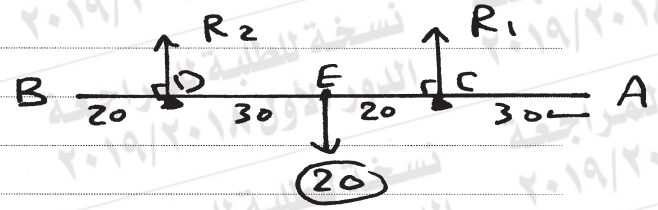
1-

(C) 26 (1)

2-

(a) $F = 15\ N$, $K = 10\ N$ (1)

3-



First case:

$R_1 + R_2 = 20$ (1)

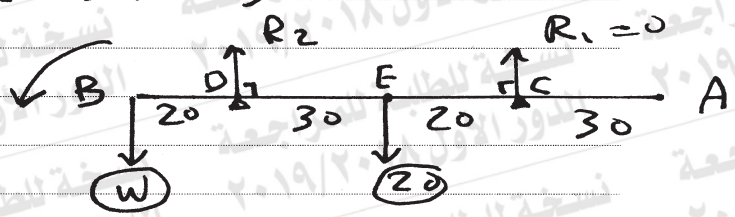
$\because M_D = 0$

$\therefore 50 \times R_1 - 20 \times 30 = 0$ (½)

$\therefore R_1 = 12\ N$

From (1) $R_2 = 8\ N$ (½)

second case:



∴ The rod is about to rotate at B

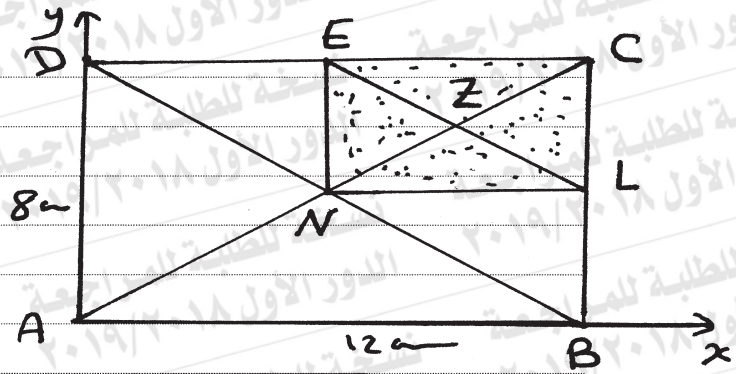
$\therefore R_1 = 0$, $M_D = 0$ (½)

$\therefore W \times 20 - 20 \times 30 = 0$

$\therefore W = 30\ N$ (½)

(2)

4-



	N	Z
mass	4 m	- m
x	6	9
y	4	6

$$X_G = \frac{4m \times 6 - 9m}{3m} = 5\,cm$$

$$Y_G = \frac{4m \times 4 - 6m}{3m} = \frac{10}{3}\,cm$$

3

5-

(b) $(4,0)$ (1)

6-

(c) $\left(\frac{13}{2}, 3\frac{\sqrt{3}}{2}\right)$ (1)

7-

(A) $\vec{M_o} = \vec{r} \times \vec{F}$

$= (1,-1,1) \times (-2,3,5)$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 1 \\ -2 & 3 & 5 \end{vmatrix}$$ (1/2)

$= -8\hat{i} - 7\hat{j} + \hat{k}$ (1/2)

$\therefore L = \frac{\|\vec{M_o}\|}{\|\vec{F}\|} = \frac{\sqrt{(-8)^2 + (-7)^2 + 1}}{\sqrt{4+9+25}}$ (1/2)

$= \sqrt{3}$ length Unit. (1/2)

(2)

(B) $\vec{M}_O = \vec{0}$

$\therefore \overrightarrow{OA} \times \vec{F}_1 + \overrightarrow{OB} \times \vec{F}_2 = \vec{0}$ ½

$\therefore (5,1) \times (1,2) + (0,3) \times (m,-4) = \vec{0}$ ½

$\therefore (9 - 3m)\hat{k} = \vec{0}$

$\therefore m = 3$ ½

$L = \frac{\|\vec{M}_O\|}{\|\vec{F}_2\|} = \frac{\|-9\hat{k}\|}{\sqrt{9+16}}$

$= \frac{9}{5}$ Length unit ½

2

(تراعى الحلول الأخرى)

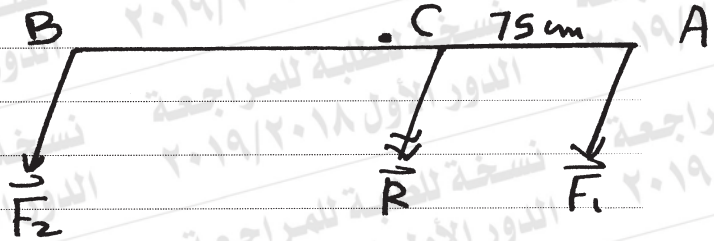
8-

(b) $-50\sqrt{2}$ (1)

9-

(b) $R = 5$ Kg.wt , $l = 1$ m (1)

10-



$\because \vec{F_1}, \vec{R}$ are in the same direction

$, R > F_1$

$\because \vec{F_2}, \vec{F_1}$ are in the same direction (½)

$\therefore R = F_1 + F_2$

$\therefore 150 = 100 + F_2$

$\therefore F_2 = 50$ N (½)

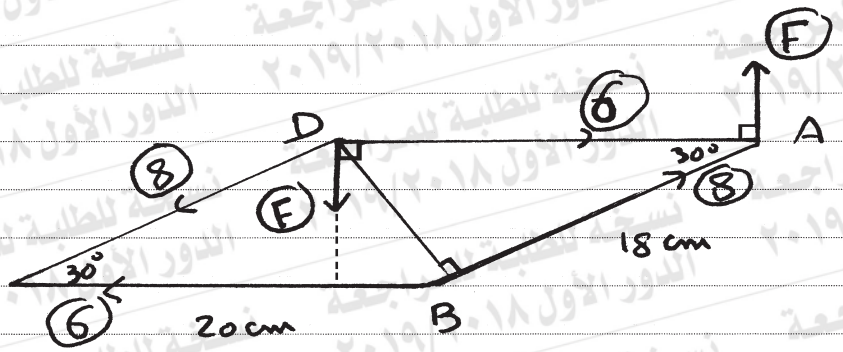
$, \because F_1 \times AC = F_2 \times BC$

$\therefore 100 \times 75 = 50\, BC$ (½)

$\therefore BC = 150$ (½)

where $B \in \overrightarrow{AC}$, $B \notin \overline{AC}$ (2)

11-



The two forces (8, 8) form a couple of moment M_1,

$M_1 = 8 \times 20 \sin 30°$

$= 80$ N.cm ½

The two forces (6, 6) form a couple of moment M_2,

$M_2 = -6 \times 18 \sin 30°$

$= -54$ N.cm ½

∴ The system is equivalent to a couple of moment $M = M_1 + M_2$

$= 80 - 54 = 26$ N.cm ½

$\therefore \|\vec{M}\| = 26$ N.cm ½

∴ The directions of the two forces F, F are as indicated in the figure ½

∴ $F \times 20 = 26$

∴ $F = 1.3$ N. ½

3

(تراعى الحلول الأخرى)

12-

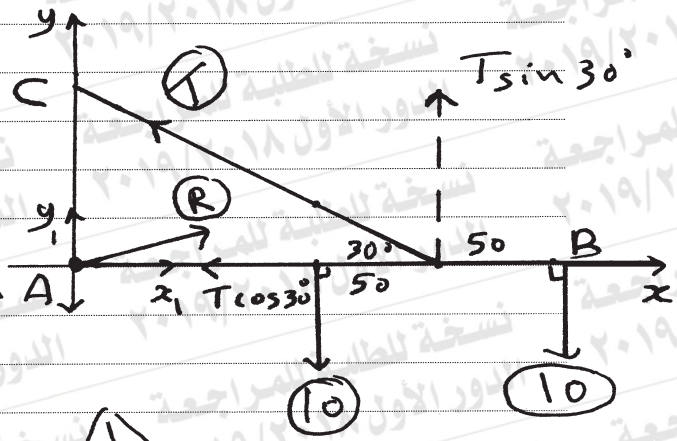
(a) 600 (1)

13-

(d) $LF\frac{\sqrt{3}}{2}$ (1)

14-

(A)



$\therefore y = 0$

$\therefore T\sin 30° + y_1 = 20$

$\therefore \frac{1}{2}T + y_1 = 20$ (1) (1/2)

$\because x = 0$

$\therefore x_1 = T\cos 30°$

$\therefore x_1 = \frac{\sqrt{3}}{2}T$ (2) (1/2)

$\because M_A = 0$

$\therefore T\sin 30° \times 150 = 10 \times 100 + 10 \times 200$ (1/2)

$\therefore 75T = 3000$

$\therefore T = 40\ N$ (1/2)

From (1) $\therefore y_1 = 0$

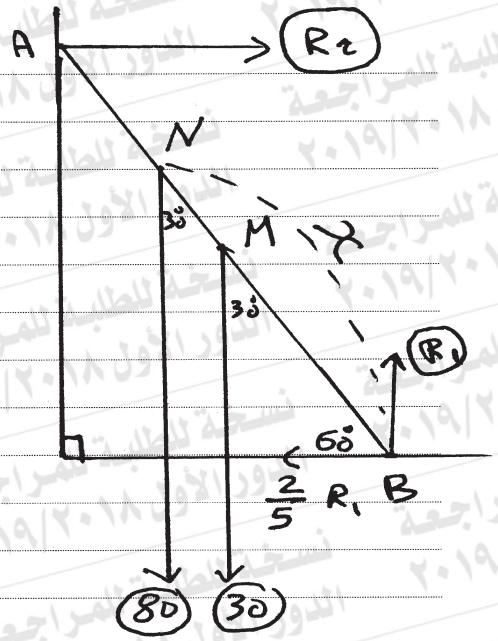
From (2) $\therefore x_1 = 20\sqrt{3}$

$\therefore R = 20\sqrt{3}\ N$ (1/2)

and acts in direction of $\overrightarrow{AB}$ (1/2)

3

(B)



Let the greatest distance the man can ascend = x

$\therefore R_1 = 30 + 80$

$\therefore R_1 = 110$ kg. wt (½)

$\because R_2 = \frac{2}{5} R_1$

$\therefore R_2 = \frac{2}{5} \times 110 = 44$ kg. wt. (½)

$\because M_B = 0$

$\therefore 30 \times 2.5 \sin 30^\circ + 80 x \sin 30^\circ - 44 \times 5 \sin 60^\circ = 0$ (1)

$\therefore 15 \times 2.5 + 40x - 22 \times 5\sqrt{3} = 0$ (½)

$\therefore x \simeq 3.83$ m (½)

3

(تراعى الحلول الأخرى)

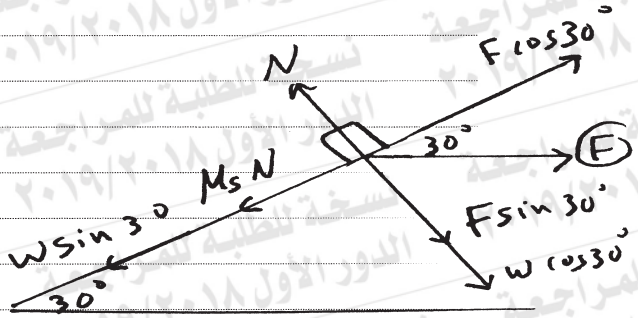
15-

(b) $\lambda = 60^\circ$ (1)

16-

(c) $P = 100\ N$, $\lambda = 30^\circ$ (1)

17-



$W = 2 \times 9.8 = 19.6\ N$ (½)

$N = F\sin 30^\circ + W\cos 30^\circ$

$= 20 \times \frac{1}{2} + 19.6 \times \frac{\sqrt{3}}{2}$

$\therefore N = \frac{50 + 49\sqrt{3}}{5}$ (½)

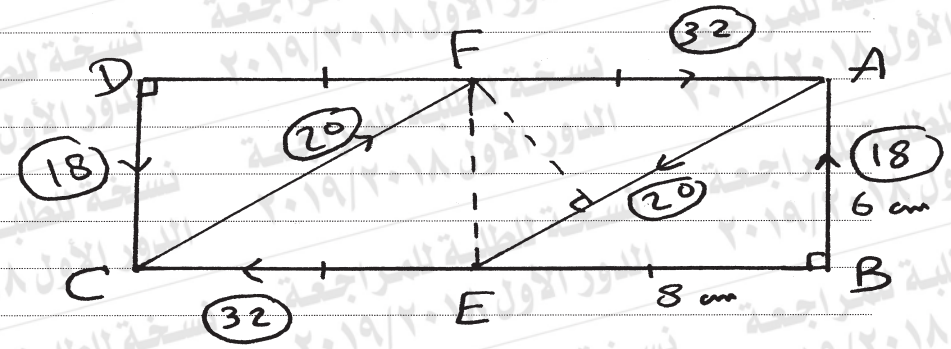
$F\cos 30^\circ = 19.6 \sin 30^\circ + \mu_s N$ (½)

$\therefore \mu_s = (10\sqrt{3} - 9.8) \div \frac{50 + 49\sqrt{3}}{5}$

$\simeq 0.2788$ (½)

2

18-



The two forces (32, 32) form a couple of moment:

$M_1 = -32 \times 6 = -192$ N.m ½

The two forces (18, 18) form a couple of moment:

$M_2 = 18 \times 16 = 288$ N.m ½

The two forces (20, 20) form a couple of moment:

$M_3 = -20 \times \frac{6 \times 8}{10} = -96$ N.m 1

$\therefore M_1 + M_2 + M_3 = -192 + 288 - 96$

$= 0$ ½

$\therefore$ The system is in equilibrium ½

3

(تراعى الحلول الأخرى)

(انتهت الإجابة وتراعى الحلول الأخرى)