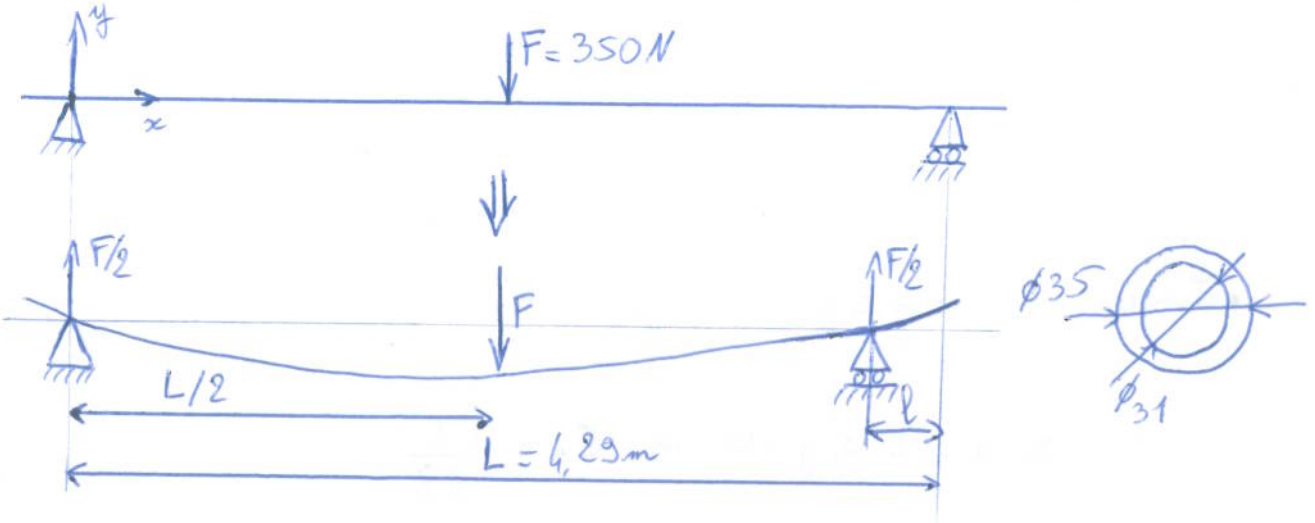
Poutre en flexion



⇒ **Calcul des moments de flexion :**

- Sur $0 < x < \frac{L}{2}$: $M_f = -\frac{F}{2} x$
- Sur $\frac{L}{2} < x < L$: $M_f = -\frac{F}{2} x + F\left(x - \frac{L}{2}\right) = \frac{Fx}{2} - \frac{FL}{2}$

⇒ **Contraintes :**

- Sur $0 < x < \frac{L}{2}$: $\sigma = \frac{M_f}{I} y$ avec $I = \frac{\pi (D^4 - d^4)}{64}$

$$\sigma_{max} = -\frac{F}{2} x \times \frac{64}{\pi (D^4 - d^4)} \times \frac{D}{2}$$

$$\sigma_{max} = -\frac{F}{2} \frac{L}{2} \frac{64}{\pi (D^4 - d^4)} \times \frac{D}{2}$$

$$\sigma_{max} = \frac{8 F . L . D}{\pi (D^4 - d^4)}$$

Soit $\boxed{\sigma_{max} = 232 \text{ MPa}} < R_e = 235 \text{ MPa}$

⇒ **Allongement :**

$$\sigma = E . \varepsilon \Rightarrow \varepsilon_{max} = \frac{\sigma_{max}}{E} = \frac{232}{210\,000}$$

$$\varepsilon_{max} = 1,1\ \%$$

$$\varepsilon = \frac{L - L_0}{L_0} \Rightarrow \boxed{L = L_0 \varepsilon + L_0 = 4,295 \text{ m}}$$