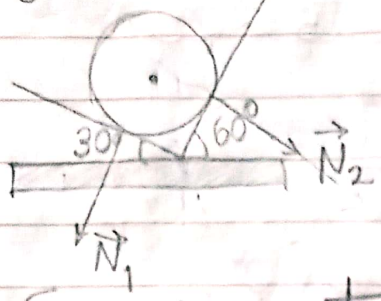
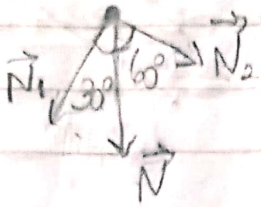
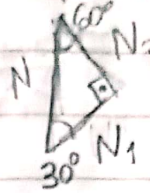
1) $g = 9{,}8\ m/s^2$







$\|\vec{N}\| = \|\vec{P}\| = mg = 1 \cdot 9{,}8$

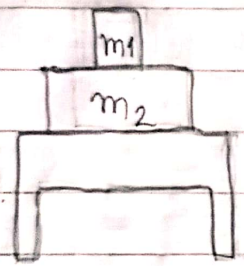
$\|\vec{N}\| = 9{,}8\ N$

Com isso, temos que:

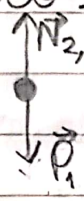
$\cos 30° = \frac{N_1}{N} \Rightarrow \frac{\sqrt{3}}{2} = \frac{N_1}{9{,}8} \Rightarrow \boxed{N_1 = 4{,}9\sqrt{3}\ N}$

$\operatorname{sen} 30° = \frac{N_2}{N} \Rightarrow \frac{1}{2} = \frac{N_2}{9{,}8} \Rightarrow \boxed{N_2 = 4{,}9\ N}$

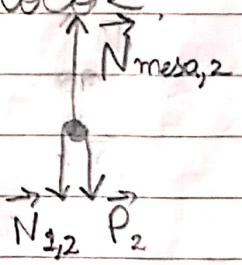
2)



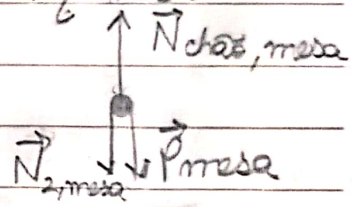
a) bloco 1:



bloco 2:

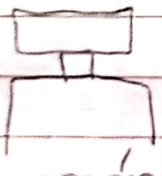


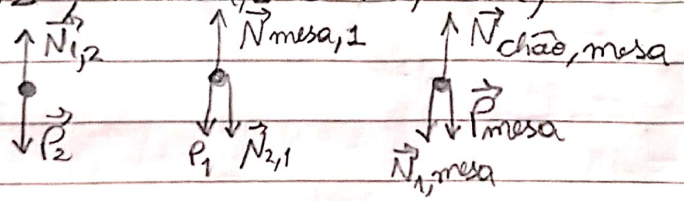
mesa:



b) $\vec{N}_{2,1}$ e $\vec{N}_{1,2}$; $\vec{N}_{mesa,2}$ e $\vec{N}_{2,mesa}$;

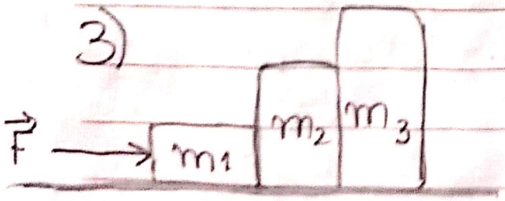
c)





os módulos permanecem os mesmos, o que muda é a posição de alguns vetores

3)



a) $\Sigma \vec{F} = m \cdot \vec{a}$

$m_1 a_1 + m_2 a_2 + m_3 a_3 = m\vec{a} = 18$

$m = m_1 + m_2 + m_3 = 9\ kg$

$18 = 9 \cdot a \Rightarrow a = 2\ m/s^2$

$a_1 = a_2 = a_3 = a = 2\ m/s^2$ pois se movem juntos

b) $F_1 = 2 \cdot 2 = 4\ N$. $F_2 = 3 \cdot 2 = 6\ N$; $F_3 = 4 \cdot 2 = 8\ N$

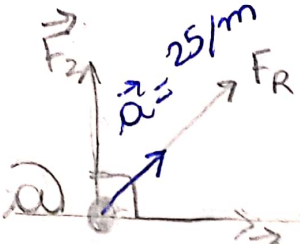
c) $F_{1,2} = F - F_1 = 18 - 4 = 14\ N$

$F_{2,3} = F - F_1 - F_2 = 18 - 4 - 6 = 8\ N$

$F_{2,1} = -14\ N$

$F_{3,2} = -8\ N$

4) a)

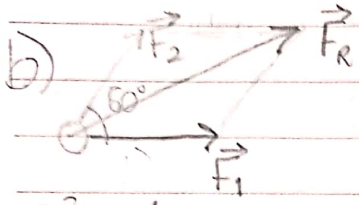


$\vec{F}_R = \vec{F}_1 + \vec{F}_2 \Rightarrow F_R^2 = F_1^2 + F_2^2$

$F_R^2 = 400 + 225 \Rightarrow F_R = \sqrt{625} = 25\,N$

$F_R = m \cdot a \Rightarrow a = \frac{F_R}{m} \Rightarrow \boxed{a = \frac{25}{m}}$

b)



$F_R^2 = F_1^2 + F_2^2 + 2F_1F_2\cos 60°$

$F_R^2 = 20^2 + 15^2 + 2 \cdot 20 \cdot 15 \cdot 1/2$

$F_R^2 = 400 + 225 + 300 \Rightarrow F_R^2 = 925 \Rightarrow F_R = \sqrt{925}$

$F_R = 5\sqrt{37}\,N$

5) $\vec{F} = m \cdot \vec{a} = 3(2\hat{i} + 5\hat{j}) = (6\hat{i} + 15\hat{j})\,N$

6) $V = V_0 + at$ $\quad V_x = V_{x0} + a_x t$ $\quad V_y = V_{y0} + a_y t$

$8 = 3 + a_x 8 \Rightarrow 5 = 8a_x \Rightarrow a_x = 5/8\,\hat{i}\,m/s^2$

$10 = 0 + a_y \cdot 8 \Rightarrow a_y = 10/8 = 5/4\,\hat{j}\,m/s^2$

$\vec{F}_R = m \cdot \vec{a} \Rightarrow \vec{F}_R = 4(5/8\,\hat{i} + 5/4\,\hat{j}) \Rightarrow \vec{F}_R = (5/2)\hat{i} + 5\hat{j})\,N$

7) a) $V^2 = V_0^2 + 2 \cdot a \cdot \Delta s \Rightarrow (7 \cdot 10^5)^2 = (3 \cdot 10^5)^2 + 2 \cdot a \cdot 5 \cdot 10^{-2}$

$49 \cdot 10^{10} = 9 \cdot 10^{10} + 10^{-1} a \Rightarrow 4 \cdot 10^{11} = 10^{-1} a$

$\vec{a} = 4{,}0 \cdot 10^{12}\,m/s^2$

$\vec{F} = m \cdot \vec{a}$

$\vec{F} = 9{,}11 \cdot 10^{-31} \cdot 4{,}0 \cdot 10^{12} \Rightarrow \vec{F} = 3{,}64 \cdot 10^{-18}\,N$

b) $P = m \cdot g = 9{,}11 \cdot 10^{-31} \cdot 9{,}8 \Rightarrow P = 8{,}93 \cdot 10^{-30}\,N$

$P \approx 10^{-31}$ $\quad \frac{F}{P} = \frac{10^{-18}}{10^{-31}} = 10^{13}$ A força resultante é 10^{13} vezes maior que o peso.

8) a) $\vec{F}_R = m \cdot \vec{a}$

$(-2\hat{i} + 2\hat{j}) + (5\hat{i} - 3\hat{j}) + (-15\hat{i}) = m \cdot \vec{a}$

$\vec{a} = \left(\frac{-12}{m}\hat{i} - \frac{1}{m}\hat{j}\right) m/s^2$

b) $|\vec{a}| = 3{,}75 = \sqrt{\frac{12^2}{m^2} + \frac{1}{m^2}} \Rightarrow 3{,}75^2 = \frac{12^2 + 1}{m^2}$

$m^2 = \frac{1765}{14{,}0625} \Rightarrow m = 11{,}2\,kg$

8)

c) $\vec{a} = \frac{-42}{11,2}\hat{i} - \frac{1}{11,2}\hat{j} = (-3,75\hat{i} - 0,09\hat{j})\ m/s^2$

d) $V = V_0 + at$

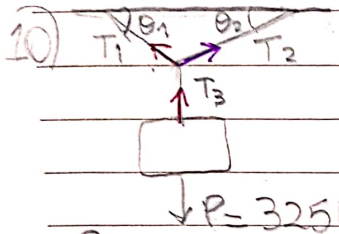
$V = 0 + 3,75 \cdot 10 \Rightarrow V = 37,5\ m/s$

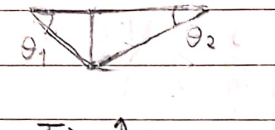
9) a) $F_R = m.a$ $\quad s = s_0 + v_0 t + \frac{a}{2}t^2$ $\quad a_x = 5\ m/s^2$

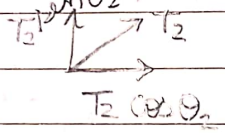
$a_y = 3\ m/s^2$ $\quad F_R = 3(5\hat{i} + 3\hat{j}) = (15\hat{i} + 9\hat{j})\ N$

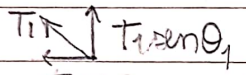
b) $(15\hat{i} + 9\hat{j})\ N$ pois a aceleração é constante

10)









Em x:

$T_1 \cos\theta_1 = T_2 \cos\theta_2$

$T_2 = \frac{T_1 \cos 60°}{\cos 25°}$

$T_2 = 0,552\ T_1$

Em y:

$T_3 = P = 325\ N$

$T_1 \operatorname{sen}\theta_1 + T_2 \operatorname{sen}\theta_2 = T_3$

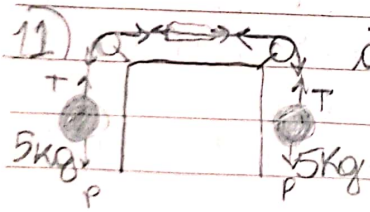
$T_1 \operatorname{sen} 60° + (0,552\ T_1) \operatorname{sen} 25° = 325$

$0,866 T_1 + 0,233 T_1 = 325$

$1,099\ T_1 = 325 \Rightarrow T_1 = 295,7\ N$

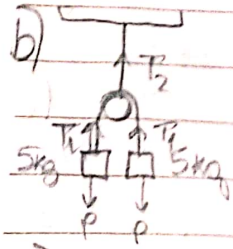
$T_2 = 163,2\ N$

11)



a) $D = 2T = 2P = 2 \cdot 5 \cdot 9,8 = 98\ N$

b)



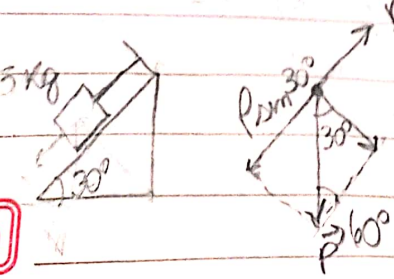
$T_1 = P$

$T_2 = 2T_1$

$T_2 = 2 \cdot 5 \cdot 9,8$

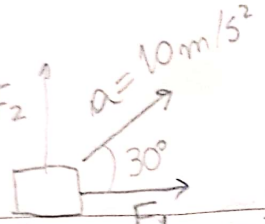
$T_2 = 98\ N = D$

c)



$D = P \operatorname{sen} 30°$

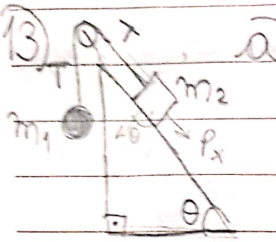
$D = 5 \cdot 9,8 \cdot \frac{1}{2} = 24,5\ N$

12) 

$F_R = m \cdot a = 1 \cdot 10 = 10\,N$

$F_R^2 = F_1^2 + F_2^2 \Rightarrow 100 = F_1^2 + 25 \Rightarrow F_1^2 = 75 \Rightarrow F_1 = \sqrt{75}$

$F_1 = \sqrt{25 \cdot 3} \Rightarrow F_1 = 5\sqrt{3}\,N$

13) 

a) $\begin{cases} P_x - T = m_2 \cdot a \\ T - P_1 = m_1 \cdot a \\ P_x - P_1 = (m_1 + m_2)\,a \end{cases}$

$m_2 g \operatorname{sen}\theta - m_1 g = (m_1 + m_2)\,a$

$48{,}2 - 19{,}6 = 8 \cdot a \Rightarrow a = 3{,}575\ m/s^2$

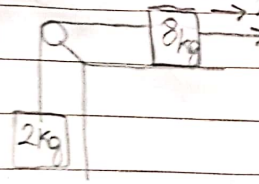
b) $T - m_1 g = m_1 \cdot a \Rightarrow T - 19{,}6 = 2 \cdot 3{,}575$

$T = 26{,}75\,N$

c) $t = 2s \quad V = V_0 + at \Rightarrow V = 0 + 3{,}575 \cdot 2 = 7{,}15\ m/s$

14) $\begin{cases} F - T = m_2 \cdot a \\ T = m_1 \cdot a \end{cases} \Rightarrow F = (m_1 + m_2)\,a \Rightarrow \boxed{a = \frac{F}{(m_1 + m_2)}}$

$T = \frac{m_1 \cdot F}{(m_1 + m_2)}$

15) 

a) $\begin{cases} F_x - T = 8a_x \\ T - 2 \cdot 9{,}8 = 2 \cdot a_x \end{cases}$

$F_x - 19{,}6 = 10 a_x$

$\boxed{F_x = 10 a_x + 19{,}6}$

b) $F_x - T = 8a_x$ se $F_x = 8a_x \Rightarrow T = 0$

/ /

17) V = constante $\Rightarrow a = 0 \Rightarrow \Sigma F = 0$ $\quad g = 10\ m/s^2$

$F = F_{at\,est} = 75\ N$; $F_{at\,est} = \mu_{est} N = \mu_{est}\, mg$

$75 = \mu_{est} \cdot 25 \cdot 10 \Rightarrow \boxed{\mu_{est} = 0{,}3}$

$F = F_{at\,din} = 60 = \mu_{din} N$

$60 = \mu_{din} \cdot 25 \cdot 10 \Rightarrow \mu_{din} = 0{,}24$

18) $F_{at} = F_R = m \cdot a$ $\quad \mu_{din} mg = ma \Rightarrow \mu_{din} g = a$

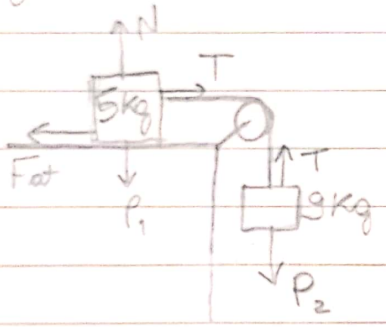
$g = 10\ m/s^2$ $\quad 0{,}1 \cdot 10 = a \Rightarrow a = 1\ m/s^2$

$V^2 = V_0^2 + 2a\Delta s$ $\quad 75\ km/h = (750/36)\ m/s = (375/18)\ m/s$

$0 = \left(\frac{375}{18}\right)^2 - 2 \cdot 1 \cdot \Delta s \Rightarrow \Delta s \cong 217\ m$

Fazer a mesma coisa, mas com $\mu = 0{,}6$

19)



$\begin{cases} P_2 - T = m_2 \cdot a \\ T - F_{at} = m_1 \cdot a \end{cases}$ $\quad g = 10\ m/s^2$

$P_2 - F_{at} = (m_1 + m_2)\, a$

$9 \cdot 10 - 0{,}2 \cdot 5 \cdot 10 = (5+9) \cdot a$

$90 - 10 = 14a \Rightarrow \boxed{a = \frac{80}{14} = \frac{40}{7}\ m/s^2}$

$P_2 - T = m_2 \cdot a$

$90 - T = 9 \cdot \frac{40}{7} \Rightarrow \boxed{T \cong 38{,}6\ N}$

20) a) $\begin{cases} P_1 - T_1 = m_1 \cdot a \\ T_1 - T_2 - F_{at} = m_2 \cdot a \\ T_2 - P_3 = m_3 \cdot a \end{cases} \Rightarrow P_1 - P_3 - F_{at} = (m_1 + m_2 + m_3)\, a$

$4 \cdot 10 - 2 \cdot 10 - 0{,}35 \cdot 1 \cdot 10 = 7 \cdot a$

$40 - 20 - 3{,}5 = 7a \Rightarrow a = 16{,}5/7 = 33/14 \Rightarrow \boxed{a = 2{,}36\ m/s^2}$

b) $P_1 - T_1 = m_1 \cdot a \Rightarrow 40 - T_1 = 4 \cdot 2{,}36$

$T_1 = 30{,}56\ N$

$T_2 - P_3 = m_3 \cdot a \Rightarrow T_2 - 20 = 2 \cdot 2{,}36 \Rightarrow \boxed{T_2 = 24{,}72\ N}$