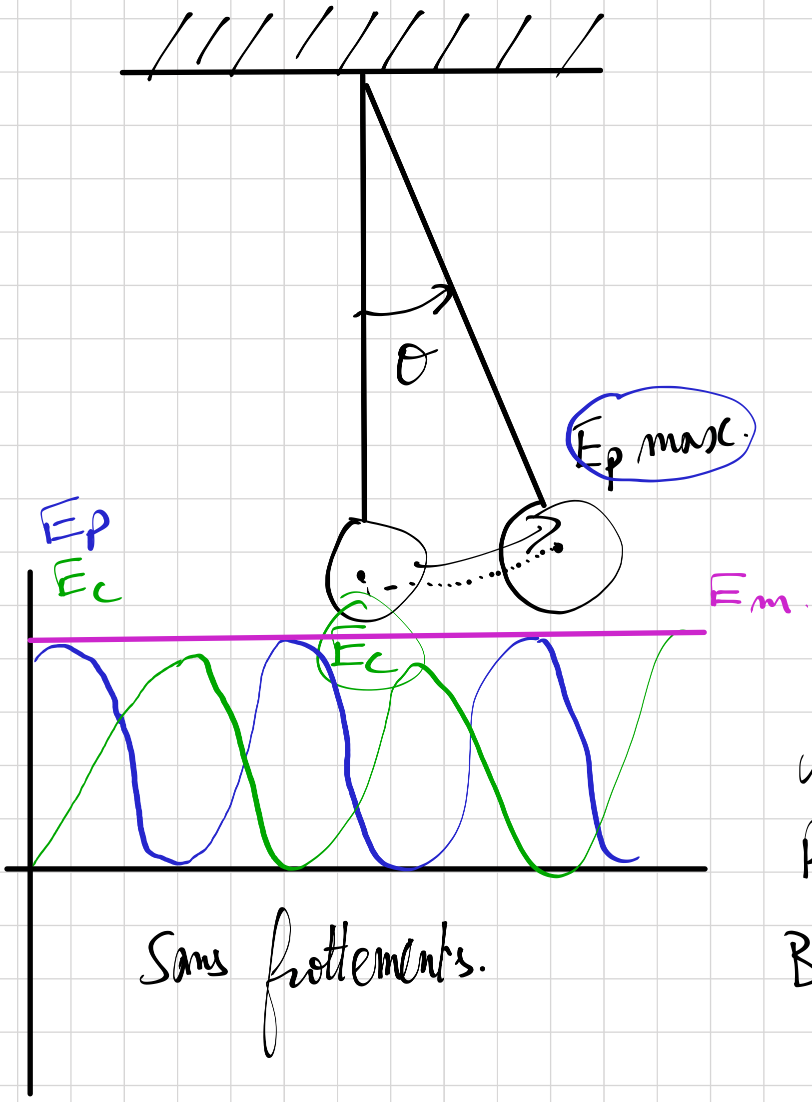
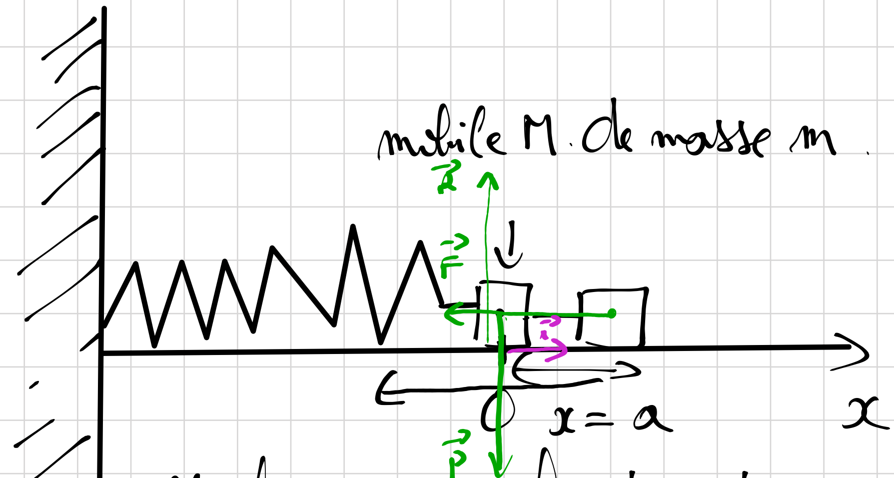
Séance du 07/10/19. Ondes.



Sans frottements.



M glisse sans frottement.

Système : {mobile de masse m}.

Réf : terrestre supposé gal.

Bdf : * $\vec{P} = m\vec{g}$.

* $\vec{R}$

* $\vec{F} = -k x \vec{i}$ k : constante de raideur.

k : $N.m^{-1}$.

On applique la 2ème Loi de Newton :

$$\sum \vec{F_{ext}} = m\vec{a}.$$

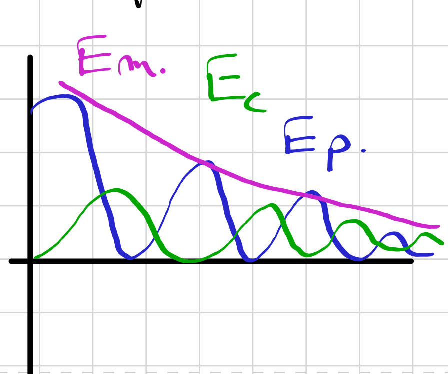
$$\underbrace{\vec{P}+\vec{R}}_{\text{se compensent } = \vec{0}} + \vec{F} = m\frac{d^2x}{dt^2}\vec{i}.$$

On projette sur (Ox) $\quad -kx = m\frac{d^2x}{dt^2}$

$$-\frac{k}{m}x = \frac{d^2x}{dt^2}.$$

$$\frac{d^2u}{dt^2} + \omega_0^2 u = 0$$

Avec frottements.



$$-\frac{d^2x}{dt} - \frac{k}{m}x = 0 \iff \boxed{\frac{d^2x(t)}{dt^2} + \frac{k}{m}x(t) = 0.}$$

$$x(t) = X_m \cos(\omega t + \varphi)$$

$$u(t) = a \cos(\omega t).$$

$$\cos'(u) = -u' \sin(u).$$

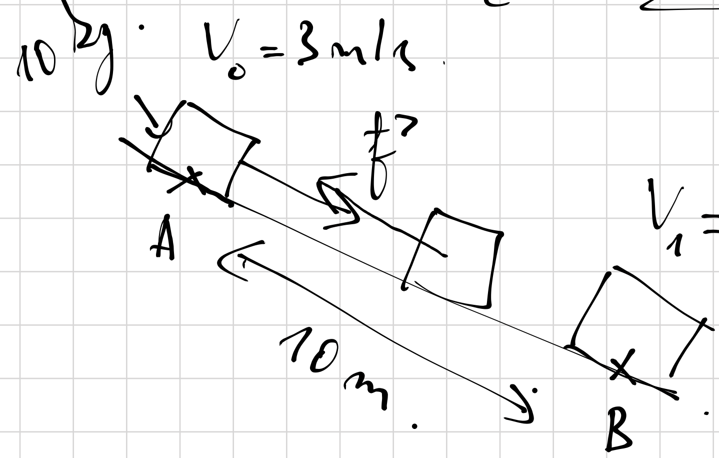
$$v = \frac{du(t)}{dt} = -a\omega \sin(\omega t)$$

$$E_c = \frac{1}{2} m \times v^2 = \frac{1}{2} m \left(\frac{du(t)}{dt}\right)^2 = \frac{1}{2} m \left(-a\omega \sin(\omega t)\right)^2$$

$$E_c = \frac{1}{2} m \times a^2 \omega^2 \sin^2(\omega t).$$

Théorème de l'énergie cinétique :

$$\Delta E_c = \sum W\left(\vec{F}_{\text{non conservatives}}\right).$$



$$V_1 = 0 \text{ m/s}.$$

$$\Delta E_c = W_{AB}\vec{F}$$

$$0 - \frac{1}{2} \times 10 \times 3^2 = -f \times 10.$$

$$45 = f \times 10.$$

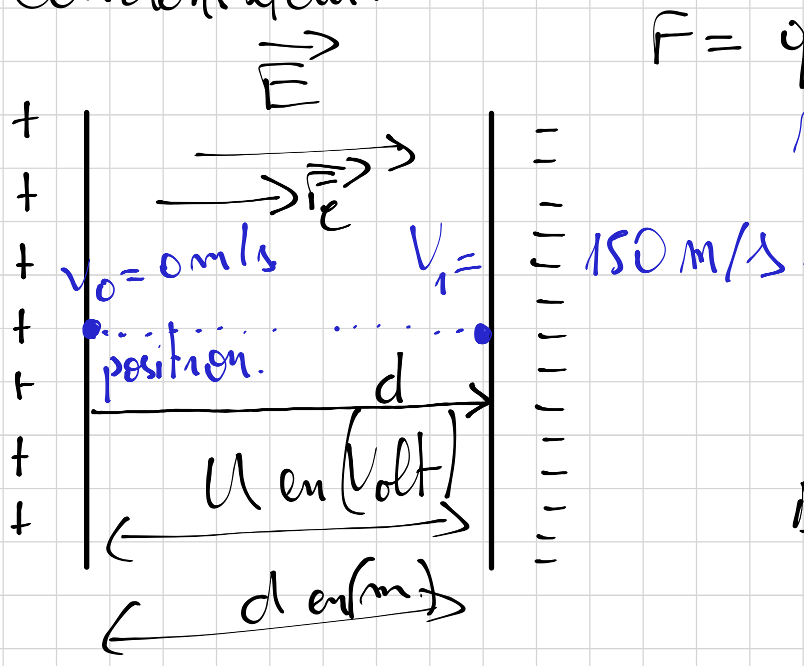
$$\frac{45}{10} = f$$

$$f = 4{,}5 \text{ N}.$$

Condensateur.

$$E = \frac{U}{d} = \frac{V}{d}.$$

$$\vec{F} = q\vec{E}$$

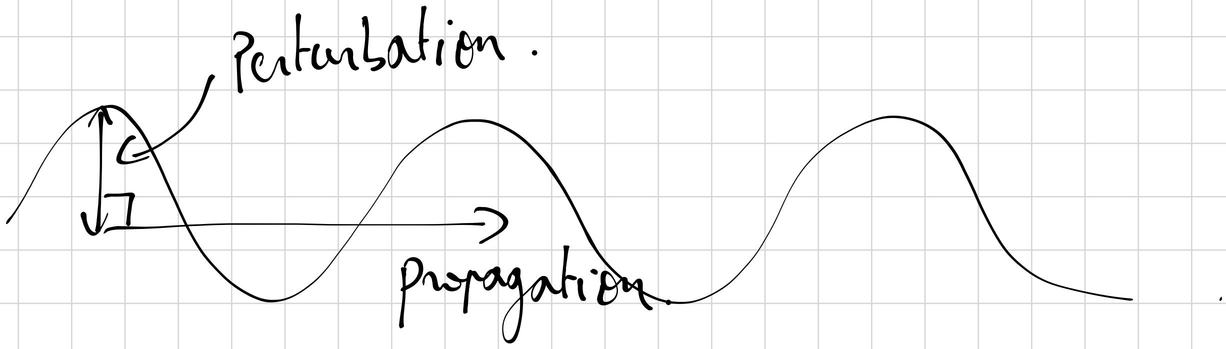


non conservé

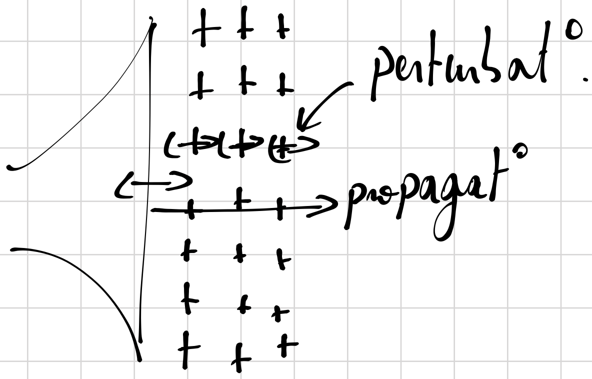
$$\Delta E_c = W_d(\vec{F_e}) = d \times F_e \times \cos(\vec{d}; \vec{F_e})$$

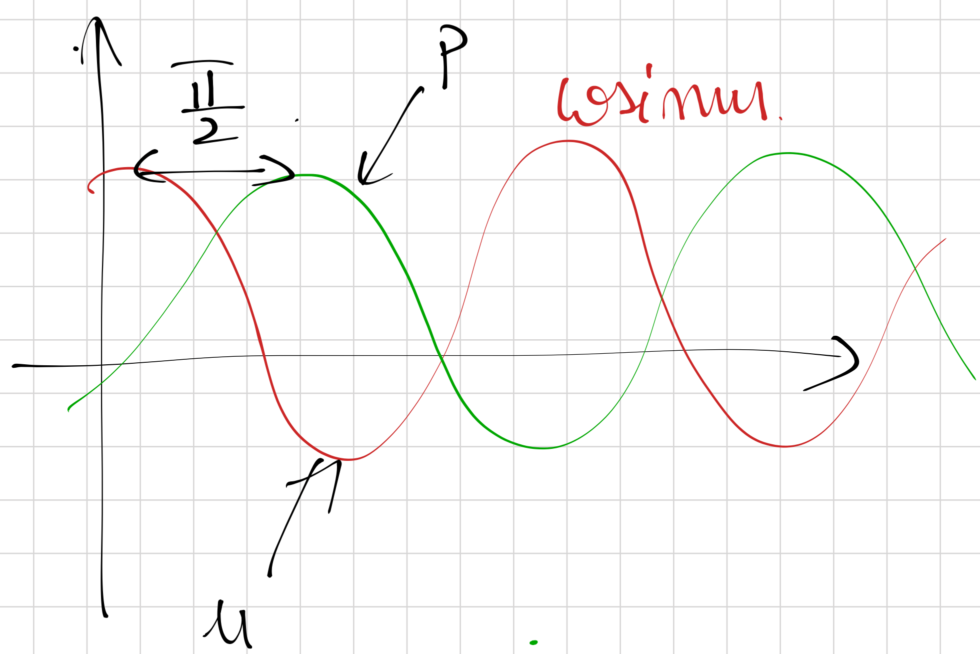
$$\Delta E_c = d \times \underbrace{q \times E}_{F_e}.$$

Onde transversale :



Onde longitudinale :





$$p = P_0 + \delta p$$

* δp petite variation de p.
* Δp grosse variation de p.
* dp très petite var° de p.

$$C = \sqrt{\gamma \frac{P_0}{\rho_0}} = \sqrt{\gamma \times \frac{\frac{nRT}{\cancel{V}}}{\frac{m}{\cancel{V}}}}$$

$$= \sqrt{\gamma \times \frac{1}{M} \times RT}$$

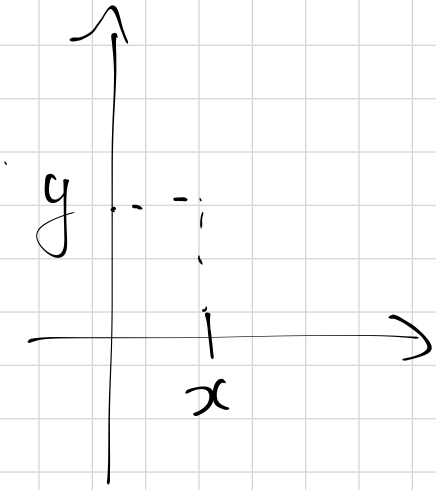
$$PV = nRT$$

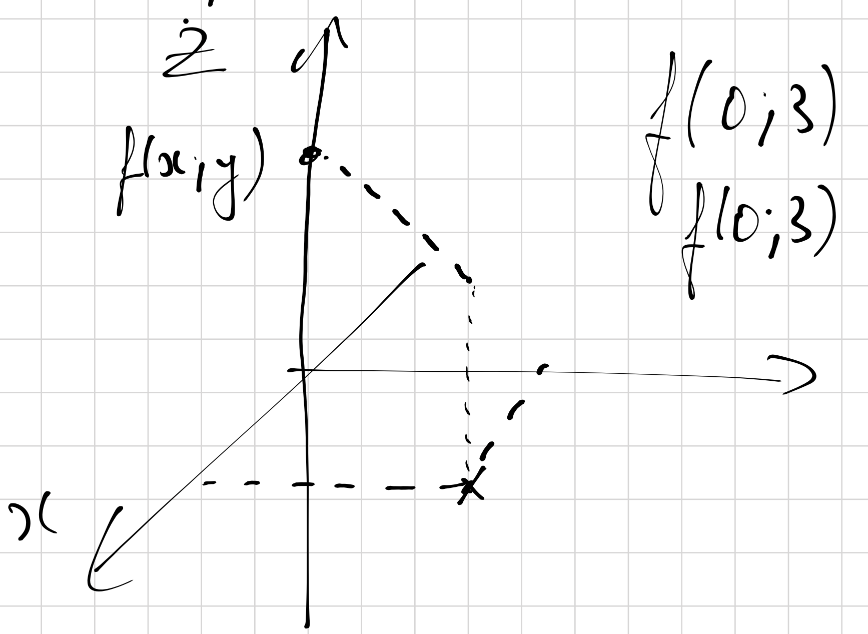
$$P = \frac{nRT}{V}$$

$$M = \frac{m}{n}$$

$$\frac{1}{M} = \frac{n}{m}$$

$f(x;y) = x^2+2y+5$. $f(x) = y$.





$f(0;3) = 0^2+2\times3+5$.

$f(0;3) = 11 = z$

$$\frac{\partial f(x;y)}{\partial y} = 2.$$

$$\frac{\partial P(T;\rho;\dots)}{\partial \rho} \qquad \frac{\partial f(x;y)}{\partial x} = 2x.$$

$\rho = \frac{m}{V}$

$$P = \frac{nRT}{V} \qquad n = \frac{m}{M} = \frac{\rho\times V}{M}.$$

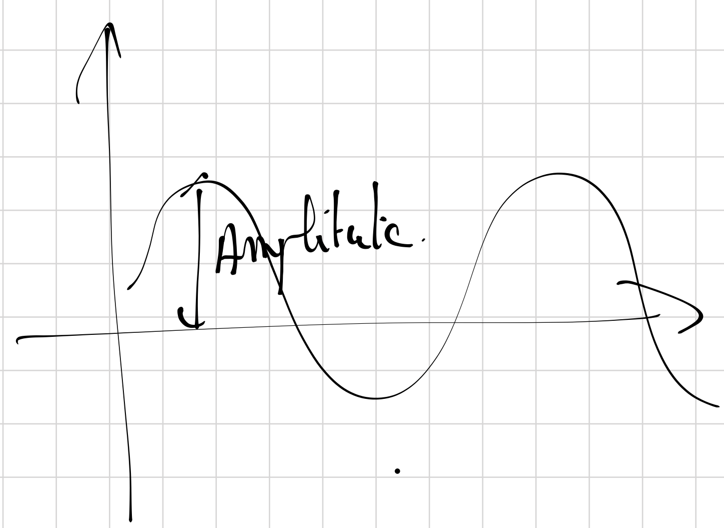
$$P = \frac{\rho\times \cancel{V}\times R\times T}{\cancel{V}\times M} = x\,\underbrace{\frac{\rho RT}{M}}_{K}. \quad (Kx)$$

Syn

$E_{tot} \propto (\text{Amplitude})^2$

Si $(\text{Amplitude})^2 \times K$

Alors $E_{tot} \times K$.



$$\theta = \frac{\lambda}{a}. \qquad \lambda \text{ fixé}.$$

$\theta = (\lambda)\times\left(\frac{1}{a}\right)$.

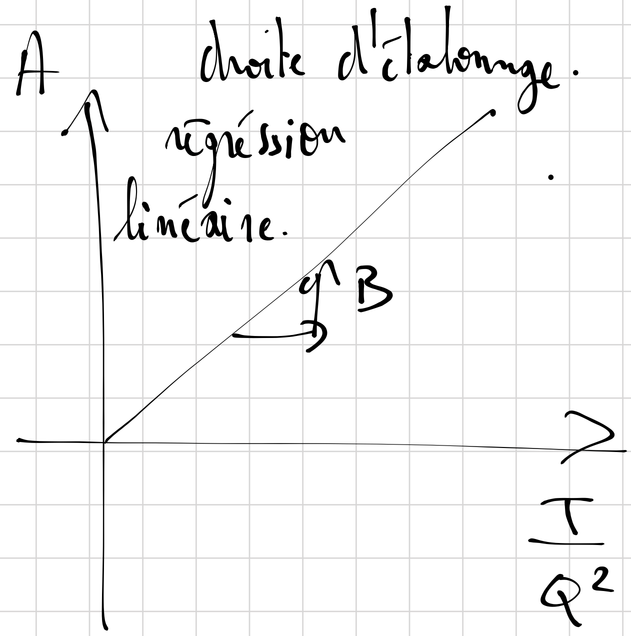
$\sigma = K \times x$

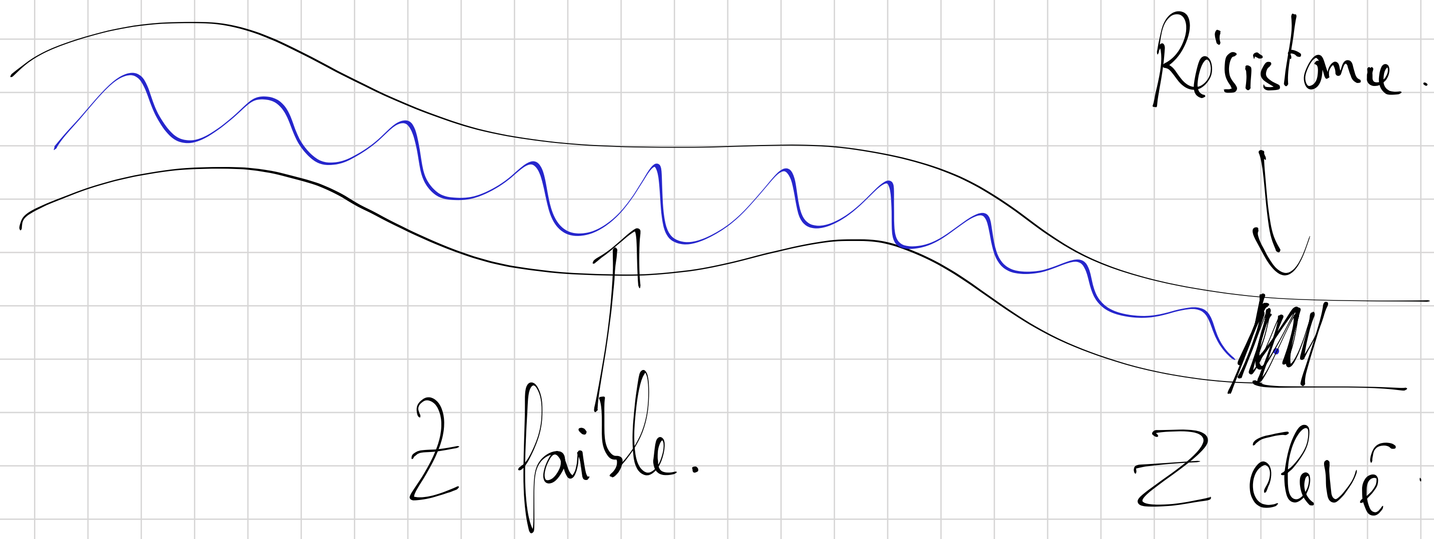
QCM :

$$A = \frac{B \times T}{Q^2}$$

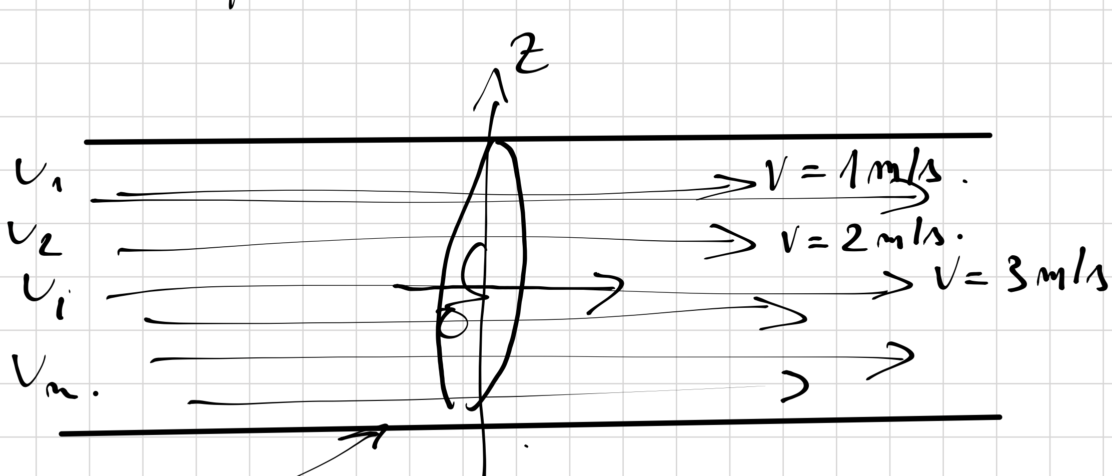
$$A \propto \frac{T}{Q^2}$$

B est fixé.





Mécanique des fluides.



Si $V_i \neq$ alors frottements.

frottements dus aux parois.

Ces frottements ont tendance à harmoniser la vitesse du fluide dans son ensemble.

↳ forces de viscosité : $|F_{vis}| = \eta S \frac{dv}{dz}$.

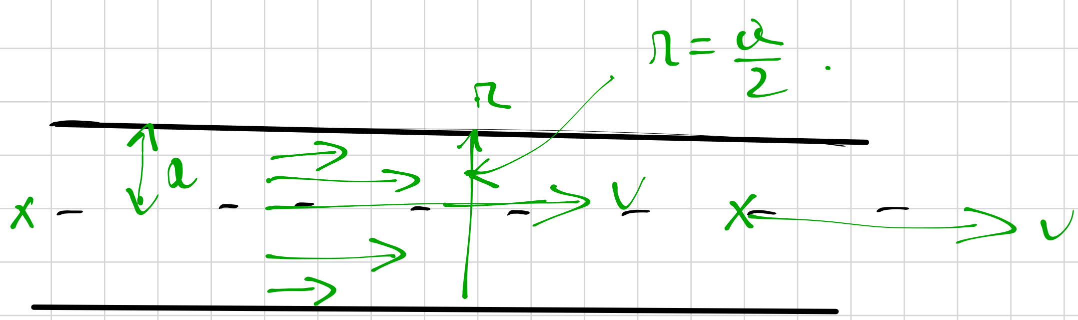
F_{vis} est la force de viscosité en N.

η viscosité en Pa.

S : surface en m^2

V : vitesse en m/s.

z : altitude en m.



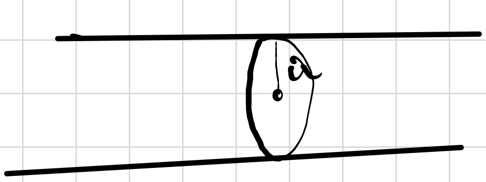
r : distance à l'axe.
$r \geq 0$.

$v \propto (a^2 - r^2)$

Vitesse moyenne : $\boxed{\bar{v} = \frac{1}{2} v_{max}.}$

Relation entre débit Q et vitesse moyenne :

$$Q = S \times \bar{v} = \underbrace{\pi a^2}_{\text{Surface d'un disque de rayon } a.} \times \bar{v}$$



Q : en $m^3 \cdot s^{-1}$.

Perte de pression dans un conduit cylindrique :

P_1 force de frottements P_2

Conséquence : bai

$P_1 > P_2$.