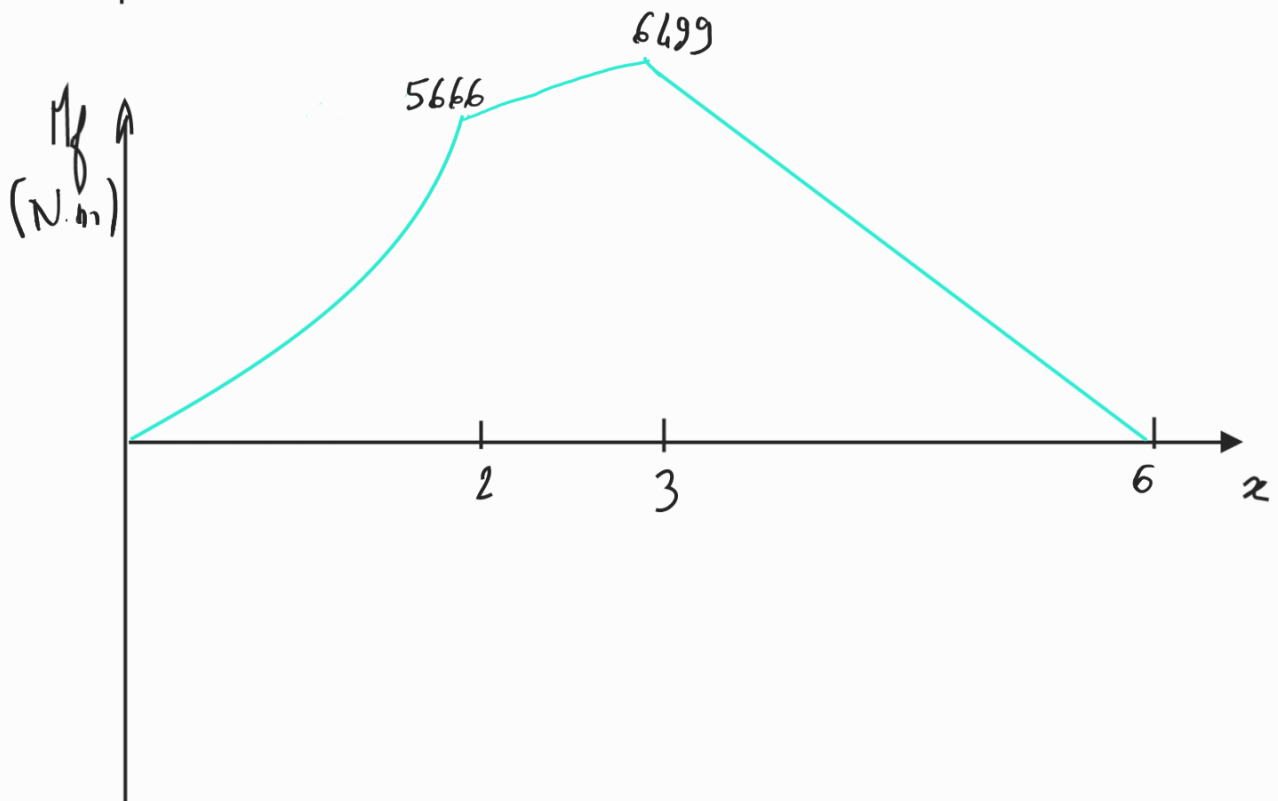
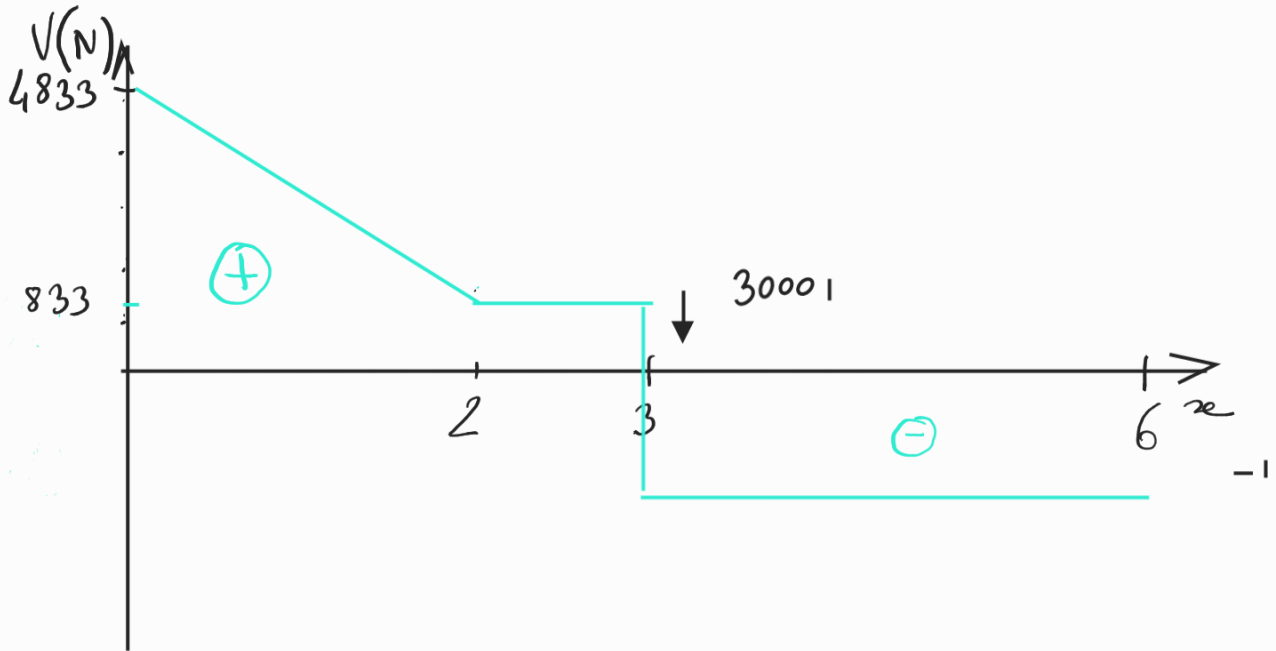
$$\sum M_{1/2} = 0 \quad Y_A \alpha - Q(\alpha - 1) - F_1(\alpha - 3) - M_f = 0$$

$$V_f = 4833x - 4000x + 4000$$

$$- 3000x + 9000$$

$$M_f(x) = -2167x + 13000 \text{ N.m}$$

## Diagrammes



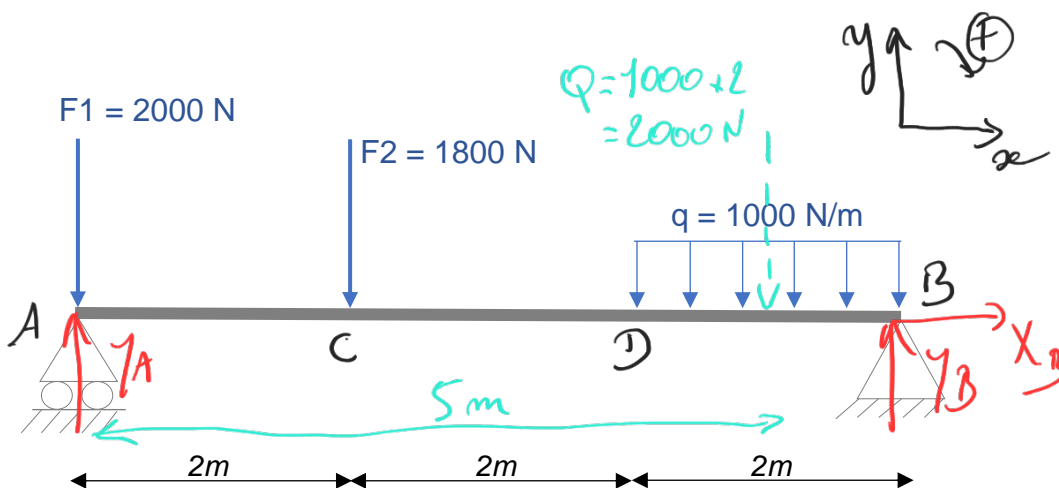
**BTS Bât 1 – Devoir en autonomie U41**

**Diagramme des efforts internes**

**Groupe 3**

/ 20

Tracer les diagrammes des efforts internes de la structure suivante.



Réactions aux appuis

$$\sum F_x = 0 \quad X_B = 0$$

$$\sum F_y = 0 \quad Y_A - F_1 - F_2 - Q + Y_B = 0$$

$$Y_A + Y_B = 2000 + 1800 + 2000 = 5800\text{ N}$$

$$\sum M_A = 0 \quad F_2 \times 2 + Q \times 5 - Y_B \times 6 = 0$$

$$Y_B = \frac{1800 \times 2 + 2000 \times 5}{6}$$

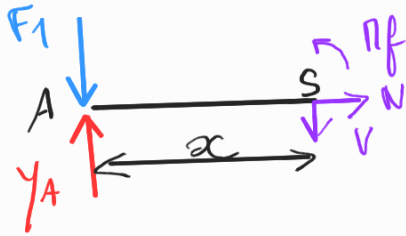
$$= 2266,7\text{ N}$$

$$\Rightarrow Y_A = 5800 - 2266,7 = 3533,3\text{ N}$$

## - Efforts internes

Il y a 4 singularités = 3 coupures.

• Coupure 1, entre A et C



$$N = 0$$

$$\sum F_y = 0 \quad Y_A - F_1 - V = 0$$

$$V = 3533,3 - 2000 = 1533,3 \text{ N}$$

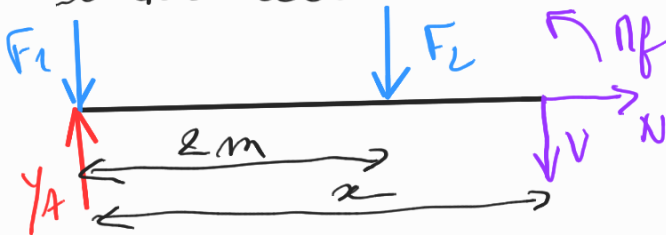
$$\sum M_{/S} = 0 \quad Y_A \times x - F_1 \times x - M_f = 0$$

$$M_f = 3533,3x - 2000x$$

$$= 1533,3x \text{ N.m}$$

$$M_f(2) = 3066,6 \text{ N.m}$$

• Coupure 2, entre C et D



$$N = 0$$

$$\sum F_y = 0 \quad Y_A - F_1 - F_2 - V = 0$$

$$V = 3533,3 - 2000 - 1800 = -266,7 \text{ N}$$

$$\sum M_{/S} = 0 \quad Y_A \times x - F_1 \times x - F_2(x-2) - M_f = 0$$

$$M_f = 3533,3x - 2000x - 1800x + 3600$$

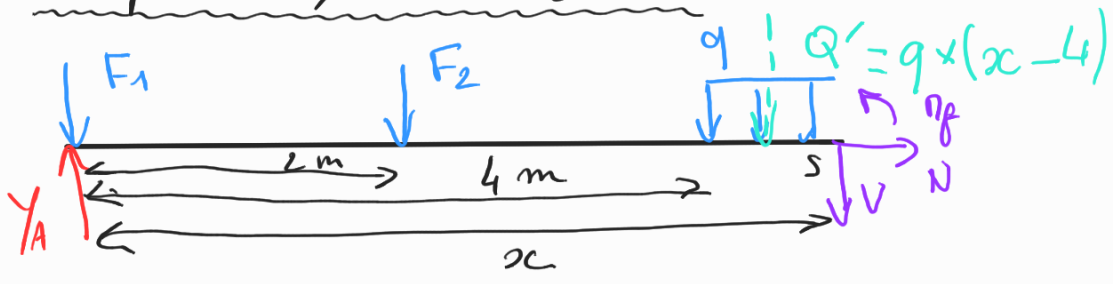
$$= -266,7x + 3600$$

$$M_f(2) = 3066,6 \text{ N.m}$$

$$M_f(4) = 2533,2 \text{ N.m}$$

Coupure 3, entre D et B

• Coupure 5, entre y et 6



$N=0$

$$\sum F_y = 0 \quad Y_A - F_1 - F_2 - Q' - V = 0$$

$$V = 3533,3 - 2000 - 1800 - 1000(x-4)$$

$$= -266,7 + 4000 - 1000x$$

$$= 3733,3 - 1000x$$

$$\sum \Pi_s = 0 \quad Y_A \times x - F_1 x - F_2(x-2) - Q' \left( \frac{x-4}{2} \right) - \Pi_f = 0$$

$$\Pi_f = 3533,3x - 2000x - 1800x + 3600 - \frac{q}{2}(x-4)^2$$

$$= -266,7x + 3600 - 500(x^2 - 8x + 16)$$

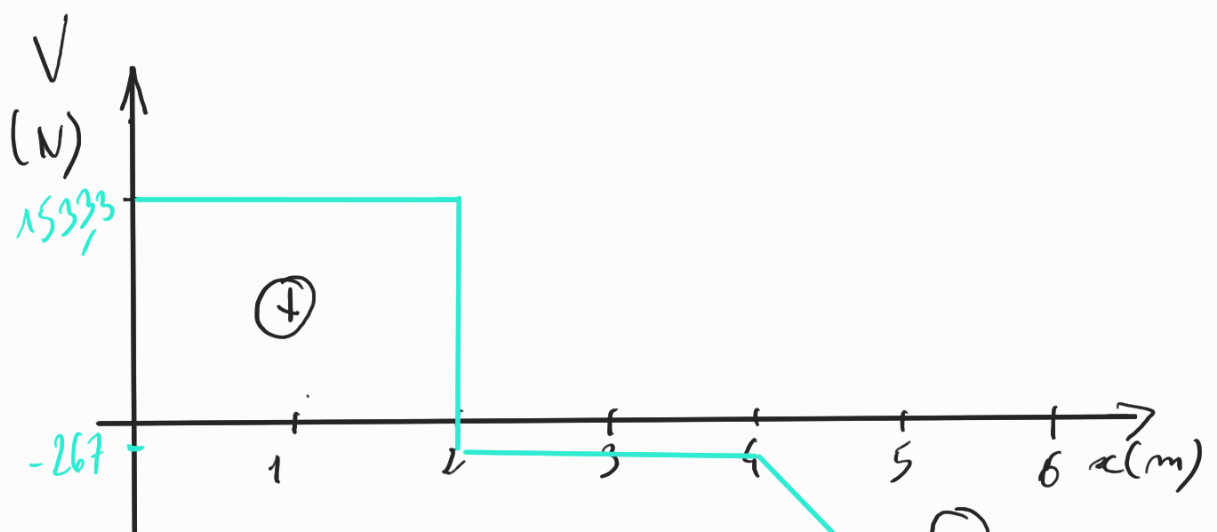
$$= -266,7x - 500x^2 + 4000x - 8000 + 3600$$

$$= -500x^2 + 3733,3x - 4400$$

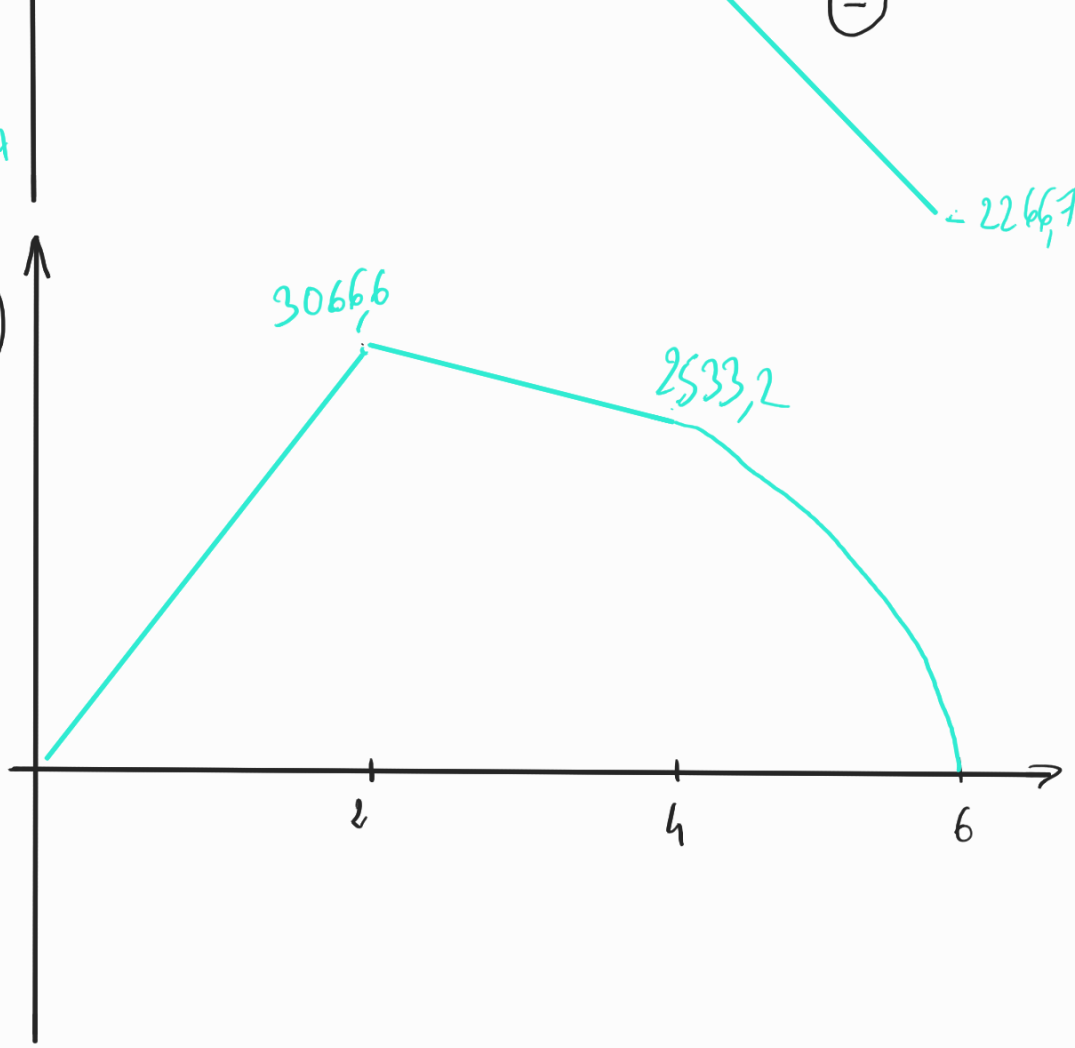
$\Pi_f(4) = 2533,2 \text{ N.m}$

$\Pi_f(6) = 0 \text{ N.m}$

• Diagrammes



-2266,7  
M<sub>B</sub>  
(N.m)



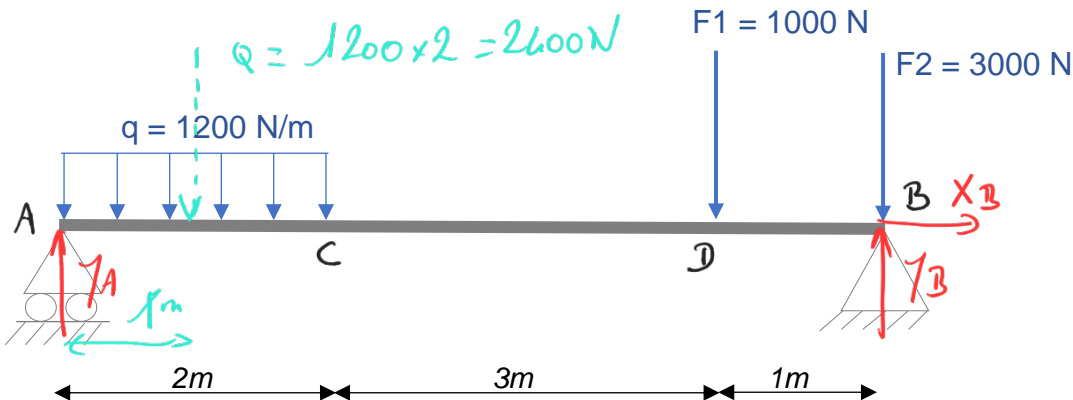
**BTS Bât 1 – Devoir en autonomie U41**

**Diagramme des efforts internes**

**Groupe 5**

/ 20

Tracer les diagrammes des efforts internes de la structure suivante.



Réactions aux appuis

PFS  $\sum F_x = 0 \Rightarrow X_B = 0$

$\sum F_y = 0 \Rightarrow Y_A - Q - F_1 - F_2 + Y_B = 0$

$Y_A + Y_B = Q + F_1 + F_2$   
 $= 2400 + 1000 + 3000$   
 $= 6400 \text{ N}$

$\sum M_A = 0 \Rightarrow Q \times 1 + F_1 \times 5 + F_2 \times 6 - Y_B \times 6 = 0$

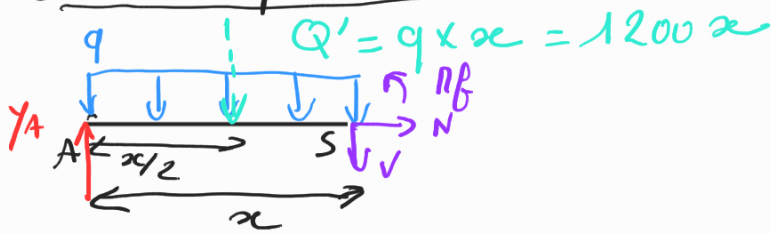
$Y_B = \frac{2400 + 5000 + 18000}{6}$   
 $\approx 4233 \text{ N}$

$Y_A = 6400 - 4233 = 2167 \text{ N}$

Efforts internes

4 singularités  $\Rightarrow$  3 coupures

• 1<sup>ère</sup> coupure entre A et C



$$N = 0$$

$$\sum F_x = 0 \quad Y_A - Q' - V = 0$$

$$V = Y_A - Q' = 2167 - 1200x \quad V(2) = -233 \text{ N}$$

$$V(x) = 0 \text{ pour } x \approx 1,8 \text{ m}$$

$$\sum M_{/S} = 0 \quad Y_A \times \frac{x}{2} - Q' \times \frac{x}{2} - M_f = 0$$

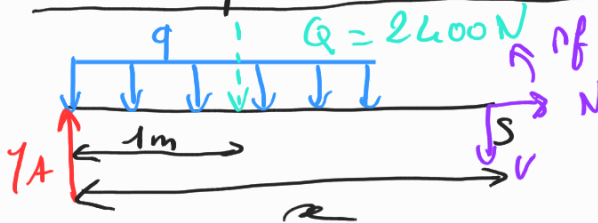
$$M_f = 2167x - 600x^2$$

$$M_f(2) = 1934 \text{ N.m}$$

$$M_f(1,8) \approx 1957 \text{ N.m}$$

$\rightarrow$  max.

• 2<sup>ème</sup> coupure entre C et D



$$N = 0$$

$$\sum F_y = 0 \quad Y_A - Q - V = 0$$

$$V = Y_A - Q = 2167 - 2400 = -233 \text{ N}$$

$$\sum M_{/S} = 0 \quad Y_A \times x - Q(x-1) - M_f = 0$$

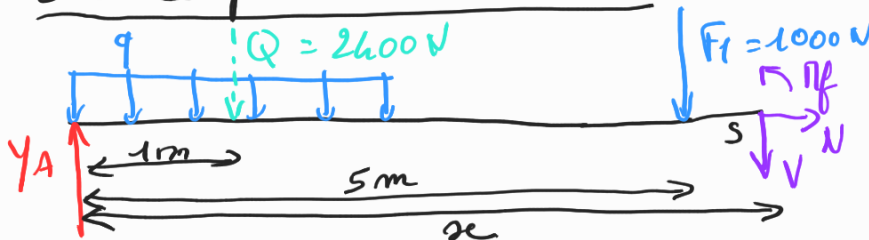
$$M_f = 2167x - 2400x + 2400$$

$$= -233x + 2400$$

$$M_f(2) = 1934 \text{ N.m}$$

$$M_f(5) = 1235 \text{ N.m}$$

• 3<sup>ème</sup> coupure entre D et B



$$N = 0$$

$$\sum F_y = 0 \quad Y_A - Q - F_1 - V = 0$$

$$V = 2167 - 2400 - 1000 = -1233 \text{ N}$$

$$\sum M_{/S} = 0 \quad Y_A \times x - Q(x-1) - F_1(x-5) - M_f = 0$$

$$\pi_f = 2167x - 2400x + 2400 - 1000x + 5000$$

$$= -1233x + 7400$$

$$\pi_f(5) = 1235 \text{ N}\cdot\text{m}$$

$$\pi_f(6) = 0 \text{ N}\cdot\text{m}$$

