MECAB

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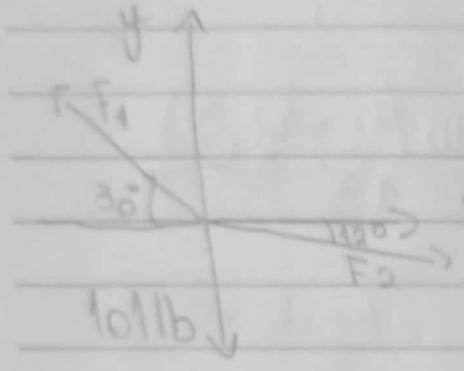
(1) N-78

$\sum m\ x: F_2\cos(12) - F_1\cos(30) = 0$

$\sum m\ y: F_1\sen(30) - F_2\sen(12) - 101 = 0$

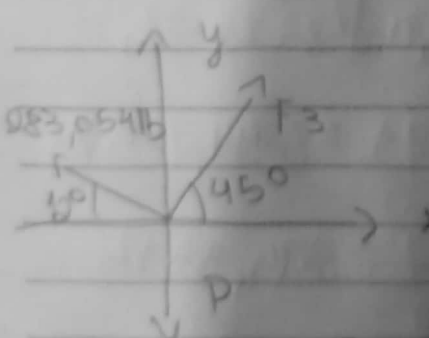


$$\begin{cases} F_1\cos(30°) - F_2\cos(12°) = 0 \\ F_1\sen(30°) - F_2\sen(12°) = 101 \end{cases}$$

$F_1 = \dfrac{F_2\cos(12)}{\cos(30°)} \Rightarrow F_2\cos(12°)\tg(30°) - F_2\sen(12°) = 101$

$F_2\left[\dfrac{\sqrt{3}}{3}\cos(12°) - \sen(12°)\right] = 101 \Rightarrow F_2 = \dfrac{101}{\left[\dfrac{\sqrt{3}}{2}\cos(12°) - \sen(12°)\right]}$

$\boxed{F_2 = 283{,}054\text{lb}}$



$\sum m\ x: -283{,}054\cos(12°) + F_3\cos(45°) = 0$

$\sum m\ y\ 283{,}054\sen(12°) + F_3\sen(45°) - P = 0$

$F_3 = \dfrac{283{,}054\cos(12°)}{\cos(45°)} = 391{,}551\text{lb}$

$P = 283{,}054\sen(12) + 391{,}551\sen(45°) = 335{,}718\text{lb}$

$\boxed{P = 335{,}718\text{lb}}$

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(2) $A=(0,0,0)$ $B=(0,y,0)$ $C=(2,-6,3)$ $D=(2,-6,3/2)$

$\vec{AB}=(0,y,0)$ $\vec{AC}=(2,-6,3)$ $\vec{AD}=(2,-6,\frac{3}{2})$

$\vec{1}_{AB}=1_{AB}(0,1,0)$ $\vec{1}_{AC}=\frac{1_{AC}(2,-6,3)}{\sqrt{4+36+9}}=\frac{1_{AC}(2,-6,3)}{7}$

$\vec{1}_{AD}=\frac{1_{AD}(2,-6,3/2)}{\sqrt{4+36+9/4}}=\frac{1_{AD}(2,-6,3/2)}{13/2}=\frac{1_{AD}(4,-12,3)}{13}$

Em x: $\frac{2\,1_{AC}}{7}-\frac{4\,1_{AD}}{13}=0$

Em y: $1_{AB}-\frac{6\,1_{AC}}{7}-\frac{12\,1_{AD}}{13}=0$ $\quad P=9,81\cdot 91=892,71$

Em z: $\frac{3\,1_{AC}}{7}+\frac{3\,1_{AD}}{13}-P=0$

$$\begin{bmatrix} 0 & 2/7 & -4/13 & 0 \\ 1 & -6/7 & -12/13 & 0 \\ 0 & 3/7 & 3/13 & 892,71 \end{bmatrix} \sim \begin{bmatrix} 1 & -6/7 & -12/13 & 0 \\ 0 & 2/7 & -4/13 & 0 \\ 0 & 3/7 & 3/13 & 892,71 \end{bmatrix} L_3=2L_3-3L_1$$

$$\begin{bmatrix} 1 & -6/7 & -12/13 & 0 \\ 0 & 2/7 & -4/13 & 0 \\ 0 & 0 & 18/13 & 892,71 \end{bmatrix}$$

$1_{AD}=\frac{13\cdot 892,71}{18}=644,735\,N$

$1_{AC}=\frac{4\,1_{AD}}{13}\cdot\frac{7}{2}=694,33\,N$

$1_{AB}=\frac{12\,1_{AD}}{8}+\frac{6\,1_{AC}}{7}=1190,28\,N$

$1_{AB}=1190,28\,N$
$1_{AC}=694,33\,N$
$1_{AD}=644,735\,N$

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③ Momento do mosca:

$M = 99\ kg$, $P = 971,19\ N$

$M_A = 971,19 \cdot 0,3 = 291,357\ N.m$ ↺

Momentos de F:

$F_x = F\,sen(30°) = \frac{F}{2}$ $\quad F_y = F\,cos(30°) = \frac{\sqrt{3}F}{3}$

$M_A = F_x d_x + F_y d_y = \frac{1,5F}{2} + \frac{1,5\sqrt{3}F}{3}$ ↻

Equilíbrio:

$\sum M_A = 0$

$\frac{1,5F}{2} + \frac{1,5\sqrt{3}F}{3} - 291,357 = 0$

$\frac{4,5F + 2,5\sqrt{3}F}{6} = 291,357 \Rightarrow F = \frac{291,357 \cdot 6}{4,5 + 2,5\sqrt{3}} = 197,974$

$F = 197,974\ N$

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(4) $A = (2,5 \; , \cos(15), \operatorname{sen}(15))$

$B = (0,5 \; ; 0 ; 2) \quad \overrightarrow{AB} = (2, \cos(15) \; 2 - \operatorname{sen}(15))$

$\vec{F} = \dfrac{850(2 ; 0,965 ; 1,741)}{|\overrightarrow{AB}|} = 301,23 \; (2 ; 0,965 ; 1,741)$

$\vec{r} = \overrightarrow{OB} = (0,5 \; , 0 ; 2)$

$\vec{M} = \vec{r} \times \vec{F} =$

$\hat{i}$	$\hat{j}$	$\hat{k}$
1/2	0	2
602,46	290,686	524,441

$\vec{M} = -581,372\hat{i} + 942,699\hat{j} + 145,343\hat{k}$

$|M| = \sqrt{M \cdot M} = 1117,049$

$\alpha = \cos^{-1}\left(\dfrac{-581,372}{1117,049}\right) = 121,360^{\circ}$

$\beta = \cos^{-1}\left(\dfrac{942,699}{1117,049}\right) = 32,443^{\circ}$

$\gamma = \cos^{-1}\left(\dfrac{142,343}{1117,049}\right) = 82,679^{\circ}$

$|M| = 1117,049 \; N \cdot m \quad \alpha = 121,302^{\circ} \quad \beta = 32,443^{\circ} \quad \gamma = 82,679^{\circ}$

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(5) $|\vec{F_1}| = 91\,N \quad |\vec{F_2}| = 85\,N$

$\vec{F_1} = 91\,(\cos(45), \operatorname{sen}(45)) = \left(\frac{91\sqrt{2}}{2}, \frac{91\sqrt{2}}{2}\right) N$

$\vec{F_2} = 85\,(\cos(60), \operatorname{sen}(60)) = \left(\frac{-85}{2}, \frac{85\sqrt{3}}{2}\right)$

$\vec{F_1} + \vec{F_2} = \left(\frac{91\sqrt{2} - 85\sqrt{3}}{2}, \frac{91\sqrt{2} + 85\sqrt{3}}{2}\right)$

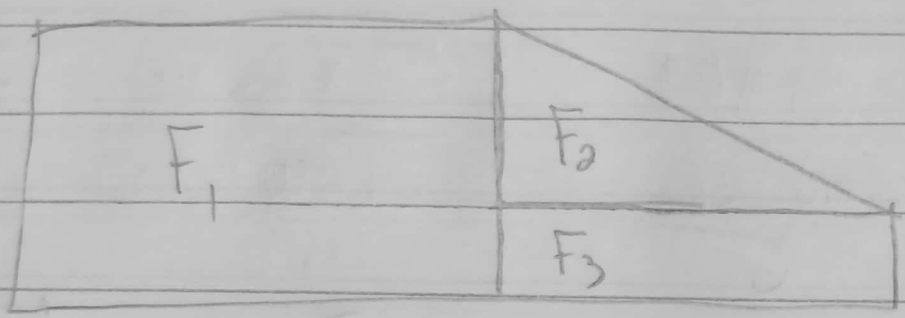
Momento:

$M_O = |\vec{F_1} + \vec{F_2}| \cdot 3{,}3 + |\vec{F_1} + \vec{F_2}| \cdot 1{,}8 = 1{,}5\,|\vec{F_1} + \vec{F_2}| = 209{,}516$ ↺

$M_O = 209{,}516\,N \cdot m$ ↺

$M_O = 209,516\ N \cdot m$ ↺

⑥



$F_1 = w_1 \cdot 2 = 630 \cdot 2 = 1260$

$F_2 = 3(w_1 - w_2) = 3 \cdot 470 = 1410$

$F_3 = 3 w_2 = 3 \cdot 160 = 480$

$\bar{x}_1 = 1 \qquad \bar{x}_2 = 2 + \frac{3}{3} = 3 \qquad \bar{x}_3 = 2 \times 1,5 = 3,5$

$$\bar{X} = \frac{1260 + 3 \cdot 1410 + 3,5 \cdot 480}{1260 + 1410 + 480} = 2,276$$

$F_R = 3150\ N \qquad \bar{x} = 2,276\ m$