١

1-

(a) 4 (1)

2-

(d) $\left(\frac{2}{3}; \frac{5}{3}\right)$ (1)

3-

(a)

$\vec{R} = \vec{BA} = (-1; 1; -4)$ ($\frac{1}{2}$)

$M_B = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -1 & 1 & -4 \\ 3 & -2 & 4 \end{vmatrix}$ ($\frac{1}{2}$)

$= -4\vec{i} - 8\vec{j} - \vec{k}$ ($\frac{1}{2}$)

la longueur de la perpendiculaire

$= \frac{\| \vec{M_B} \|}{\| \vec{F} \|}$ ($\frac{1}{2}$)

$= \frac{\sqrt{(-4)^2 + (-8)^2 + (-1)^2}}{\sqrt{(3)^2 + (-2)^2 + (4)^2}}$ ($\frac{1}{2}$)

$= \frac{9\sqrt{29}}{29}$

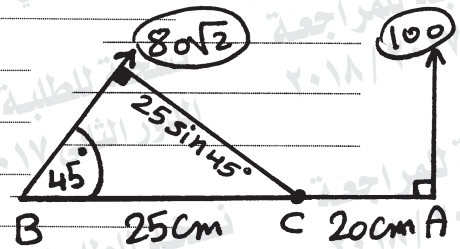
$= 1,67$ ($\frac{1}{2}$) Unités de longueur

(b)

$\therefore M_C = 100 \times 20 - 80\sqrt{2} \times 25 \sin 45°$ (1)

$= 2000 - 2000$

$=$ Zéro $(\frac{1}{2})$



$\therefore$ la ligne de l'action de la résultante passe par le point C $(\frac{1}{2})$

la norme du moment de la résultante par rapport A

$= -80\sqrt{2} \times 45 \sin 45$ $(\frac{1}{2})$

$= -3600$ Newton.m $(\frac{1}{2})$

(تراعى الحلول الأخرى)

4-

(b) 18 (1)

5-

(b) 55 (1)

6-

(a)

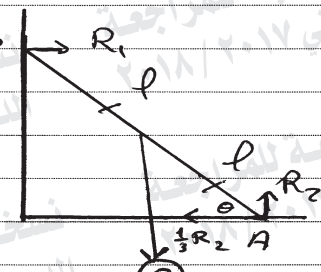
∴ la barre est équilibre

∴ $x = 0$; $y = 0$ et $M_A = 0$

$R_2 = P$

$R_1 = \frac{1}{3} R_2$

$R_1 = \frac{1}{3} P$ ($\frac{1}{2}$)



($\frac{1}{2}$)

On suppose que la longueur de la barre = 2ℓ cm

∴ $M_A = 0$ ($\frac{1}{2}$)

∴ $P \times \ell \cos\theta - R_1 \times 2\ell \sin\theta = 0$

∴ $P\ell \cos\theta = \frac{1}{3} P \times 2\ell \sin\theta$ ($\frac{1}{2}$)

∴ $\frac{\sin\theta}{\cos\theta} = \frac{3}{2} \Rightarrow \tan\theta = \frac{3}{2}$ ($\frac{1}{2}$)

∴ $m(\angle\theta) = 56^\circ 19'$ ($\frac{1}{2}$)

(b)

∴ la tige est équilibre

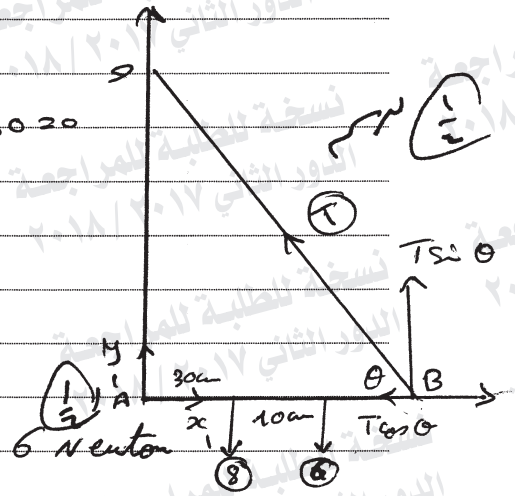
∴ $x = 0$; $y = 0$ et $M_A = 0$ (1/2)

∴ $M_A = 0$

∴ $T \sin\theta \times 60 - 6 \times 40 - 8 \times 30 = 0$

$T \times \frac{4}{5} \times 60 = 480$

$T = 10$ Newton (1/2)



$x_1 = T \cos\theta = 10 \times \frac{3}{5} = 6$ Newton

$y_1 = 6 + 8 - T \sin\theta = 14 - 10 \times \frac{4}{5}$

$y_1 = 6$ Newton (1/2)

∴ $R = \sqrt{(x_1)^2 + (y_1)^2} = \sqrt{(6)^2 + (6)^2}$

$= 6\sqrt{2}$ Newton (1/2)

(تراعى الحلول الأخرى)

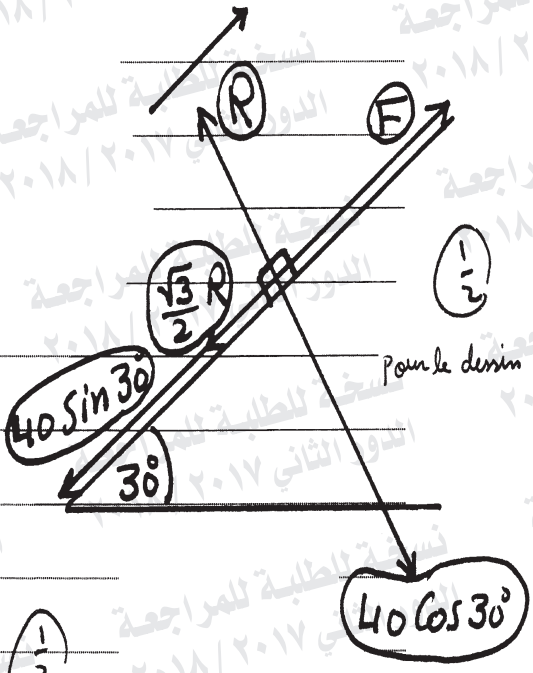
7-

(c) $\mu_s > \mu_D$ (1)

8-

(d) 32 (1)

9-



$\therefore R = 40 \cos 30$

$\therefore R = 20\sqrt{3}$ Newton $\frac{1}{2}$

$F = 40 \sin 30 + \frac{\sqrt{3}}{2} R$ $\frac{1}{2}$

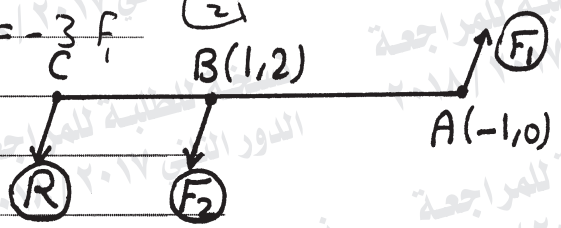
$= 20 + \frac{\sqrt{3}}{2} \times 20\sqrt{3} = 50$ Newton $\frac{1}{2}$

10-

$\therefore \vec{F_1} = 3\vec{i} - \vec{j} \Rightarrow A(-1;0)$

$\vec{F_2} = -9\vec{i} + 3\vec{j} \Rightarrow B(1;2)$

$\therefore \vec{F_2} = -3(3\vec{i} - \vec{j}) = -3\vec{F_1}$ (1/2)



$\therefore$ C est le point d'application

de la résultante partage $\overline{AB}$

extérieurement du rapport 3 : 1 (1/2)

$\therefore \vec{R} = \vec{F_1} + \vec{F_2} = -6\vec{i} + 2\vec{j}$ (1/2)

$C = \left(\frac{3\times 1 - 1(-1)}{3-1} ; \frac{3\times 2 - 1\times 0}{3-1} \right)$

$= (2;3)$ (1/2)

(تراعى الحلول الأخرى)

11-

(b) $20\sqrt{5}$ (1)

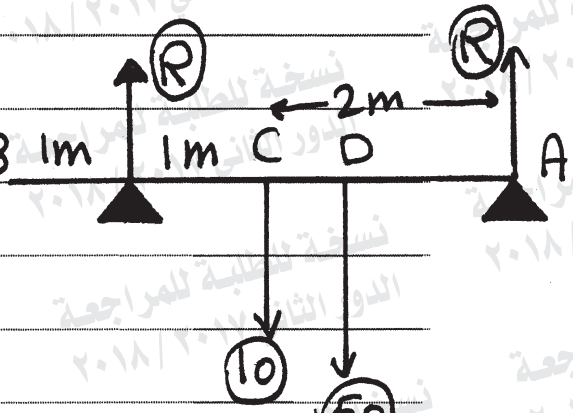
12-

(C) 49 (1)

13-

$R + R = 50 + 10$

$R = 30$ ($\frac{1}{2}$)

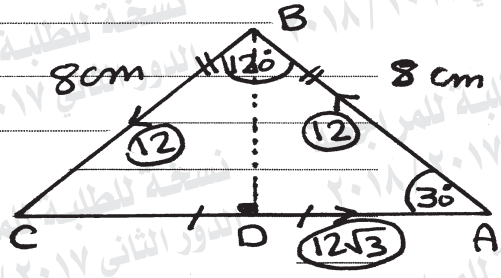


$M_A = 0$ ($\frac{1}{2}$)

$50 \times AD + 10 \times 2 - 30 \times 3 = 0$ ($\frac{1}{2}$)

$\therefore AD = 1,4$ mètre ($\frac{1}{2}$)

14-



$\therefore AD = 8 \cos 30$

$\therefore AD = 4\sqrt{3}$ cm

$\therefore AC = 8\sqrt{3}$ cm

$\therefore \frac{12}{8} = \frac{12}{8} = \frac{12\sqrt{3}}{8\sqrt{3}} = \frac{3}{2} = m$ (1)

$\therefore$ les forces sont prise dans un ordre cyclique

$\therefore$ le système equivalent à un couple ($\frac{1}{2}$)

$\therefore$ la norme du moment du couple

$= 2 \times$ l'aire du triangle $\times m$ ($\frac{1}{2}$)

$= 2 \times \left(\frac{1}{2} \times 8 \times 8 \times \sin 120°\right) \times \frac{3}{2}$ ($\frac{1}{2}$)

$= 48\sqrt{3}$ N.cm ($\frac{1}{2}$)

(تراعى الحلول الأخرى)

15-

(c) $\frac{\sqrt{3}}{2}$ f l (1)

16-

(c) $20\sqrt{3}$ (1)

17-

$\therefore \vec{R} = \vec{F_1} + \vec{F_2} + \vec{F_3}$

$= 2\vec{i} - 4\vec{j} + \vec{i} - 3\vec{j} - 3\vec{i} + 7\vec{j}$

$\therefore \vec{R} = \vec{0}$ ... (1) (1)

$\therefore \vec{R_0} = \vec{OA} \times \vec{F_1} + \vec{OB} \times \vec{F_2} + \vec{OC} \times \vec{F_3}$ (½)

$= (-1;1)(2;-4) + (-2;3)(1;-3)$ (½)

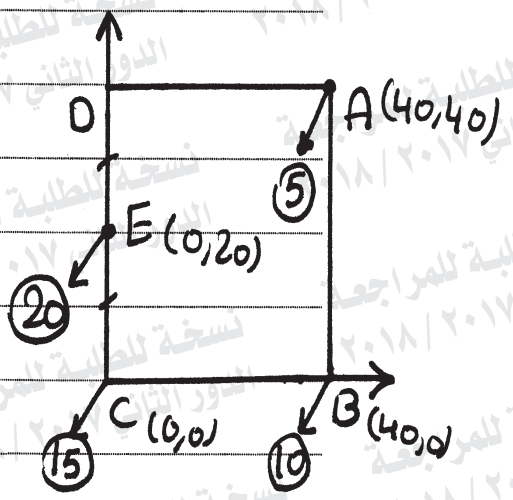
$+ (0;1)(-3;7)$

$= 2\vec{k} + 3\vec{k} + 3\vec{k}$ (½)

$= 8\vec{k}$ (½) Unités du moment

18-

	C	B	A	E
	15	10	5	20
x	0	40	40	0
y	0	0	40	20



$$x_G = \frac{15\times0 + 10\times40 + 5\times40 + 20\times0}{15+10+5+20}$$

$$= 12 \text{ cm} \quad (\tfrac{1}{2})$$

$$y_G = \frac{5\times40 + 20\times20}{50}$$

$$= 12 \text{ cm} \quad (\tfrac{1}{2})$$

$\therefore$ le Centre de gravité (12, 12)

$$\tan\theta = \frac{y_G}{x_G} = 1 \quad (\tfrac{1}{2})$$

$$m(\angle\theta) = 45^\circ \quad (\tfrac{1}{2})$$

(تراعى الحلول الأخرى)

(انتهت الإجابة وتراعى الحلول الأخرى)