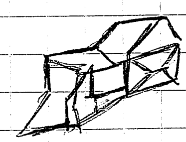
$$\frac{\Delta \rho}{\rho} \leq \cancel{\text{moyenne}} \; ① \frac{\Delta m}{m} + ① \frac{\Delta h}{h} + ② \frac{\Delta D}{D}$$ relative

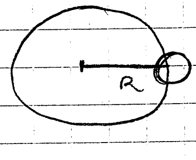


$$\frac{\Delta \left(x_1^{\alpha_1} x_2^{\alpha_2} \cdots x_n^{\alpha_n}\right)}{x_1^{\alpha_1} \cdots x_n^{\alpha_n}} \leq \sum \frac{\Delta x_i}{x_i} |\alpha_i|$$

DEVELOPPEMENT LIMITE = approximat° locale

photo 11/09
DL à l'ordre 2

① $g = \frac{g_0 R^2}{(R+z)^2}$ $\quad z \ll R \quad z + R \simeq R$



① $g(z) = g_0 \frac{R^2}{(R+z)^2}$ $\qquad g(R+z) \to$ on se place à $z=0$
faible altitude

$g(z) \simeq g(0) = g_0$

$\frac{dg}{dz}\Big|_{z=0} = g'(0)$

$g'(z) = g_0 R^2 \times -2 \times (R+z)^{-3}$

$g'(0) = -2 g_0 R^2 R^{-3}$ $\qquad |g'(0)| \leq \frac{2g_0}{R}$ pr les faibles altitudes

$|\Delta g| \leq |g'(0)| \Delta z$ $\qquad \Delta f \leq$ H les données partielles

② $= \frac{2g_0}{R} \Delta z \leq 10^{-3}$

$\Delta z \leq 10^{-3} \times \frac{R}{2g_0}$

$= 10^{-3} \times \frac{6{,}4 \times 10^3}{2 \times 10} = \boxed{0{,}32 \text{ km}}$

$\simeq 300$ m

Calculons exactement

$|g(0{,}32) - \underset{\substack{\parallel \\ 10}}{g(0)}| = 0{,}00099 \ll 10^{-3}$

↳ erreur bien ⊕ petite que 10^{-3}

$$\frac{f(x+h)+f(x)}{h} = f'(x) + \varepsilon(h)$$

$\varepsilon(h) \to 0$

$$f(x+h) = f(x) + h\,f(x) + \underbrace{h\,\varepsilon(h)}_{\varepsilon(h)\to 0}$$

$\longrightarrow$ tracé sin $\oplus$ representative $\oplus$ l'ordre du developpement limité est élevé

$$f(b) = f(a) + (b-a)f'(a) + o(b-a)$$

⚠ $\neq$ Dl en 0 ou en A

$$f(x) = f(a) + o(a) \text{ à l'ordre } 0$$

...ouve le DL du sin à l'ordre 1/2/3/4 en 0.

~~f(x)...~~

$$\sin(x) = x + o(x^1)$$

$$\sin(x) = x - \frac{1}{6}x^3 + o(x^3)$$

$$\sin(x) = \frac{1}{120}x^5 + x - \frac{1}{6}x^3 + o(x^5)$$

$$\sin(x) = \frac{1}{5040}x^7 + \frac{1}{120}x^5 + x - \frac{1}{6}x^3 + o(x^7)$$

$\sin(x)$		0
$\sin'$	$= +\cos$	1
$''$	$= -\sin$	0
(3)	$= -\cos$	-1
(4)	$= +\sin$	0
(5)	$=$	

$$\sin(x) = f(x) = f(0) + x f'(0) + o(x)$$
$$= 0 + x + o(x)$$
$$= x + o(x)$$

② $\left(P + \frac{a}{V^2}\right)(V-b) = RT$

$$V = b + \frac{RT}{P + \frac{a}{V^2}}$$

$$V \longrightarrow V+h \qquad \frac{1}{P + \frac{a}{V^2}} = \frac{1}{P + a(V+h)^{-2}}$$

$$(V+h)^{-2} = f(h) = f(0) + h f'(0) + \frac{h^2}{2} f''(0) + o(h^2)$$

$f(h) = (V+h)^{-2}$ $\qquad f(0) = V^{-2}$

$f'(h) = -2(V+h)^{-3}$ $\qquad f'(0) = -2V^{-3}$

$f''(h) = 6(V+h)^4$ $\qquad f''(0) = 6V^4$

$$f(h) = f(0) + h f'(0) + \frac{h^2}{2} f''(0) + o\, h^2$$

$$= \underbrace{V^{-2} - 2h\, V^{-3}}\ \ \cancel{+ 3h^2 V^4 + o\, h^2}$$

$$= V^{-2} - \frac{2h}{V^3} + o(h)$$

$$f = \frac{1}{P + a\left(V^{-2} - \frac{2h}{V^3} + o(h)\right)} = \frac{1}{P + \frac{a}{V^2} - \frac{2a}{V^3} h + o(h)}$$

$$\beta = \frac{1}{\left(P + \frac{a}{V^2}\right)\left(1 + \alpha h + o(h)\right)} \quad \text{où } \alpha = \left(P + \frac{a}{V^2}\right)^{-1}\left(-\frac{2a}{V^3}\right)$$

$$\frac{1}{1 + \alpha h + o(h)} = 1 - \alpha h + o(h)$$

Trop dur

3) $f(x) = x^5 + 2x^3 + 1$ $\qquad f'(x) = 5x^4 + 6x^2$

1) $f(1+h) = f(1) + h f'(1) + o(h) \simeq f(1) + h f'(1)$

$= 4 + h\,11 + o(h)$

$f(1{,}02) = f(1) + 0{,}02 f'(1) \simeq 4{,}22$

$h = 0{,}02 \qquad 4 + 0{,}02 \times 11$

Soit $F(x) = x^5 + 2x^3 + 1$

Ecrire le DL de la Fct° f au voisinage de $x = b$

$f(b) = f(a) + (b-a) f'(1) + o(b-a) \simeq f(a) + (b-a) f'(1)$

$a = 1 \qquad\qquad b = 1{,}02$

$f(b) \simeq 4 + 11(b-a) \qquad f(1{,}02) \simeq 4 + 11 \times 0{,}02$

INTEGRATION

1) $W(\vec{F}) = \cancel{F \cdot AB}$ on ne peut pas l'utiliser car A et B Fixe

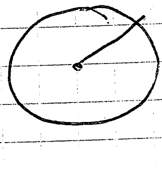
$\int \delta W = \int_0^L F \cdot dl$

$= \int_0^L K x\, dx$

$= \left[\frac{K X^2}{2} \right]_0^L$

$= \frac{K L^2}{2}$

$dV = 4\pi r^2 dr$



$\int dm = \int \rho\, dV$

$= \int_0^R \rho\, 4\pi r^2 dr$

Dim $\quad m^2$

3) $\rho = \rho_0 \left(1 - \alpha \frac{r^2}{R^2}\right)$ m^2

$\int_0^R 4\pi r^2 \rho_0 \left(1 - \alpha \frac{r^2}{R^2}\right) = \rho_0 \int_0^R \left(1 - \alpha \frac{r^2}{R^2}\right) 4\pi r^2\, dr \qquad = \rho_0 \int_0^R 4\pi r^2 \left(1 - \alpha \frac{r^2}{R^2}\right) dr$

$= \rho_0 \times 4\pi \int_0^R \left(1 - \alpha \frac{r^2}{R^2}\right) r^2\, dr$

$= \rho_0 4\pi \int_0^R r^2 - r^2 \alpha \frac{r^2}{R^2}\, dr$

$= \rho_0 4\pi \left(\frac{R^3}{3} - \frac{R^3}{5}\right)$