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Supletivo

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"30 ANOS SERVINDO QUALIDADE À CLASSE ESTUDANTIL"

	SEGUNDA	TÊRÇA	QUARTA	QUINTA	SEXTA	SÁBADO
	Port	Port	Port	Port	Quim	
	Fisic	Fisic	Biol	Biol	Quim	
	Quim	Fisic	Mat	Mat	Mat	
	P	P	P	P	Q	
	F	F	B	F	Q	
	Q	B	M	M	M	
	M	M	M	M	M	
	Q	F	B	B	Q	
	Q	F	F	B	B	

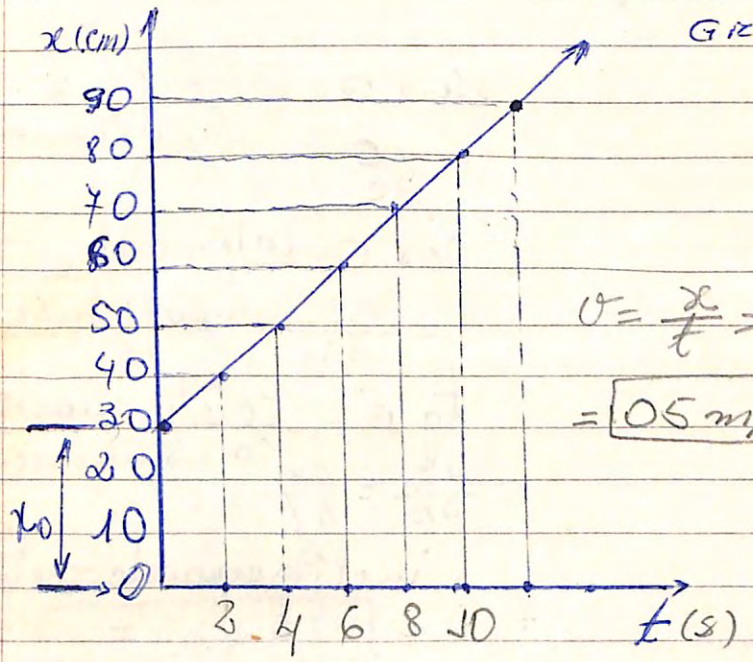
18-08-15

M.R.U

v = constante

$x = x_0 + vt$

$v \times t$ $\quad v = \frac{e}{t}$



GRÁFICO

$v = \frac{x}{t} = \frac{1m}{2s} =$

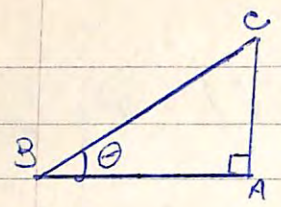
$= \boxed{0,5\ m/s}$

$t_1 = 2s$
$t_2 = 8s$
$\Delta t = t_2 - t_1$

$8s - 2s = 6s$

$x_1 = 4m$
$x_2 = 7m$
$\Delta x = x_2 - x_1 = 7m - 4m = \boxed{3m}$

$v = \frac{\Delta x}{\Delta t} = \frac{3m}{6m} = \boxed{0,5\ m/s}$



$\overline{BC}$ ⇒ hipotenusa
$\overline{AC}$ e $\overline{AB}$ → catetos

$\sin\theta = \frac{\text{cateto oposto}}{\text{hipotenusa}} = \frac{\overline{AC}}{\overline{BC}}$

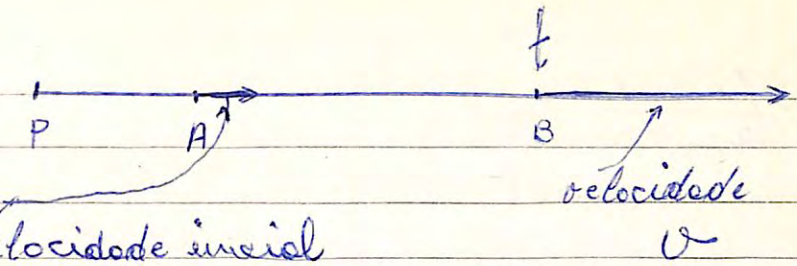
$\cos\theta = \frac{\text{cateto adjacente}}{\text{hipotenusa}} = \frac{\overline{AB}}{\overline{BC}}$

$\operatorname{tg}\theta = \frac{\text{cateto oposto}}{\text{cateto adjacente}} = \frac{\overline{AC}}{\overline{AB}} = \frac{\Delta x}{\Delta t} = v.$

inclinação da reta

$\underbrace{\Delta t \longrightarrow \Delta v}$, $\underbrace{\Delta t \longrightarrow \Delta x}$,

$\frac{\Delta v}{\Delta t} = a$ $\quad$ $\frac{\Delta x}{\Delta t} = \bar{v}$



velocidade inicial v_0

$v - v_0 = \Delta v$
$t - 0 = \Delta t$

$\frac{\Delta v}{\Delta t} = a$

$\frac{v - v_0}{t} = a$

$v - v_0 = at$

$\boxed{v = v_0 + at}$

Ex = Um corpo parte do repouso com aceleração constante de ~~5~~ 2 m/s². Qual será sua velocidade depois 7s

$v_0 = 0$
$a = 2\,m/s^2$
$t = 7s$
$v = ?$

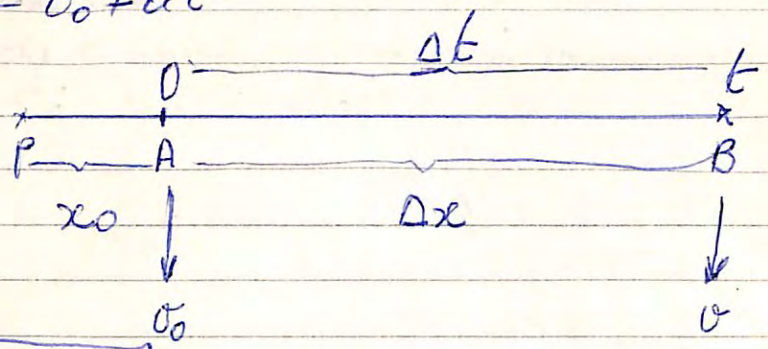
$v = v_0 + at = 0 + 2\,m/s^2 \times 7s =$
$= 0 + 14\,m/s = \boxed{14\,m/s}$

$\frac{m}{s \times s} = \frac{s}{1}$

MRUV

a = constante

$v = v_0 + at$



$$\boxed{\bar{v} = \frac{\Delta x}{\Delta t}}$$

no MUA: $\boxed{\bar{v} = \frac{v + v_0}{2}} \Rightarrow \frac{v + v_0}{2} = \frac{\Delta x}{\Delta t}$

$x = x_0 + \Delta x$

$\frac{v + v_0}{2} \cdot \Delta t = \Delta x$

$\boxed{x = x_0 + v_0 t + \frac{1}{2} a t^2}$

mas $\Delta t = t - 0 = t$

$\Delta x = \frac{v + v_0}{2} \cdot t$

$x = x_0 + \frac{v_0 + v}{2} \cdot t$

$x = x_0 + \frac{v_0 + v_0 + at}{2} \times t$

$x = x_0 + \frac{2v_0 + at}{2} \cdot t$

$x = x_0 + \left(\frac{2v_0}{2} + \frac{at}{2}\right) \cdot t$

Ex = Após percorrer 5 km um automóvel passa por um guarda com aceleração de 30 km/h² e velocidade de 40 km/h. Qual será o espaço percorrido pelo carro do início do movimento até 20 min após passar pelo guarda.

$x_0 = 5$ km

$a = 30$ km/h²

$v_0 = 40$ km/h

$t = 20$ min $= \frac{1}{3}$ h

$x = ?$

$x = 5 + 40 \times \frac{1}{3} + \frac{1}{2} 30 \times \left(\frac{1}{3}\right)^2 =$

$x = 5 + \frac{40}{3} + 15 \times \frac{1}{9} = \frac{5}{1} + \frac{40}{3} + \frac{5}{3} =$

$= \frac{15 + 40 + 5}{3} = \frac{60}{3} = 20$ km

M.R.U.

$a = 0$

v = constante

$\boxed{x = x_0 + vt}$

M.R.U.A

a = constante

$v = v_0 + at$

$\boxed{x = x_0 + v_0 t + \frac{1}{2} a t^2}$

$$\boxed{v^2 = 2ax}$$

$v = v_0 + at \therefore v - v_0 = at \therefore \frac{v - v_0}{a} = t$

Substituindo em:

$x = v_0 t + \frac{1}{2} a t^2 \therefore x = v_0 \cdot \frac{(v - v_0)}{a} + \frac{1}{2} \cdot a \cdot \left(\frac{v - v_0}{a}\right)^2$

$x = \frac{v_0 v - v_0^2}{a} + \frac{1}{2} \cdot a \cdot \frac{v^2 - 2v_0 + v_0^2}{a^2}$

$x = \frac{v_0 v - v_0^2}{a} + \frac{v^2 - 2v_0 v + v_0^2}{2a} = \frac{2v_0 v - 2v_0^2 + v^2}{2a}$

$\rightarrow \frac{2v_0 v + v_0^2}{}$

$x = \frac{v^2 - v_0^2}{2a} \therefore \boxed{v^2 - v_0^2 = 2ax}$

→ Um carro parte do repouso com aceleração de $3\ m/s^2$. Qual sua velocidade após percorrer ~~1,2 km~~ 1.200 m.

$v_0 = 0$ $\quad v^2 = 2ax = 2 \times 3 \times 1200 = 7.200$

$a = 3\ m/s^2$ $\quad v = \sqrt{7.200} = 60\sqrt{2}$.

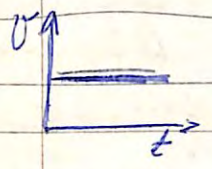
~~t~~ = ?

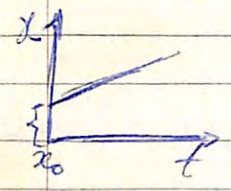
~~x~~ = 1.200

Resp: $60\sqrt{2}\ m/s$

Gráfico dos movimentos

M.R.U



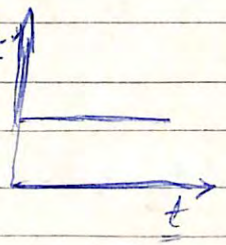


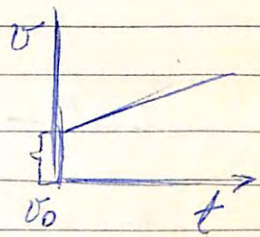
M.R.U.A.

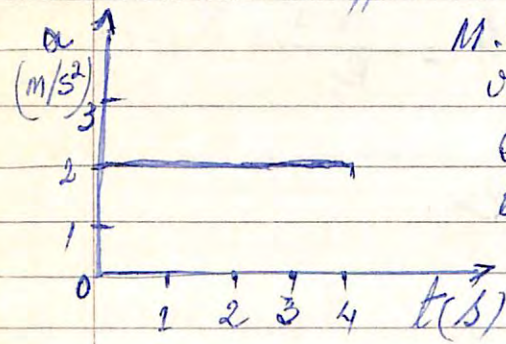
a = const.

$v = v_0 + at$

$x = x_0 + v_0 t + \frac{1}{2} a t^2$







M.R.U.A

$v_0 = 0$

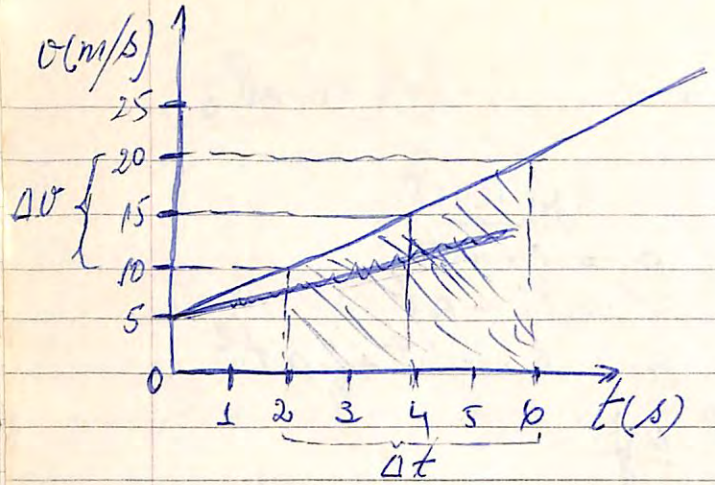
$a = 2\ m/s^2$

$t = 4\ s$

$v = v_0 + at =$

$0 + 2\ m/s^2 \times 4\ s$

$= 8\ m/s$



$v_0 = 5\ m/s$

v

t

$a = \frac{\Delta v}{\Delta t} \quad \frac{20\,m/s - 10\,m/s}{6s - 2s}$

$= \frac{10\,m/s}{4\,s} = 2{,}5\ m/s^2$

$x = 0 + 10 \times 4\,s + \frac{1}{2} \times 2{,}5 \times 4^2 = 0 + 40 + 20 = 60$

$x = 60\ m$ é o espaço.

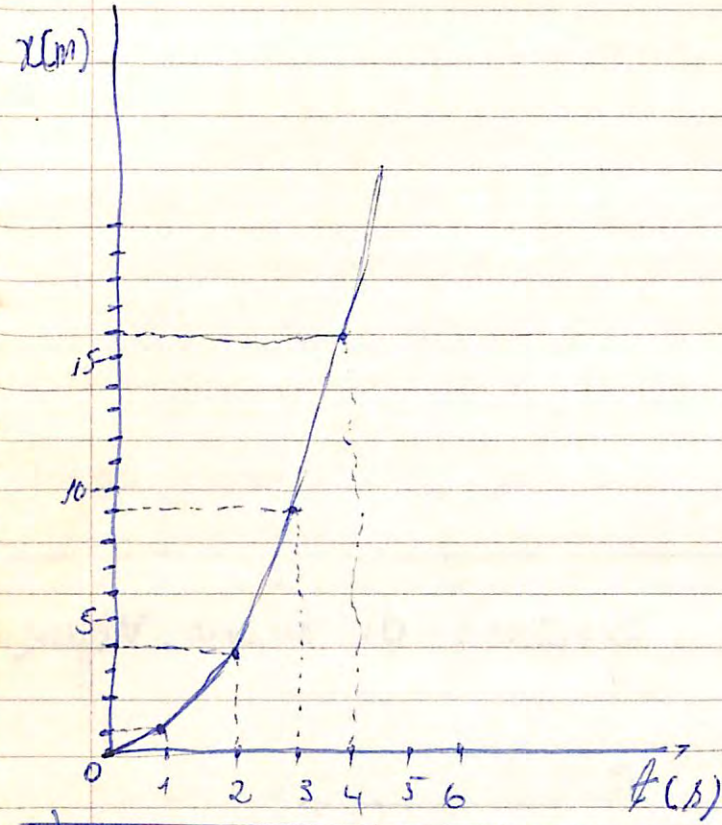
$\frac{B+b}{2} \cdot h = \frac{20+10}{2} \times 4 = \frac{30}{2} \times 4 = 60$

$v_0 = 0$

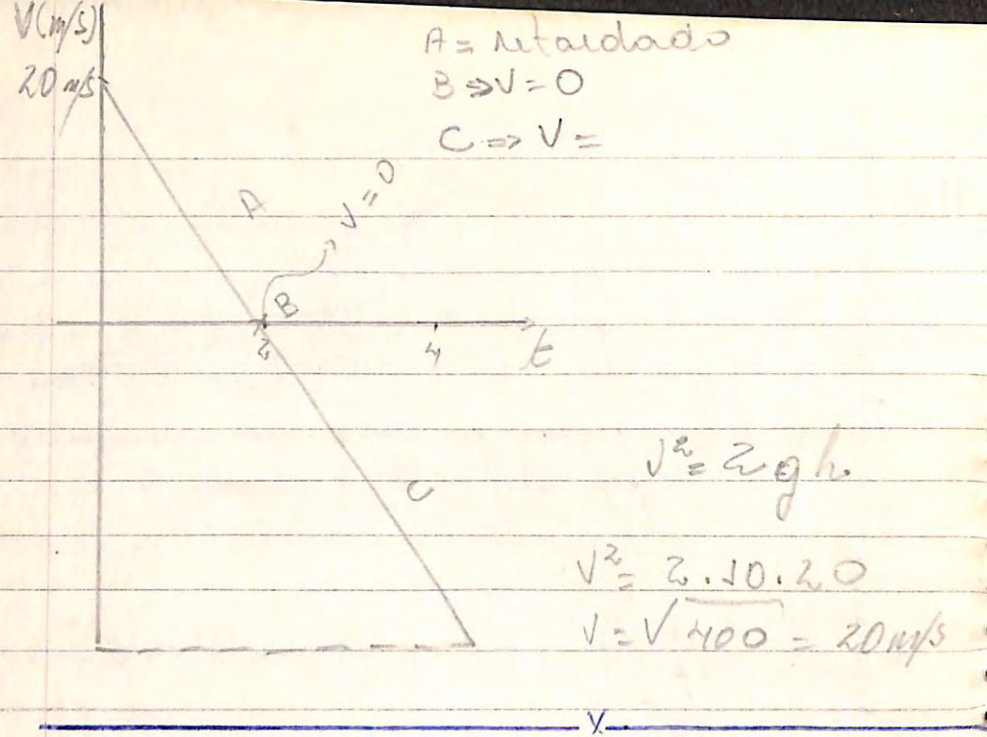
$x = 0$

$a = 2\ m/s^2$

t(s)	x(m)
0	0
1	1
2	4
3	9
4	16
5	25
3	36



	Descendo	Subindo
Equação p/ velocidade	$v = v_0 + gt$	$v = v_0 - gt$
	$v^2 = v_0^2 + 2gh$	$v^2 = v_0^2 - 2gh$
Equação para distância	$h = h_0 + v_0 t + \frac{1}{2} g t^2$ p/ $v_0 = 0$ e $h_0 = 0$ $h = \frac{1}{2} g t^2$	$h = h_0 + v_0 t - \frac{1}{2} g t^2$ $h = \frac{1}{2} g t^2$

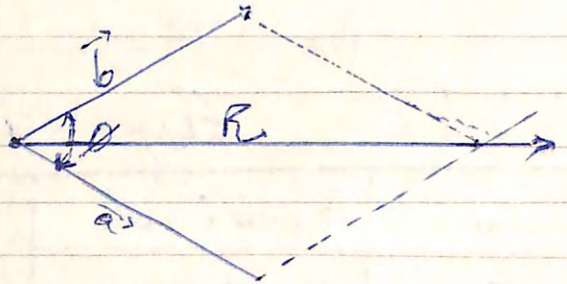


$V^2 = 2gh$

$V^2 = 2 \cdot 10 \cdot 20$

$V = \sqrt{400} = 20 m/s$

2 vetores - de mesma origem



$R = \sqrt{a^2 + b^2 + 2ab \cdot \cos\theta}$

Dados: $F_1 = F_2 = R$.

$R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$

$R^2 = F_1^2 + F_2^2 + 2F_1F_2\cos\theta$

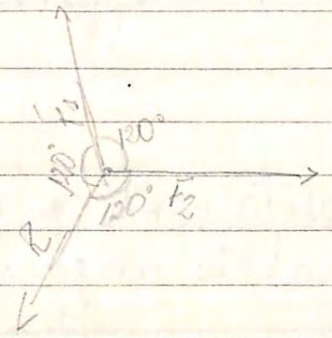
$R^2 - F_1^2 - F_2^2 = 2F_1F_2\cos\theta$

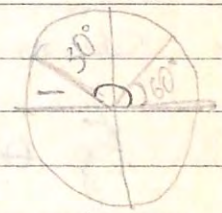
$2F_1F_2\cos\theta = R^2 - F_1^2 - F_2^2$

$\cos\theta = \frac{R^2 - F_1^2 - F_2^2}{2F_1F_2}$

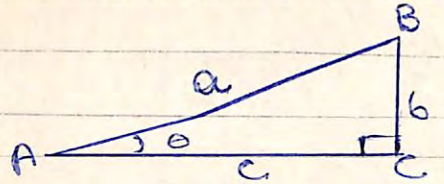
$\cos\theta = \frac{R^2 - R^2 - R^2}{2R^2}$

$\cos\theta = \frac{R^2 - 2R^2}{2R^2} = \frac{-R^2}{2R^2} = -\frac{1}{2} = 120°$





Trigonometria



$\text{sen}\ \theta = \frac{\text{cateto oposto a } \theta}{\text{hipotenusa}}$

$\text{sen}\ \theta = \frac{b}{a}$

$\cos\theta = \frac{\text{cateto adjacente a } \theta}{\text{hipotenusa}}$

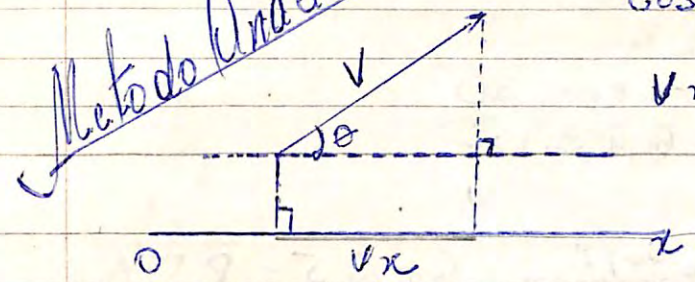
$\cos\theta \quad \frac{c}{a}$

$\text{tg}\ \theta \quad \frac{\text{cateto oposto a } \theta}{\text{cateto adjacente a } \theta}$

$\text{tg}\ \theta = \frac{b}{c}$

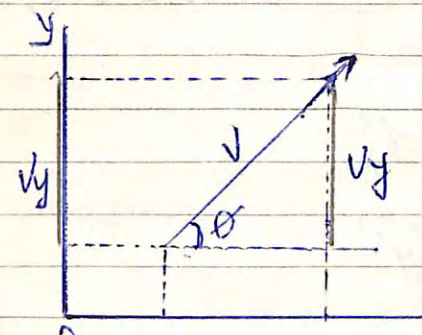
$\text{sen}\ 0° \cos 90° = 0$ pag. 80

Método Analítico



$\cos\theta = \frac{Vx}{V} \Rightarrow$

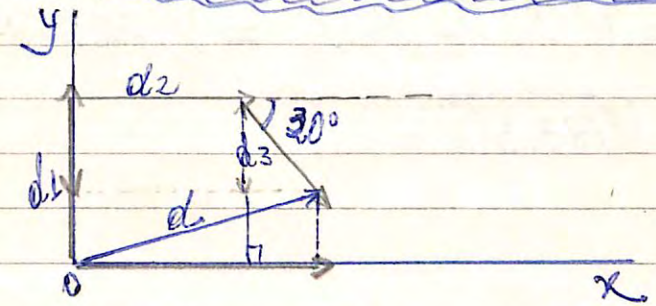
$Vx = \cos\theta \cdot V$



$\text{sen}\ \theta = \frac{Vy}{V} =$

$= Vy = \text{sen}\ \theta \cdot V$

Exemplo



$d_1 = 12\ Km$ $\quad d_{1y} = 12\ km$

$d_2 = 6\ Km$ $\quad d_{2y} = 0$

$d_3 = 3\ Km$ $\quad d_{3y} = -3 \cdot \text{sen}\ 30°$

$\vec{d} = ?$ $\quad d_y = 12 \cdot 10 - 3 \cdot \frac{1}{2}$

$d_y = 12 - \frac{3}{2} = \frac{24-3}{2} = \frac{21}{2} = 10{,}5\ km$

~~$d_y = \frac{24-3}{2} = \frac{21}{2} = 10{,}5$~~

$d_{1x} = 0\ Km$

$d_{2x} = 6\ Km$

$d_{3x} = 3 \cdot \cos 30$

$d_x = 0 + 6 + 3 \cdot \frac{\sqrt{3}}{2}$

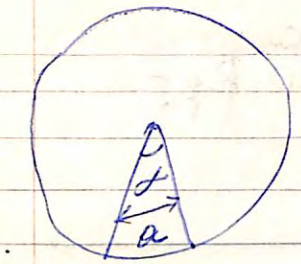
$d_x = 6 + \frac{3 \times 1,7}{2} = 6 + 2,5 = 8,5\ Km$

$d^2 = d_x^2 + d_y^2$

$d = \sqrt{d_x^2 + d_y^2}$

$d = \sqrt{(8,5)^2 + (10,5)^2} = \sqrt{72,25 + 110,25}$

$d = \sqrt{183,50} =$



$\frac{\alpha}{360^\circ} = \frac{a}{2\pi} \rightarrow 360 \cdot a = \alpha \cdot 2\pi$

$180 \cdot a = \alpha \cdot \pi$ ①

$a = \frac{\alpha \cdot \pi}{180}$ ②

$\alpha = \frac{180 \cdot a}{\pi}$ ③

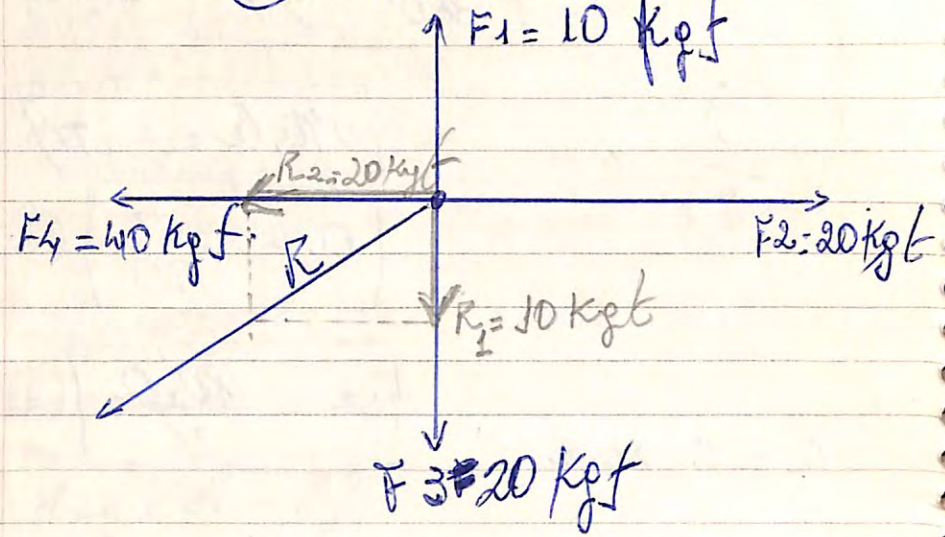
$a = 2\ rad$

$\alpha = ?$

$360 \text{ — } 2\pi\ rad$

$x \text{ — } 2\ rad$

① Dinâmico:



$R_1 = F_3 - F_1 \Rightarrow 20 - 10 = 10\ kgf$

$R_2 = F_4 - F_2 \Rightarrow 40 - 20 = 20\ kgf.$

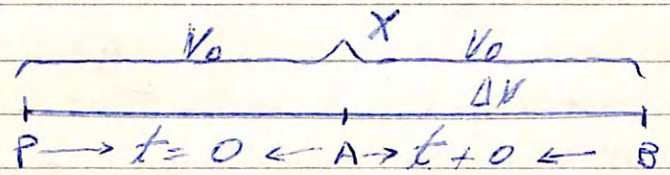
$R = \sqrt{R_1^2 + R_2^2 + 2R_1R_2\cos\theta}$ → 0

$R = \sqrt{R_1^2 + R_2^2} = R = \sqrt{100 + 400} = \sqrt{500} =$

$R = 22{,}3\ kgf.$

Aceleração = MRUV

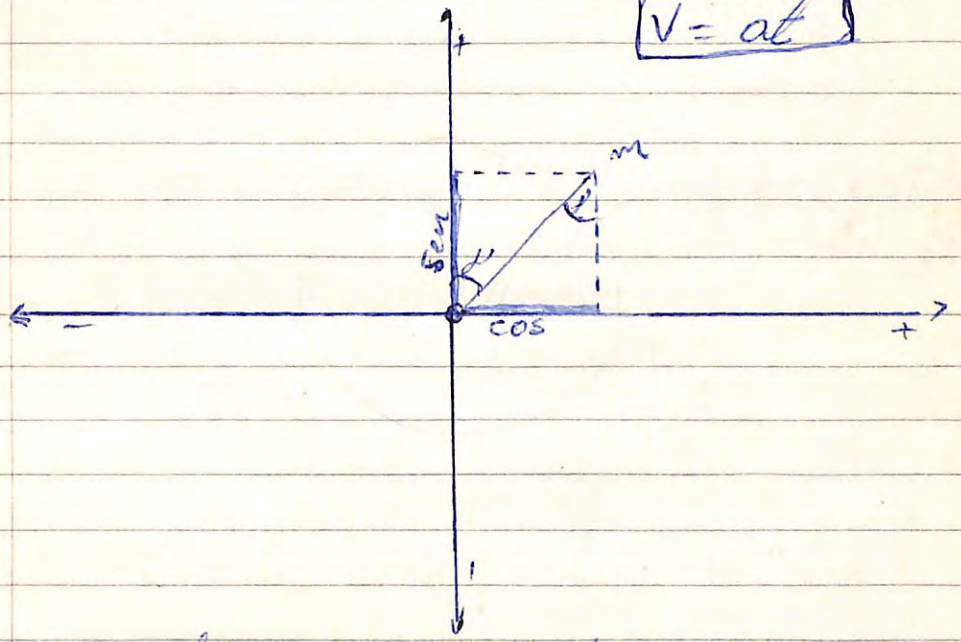
$v = \frac{e}{t} \rightarrow a = \frac{\Delta v}{\Delta t} \rightarrow \bar{a} = \frac{\Delta v}{\Delta t}$



$a = \frac{v - v_0}{t - 0} = a = \frac{v - v_0}{t} \rightarrow v - v_0 = at$

$\boxed{v = v_0 + at}$

$\boxed{v = at}$



circo trigonometrico tem Raio = 1

Dinâmica ⇒ atrito.

$c = \frac{F}{P} \Rightarrow P_c = F \Rightarrow P = \frac{F}{c}$

Três forças. Peso — Força — atrito

coeficiente de atrito = ou razão entre força e peso. (F, P)

$\begin{cases} P = m \cdot a \\ F = m \cdot g \end{cases}$

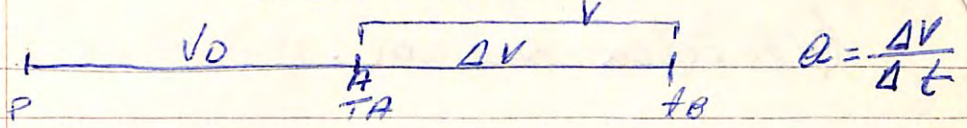
15/25

1 dina ⟶ 1 g / cm / s²

1 N ⟶ Kg / m / s²

150 | 25
0 | 6
25 | 15
100 | 1,4
0

Dia 11-02-76



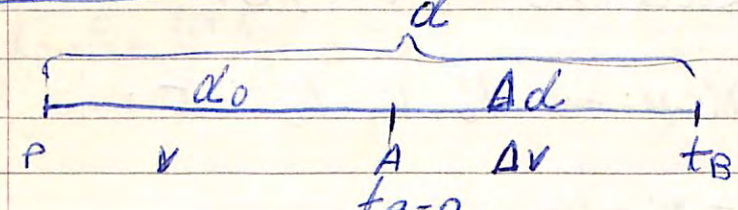
$a = \frac{\Delta V}{\Delta t}$

$\Delta V = V - V_0$

$\Delta t = T_B$

$a = \frac{\Delta V}{\Delta t} \Rightarrow a = \frac{V - V_0}{t}$

$\frac{V - V_0}{t} = \frac{at}{t} = \ldots \Rightarrow \boxed{V = V_0 + at.}$



$d = d_0 + v \cdot t$

$d = d_0 + \frac{V_0 + V}{2} t \Rightarrow d = d_0 + \frac{(V_0 + V_0 + at)t}{2}$

$\Rightarrow d = d_0 + \frac{2V_0 t + at^2}{2} =$

$= \boxed{d = d_0 + V_0 t + \frac{1}{2} a t^2}$;

1º) $d_0 = 0 \Rightarrow \boxed{d = V_0 t + \frac{1}{2} a t^2}$!

2º) $d_0 > 0 \Rightarrow \boxed{d = d_0 + V_0 t + \frac{1}{2} a t^2}$

Queda Livre.

$d = \frac{at^2}{2}$

porque espaço inicial = 0
Tempo inicial = 0
Velocidade inicial = 0

Dia 16-02-76.

MRV $\Rightarrow V_0, V, t_0$ e t.

$$\begin{cases} \Delta V = V - V_0 \\ \Delta t = t - t_0 \end{cases}$$

$a = \frac{\Delta V}{\Delta t} \Rightarrow a = \frac{V - V_0}{t} = at = V - V_0 \Rightarrow$

Ex: Nº 1 Pg. 43. $V = \frac{E}{t}$.

$d = 200$ km.

$t = 3$ h, 25 min e 15 seg.

V = Média.

$V = \frac{E}{t} = \frac{200 km}{3,4 h} = 58,$

15 seg.

√500
√0800
12315 | 3600
10800 | 3,4
01615

Ex: Nº 2 Pg. 43.

$d = 500 + 500 \rightarrow V = \frac{d}{t} = V = \frac{1000}{8} = 125$ m/s

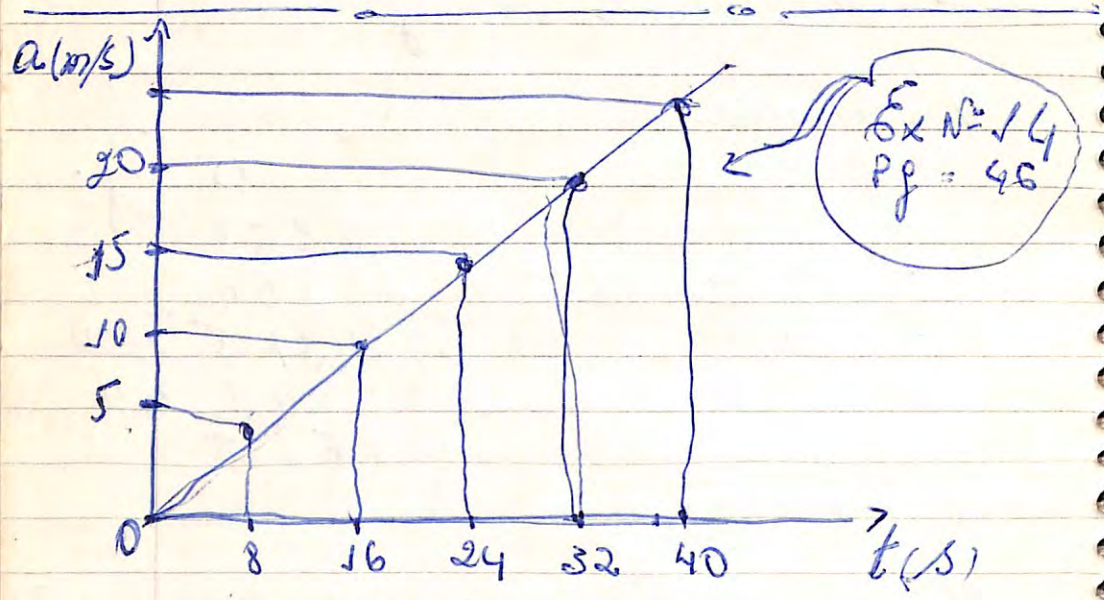
Ex: Nº 3 $d = 1000$ km.

$V = \frac{d}{t} = V = \frac{1000 km}{2,5 h} =$ 400 km/h.

$V = \frac{d}{t} = V = \frac{1000000 m}{9.000 seg.}$ 111,1 m/seg.

Ex. Nº ~~$a = \Delta t$~~

$$a = \frac{\Delta V}{\Delta t} = \frac{-\frac{30}{3} - \frac{10\,m}{seg.}}{60\ seg.} = \frac{\frac{20\,m}{seg.}}{60\ seg.} = \frac{1}{3}\,m/s^2$$



Ex Nº 14
Pg = 46

$V = V_0 + a\,t.$
$V = 0 + 10.16\ seg.$
$V = 160\ m/s$

$MRU = V_0 + V.t.$

$MRV = V_0 + at \Rightarrow V = V_0 + gt$ ou $V = gt$

$E = E_0 + Vt.$

$$\begin{cases} E = E_0 + V_0 t + \frac{1}{2} a t^2 \\ h = h_0 + V_0 t + \frac{1}{2} g t^2 \end{cases} \Rightarrow \text{Para} \begin{cases} h_0 = 0 \\ V_0 = 0 \end{cases}$$

$h_0 = 0$
$V_0 = 0 \Rightarrow h = \frac{1}{2} g t^2 \Rightarrow d = \frac{1}{2} a t^2$

MCU.

$$V = \frac{\Delta d}{\Delta t} = \frac{P - P_0}{t - t_0}$$

$$V = \frac{P - P_0}{T} \Rightarrow V = \frac{2\pi R}{t}$$

T = Tempo gasto para dar uma volta
f = frequência é o Nº de voltas dividido pelo tempo

$f = \frac{1}{T}$

$T \cdot f = 1$

$T = \frac{1}{f}$.

$$V = \frac{d - d_0}{t} = \boxed{\frac{2\pi R}{T}}$$

$V = \frac{2\pi R}{T}$ ∴ ou $V = 2\pi R f$.

Velocidade Angular.

$W = \frac{\Delta\theta}{T} = \boxed{\frac{2\pi}{T}}$

→ Relação entre elas:

$$\frac{W}{V} = \frac{\frac{2\pi}{T}}{\frac{2\pi R}{T}} = \frac{W}{V} = \frac{1}{R} \therefore V = WR.$$

---

2) $V_0 = 40 m/s$ $\quad a = \frac{\Delta V}{\Delta T} = \frac{V - V_0}{t - t_0} =$

$t_0 = 0$

$t = 5 seg.$ $\quad = \frac{10 m}{seg} - \frac{40 m}{seg.} = 30 m/seg.$

$V = 10 m/s$

$$a = \frac{30 m/seg.}{5 seg.} = -6 m/seg.$$

$-0,006 Km/seg.$
$/3600 s$

M C U.

$\Delta d = d - d_0$
$\Delta t = t - t_0$
$\Delta = t$

$T = \frac{1}{f}$

$f = \frac{1}{T}$

$V = \frac{E}{t} \Rightarrow V \frac{d - d_0}{t - t_0} \longrightarrow V = \frac{2\pi R}{t} = \frac{2\pi R}{T}$

Velocidade Angular.

$\theta_0 =$ à inicial
$\Delta\theta = \theta - \theta_0$
$\Delta t = t - t_0$

$W = \frac{\Delta d}{\Delta t} = \frac{\Delta\theta}{t} = \frac{2\pi}{T}$

$W = \frac{\Delta\theta}{T}$

π — 3,14 — 180°
2π — 6,28 — 360°

Velocidade linear → $V = \frac{2\pi R}{T}$

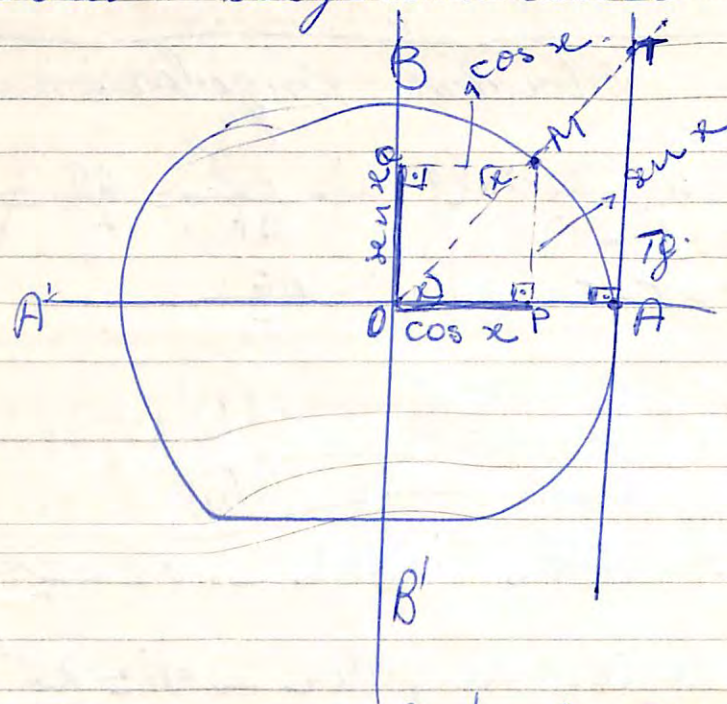
Velocidade angular → $W = \frac{2\pi}{T}$.

$$\frac{V}{W} = \frac{\frac{2\pi R}{T}}{\frac{2\pi}{T}} = \frac{V}{W} = \frac{R}{1} \quad V = WR$$

2-B) $V = V_0 + at$.

TRIGONOMETRICO.

⟹ círculo orientado e com raio igual a 1 é um círculo trigonométrico.



⟶ cos x = a projeção do raio OM sobre AA'

⟶ Sen x = a projeção do raio OM sobre BB'

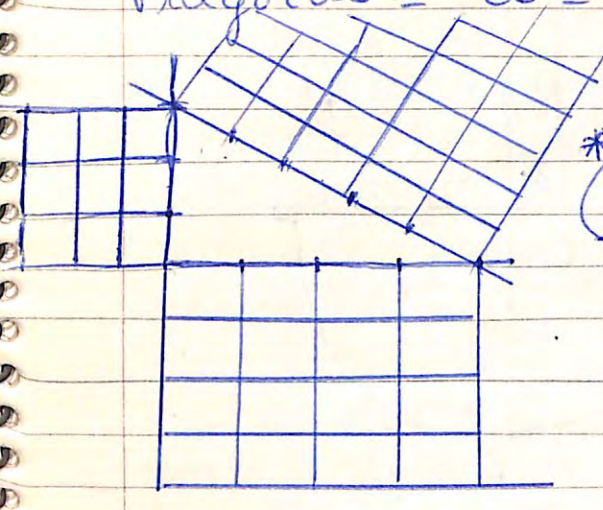
$\text{sen } x = \overline{OQ}$

$\cos x = \overline{OP}$

$\overline{OM} = 1$

$25 = 16 + 9$

Pitágoras = $a^2 = b^2 + c^2$



* $\boxed{\text{sen } x^2 + \cos x^2 = 1^2}$

→ $\boxed{a^2 + b^2 + c^2}$

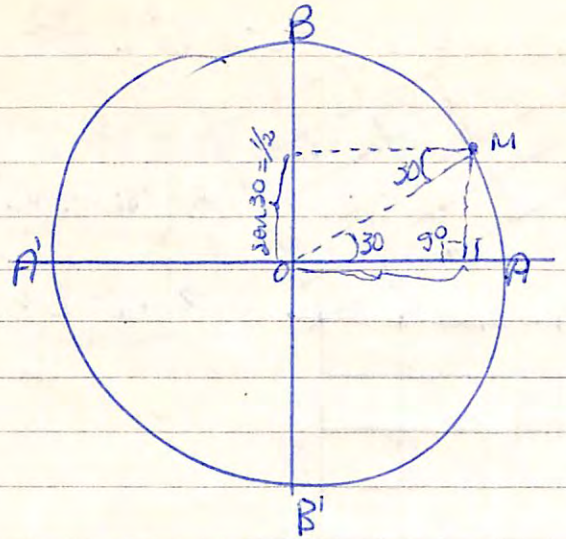
⟶ semelhança = tem mesmo $\hat{A}$ e lados diferentes

⟶ congruentes tem mesmo $\hat{A}$ e mesmos lados

⟶ triângulos semelhantes

Lado $\dfrac{\overline{OQ}}{\overline{OP}} = \dfrac{\text{Ta}}{OA} \Rightarrow \dfrac{\text{sen } x}{\cos x} = \dfrac{tg\ x}{1} =$

$= \boxed{tg = \dfrac{\text{sen } x}{\cos x}}$



→ $\operatorname{sen} 30 = \overline{OQ} = \frac{OQ}{1} = \frac{1}{2}$

$\operatorname{sen} x^2 + \cos^2 = 1$

$\cos x^2 = 1 - \operatorname{sen}^2 x$

$\cos x = \sqrt{1 - \operatorname{sen}^2 x}$

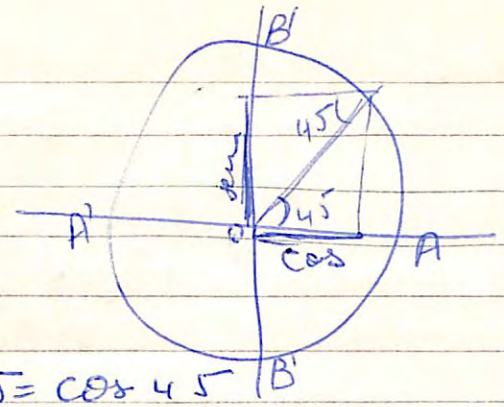
$\cos x = \sqrt{1 - \frac{1}{4}}$

$\cos x = \sqrt{\frac{4-1}{4}} = \cos x = \boxed{\sqrt{\frac{3}{2}}}$

→ $\operatorname{sen} 30 = \frac{1}{2}$

$\cos 30 = \frac{\sqrt{3}}{2}$

$tg\ 30 = \frac{\sqrt{3}}{3}$



$\operatorname{sen} 45 = \cos 45$

$\operatorname{sen}^2 x + \cos^2 x = 1$

$\operatorname{sen}^2 x + \operatorname{sen}^2 x = 1$

$2 \operatorname{sen}^2 x = 1$

$\operatorname{sen}^2 = \frac{1}{2}$

$\operatorname{sen} \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{\sqrt{2}}{4} = \boxed{\frac{\sqrt{3}}{2}}$

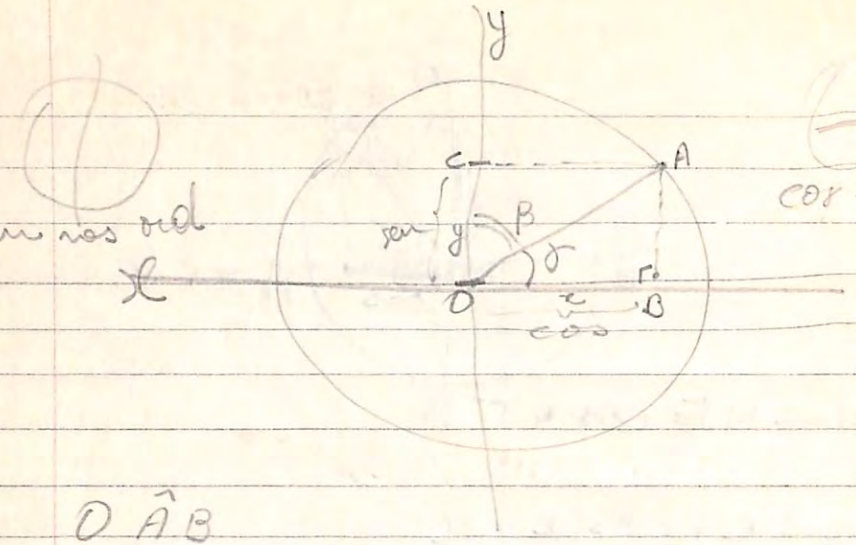
$\cos 60 = \frac{\overline{OA}}{2} = \frac{1}{2}$

$\operatorname{sen}^2 x + \cos x^2 = 1$

$\operatorname{sen} = \sqrt{1 - \cos^2} = \sqrt{1 - (\frac{1}{2})^2} =$

$= \operatorname{sen} = \sqrt{1 - \frac{1}{4}}$

$\operatorname{sen} \sqrt{\frac{4-1}{4}} = \frac{\sqrt{3}}{2}$



$\triangle OAB$

$\text{sen}\ \gamma = \frac{AB}{OA}$

$\gamma = \frac{OB}{OA} = \cos\alpha = \frac{x}{OA}$ $\boxed{x = OA \cdot \cos\alpha}$

Sinais do Seno:

$0 \to 1 \to 0 \to -1 \to 0$

mais do cos

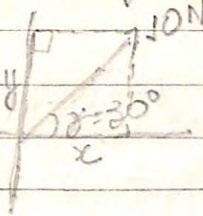
$\text{sen} = \frac{\text{cat oposto}}{\text{hipotenusa}}$

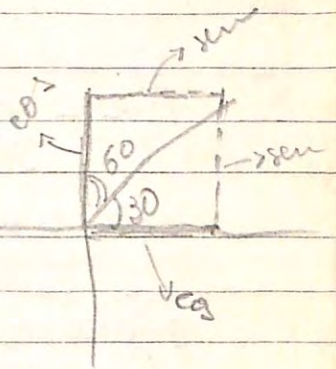
$\cos = \frac{\text{cat adjacente}}{\text{hipotenusa}}$

Decomponha as forças em $\vec{Fx}$ e $\vec{Fy}$.

$\vec{F} = 10\,N$

$\gamma = 30°$





$x = \vec{F} \cdot \cos\gamma$

$\vec{Fx} = 10 \cdot \cos 30$

$\vec{Fx} = 10 \cdot 0{,}86 \cdot \cancel{10} = \boxed{8{,}6\,N.}$

$y = \vec{F} \cdot \cos 60°$

$Fy = 10 \cdot 0{,}5 = \boxed{5\,N}$

0,5
10
50

$\begin{cases} \vec{F} = 40N \\ \gamma = 60° \end{cases}$ $x = F\cos 60°$

$Fx = 40 \cdot 0{,}5 = \boxed{20\,N.}$

$y = \vec{F} \cdot \cos 30°$

$y = 40 \cdot \cos 30$

$40 \cdot 0{,}86 = \boxed{34{,}40\,N}$

0,86
40
34,40

Resp.: $\begin{cases} \vec{Fx} = 20\,N \\ \vec{Fy} = 34{,}4\,N. \end{cases}$

$\vec{F}x = 10\ N$

$\alpha = 45°$

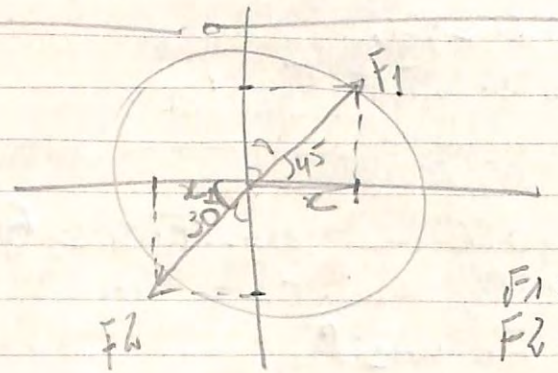
$\vec{F}x = F.\cos.45°$

$10.0,7 = 7.N$

Resp = 7 N.

$\vec{F}y = F.\cos.45°$

$10.07 = 7\ N$



F1 = 20 N
F2 = 10 N

$\Sigma x = F_1 \cos 45° - F_2 \cos 30° =$

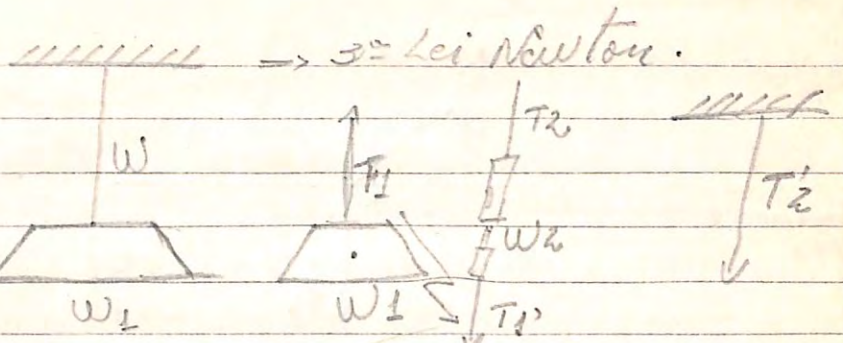
$\Sigma y = F_2 \cos 45° - F_2 \cos 60° =$

$F_1 = 20 \times 0,7 - 10 \times 0,86 = 14 - 8,6 = 5,4$

20 · 0,7 = 140 | 10 · 0,86 = 8,60 | 140 − 86 = 54

$F_2 = 20 \times 0,7 - 10 \times 0,5 = 14 - 5 = 9$

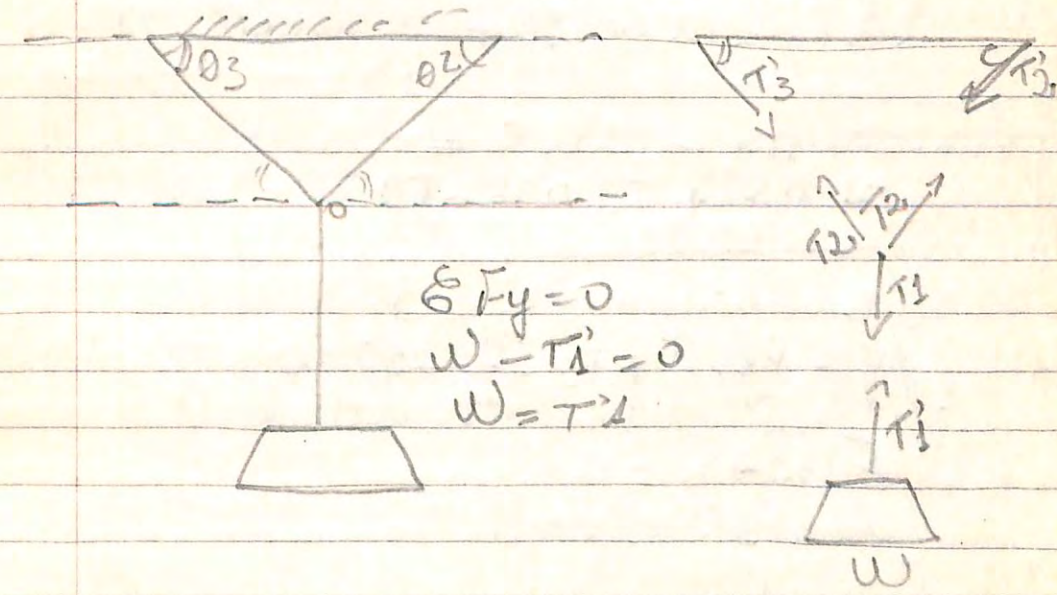
14 − 5



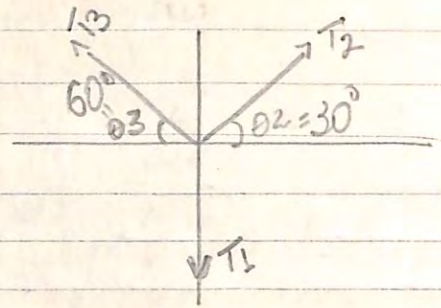
$\Sigma F_y = 0$
$T_1 - W_1 = 0$
$T_1 = W_1$

$T_1 = T_1'$
$T_2 - W_2 - T_1' = 0$
$T_2 = W_2 + T_1$

Σx: W = 20 kgf
C = 1 kgf



$\Sigma F_y = 0$
$W - T_1' = 0$
$W = T'_1$



$T_1 = T_1'$
$T_2 = T_2'$
$T_3 = T_3'$

$\sum F_x = T_2 \cos\theta_2 - T_3 \cos\theta_3$
$\sum F_y = T_2 \operatorname{sen}\theta_2 + T_3 \operatorname{sen}\theta_3 - T_1 = 0$

→ Ex: $W = 50\ kp^*$
$\theta_2 = 30°$
$\theta_3 = 60°$

$$\begin{cases} \sum F_x = T_2 \cos 30° - T_3 \cos 60° = 0 \\ \sum F_y = T_2 \operatorname{sen} 30 + T_3 \operatorname{sen} 60° - T_1 = 0 \end{cases}$$

$$\begin{cases} \sum F_x : T_2 \cdot 0{,}86 - T_3 \cdot 0{,}5 = \\ T_2 \cdot 0{,}5 + T_3\, 0{,}86 - 50 \end{cases} \quad \begin{matrix} F_3 \,25. \\ F_2 \,43{,}3 \end{matrix}$$

$$\begin{cases} fx = F_2 \cdot \frac{\sqrt{3}}{2} - F_3 \frac{1}{2} = 0 \\ fy = F_2 \cdot \frac{1}{2} + F_3 \frac{\sqrt{3}}{2} - 50 = 0 \end{cases}$$

$$\begin{cases} F_2\sqrt{3} - F_3 = 0 \\ F_2 + F_3\sqrt{3} - 100 = 0 \end{cases}$$

$F_2 = 100 - F_3\sqrt{3}$

1ª Lei. 2ª Lei
$\sum F_x = 0$ $\vec{F} = m \cdot \vec{a}$
$\sum F_y = 0$ $\vec{a} = \frac{\vec{F}}{m}$

$\sqrt{3}(100 - F_3\sqrt{3}) - F_3 = 0$
$100\sqrt{3} - 3F_3 - F_3 = 0$
$100\sqrt{3} - 4F_3 = 0$
$-4F_3 = -100\sqrt{3}$
$F_3 = \frac{-100\sqrt{3}}{4}$

$F_3 = 25\sqrt{3} = F_3 = 43{,}3\ kg^*$

$F_3 = F_2\sqrt{3}$
$43{,}3 = F_2\sqrt{3}$
$F_2 = \frac{43{,}3}{\sqrt{3}(1{,}73)} = 25.$

Ex: $m = 0{,}5\ kg.$ $F = M \cdot a$
$a = 4\ m/s^2$ $0{,}5 \times 4 = 2\ N$

Ex: $m = 1\ kg.$
$a = 10\ m/s^2$ $F = m \cdot a.$
$1 \times 10 = 10\ N$

$m = 70\ kg.$ $P = m \times g.$ aqui
$a = \frac{1}{6}(10) =$ $70 \times 10 = \frac{700}{6}$

$a = \frac{1}{6} * 700 = 700\ \frac{6}{116\ N}$.

isto na hua.

Exi $m = 20\ kg$. $\vec{Fa} - \vec{F} = m \times \vec{a}$

$a = 2\ m/s^2$ $50 - F = 20 \times 2$

F ? $10\ N$ $50 - F = 40$

$Fa = 50\ N$ $-F = 40 - 50\ (-1)$

$F = -40 + 50 = 10$

$\vec{F} = 10\ N$.

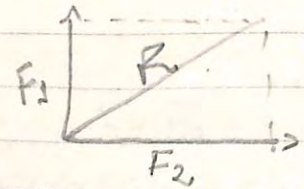
$m = 2\ kg$.

$\alpha = 90°$

$F_1 = 30°$

$F_2 = 40$

$a = 2$



$R^2 \sqrt{F_1^2 + F_2^2} = R^2 \sqrt{30^2 + 40^2} =$

$R^2 = \sqrt{900 + 1600} = R = \sqrt{2500}$

$a = \frac{F}{m}$ $R = \sqrt{2500} = 50$.

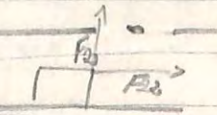
$a = \frac{50}{2} = 25\ m/s^2$

---

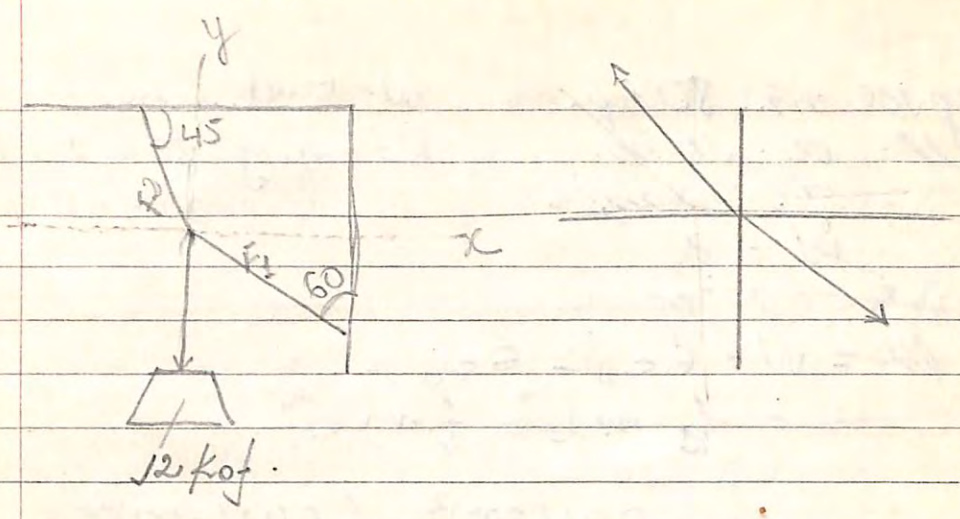
m: 6 kg.

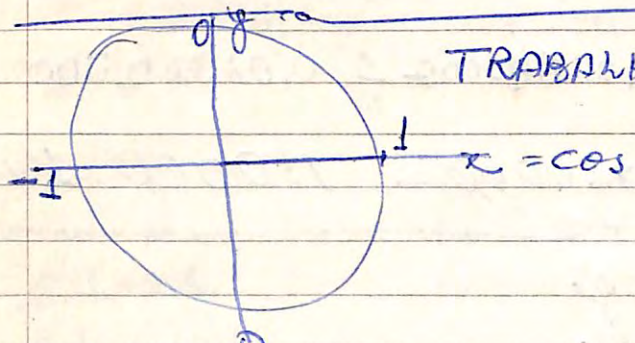
F_1: 3 N

F_2: 3 N.



$F = \sqrt{9+9} = \sqrt{18} \simeq 4{,}25\ N$





TRABALHO e ENERGIA

$W = F \cdot d \times 1°$

$W = E \cdot d \cos 45°$

$W = 1 \cdot d \cos 90°$

$W\ F \cdot d \cos 180°$

ENERGIA = POTENCIAL.

$\frac{h}{2} \rightarrow Ep = Ec \Rightarrow m \cdot g \cdot h = \frac{1}{2} m \cdot v^2$

pag. 128 m. 80 kg. $W = F \cdot d \cdot \cos\alpha$

11. d. 10 m. $P = m \cdot g = 80 \times 9{,}8 = 784$

g. 9,8 m/s² $784 \times 10 = 7840$

W = ?

---

12 = $W = E_{c_A} - E_{c_B} =$

$= \frac{1}{2} \cdot m V_1^2 - \frac{1}{2} \cdot m V_2^2$

$= \frac{1}{2} \cdot 0{,}01 (800)^2 - \frac{1}{2} 0{,}01 (600)^2$

$= \frac{1}{2} 0{,}01 640.000 - \frac{1}{2} 0{,}01 360.000$

$= 3200 - 1800 = 1400$

---

13 = N = 70 kg.

h = 400 m

---

14 = N = 80

I = 30°

d = 4m

---

15 ⇒ m = 30 kg. $E_c = \frac{1}{2} m \cdot V^2$

a = 3,0 m/s²

d = 4 min $V = a \cdot t = 3 \cdot 4 = 12$

E_c = ?

$E_c = \frac{1}{2} \cdot 30 \cdot 144 = 2.160$ J

---

17 ⇒ m_1 = 5 kg $Q = m \cdot \Delta V$

V_1 = 800 m/s $m_1 \cdot V_1 = m_2 \cdot V_2$.

m_2 = 2.000 kg. $5 \cdot 800 = 2000 \cdot V_2$.

V_2 = ? $V_2 = \frac{4000}{2000} = 2$ m/s

---

18 ⇒ m2 kg. $Q = m \cdot \Delta V$

~~t2 seg.~~ $Q = 2 \cdot 10 = 20$ kg m/s

V = 10 m/s

---

19 ⇒ m = 600 kg. $Q = m \cdot \Delta V$

V_1 = 10 m/s $600 \times 10 = 1000 \times V_2$

m_2 = 400 kg.

V_2 = ? $V_2 = \frac{6.000}{1.000} = 6$ m/s

→ MF quando o Â é = 90° → **MF = F × d**

Pag. 146. MF = F × d × 1

{ 20 = N
{ 3 =
MF = 20 × 3 = 60 N × m

→ MF quando o angulo é menor que 90°

→ **MF = F × d × sen r**

Ex: F = 20 D
Â = 45°
d = 10
MF = 20 × 10 × 0,7 = 14.000 D/cm

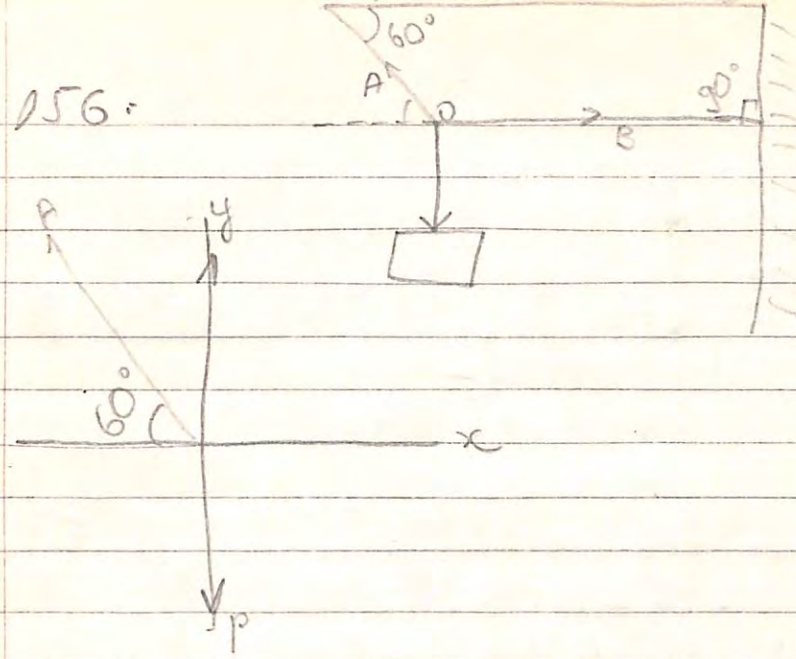
200 × 0,7 = 140,0

D = cm
N = m
Kgf = m

F = 1 kgf MF = F × d × sen r
r = 30°
d = 0,20 cm MF = 1 × 0,20 × 0,5 = 0,10 kgf
0,2 m

somatoria do momento → $\sum M = 0$
somatoria da resultante → $\sum R = 0$

Pag. 156.



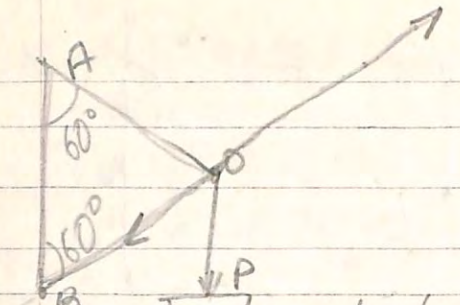
→ $R_x = 0$ $B - A\cos 60° = 0 \Rightarrow B = A\cos 60°$
$R_y = 0$ $A \operatorname{sen} 60° - 5 = 0 \Rightarrow A \operatorname{sen} 60° = P$
$= A\frac{\sqrt{3}}{2} = 200 \rightarrow A = \frac{200}{\frac{\sqrt{3}}{2}} = \frac{200 \times 2}{\sqrt{3}} =$

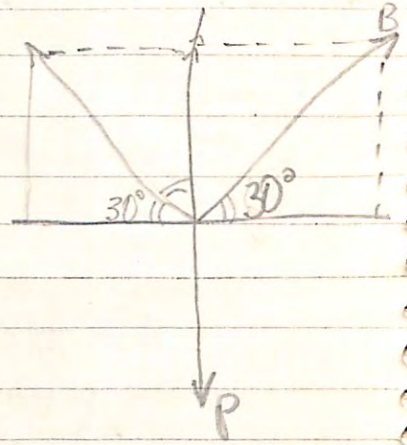
$\frac{400}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{400\sqrt{3}}{3} = 230\ N.$

↓ $B = 230 \times \frac{1}{2} = 115\ N.$

pag - 157

$\Sigma x = C$



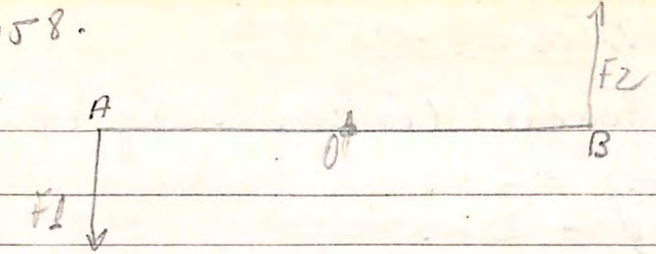


$R_x = B\cos 30° - A\cos 30° = 0$

$R_y = B\operatorname{sen} 30° + A\operatorname{sen} 30° - P = 0$

pag - 158.

Σx_A



$$M_A = F_1 \times 0 + R \cdot \frac{AB}{2} + F_2 \cdot AB = 0$$

$$R \frac{AB}{2} = -F_2 AB$$

$$R = \frac{F_2 AB}{\frac{AB}{2}} = \frac{-F_2 AB \times 2}{AB} = -2F_2$$

Dia 04-05-76

Dilatação linear. Pg 176 - 6 x 7

Comp = 3 m
Larg = 2 m
$\Delta t = 80°C$
$\alpha = 26\ 10^{-6}\ C^{-1}$
$\Delta A = ?$

$A = A_0(1 + \beta . \Delta t)$
$A = 6m^2(1 + 52.10^{-6}C^{-1} . 80°C)$
$A = 6(1 + 4160.10^{-6})$
$A = 6 + 0,024$
$A = 6,024\ m^2$
$\Delta A = A - A_0 = 6,024 - 6 = 0,24\ m^2$

Comp = 0,60 m
Larg = 0,40 m
Alt = 0,20 m
$t_0 = 10°C$
$t_f = 130°C$
$V = ?$
$\alpha = 14 \times 10^{-6}C^{-1}$

0,60 × 0,40 = 0,2400 × 0,20 = 0,0480000

$\beta = 3\alpha$
$\beta = 42.10^{-6}.C^{-1}$
$130 - 10 = 120$

$V = V_0(1 + \beta . \Delta t)$
$V = 0,048(1 + 42.10^{-6}C^{-1} . 120°C)$
$V = 0,048(1 + 5040.10^{-6})$
$V = 0,048(1 + 0,00504) =$
$V = 0,048 + 0,00024 =$
$V = 0,04824\ M^3$

Dilatação do líquido. Pg 181-183 N=4

$L_0 = 156$ cm
$t_0 = 0°C$
$\Delta L = 0,25$
$t = 90°C.$

$\Delta L = L_0 . \alpha . \Delta t.$
$0,25 = 156 . \alpha . 90°$
$14040\alpha = 0,25$
$\alpha = \frac{0,25}{14040} = 1,8 \times 10^{-5}C^{-1}$

Pg 184 - Nº 5

$L = L_0(1 + \alpha \Delta t)$
$L = 100(1 + 1,1 \times 10^{-5} . 10^2)$
$L = 100(1 + 1,1 \times 10^{-3})$
$L = 100 + 1,1 \times 10^{-1}$
$L = 100 + 0,11 =$ **100,11**

Pg 184 - Nº 6

$V = V_0(1 + \delta \Delta t)$
$\Delta V = V_0\ \delta \Delta t.$
$6.10^{-3} V_0 = V_0 . 20.10^{-6} \Delta t$
$\Delta t = \frac{6^3.10^{-3}}{20.10^{-5}}$
$\Delta t = 3.10^{-3} . 10^5$
$\Delta t = 3.10^2 = 300°C$

$\Delta V = 0,6\%$
$\delta = 2,0 \times 10^{-6}$
$\Delta V = 6.10^{-3}$

Pag. 184, Nº 8

220 - 20 = 200

$\Delta A = A_0 . \beta . \Delta t$ $\quad 17 . 10^{-6} \times 2 = 34 . 10^{-6}$

$\Delta A = 200 . 34 . 10^{-6} . 200°$

$\Delta A = 4 . 10^{4} . 34 . 10^{-6}$

$\Delta A = 136 . 10^{-2} = 1,36\ mm^2$

Pag. 185 - Nº 9

$V = V_0 (1 + \delta \Delta t)$

$5000 (1 + 10 \times 10^{-4} . 20)$

$V = 5000 (1 + 200 \times 10^{-4})$

$5000 + 1000000 \times 10^{-4}$

$1000000 = 10^6$

$5000 + 10^{6} . 10^{-4}$

$5000 + 10^{2}$

$5000 + 100 = 5.100\ l.$

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$C = \frac{Q}{\Delta T}$ $\quad c_e = \frac{C}{m}$ $\quad \Rightarrow c = \frac{\frac{Q}{\Delta T}}{m} = \frac{Q}{\Delta T} \times \frac{1}{m} = \frac{Q}{m . \Delta T}$

$Q = c . m . \Delta T$

$Q_{cedida} = Q_{recebida}$

1 = m 230g $\quad Q = c . m . \Delta T$

20 a 160° ΔT $\quad Q = 0,15 . 230 . 140 = 4.830$

Q ?

c = 0,15

160 − 20 = 140

C = cal/°c

Q = cal ou Kcal

c_e = cal/g x °c

---

2 = C = ? $\quad c_e = \frac{C}{m}$

10 kg. = 10.000 g x 0,217 =

c_e = 0,217

---

3 = C = 4,984 Cal/°c $\quad c_e = \frac{C}{m}$

c_e = 0,178 cal/g x °c .

m ?

$m = \frac{C}{c_e} = 4,984 : 0,178 =$

4- Misturando-se 120gr de água a 25°C com 150 gr de água a 42°C, qual a temperatura final da mistura.

calor específico p/ água = 1

$m_1 = 120\,gr$, $t_1 = 25°C$ } recebe calor

$m_2 = 150\,gr$, $t_2 = 42°C$ } cede calor

$T_f = ?$ $\quad Q = m \cdot c \cdot \Delta T$ → 1 → água

$m_2 \cdot c\,(42 - T_f) = M_1 \cdot c\,(T_f - 25)$

$150 \cdot 1\,(42 - T_f) = 120 \cdot 1\,(T_f - 25)$

$6.300 - 150T_f = 120T_f - 3.000$

$-150T_f - 120T_f = -3.000 - 6.300$

$(-1)\ 150T_f + 120T_f = 3.000 + 6.300$.

2. Pg 194 = m_1? $T_1 = 2°C$ $\quad m_2 \cdot C_2 (T_2 - T_f) = m_1 \cdot C_1 (T_f - T_1)$

$m_2 \cdot 1\,(42 - 12) = m_1 \cdot 1\,(12 - 2)$

m_2 = ? $T_2 = 42°C$ $\quad 30\,m_2 = 10\,m_1$

$m_1 = \frac{30 m_2}{10} \Rightarrow m_1 = 3m_2$

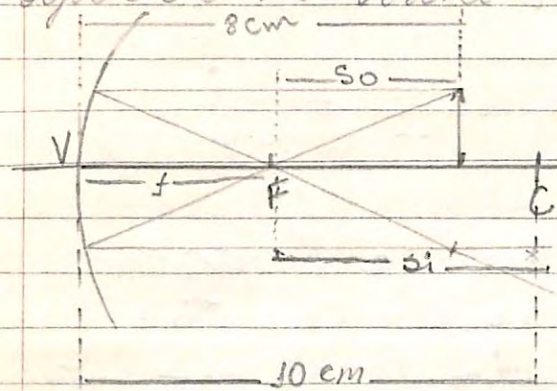
$T_f = 12°C$

$10\,Kg = 10.000\,gr = m_1 + m_2$

Ótica = Espelho côncavo.

$F = 5\,cm$

Objeto = 8 cm do vértice.



$si \cdot So = f^2$

$si \cdot So = 25$

$si \cdot 3 = 25$

$si = \frac{25}{3} = 8,3$

$V \rightarrow Hi$

$f + si$

$5 + 8,3 = 13,3$.

$Ho = 3\,cm$

$V - O = 10\,cm$

$f = 6\,cm$

$\frac{Hi}{Ho} = \frac{F}{So} = \frac{Hi}{3} = \frac{6}{4}$

$4Hi = 18 \Rightarrow Hi = \frac{18}{4} = 4,5$

$f = \begin{cases} > 0 \rightarrow \text{côncavo} \\ < 0 \rightarrow \text{convexo} \end{cases}$

$DO \begin{cases} > 0 \rightarrow \text{objeto real} \\ < 0 \rightarrow \text{>> virtual} \end{cases}$

$si \begin{cases} > 0 \rightarrow \text{imagem real} \\ < 0 \rightarrow \text{>> virtual} \end{cases}$

$\frac{Hi^\circ}{HO}\begin{cases} > 0 \longrightarrow \text{imagem invertida} \\ < 0 \longrightarrow \text{imagem direta.} \end{cases}$

$$\frac{Hi^\circ}{Ho} = \frac{f}{SO} = \frac{Si^\circ}{f} = \frac{Di^\circ}{DO}.$$

Hi° = altura da imagem
Ho = altura do objeto.
f = distância focal $\rightarrow f = \frac{c}{2}$
So = distância do objeto ao foco
Si = distância da imagem ao foco
Di = distância da imagem ao vértice
DO = distância do objeto ao vértice

Ex: Determinar graficamente as características e o valor da imagem fornecida por um espelho côncavo de distância focal igual a 4 cm, para um objeto de tamanho igual a 1,5 cm, acima do eixo principal nas seguintes posições:

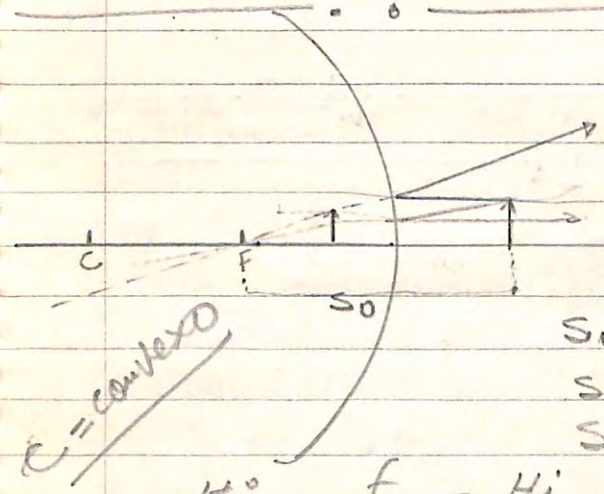
a) 7 cm do espelho (V)
b) 6 cm do espelho (V)
c) 3 cm do espelho (V)

$Ho = 1,5$ cm.
$f = 4$ cm
$Hi = ?$
$DO = 9$ cm
$SO = 5$ cm

$$\frac{Hi^\circ}{HO} = \frac{f}{SO} =$$

$$= \frac{Hi^\circ}{1,5} = \frac{4}{5} = 5Hi = 6$$

$$Hi = \frac{6}{5} = 1,2 \text{ cm}.$$



$Ho = 1,5$ cm.
$f = 4$ cm
$Hi = ?$
$DO = 3$ cm
$SO =$

$So = DO - f.$
$So = 3 - 4$
$So = -1$

$$\frac{Hi^\circ}{Ho} = \frac{f}{SO} = \frac{Hi}{1,5} = \frac{4}{7} \Rightarrow 7Hi^\circ = 6 \Rightarrow Hi = \frac{6}{7}$$

$= 0,85$ cm.

---

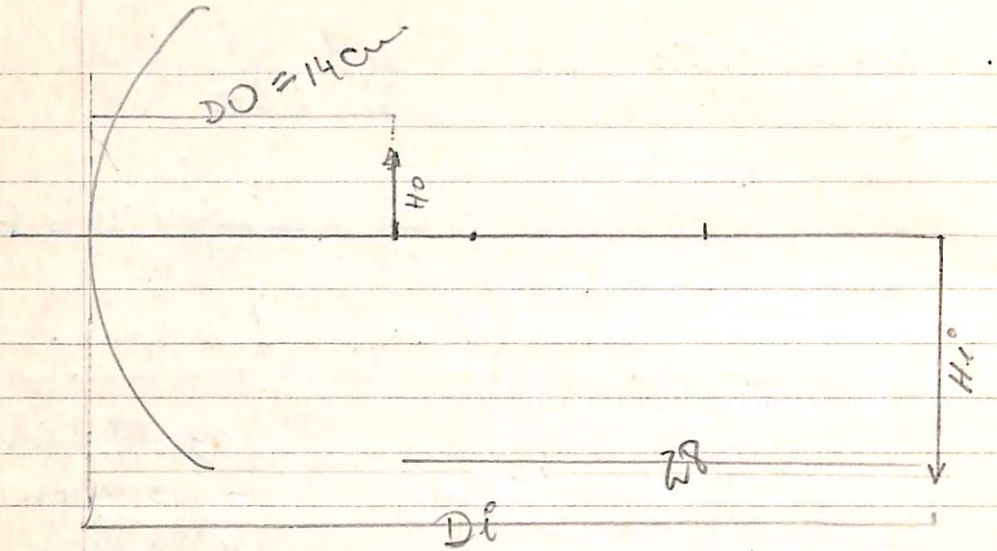
pag. 240 - Nº 3) $f = 22,5$ cm. $Ho^\circ = 15$
$DO = 60$ cm. $Hi^\circ = ?$.

$$\frac{Hi}{HO} = \frac{f}{SO} = \frac{Hi}{15} = \frac{22,5}{37,5} \Rightarrow 37,5Hi = 337,5$$

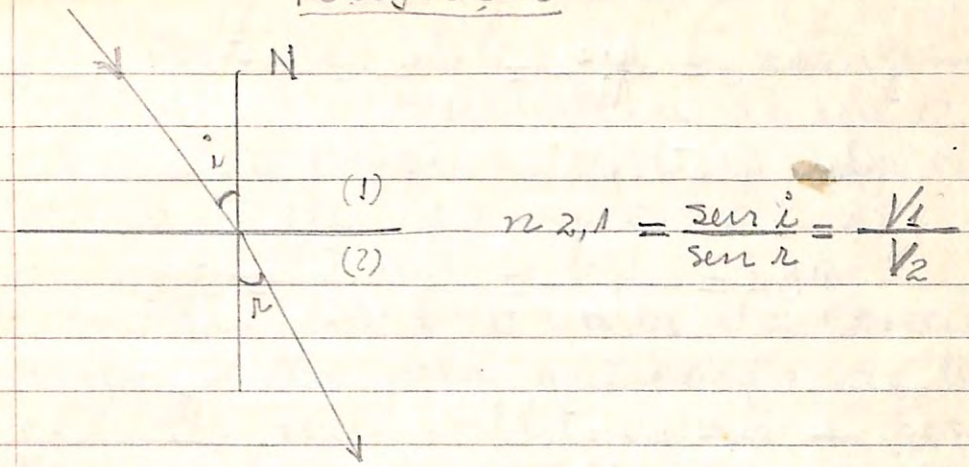
$$Hi = \frac{337,5}{37,5} = 9 \text{ cm}$$

60
22,5
375
300

Pág = 240 = Nº 4



Refração



$$n_{2,1} = \frac{\operatorname{sen} i}{\operatorname{sen} r} = \frac{V_1}{V_2}$$

Ex: A velocidade de propagação da luz em um meio A é $2,5 \times 10^8$ m/s e em um meio B é $2,0 \times 10^8$ m/s

CALCULAR:

1) Os índices de refração absoluto de cada meio (n_A e n_B)
2) Os índices de refração relativo (n_{AB} e n_{BA})
3) Ângulo limite L para estes dois meios

Obs: Velocidade Luz = $3,0 \times 10^8$

1) $n = \frac{c}{v} = \frac{300000000}{250000000} = \frac{30}{25} = 1,2$

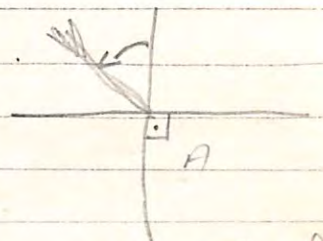
2) $n = \frac{c}{v} = \frac{300000000}{200000000} = 1,5$

2) $n_{AB} = \frac{MB}{MA} = \frac{VA}{VB} = \frac{2,5 \cdot 10^{7}}{2,0 \cdot 10^{8}} = 1,25$

Resp. 1,25 (B)

$n_{BA} = \frac{VB}{VA} = \frac{2,0 \cdot 10^{8}}{2,5 \cdot 10^{8}} = 0,80$ (A)

3) + R = 1,25 (B)
− R = 0,80 (A)



$\frac{\text{sen } i}{\text{sen } r} = 0,80$ $\frac{\text{sen } i}{1} = 0,80 = 53°$ pela tabela

Ângulo limite = 53°.

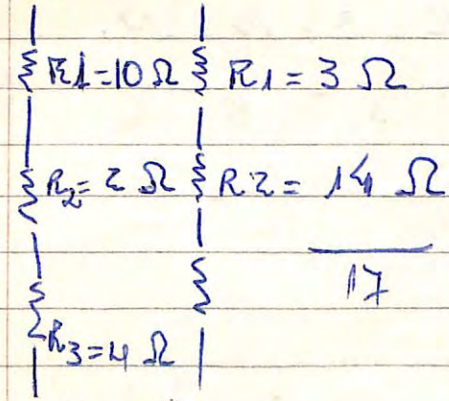
ELETRICIDADE

→ Um Volt é o valor da tensão que aplicada à resistência de um Ohm = Ω origina a intensidade de corrente de 1 Ampére = A.

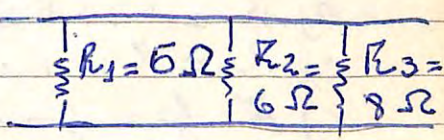
→ Um Ampére é o valor da corrente originada pela aplicação da tensão de um volt sobre a resistência de um ohm = Ω.

→ Um ohm é o valor da resistência que sendo aplicada sobre ela a tensão de um volt origina a corrente de um Ampére

a) b)

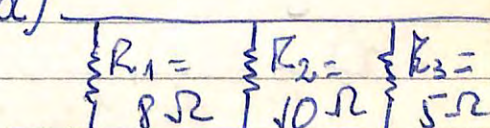


c)



$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

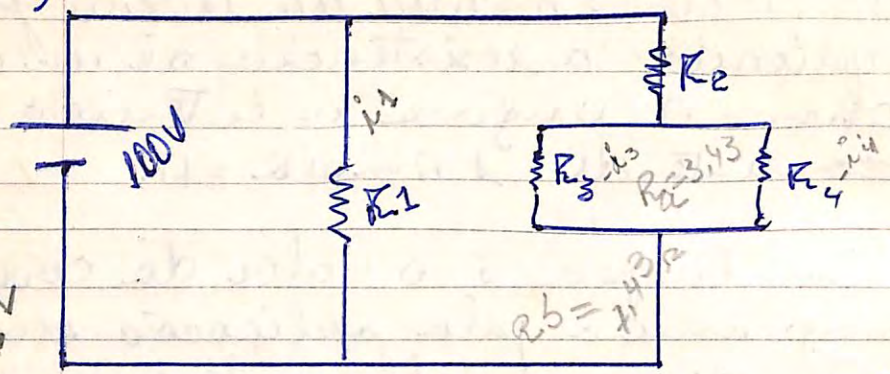
d)



$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$R = R_1 + R_2 + R_3$

e)



$R = 5,42\ \Omega$

$R_1 = 20\ \Omega$
$R_2 = 4\ \Omega$
$R_3 = 8\ \Omega$
$R_4 = 6\ \Omega$

ⓐ Resistencia total?
ⓑ As correntes em cada resistência?
ⓒ A corrente total no circuito?

= Soluções =

a) $R = R_1 + R_2 + R_3 \Rightarrow R = 10 + 2 + 4 = 14.$

b) $R = R_1 + R_2 \Leftrightarrow R = 3 + 14 = 17.$

c) $\frac{1}{R} = \frac{1}{R_2} + \frac{1}{R_2} + \frac{1}{3} = \frac{1}{5} + \frac{1}{6} + \frac{1}{8} =$

$= \frac{24 + 20 + 15}{120} = \frac{59}{120} \therefore \frac{1}{R} = \frac{59}{120}$

$R = \frac{120}{59} = 2,03$

d) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{8} + \frac{1}{10} + \frac{1}{5} =$

$= \frac{5 + 4 + 8}{40} = \frac{17}{40} \therefore \frac{1}{R} = \frac{17}{40} \therefore R = \frac{40}{17} = 2,35$

e) $\frac{1}{R} = \frac{1}{3} + \frac{1}{R_4} \Rightarrow \frac{1}{R} = \frac{1}{8} + \frac{1}{6} = \frac{3+4}{24} = \frac{7}{24} \Rightarrow$

$\Rightarrow \frac{1}{R} = \frac{7}{24} = \frac{24}{7} = 3,43\ \Omega$

$\Rightarrow R = R_2 + R = 4,43 + 4 = 7,43\ \Omega$

$\Rightarrow \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_b} = \frac{1}{20 + 7,43} = \frac{7,43 + 20}{148,6} =$

$= \frac{27,43}{148,6} = \frac{1}{R} = \frac{27,43}{148,6} = R = \frac{148,6}{27,43}$

ⓐ $R = 5,42\ \Omega.$

$\Rightarrow V = R \cdot i \therefore i_1 = \frac{V}{R_1} = \frac{100}{20} = 5\ A$

ⓑ

$\Rightarrow i_2 = \frac{100}{7,43} = 13,45\ A.$

$\Rightarrow V = V_1 \rightarrow V - V_1 = 100 - R_2 \cdot i_2$

$V_1 = 100 - 4 \cdot 13,45$

$100 - 53,8 = 46,2$

$V = R\,i$

$i_3 = \frac{V}{R_3} = \frac{46,2}{8} = 5,775\ A$

$i_4 \frac{46,2}{6} = 7,7\ A$

ⓒ $A = 13,45 + 5 = 18,45\ A.$