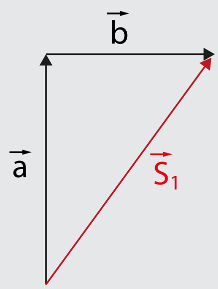
Capítulo 3 - A Linguagem Vetorial

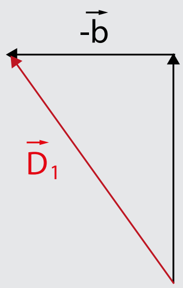
2.



Triângulo Pitagórico

$|\vec{S_1}| = 5$

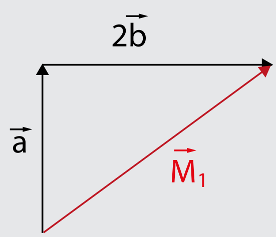
3.



Triângulo Pitagórico

$|\vec{D_1}| = 5$

4.

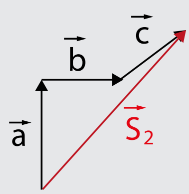


$|\vec{M_1}|^2 = 4^2 + 6^2$

$|\vec{M_1}|^2 = 52$

$|\vec{M_1}| = 2\sqrt{13}$

5.

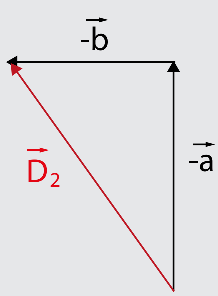


$|\vec{S_2}|^2 = 6^2 + 6^2$

$|\vec{S_2}| = \sqrt{2.6^2}$

$|\vec{S_2}| = 6\sqrt{2}$

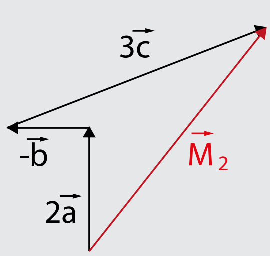
6.



Triângulo Pitagórico

$|\vec{D_2}| = 5$

7.

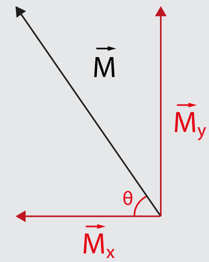


$|\vec{M_2}|^2 = 6^2 + 14^2$

$|\vec{M_2}|^2 = 36 + 196$

$|\vec{M_2}| = \sqrt{232}$

8.



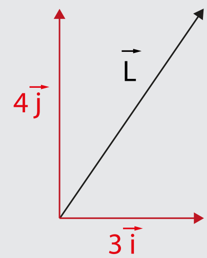
$|\vec{M_x}| = |\vec{M}|.\cos(\theta)$

$|\vec{M_x}| = 10.0,8 = 8$

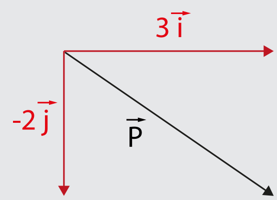
$|\vec{M_y}| = |\vec{M}|.\text{sen}(\theta)$

$|\vec{M_y}| = 10.0,6 = 6$

9.

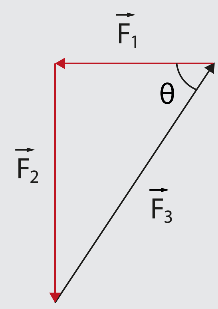


$\vec{L} = 3\vec{i} + 4\vec{j}$



$\vec{P} = 3\vec{i} - 2\vec{j}$

10.



$|\vec{F_3}|^2 = |\vec{F_1}|^2 + |\vec{F_2}|^2$

$|\vec{F_3}| = 10\text{ N}$

$\text{sen}(\theta) = \dfrac{|\vec{F_2}|}{|\vec{F_3}|} = \dfrac{8}{10} = 0,8$

$\cos(\theta) = \dfrac{|\vec{F_2}|}{|\vec{F_3}|} = \dfrac{6}{10} = 0,6$

11.

a)

$\vec{a} = \vec{x} + \vec{y}$

$\vec{a} = -2\vec{i} + 3\vec{i}$

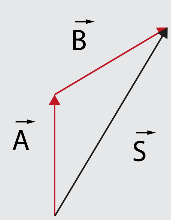
$\vec{a} = \vec{i}$

$\vec{b} = \vec{x} + \vec{y} + \vec{z}$

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

$\vec{b} = \vec{i} + 3\vec{j}$

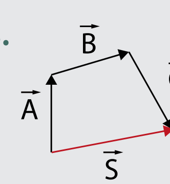
12.



$|\vec{S}|^2 = 2^2 + 3^2$

$|\vec{S}| = \sqrt{13}$

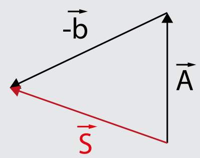
13.



$|\vec{S}|^2 = 1^2 + 3^2$

$|\vec{S}| = \sqrt{10}$

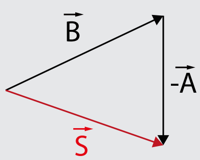
14.



$|\vec{S}|^2 = 1^2 + 2^2$

$|\vec{S}| = \sqrt{5}$

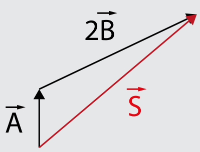
15.



$|\vec{S}|^2 = 1^2 + 2^2$

$|\vec{S}| = \sqrt{5}$

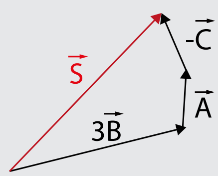
16.



$|\vec{S}|^2 = 4^2 + 4^2$

$|\vec{S}| = 4\sqrt{2}$

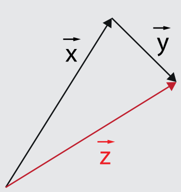
17.



$|\vec{S}|^2 = 7^2 + 5^2$

$|\vec{S}| = \sqrt{74}$

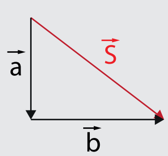
18.



$|\vec{Z}|^2 = 3^2 + 4^2$

$|\vec{Z}| = 5\ \text{m}$

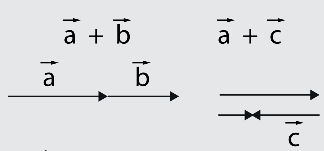
19.



Triângulo pitagórico

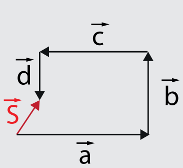
$|\vec{S}| = 10$

20.



$|\vec{a} + \vec{b}| = 5$ $\quad |\vec{a} + \vec{c}| = 1$

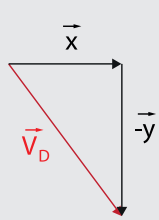
21.



$|\vec{S}|^2 = 1^2 + 1^2$

$|\vec{S}| = \sqrt{2}$

22.



Triângulo pitagórico

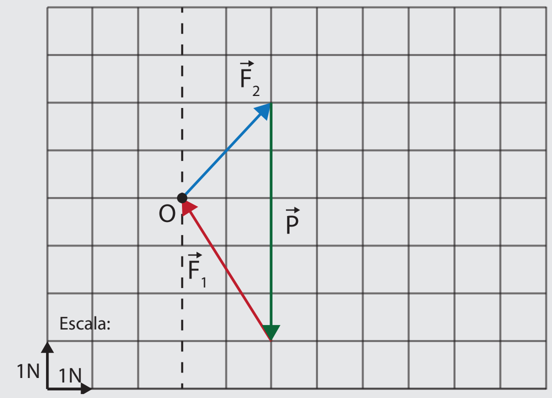
$|\vec{V}_D| = 5$

23.

Sistema em equilibrio:

$\vec{P} + \vec{F}_1 + \vec{F}_2 = \vec{0}$

dessa forma, os vetores formam um polígono fechado.



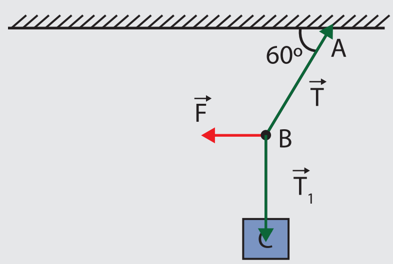
Pela figura conclui-se que

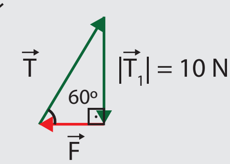
$|\vec{P}| = 5$

$m \,.\, g = 5$

$m = 0{,}5\ \text{kg}$

24.





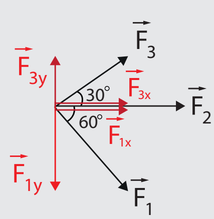
Os vetores $\vec{T}$, $\vec{T}_1$ e $\vec{F}$ formam um polígono fechado

$T_1 = P = 10\ \text{N}$

$\text{sen } 60° = \dfrac{10}{T} \rightarrow \dfrac{\sqrt{3}}{2} = \dfrac{10}{T}$

$T = \dfrac{20}{\sqrt{3}} = \dfrac{20\sqrt{3}}{3}\ \text{N}$

25.



$|\vec{F}_{1x}| = |\vec{F}_1|.\cos(60°)$

$|\vec{F}_{1x}| = 32.\dfrac{1}{2} = 16\ \text{N}$

$|\vec{F}_{1y}| = |\vec{F}_1|.\text{sen}(60°)$

$|\vec{F}_{1y}| = 32.\dfrac{\sqrt{3}}{2} = 16\sqrt{3}\ \text{N}$

$|\vec{F}_{3x}| = |\vec{F}_3|.\cos(30^\circ)$

$|\vec{F}_{3x}| = 41.\frac{\sqrt{3}}{2}\,N \cong 35,5\,N$

$|\vec{F}_{3y}| = |\vec{F}_3|.\text{sen}(30^\circ)$

$|\vec{F}_{3y}| = 41.\frac{1}{2} = \frac{41}{2}\,N$

$|\vec{F}_{Rx}| = |\vec{F}_{1x}| + |\vec{F}_2| + |\vec{F}_{3x}|$

$|\vec{F}_{Rx}| = 16 + 35,5 + 55 = 106,5\,N$

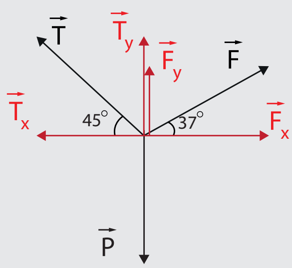
$|\vec{F}_{Ry}| = |\vec{F}_{1y}| - |\vec{F}_{3y}|$

$|\vec{F}_{Ry}| = 27,7 - 20,5 = 7,2\,N$

$|\vec{F}_R|^2 = |\vec{F}_{Rx}|^2 + |\vec{F}_{Ry}|^2 \Rightarrow 106,5^2 + 7,2^2\,N$

$|\vec{F}_R| \cong 106,7\,N$

26.



(I) $|\vec{T}_y| + |\vec{F}_y| = P \Rightarrow |\vec{T}|\frac{\sqrt{2}}{2} + |\vec{F}|.0,6 = 280 \Rightarrow$

$0,7|\vec{T}| + 0,6|\vec{F}| = 280$

(II) $|\vec{T}_x| = |\vec{F}_x| \Rightarrow |\vec{T}|\frac{\sqrt{2}}{2} = |\vec{F}|.0,6 \Rightarrow |\vec{T}| = 1,14|\vec{F}|$

Substituindo (II) em (I) temos:

$0,8|\vec{F}| + 0,6|\vec{F}| = 280 \Rightarrow 1,4|\vec{F}| = 280$

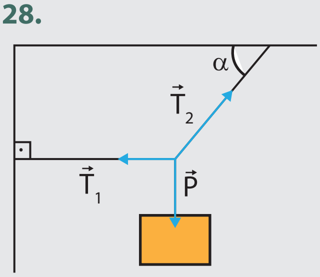
$|\vec{F}| \approx 200\,N$

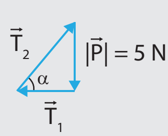
27.

$|\vec{P}| = |T_{1y}| + |T_{2y}| \Rightarrow |\vec{P}| = 3,16.\text{sen}(60^\circ) + 2,23.\text{sen}(45^\circ)$

$|\vec{P}| \cong 2,7 + 1,58 \Rightarrow |\vec{P}| \cong 4,28\,N$

28.





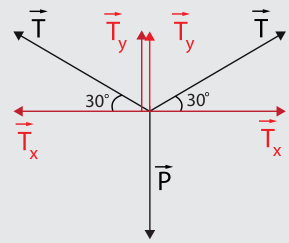
$\vec{T}_1 + \vec{T}_2 + \vec{P} = \vec{0}$

$\text{sen}\,\alpha = \frac{P}{T_2} \rightarrow \frac{5}{13} = \frac{5}{T_2} \therefore T_2 = 13\,N$

$\cos\alpha = \frac{T_1}{T_2} \rightarrow \frac{12}{13} = \frac{T_1}{13}$

$T_1 = 12\,N$

29.



$2|\vec{T}_y| = |\vec{P}| \rightarrow 2.|\vec{T}|.\text{sen}(30^\circ) = |\vec{P}|$

$|\vec{P}| = 2.600.\frac{1}{2} \rightarrow |\vec{P}| = 600\,N$

30.

$2.|\vec{T}|.\text{sen}(30^\circ) = |\vec{P}|$ $\eta = \frac{1300N}{300} = 4,33,$

$|\vec{P}| = |\vec{T}|$ Logo podem sentar 4 crianças

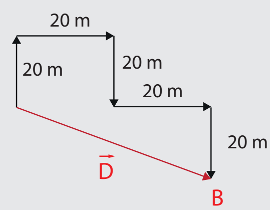
31.

$|\vec{D}|^2 = 20^2 + 40^2$

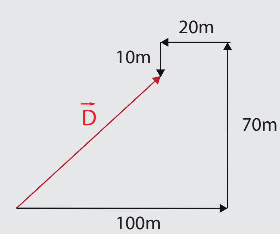
$|\vec{D}|^2 = 400 + 1600$

$|\vec{D}|^2 = 2000$

$|\vec{D}|^2 = \sqrt{2000}\,m$



32.



$|\vec{D}|^2 = 60^2 + 80^2$

$|\vec{D}|^2 = 3600 + 6400$

$|\vec{D}|^2 = 10.000$

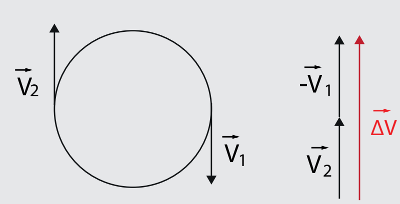
$|\vec{D}| = 100\,m$

$|\vec{V}_m| = \frac{|\vec{D}|}{\Delta t}$

$|\vec{V}_m| = \frac{100}{400}$

$|\vec{V}_m| = 0,25\,m/s$

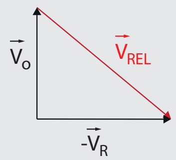
33.



$|\vec{a}_m| = \frac{|\Delta\vec{V}|}{\Delta t} = \frac{100\,km/h}{14.24\,h} \approx 0,3\,km/h^2$

34.

$\vec{V}_{REL} = \vec{V}_0 - \vec{V}_R$



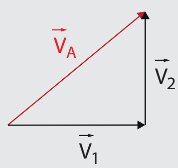
$|\vec{V}_{REL}|^2 = |V_0|^2 + |V_R|^2$

$|\vec{V}_{REL}|^2 = 20^2 + 30^2$

$|\vec{V}_{REL}|^2 = 400 + 900$

$|\vec{V}_{REL}| = \sqrt{1300}$ m/s

35.



$|\vec{V}_R|^2 = |\vec{V}_1|^2 + |\vec{V}_2|^2$

$|\vec{V}_R|^2 = 12^2 + 9^2$

$|\vec{V}_R| = 15$ cm/s

36.

(1) C

(2) E

$|\vec{V}_R|^2 = 240^2 + 50^2 \Rightarrow |\vec{V}_R|^2 = 60100 \Rightarrow |\vec{V}_R| \cong 245$ km/h

$|\vec{D}| = |\vec{V}_R|.\Delta t \Rightarrow |\vec{D}| = 245 \,.\, 0{,}5 \Rightarrow |\vec{D}| = 122{,}5$ km

(3) C

(4) C. A velocidade em relação ao solo é maior.

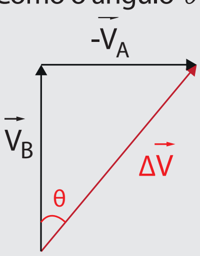
37.

(1) E

$\vec{a}_m = \dfrac{\Delta \vec{V}}{\Delta t} \Rightarrow \vec{a}_m = \dfrac{5}{5}$ m/s$^2 \Rightarrow |\vec{a}_m| = 1$ m/s^2

(2) E

Como o ângulo $\theta \neq 45°$, o item está errado.



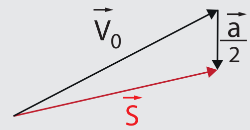
(3) C

$|\vec{a}_x| = |\vec{a}_m|.\,\text{sen}(\theta) \rightarrow |\vec{a}_x| = \dfrac{\cancel{5}}{5} \cdot \dfrac{3}{\cancel{5}} = \dfrac{3}{5} = 0{,}6$ m/s^2

38.

(1) E

$\vec{S} = \vec{V}_o.1 + \dfrac{\vec{a}}{2}.1 \rightarrow \vec{S} = \vec{V}_o + \dfrac{\vec{a}}{2}$



$|\vec{S}|^2 = 4^2 + 1^2 \rightarrow |\vec{S}| = \sqrt{17}$

(2) E

$|\vec{V}_o|^2 = 2^2 + 4^2 \rightarrow |\vec{V}_o| = \sqrt{20}$

(3) E

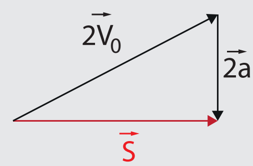
(4) C

$\vec{S}(0) = 0$

(5) C

(6) “d“

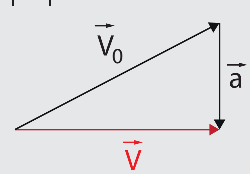
$\vec{S} = 2\vec{V}_o + 2\vec{a}$



$|\vec{S}| = 8$

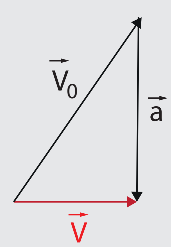
(7) $V = V_o + a.t \xrightarrow{t > 1m} \vec{V} = \vec{V}_o + \vec{a}$

$|\vec{V}| = 4$



39.

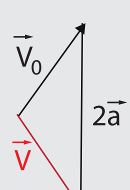
(1) E



$\vec{V}_{(1)} = \vec{V}_o + \vec{a}$

$|\vec{V}_{(1)}| = 2$

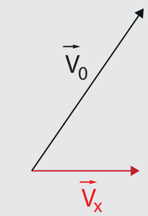
(2) E



$\vec{V}_{(2)} = \vec{V}_o + 2\vec{a}$

(3) E - A força resultante é vertical para baixo.

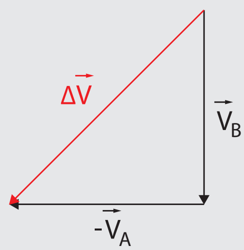
(4) C



(5) C

40.

(1)

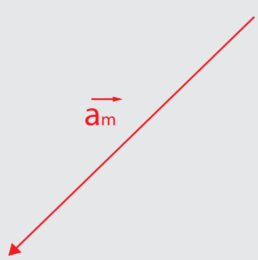


$|\Delta\vec{V}|^2 = |\vec{V}_B|^2 + |\vec{V}_A|^2$

Triângulo Pitagórico

$|\Delta\vec{V}| = 50$ m/s

(2)

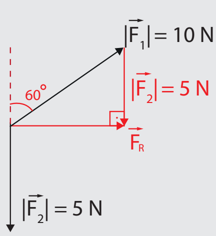


$\vec{a}_m = \dfrac{\Delta\vec{V}}{\Delta t} \xrightarrow{1s} \vec{a}_m = \Delta\vec{V}$

$|\vec{a}_m| = 50$ m/s^2

41.

a)



$\vec{F}_R = \vec{F}_1 + \vec{F}_2$

Como $\vec{F}_R = m\,.\,\vec{a}$ então $\vec{F}_R$ e $\vec{a}$ têm a mesma direção, horizontal.

Utilizando o teorema de pitágoras para os lados do triângulo formado:

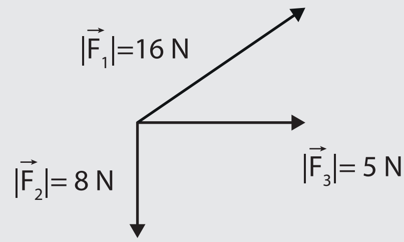
$F_1^2 = F_2^2 + F_R^2 \rightarrow 10^2 = 5^2 + F_R^2$

$F_R = 5\sqrt{3}$ N

$F_R = m\,.\,a \rightarrow 5\sqrt{3} = 2\sqrt{2}.a$

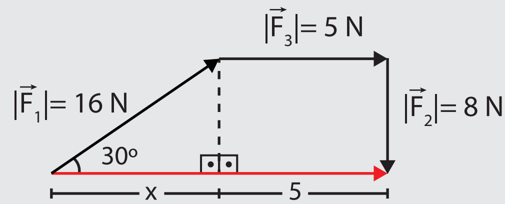
$a = \dfrac{5\sqrt{3}}{2\sqrt{2}} = \dfrac{5\sqrt{6}}{4}$ m/s^2

b)



$\vec{F}_R = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$

Utilizando o método do polígono:



$\cos 30° = \dfrac{x}{16} \rightarrow \dfrac{\sqrt{3}}{2} = \dfrac{x}{16}$

$x = 8.\sqrt{3}$

daí,

$F_R = x + 5$

$m.a = x + 5$

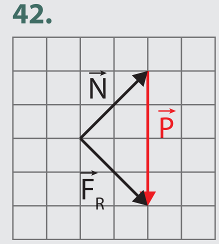
$2\sqrt{2}.a = 8.\sqrt{3} + 5$

$a = \dfrac{8\sqrt{3} + 5}{2\sqrt{2}}$

racionalizando,

$a = 2\sqrt{6} + \dfrac{5\sqrt{2}}{4}$

42.

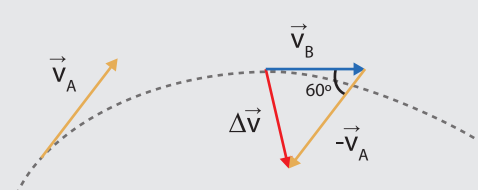


$F_R^2 = 2^2 + 2^2$

$F_R^2 = 8 \rightarrow F_R = \sqrt{8}$

$|\vec{F}_R| = 2\sqrt{2}$ N

43.



$|\Delta\vec{V}|^2 = |\vec{V}_A|^2 + |\vec{V}_B|^2 - 2|\vec{V}_A|.|\vec{V}_B|.\cos 60°$

$|\Delta\vec{V}|^2 = 300^2 + 800^2 - 2\,.\,300\,.\,800\,.\,\cos 60°$

$|\Delta\vec{V}|^2 = 490000$

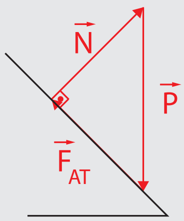
$|\Delta\vec{V}| = 700$ km/h $\cong 194{,}4$ m/s

daí,

$|\vec{F}_R| = m.\frac{|\Delta\vec{V}|}{\Delta t} \rightarrow |\vec{F}_R| = 200 \,.\, \frac{194,4}{93600}$

$|\vec{F}_R| \cong 0,4\text{ N}$

44.



$|\vec{P}|^2 = |\vec{N}|^2 + |\vec{F}_{AT}|^2$

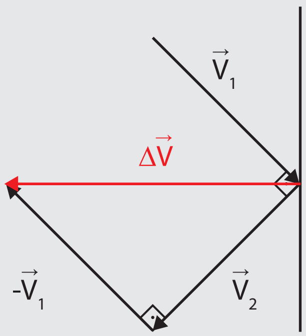
$120^2 = 96^2 + |\vec{F}_{AT}|^2$

$|\vec{F}_{AT}|^2 = 14400 - 9216$

$|\vec{F}_{AT}| = \sqrt{5184}$

$|\vec{F}_{AT}| = 72\text{ N}$

45.



$|\Delta\vec{V}|^2 = |\vec{V}_1|^2 + |\vec{V}_2|^2$

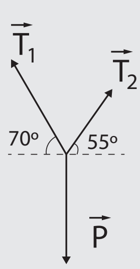
$|\Delta\vec{V}|^2 = (10^6)^2 + (10^6)^2$

$|\Delta\vec{V}| = 10^6\sqrt{2}\text{ m/s}$

$|\vec{F}_R| = m.\frac{\Delta\vec{V}}{\Delta t} \rightarrow |\vec{F}_R| = 10^{-8}.\frac{10^6\sqrt{2}}{10^{-2}}$

$|\vec{F}_R| = \sqrt{2}\text{ N}$

46.



$|\vec{T}_1| = 1,18\text{ N}$

$|\vec{T}_2| = 0,7\text{ N}$

a)

$|\vec{T}_{1x}| = |\vec{T}_1|.\cos 70°$

$|\vec{T}_{1x}| = 1,18 \,.\, 0,34 \rightarrow |\vec{T}_{1x}| = 0,4\text{ N}$

$|\vec{T}_{2x}| = 0,7.\cos 55°$

$|\vec{T}_{2x}| = 1,18 \,.\, 0,57 \rightarrow |\vec{T}_{2x}| = 0,4\text{ N}$

b)

$|\vec{T}_{1y}| = |\vec{T}_y|.\text{sen } 70°$

$|\vec{T}_{1y}| = 1,18 \,.\, 0,94 \rightarrow |\vec{T}_{1y}| = 1,1\text{N}$

$|\vec{T}_{2y}| = 0,7.\text{sen } 55°$

$|\vec{T}_{2y}| = 1,18 \,.\, 0,82 \rightarrow |\vec{T}_{2y}| = 0,57\text{ N}$

c)

$|\vec{P}| = |\vec{T}_{2y}| + |\vec{T}_{1y}|$

$|\vec{P}| = 1,1 + 0,57$

$|\vec{P}| = 1,67\text{ N}$