Correction

Exercice 1

1°/ a) $W_{A-B}(\vec{F}) = \vec{F}.\,AB.\,\cos(\alpha)$

$\alpha = (\vec{F}, \vec{AB}) = 180°$

$W_{A-B}(\vec{F}) = 3500 \times 280 \times \underbrace{\cos 180°}_{-1} =$

$\boxed{W_{A-B}(\vec{F}) = -980\ \text{KJ}}$

b) le travail est negatif, car la herse subit des frottements dans la direction opposée par rapport à son déplacement $\Rightarrow \alpha = (\vec{F}, \vec{AB}) = 180° = \pi$

Le travail est résistant $\Rightarrow$ la force de frottement est résistante, elle s'oppose au déplacement.

2°/ a) $W_{A-B}(\vec{P}) = P \times AB \times \cos(\alpha)$ ici $\alpha = (\vec{P}, \vec{AB})$

$\alpha = \pi/2 \Rightarrow \cos(\alpha) = 0$

b) $W_{A-B}(\vec{P}) = m \times g \times AB \times 0 = 0$

le poids de la herse ne fournit aucun travail

3°/ $W_{A-B}(\vec{F}) = 0{,}8 \times W_{A-B}(\vec{T})$ ①

$W_{AB}(\vec{T}) = T \times AB \times \cos(\alpha)$ ici $\alpha = (\vec{T}, \vec{AB})$

$\alpha = 18°$

$T = \dfrac{W_{AB}(\vec{T})}{AB \times \cos(18°)}$

① $\Rightarrow W_{AB}(\vec{T}) = \dfrac{W_{AB}(\vec{F})}{0{,}8} = \dfrac{980.10^3}{0{,}8}$

$W_{AB}(\vec{T}) = 1225\ \text{KJ}$

AN: $T = \dfrac{1225.10^3}{280 \times \cos(18°)} = 4{,}6.10^3\ \text{N}$

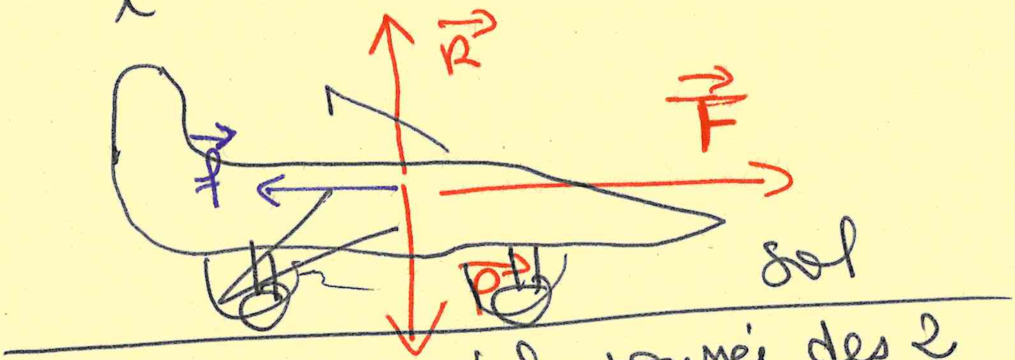
$\boxed{T = 4600\ \text{N}}$

Exercice 2

$m = 12\,T = 12.10^3\,kg$.

$AB = d = 250\,m$, $W_{AB}(\vec{F}) = 25.MJ$

$\Delta E_c = \sum_i W(\vec{F_i}) = W_{A-B}(\vec{P}) + W_{AB}(\vec{R}) + W_{AB}(\vec{f})$



seule la force due à la poussée des 2 réacteurs fournit un travail.

le poids $\vec{P}$ de l'avion et la réaction du sol $\vec{R}$ sont perpendiculaire au déplacement.

$\alpha = \pi/2 = 90° \Rightarrow \cos(90°) = 0$

$W_{AB}(\vec{P}) = P \times d \times \cos(90°) = 0$

$W_{A-B}(\vec{R}) = R \times d \times \cos(90°) = 0$

on a négligé la force de frottement $\vec{f}$

$E_{c2} - E_{c1} = W_{AB}(\vec{F}) = F \times d \times \cos(\alpha)$

$\alpha = (\vec{F}; \vec{AB}) = 0 \Rightarrow \cos(0) = 1$

$E_{c2} = \frac{1}{2} m V_d^2$

$E_{c1} = \frac{1}{2} m V_1^2 \leftarrow$ avion était à l'arrêt donc $V_1 = 0$

$\Delta E_c = \frac{1}{2} m V_d^2 - \underbrace{\frac{1}{2} m V_1^2}_{0} = F \times d \times 1 = F \times d$

$\frac{1}{2} m V_d^2 = F \times d \Rightarrow m V_d^2 = 2 \times \underbrace{F \times d}_{W(\vec{F})}$

$V_d^2 = \frac{2 W(\vec{F})}{m} \Rightarrow \boxed{V_d = \sqrt{\frac{2 \times W(\vec{F})}{m}}}$

$V_d = \sqrt{\frac{2 \times 25.10^6}{12 \times 10^3}} = \sqrt{\frac{50.10^3}{12}} = 64{,}6\ \text{m/s}$

v= 64.6*3.6= 232.6 km/h

Exercice 3

$m = 240g \longrightarrow$ propane C_3H_8

1°/ $C_3H_8 + 5O_2 \rightleftarrows 3CO_2 + 4H_2O$

2°/ $\Delta H_s = 3\Delta H(CO_2) + 4\Delta H^\circ(H_2O) - \Delta H^\circ(C_3H_8) - 5\underbrace{\Delta H^\circ(O_2)}_{0}$

$\Delta H_s = 3 \times (-394) + 4(-\overset{242}{\ }) - (-104)$

$\boxed{\Delta H_s = -2046 \text{ kJ.mol}^{-1}}$

3°/ $n = \dfrac{m}{M}$

$M(C_3H_8) = 3 \times M(C) + 8M(H)$
$= 3 \times 12 + 8 \times 1 = 44 \text{ g.mol}^{-1}$

$\boxed{n = \dfrac{240}{44} = 5{,}46 \text{ mol}}$

4°/ $E_{comb} = n \times \Delta H^\circ_s = 5{,}46 \times (-2046)$

$\boxed{E_{comb} = -11{,}17 \times 10^6 \text{ MJ}}$

Exercice 4 /

1°/ $Q = I \times t = 0{,}075 \times 1000 = 75\text{Ah}$

2°/ $E = Q \times U = 75 \times 12 = 900$ **Wh = 324 kJ**

3°/ $Q = n(\bar{e}) \times F \Longrightarrow n(\bar{e}) = \dfrac{Q}{F}$

$F = 96500\text{ C}$

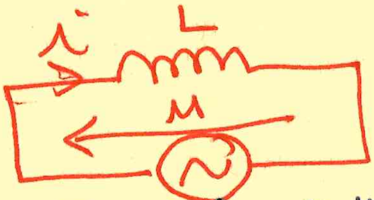
$Q = 75\text{Ah} = 75 \times 3600 = 27 \times 10^4 \text{ C}$

$n(\bar{e}) = \dfrac{27.10^4}{96500} = 2{,}8 \text{ mol}$

Nombre d'$\bar{e}$: $N = n(\bar{e}) \times N_A = 2{,}8 \times 6{,}02.10^{23}$

$\boxed{N = 16{,}84 \times 10^{23}\ \bar{e}}$

Exercice 5



$L = 275 \, mH$

$u(t) = 318 \cdot \sin(314t + \frac{\pi}{3})$

1°/ Fréquence $F = \frac{\omega}{2\pi} = \frac{314}{2\pi} = 50 \, Hz$

2°/ $U = \frac{U_{max}}{\sqrt{2}} \simeq \underline{\underline{225 \, V}}$

la phase à l'origine de $u(t)$: $\varphi_u = \underline{\underline{\frac{\pi}{3} \, rad}}$

3°/ $Z_L = L \times \omega = 0{,}275 \times 314 = \underline{\underline{86{,}625 \, \Omega}}$

4°/ $\underline{Z_L} = [L\omega \, ; +\frac{\pi}{2}] = [86{,}625 \, ; +\frac{\pi}{2}]$

5°/ $u(t) = 314 \cdot \sin(314t + \pi/3)$

$\underline{U} = [U \, ; \varphi_u] = [225 \, ; +\frac{\pi}{3}]$

6°/ $I = \frac{U}{Z_L} = \frac{225}{86{,}625} \simeq 2{,}6 \, A$

7°/ Puissance active : $P = U \cdot I \cdot \cos(\varphi_L)$

$P = 225 \times 2{,}6 \times \underbrace{\cos(\frac{\pi}{2})}_{0} = 0 \, W$

Puissance apparente : $S = U \cdot I$

$S = 225 \times 2{,}6 = \underline{\underline{585 \, VA}}$

$\boxed{P = 0 \, W}$ $\boxed{S = 585 \, V.A}$

Q5

$$f(x) = 2x - 1 - \ln(x)$$

$$x \in]0, +\infty[$$

a) $f'(x) = 2 - \frac{1}{x} = \frac{2x-1}{x}$

$\forall x \in]0, +\infty[$

b)

x	0		$1/2$		$+\infty$
$f'(x)$	‖	$-$	0	$+$	
$f(x)$	‖ $+\infty$	↘	$-\ln(1/2) = \ln 2$	↗	$+\infty$

Signe de $f'(x)$

x	0		$1/2$		$+\infty$
x	‖	$+$		$+$	
$2x-1$	‖	$-$	0	$+$	
$f'(x)$	‖	$-$	0	$+$	

$f\left(\frac{1}{2}\right) = -\ln\left(\frac{1}{2}\right)$
$= \ln 2$

$$\lim_{\substack{x \to 0 \\ x>0}} f(x) = \lim_{\substack{x \to 0 \\ x>0}} 2x - 1 - (\ln(x)) = -(-\infty) = +\infty$$

$$\lim_{x \to +\infty} f(x) = \lim_{x \to +\infty} (2x - 1 - \ln(x))$$

$$= \lim_{x \to +\infty} x\left(2 - \underbrace{\frac{1}{x}}_{0} - \underbrace{\frac{\ln(x)}{x}}_{0}\right) \quad \text{car } \ln x < x$$

$$= +\infty \times 2$$

$$=$$

$$\boxed{\lim_{x \to +\infty} f(x) = +\infty}$$

Mathématiques

Q1

1°/ $\ln(35) = \ln(5 \times 7) = \ln(5) + \ln(7)$

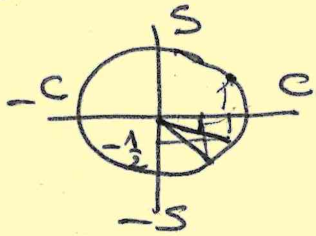
2°/ $e^{20} = e^{5+15} = e^{5} \times e^{15} \quad (e^{a} \times e^{b} = e^{a+b})$

Q2

a) $z_1 = \sqrt{3} - i$

module de $z_1 = \sqrt{(\sqrt{3})^2 + (-1)^2} = \sqrt{3+1} = 2$

argument de z_1 : $\begin{cases} \cos\theta_1 = \dfrac{\sqrt{3}}{2} \\ \sin\theta_1 = -\dfrac{1}{2} \end{cases}$



$\theta_1 = -\dfrac{\pi}{6}$

$$\boxed{z_1 = 2e^{-i\frac{\pi}{6}}}$$

b) $\dfrac{z_1}{z_2} = \dfrac{2e^{-i\pi/6}}{-\sqrt{2}.e^{i\pi/4}} = -\dfrac{2}{\sqrt{2}} e^{i(-\frac{\pi}{6} - \pi/4)}$

$\dfrac{z_1}{z_2} = -\sqrt{2}\, e^{-i(\frac{\pi}{6} + \frac{\pi}{4})} = -\sqrt{2} . e^{-i(\frac{2\pi + 3\pi}{12})}$

$\dfrac{z_1}{z_2} = -\sqrt{2}\, e^{-i\frac{5\pi}{12}} \qquad -1 = e^{i\pi}$

donc $\dfrac{z_1}{z_2} = (-1) \times \sqrt{2}\, e^{-i\frac{5\pi}{2}} = e^{i\pi} \times \sqrt{2}\, e^{-i\frac{5\pi}{12}}$

$\dfrac{z_1}{z_2} = \sqrt{2} . e^{i(\pi - \frac{5\pi}{12})} = \sqrt{2}\, e^{i(\frac{12\pi - 5\pi}{12})}$

$$\boxed{\dfrac{z_1}{z_2} = \sqrt{2} . e^{i\frac{7\pi}{12}}}$$

Q3

a) $e^{-0,0434x} = 0,01$

$\Longrightarrow -0,0434x = \ln(0,01)$

$\Longrightarrow x = \dfrac{-\ln(0,01)}{0,0434} = 106,11$

b) $P(0) = 6,75\,mW$

lorsque le signal aura perdu 99% de sa puissance il lui reste donc il lui reste 1% du signal.

$$P(x) = \cancel{6,75}.e^{-0,0434x} = \underbrace{(1-0,99)\times \cancel{6,75}}_{1\% \text{ du signal}}$$

$\Longrightarrow e^{-0,0434x} = 0,01$

$\Longrightarrow x = 106,1\,km$

$\boxed{x \simeq 107\,km}$

Q4 $f(x) = \ln(x)$ $x \in]0, +\infty[$

A : $(e, 1)$

équation de la tangente au point A

$y(x) = f'(e)(x-e) + f(e)$

$f'(x) = \dfrac{1}{x} \Longrightarrow f'(e) = \dfrac{1}{e}$; $f(e) = \ln(e) = $

$y(x) = \dfrac{1}{e}(x-e) + 1 = e^{-1}x - 1 + 1 = \dfrac{x}{e}$

$y(x) = \dfrac{x}{e}$ et $y(0) = 0$

donc la tangente à la courbe C_f au point A passe par l'origine.