Certificat MEP 2018 :
Corrigés

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partie 1

1. $\frac{7}{7+5+4} = \frac{7}{16}$

2. L'octaèdre

3. $4 \cdot 10 = 40\,N$

4. Poulie mobile à 3 brins : $\frac{12}{3} \cdot 10 = 40\,N$

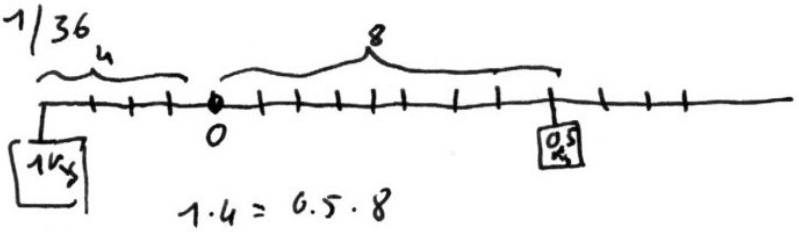
5. virtuelle et droite

6. la distance focale

7. $x^2 - 12x + 32 = (x-4)(x-8) \Rightarrow E_D = \mathbb{R} \setminus \{4; 8\}$

8 $f(x) = -3/2\,x$

9. $1/36$

10. 

$1 \cdot 4 = 0.5 \cdot 8$

11. $\rho = \frac{0.460}{0.5 \cdot 10^{-3}} = 920 \text{ kg} \cdot \text{m}^{-3}$

12. Fonction valeur absolue

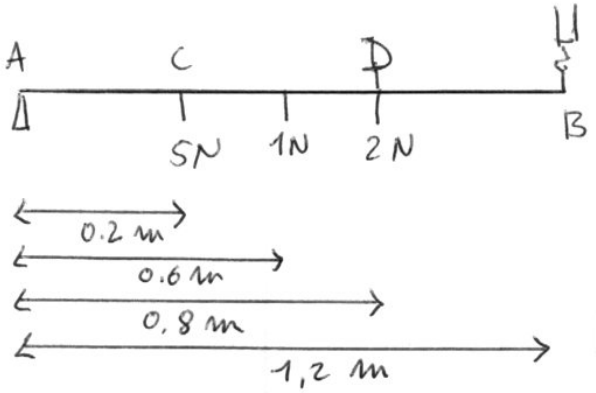
13. Fonction partie entière

14. $E_V = \mathbb{R}^*$; $E_D = \mathbb{R}$

15. (eau)

Partie 2

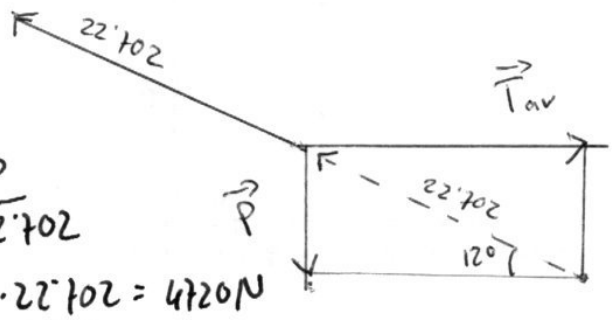
1. $\frac{3}{5} \cdot \frac{3}{5} + \frac{2}{5} \cdot \frac{2}{5} = \frac{13}{25}$

2. 

$F \cdot 1.2 = 5 \cdot 0.2 + 1 \cdot 0.6 + 2 \cdot 0.8 = 3.2 \text{ N} \cdot \text{m}$

$F = \frac{3.2}{1.2} = 2{,}67 \text{ N}$

3.



$\sin(12) = \frac{P}{22'702}$

$P = \sin(12) \cdot 22'702 = 4720\,N$

$m = \frac{P}{g} = \frac{4720}{10} = 472\,kg$

4. a) $m \neq 0$

b) $\Delta = 5^2 - 4 \cdot m \cdot m = 25 - 4m^2 = (5-2m)(5+2m)$

c) $\Delta = 0 \Rightarrow 25 - 4m^2 = 0 \Rightarrow m^2 = \frac{25}{4}$ $m = \pm \frac{5}{2}$

5. a) $m_{eau} \cdot C_{eau} \cdot (T_{i\,eau} - T_E) = m_{alu} \cdot C_{alu} \cdot (T_E - T_{i\,alu})$

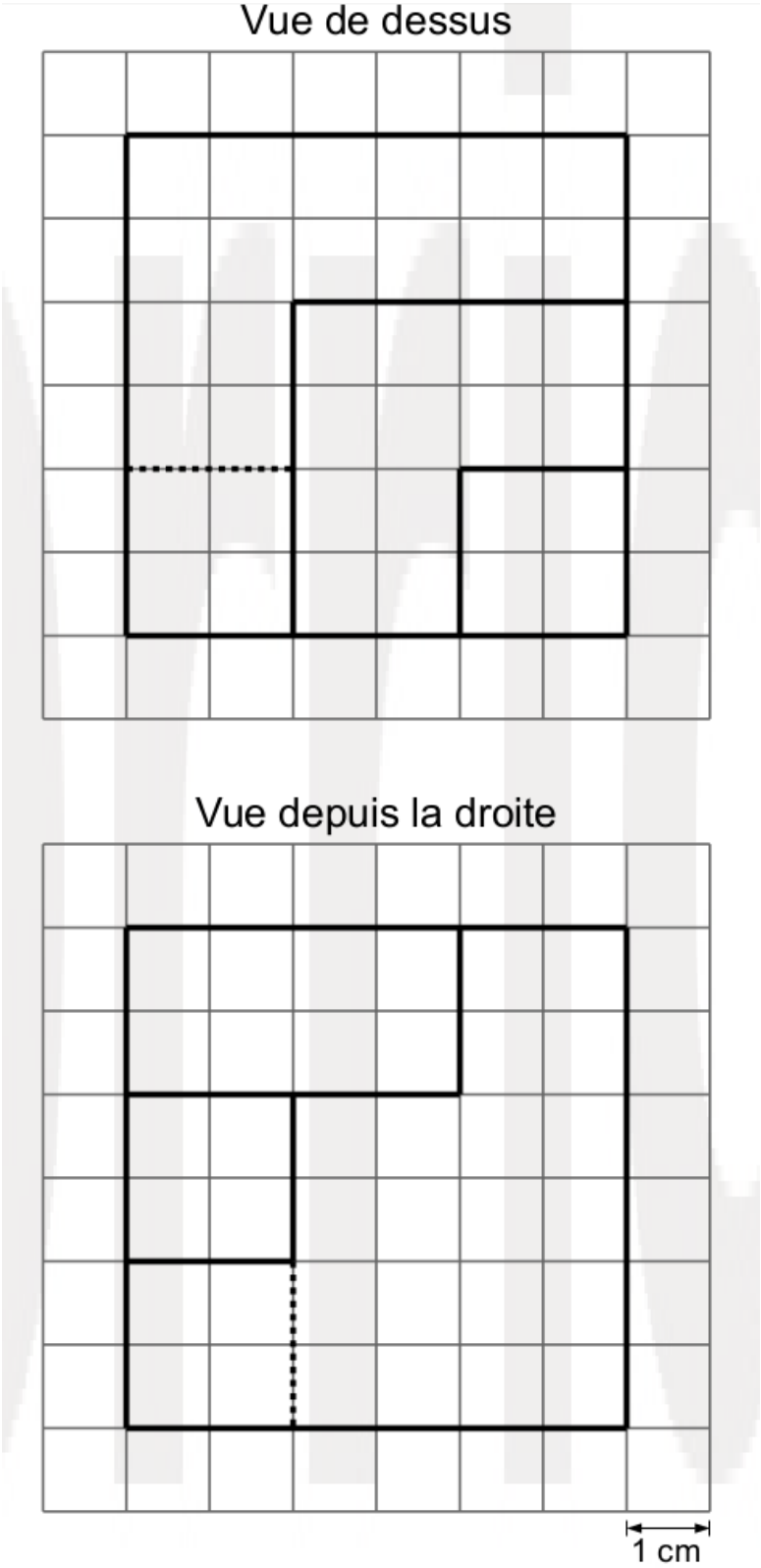
$0.1 \cdot 4180\,(90 - T_E) = 0.1 \cdot 897\,(T_E - 20)$

$37620 - 418\,T_E = 89{,}7\,T_E - 1794$

$39'414 = 507.7\,T_E \Rightarrow T_E = 77.63°$

b. La température aurait été plus élevée, il aurait fallu refroidir le calorimètre qui était à 90°C au départ.

6.



Partie 3

même pente :

$3m - 7(m+4) = 7m + 28$; $4m = -28$; $m = -7$

même ordonnée à l'origine :

$8m + 2 = -7$

$8m = -9$; $m = \frac{9}{8}$

a) $m = \{-7\}$

b) $m = \emptyset$

c) $m = \mathbb{R} \setminus \{-7\}$

d) $\frac{1}{-3m} = 7(m+4)$

$-1 = 21m(m+4)$

$21m^2 + 84m + 1 = 0$

$\Delta = 84^2 - 4 \cdot 21 \cdot 1 = 6972$

$m_1 = \frac{-84 + \sqrt{6972}}{2 \cdot 21} \approx -3.99$

$m_2 = \frac{-84 - \sqrt{6972}}{2 \cdot 21} = -0.0479$

$m = \{-3.99 ; -0.0479\}$

2. $P_u = \frac{40}{100} \cdot 100\,kW = 40\,kW = 40 \cdot 10^3\,W$

en 1 heure :

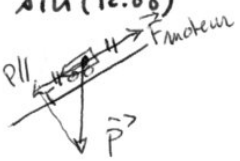
$E_u = P_u \cdot 3600 = 1.44 \cdot 10^8\,J = W$

$W = F_{moteur} \cdot d \Rightarrow F_{moteur} = \frac{W}{d} = \frac{1.44 \cdot 10^8}{10 \cdot 10^3} = 1.44 \cdot 10^4\,N$

$\tan\alpha = \frac{22.5}{100} \Rightarrow \alpha \cong 12.68°$

$P_{//} = F_{moteur}$; $\sin(12.68) = \frac{P_{//}}{P} \Rightarrow P = \frac{14'400}{\sin(12.68)} =$

$6.54 \cdot 10^4\,N$



$m_{totale} = \frac{P}{g} = 6.54 \cdot 10^3\,kg$

$m_{personnes} : 6.54 \cdot 10^3 - 3 \cdot 10^3 = 3.54 \cdot 10^3\,kg$

Nb personnes : $\frac{3.54 \cdot 10^3}{70} = 50.06 \rightarrow$ 50 personnes

3. a) $m \cdot g \cdot \Delta h = \frac{1}{2} m V^2$

$V = \sqrt{2 g \Delta h} = \sqrt{2 \cdot 10 \cdot 40} = \sqrt{800} \cong 28.3\,m\,s^{-1}$

b) $E = 0.8 \cdot m \cdot g \cdot \Delta h = 0.8 \cdot 0.1 \cdot 10 \cdot 40 = 32\,J$

$E = m\,C_{fer} \cdot \Delta T \Rightarrow \Delta T = \frac{E}{m \cdot C_{fer}} = \frac{32}{0.1 \cdot 449} = 0.71\,°C$

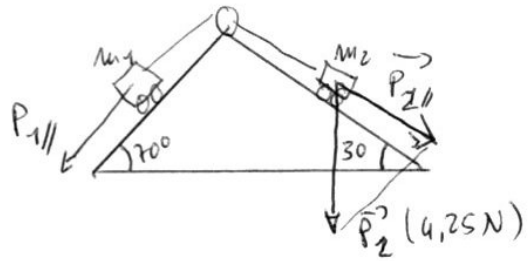
c) E pour faire fondre le fer ($T°_{fusion} = 1538°C$)

$m \cdot C \cdot \Delta T + m \cdot L_f = 0.1 \cdot 449 \cdot (1538 - 20) + 0.1 \cdot 2.47 \cdot 10^5 =$

$9.286 \cdot 10^4\,J$

$\Delta h = \frac{E}{m \cdot g} = \frac{9,286 \cdot 10^4}{0.1 \cdot 10} = 9.286 \cdot 10^4\,m \cong 93\,km$

4.



$m_2 = 0.3 + 0.125 = 0.425\ kg \Rightarrow P_2 = 4,25\ N$

$\sin(30°) = \frac{P_{2//}}{P_2} \Rightarrow P_{2//} = P_2 \cdot \sin(30) = 2.125\ N$

$P_{1//} = P_{2//} = 2.125\ N$

$\sin(70) = \frac{P_{1//}}{P_1} \Rightarrow P_1 = \frac{P_{1//}}{\sin(70)} = \frac{2,125}{\sin(70)} = 2,261\ N$

$m_1\ totale = \frac{P_1}{g} = 0,2261\ kg$

$m\ piece = 0,2261 - 0.125 = \underline{\underline{0.1011}}\ kg$

5. $g = 3.6\ cm$; $p' = 1200\ cm$, $g' = 200\ cm$

$\frac{g'}{g} = \frac{p'}{p} \Rightarrow p = \frac{p' \cdot g}{g'} = \frac{1200 \cdot 3.6}{200} = 21.6\ cm$

$\frac{1}{f} = \frac{1}{p_\infty} + \frac{1}{p'} \Rightarrow f = \frac{1}{\frac{1}{p} + \frac{1}{p'}} = \frac{1}{\frac{1}{21.6} + \frac{1}{1200}} = \underline{\underline{21.2\ cm}}$

6. une vaisselle :

	A	B	C
m_{eau} [kg]	5	10	20
$\Delta T°$ [°C]	60	30	30
E [J] $(m_{eau} \cdot C \cdot \Delta T)$	$1.254 \cdot 10^6$	$1.254 \cdot 10^6$	$2,508 \cdot 10^6$

$1\,kWh = 3.6 \cdot 10^6$ J

$$\text{Prix par année} = \frac{E\,[J] \cdot 365 \cdot 0.2}{3.6 \cdot 10^6}$$

Prix A : 25.43 fr

Prix B : 25.43 fr

Prix C : 50.86 fr