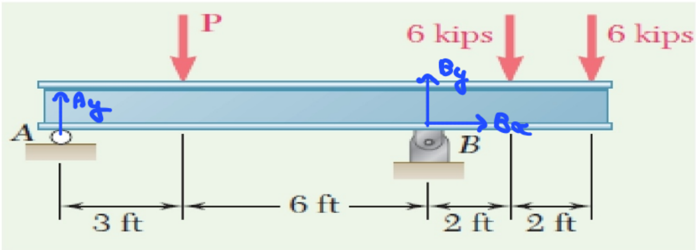
TD (0)

Exercise 1:

Three loads are applied to a beam as shown. The beam is supported by a roller at *A* and by a pin at *B*. Neglecting the weight of the beam, determine the reactions at *A* and *B* when *P* = 15 kips



$$\sum \vec{F}_{ext} = \vec{0} \Rightarrow \begin{cases} (Ox): & B_x = 0 \\ (Oy): & -P - 12 + A_y + B_y = 0 \end{cases}$$

$$\sum \mathcal{M}(\vec{F}) = 0 \Rightarrow -3P + 9B_y - (6 \times 11) - (6 \times 13) = 0$$

$$\Leftrightarrow -3(15) + 9B_y - (6 \times 11) - (6 \times 13) = 0$$

$$B_y = \frac{3 \times 15 + 6 \times 11 + 6 \times 13}{9}$$

$B_y = 21$ kips

$$-15 - 12 + A_y + B_y = 0$$

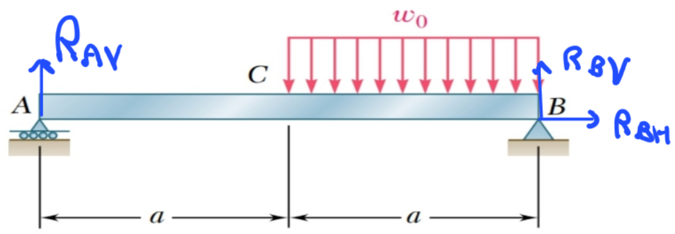
$\Rightarrow A_y = 6$ kips

$$\boxed{\begin{cases} A_y = 6 \text{ kips} \\ B_y = 21 \text{ kips} \end{cases}}$$

$$\boxed{B_x = 0 \text{ kips}}$$

Exercice 2 :

Déterminer l'expression des réactions R_{HB} et R_{VB} des systèmes représentés ci-après. q_0 et w_0 sont les densités de charge (en N/m).



$$\sum \vec{F}_{ext} = 0 \Rightarrow \begin{cases} (Ox) : R_{BH} = 0 \\ (Oy) : R_{BV} + R_{AV} + a w_0 = 0 \end{cases}$$

$$w_0 = \frac{F}{a} \Rightarrow F = w_0 . a$$

$$\sum M(\vec{F}) = 0 \Rightarrow -w_0 a \left(a + \frac{a}{2}\right) + R_{BV}(2a) = 0$$

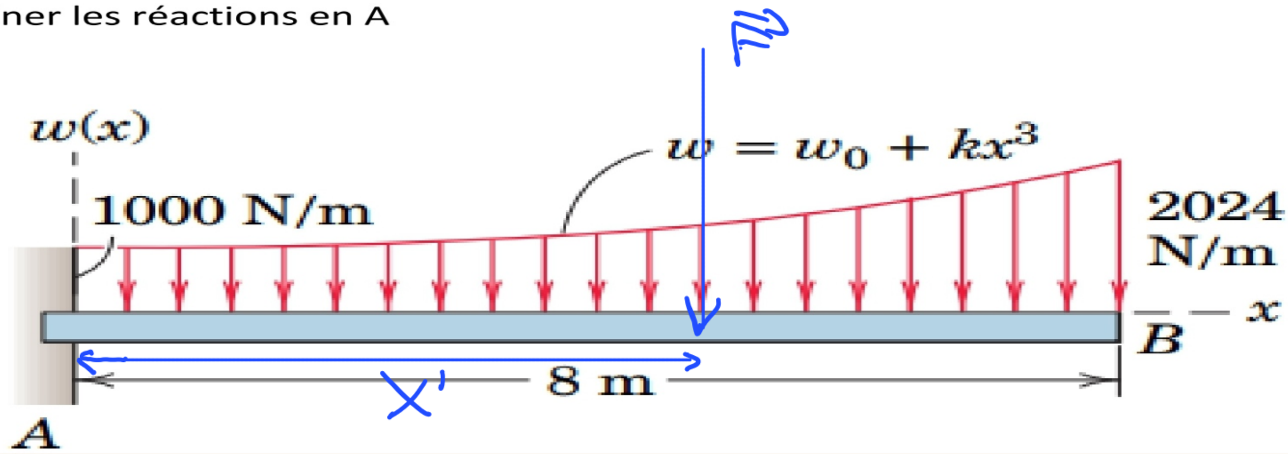
$$\boxed{R_{BV} = \frac{3a}{4} w_0}$$

$$\frac{3a}{4} w_0 + a w_0 + R_{AV} = 0$$

$$\boxed{R_{AV} = \frac{-7 a w_0}{4}}$$

Exercice 3 :

Déterminer les réactions en A



$\omega(0) = \omega_0 = 1000 \ N/m$

$\omega(8) = 1000 + k(8)^3 = 2024 \Rightarrow k = 2$

$$\omega(x) = 1000 + 2x^3$$

$$F = \int_0^8 (1000 + 2x^3)\,dx = \left[1000x + \frac{x^4}{2}\right]_0^8$$

$$\boxed{F = 10\,048 \ N}$$

$$x' F = \int_0^8 x\,(1000 + 2x^3)\,dx$$

$$= \left[\frac{2}{5}x^5 + 500x^2\right]_0^8 = 45107{,}2 \ Nm$$

$$\boxed{x' = 4{,}49 m}$$

$$\sum \vec{F_{ext}} = \vec{0} \Rightarrow R_A - F = 0$$

$$R_A = F = 10048 \ N$$

$$\sum M_{\vec{F}} = 0 \Rightarrow -F x' + M = 0$$

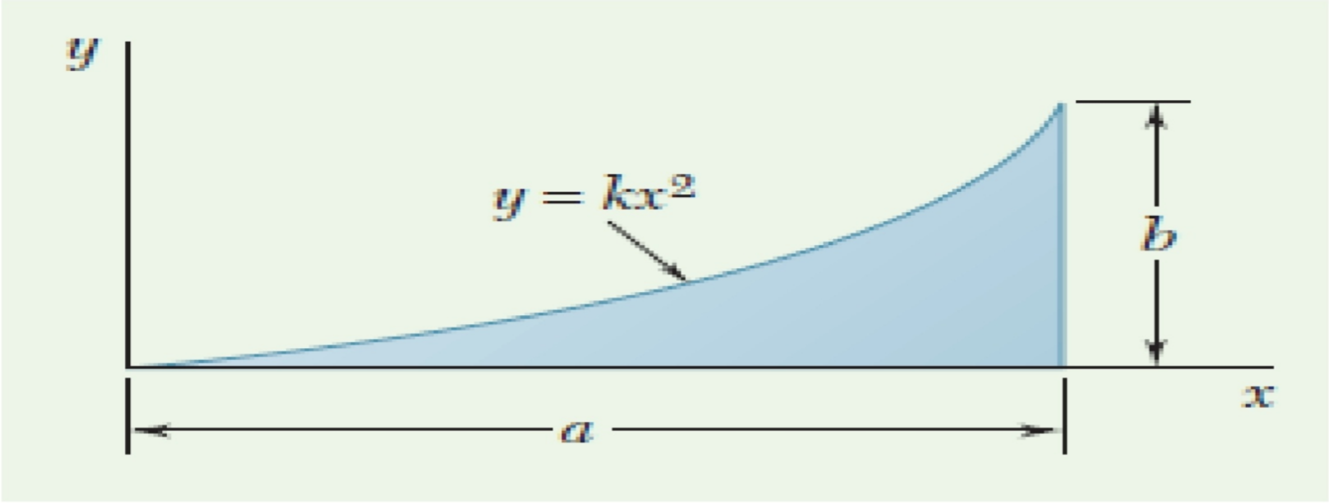
$$M = F x' = 4{,}49 \times 10048$$

$$\boxed{M = 45115{,}52 \ Nm}$$

Exercise 4 :

Evaluate the dashed surface using a vertical differential element.

Calculer la surface suivante en utilisant un élément différentiel vertical.



$$b = k a^2 \iff \boxed{k = \frac{b}{a^2}} \qquad y = \left(\frac{b}{a^2}\right) x^2$$

Ecrire x en fonction de y :

$$\boxed{x = \frac{a}{\sqrt{b}} \sqrt{y}}$$

$$A = \int_0^b x \, dy = \frac{a}{\sqrt{b}} \int_0^b (y)^{1/2} \, dy$$

$$= \frac{2}{3} \frac{a}{\sqrt{b}} (b)^{3/2}$$

$$\boxed{A = \frac{2ab}{3}}$$