1ª série – Física Geral

1. $v_m = \dfrac{x_f - x_i}{t_f - t_i}$

a) $v_m = \dfrac{10-0}{2-0} = 5\ m/s$

b) $v_m = \dfrac{5-0}{4-0} = \dfrac{5}{4}\ m/s.$

c) $v_m = \dfrac{5-10}{4-2} = -\dfrac{5}{2}\ m/s$

d) $v_m = \dfrac{-5-5}{7-4} = -\dfrac{10}{3}\ m/s$

e) $v_m = \dfrac{0-0}{8-0} = 0\ m/s.$

2. a) $x = 2{,}0 + 3{,}0t - 1{,}0t^2$

$t = 3s$

$x = 2{,}0 + 3{,}0 \times 3 - 1{,}0 \times 3^2 = 2{,}0\ m$

b) $v = \dfrac{dx}{dt} = 3{,}0 - 2{,}0t \quad m/s.$

$t = 3s\ ;\ v = 3{,}0 - 2{,}0 \times 3 = -3{,}0\ m/s.$

c) $a = \dfrac{dv}{dt} = -2{,}0 \quad m/s^2$

$t = 3s\ ;\ a = -2{,}0\ m/s^2$

3. 

$v_f = 0$

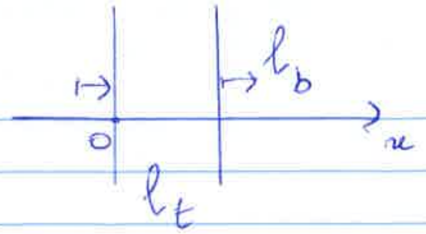
a) $v_f = v_i - at \quad \Rightarrow \quad t = -\dfrac{v_f - v_i}{a} = 20\ s$

b) $x = v_i t - \frac{1}{2} a t^2$

$x = 100 \times 20 - \frac{1}{2} 5{,}0 \times 20^2 = 1000\ m = 1\ Km$

$1{,}0\ km > 0{,}8\ Km$ não pode

4.



a médio ~ a constante $= \frac{v_f - v_i}{t_1}$

$$\begin{cases} v = v_i - at \\ x = v_i t - \frac{1}{2} a t^2 \end{cases}$$

$v = v_f \qquad x = l_t + l_b$

$$\begin{cases} v_f = v_i - a t_1 \\ l_t + l_b = v_i t_1 - \frac{1}{2} a t_1^2 \end{cases} \qquad a = \frac{v_f - v_i}{t_1}$$

$\therefore \; t_1 = 3.43 \times 10^{-4}\,s$.

a) $a = 40.8 \times 10^4 / s^2$

b) $v = v_i - at$

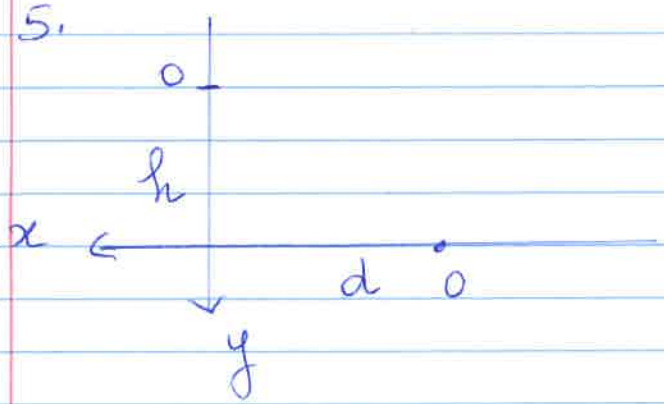
$v = 0 \;; \quad t = \frac{v_i}{a} = \frac{420}{40.8} \times 10^{-4} = 10.3 \times 10^{-4}\,s$

$$l_t' + l_b = v_i t - \frac{1}{2} a t^2$$

$= 216 \times 10^{-3}\,m = 21.6\,cm$.

$l_t' = 21.6 - 2.00 = \underline{19.6}\,cm$

5.



$v_c = 10.0\,m/s$

$h = 3.00\,m$

mulher $v_0 = 0$ $a = 9.8\ ms^{-2}$

$y_0 = 0$

$$y = y_0 + v_0 t + \frac{1}{2} a t^2$$

$$y = \frac{1}{2} a t^2$$

b) $y = h \Rightarrow t^* = \sqrt{\frac{2h}{a}} = \sqrt{\frac{2 \times 3.00}{9{,}8}} = 0{,}78\ s.$

a) cavalo $x = v_c t$

$x = d$: $d = v_c t^* = 10{,}0 \times 0{,}78 = 7.8\ m$

6. $x = (-5.0 \sin t)\ m$

$y = (4.0 - 5{,}0 \cos t)\ m.$

$$\vec{r} = -5.0 \sin t\ \vec{i} + (4.0 - 5.0 \cos t)\ \vec{j}$$

$$\vec{v} = \frac{d\vec{r}}{dt} = -5{,}0 \cos t\ \vec{i} + 5{,}0 \sin t\ \vec{j}$$

$t = 0$ $\vec{v} = -5{,}0\ \vec{i}$

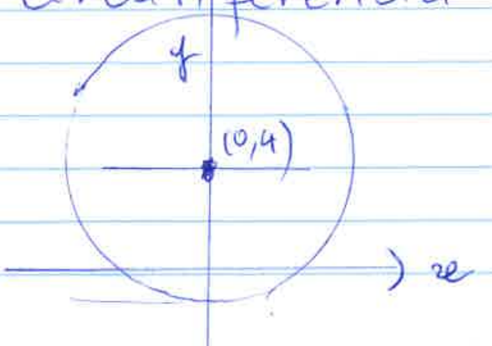
$$\vec{a} = \frac{d\vec{v}}{dt} = 5{,}0 \sin t\ \vec{i} + 5{,}0 \cos t\ \vec{j}$$

$t = 0$: $\vec{a} = 5{,}0\ \vec{j}$

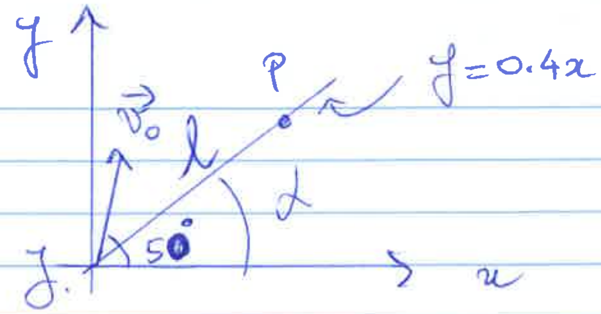
trajetória. $\sin t = -\frac{x}{5.0}$ $\cos t = -\frac{y - 4.0}{5.0}$

$$\sin^2 t + \cos^2 t = 1 \Rightarrow \frac{x^2}{5.0^2} + \frac{(y-4.0)^2}{5.0^2} = 1.$$

circunferência no plano xy c centro em $(0,4)$ c raio 5.0



7.



$l = 30\,m.$

$\theta = 50°$

$$\vec{v} = \vec{v}_0 + \vec{a}\,t = v_0 \cos\theta\, \vec{u}_x + (v_0 \sin\theta - gt)\,\vec{u}_y$$

$$\vec{r} = \vec{r}_0 + \vec{v}_0 t + \frac{1}{2}\vec{a}\,t^2$$

$$\vec{r} = \underbrace{(v_0 t \cos\theta)}_{x}\,\vec{u}_x + \underbrace{(v_0 t \sin\theta - \frac{1}{2} g t^2)}_{y}\,\vec{u}_y$$

Pedro : $\frac{y}{x} = 0,4 = tg\,\alpha \qquad \alpha = tg^{-1} 0,4 = 22°$

$$\begin{cases} x_P = l \cos\alpha \\ y_P = l \sin\alpha. \end{cases}$$

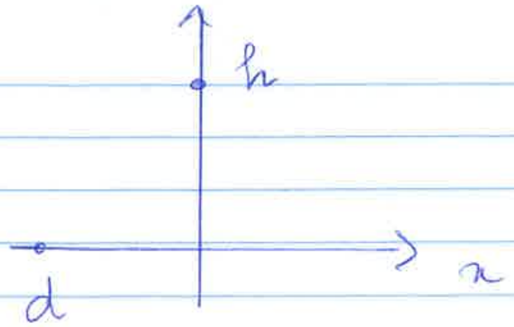
Para a maça chegar ao Pedro.

$$\begin{cases} l \cos\alpha = v_0 t \cos\theta \\ l \sin\alpha = v_0 t \sin\theta - \frac{1}{2} g t^2 \end{cases}$$

$$\begin{cases} t = \frac{l \cos\alpha}{v_0 \cos\theta} \\ v_0^2 = \frac{1}{2} g\, l \,\frac{\cos\alpha}{\cos^2\theta} \times \frac{1}{(tg\,\theta - tg\,\alpha)} \end{cases}$$

ou seja $v_0 = 20\,m/s.$

8.



$h = 240\,m.$
$d = 1.0\,km.$

elevador: $\vec{r}_0 = h\,\vec{u}_y$ $\quad \vec{v}_0 = \vec{0}$ $\quad \vec{a} = -g\,\vec{u}_y$

$$\vec{v} = \vec{v}_0 + \vec{a}\,t = -g\,t\,\vec{u}_y$$

$$\vec{r} = \vec{r}_0 + \vec{v}_0\,t + \frac{1}{2}\vec{a}\,t^2$$

$$= h\,\vec{u}_y - \frac{1}{2} g\,t^2\,\vec{u}_y$$

$$= \left(h - \frac{1}{2} g\,t^2\right)\vec{u}_y$$

$\vec{r} = 0 \qquad h - \frac{1}{2} g\,t^2 = 0 \Rightarrow t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 240}{9.8}}$

$= 7.0\,s.$

Superhomem: $\vec{a}_s = 0 \quad \vec{v}_s \quad \vec{r}_{s0} = -d\,\vec{u}_x$

$$\vec{r}_s = \vec{r}_{s0} + \vec{v}_s\,t$$

$$\vec{r}_s = (-d + v_s\,t)\,\vec{u}_x$$

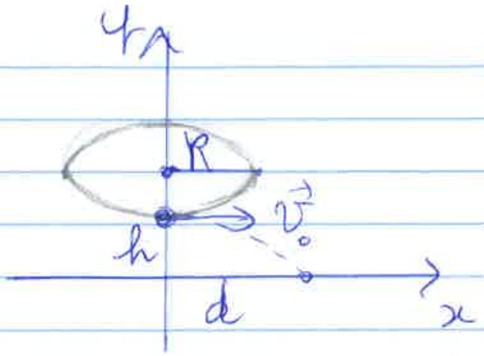
$\vec{r}_s = 0 \qquad d = v_s\,t$

$v_s = \frac{d}{t} \Rightarrow v_s = \frac{1.00 \times 10^3}{7.0} = 1.4 \times 10^2\,m/s.$

Se subtrair a altura das árvores fica

$240 - 10 = 230$ e dá $v_s = 1.5 \times 10^2\,m/s.$

9.



$R = 0.30\,m$.
$h = 1.2\,m$
$d = 2.0\,m$.

$$a_c = \frac{v_0^2}{r}$$

$$\vec{r}_0 = h\vec{u}_y \qquad \vec{v}_0 = v_0\vec{u}_x \qquad \vec{a} = -g\vec{u}_y$$

$$\vec{v} = \vec{v}_0 + \vec{a}\,t$$
$$\vec{r} = \vec{r}_0 + \vec{v}_0 t + \frac{1}{2}\vec{a}\,t^2$$

$$\vec{r} = h\vec{u}_y + v_0 t\,\vec{u}_x - \frac{1}{2}g t^2 \vec{u}_y$$
$$= (v_0 t)\vec{u}_x + (h - \frac{1}{2}g t^2)\,\vec{u}_y$$

$$y = 0 : \quad h - \frac{1}{2}g t^2 = 0 \qquad t = \sqrt{\frac{2h}{g}}$$

$$x = d : \quad d = v_0 t \Rightarrow v_0 = \frac{d}{t} = d\sqrt{\frac{g}{2h}}$$

$$a_c = \frac{g d^2}{2hr} = \frac{9.8 \times 2.0^2}{2 \times 1.2 \times 0.30} = 54\,m/s^2$$

10. $v_i = 90\,km/h = 25.0\,ms^{-1}$ $\quad v_f = 50.0\,km/h = 13.9\,ms^{-1}$

$$a_t = \frac{v_f - v_i}{\Delta t} = -0.74\,m\,s^{-2} = -9.59\times10^3\,km/h^2$$

$$a_c = \frac{v^2}{r} = \frac{13.9^2}{150} = 1.29\,ms^{-2} = 16.7\times10^3\,km/h^2$$

$$a = \sqrt{a_t^2 + a_c^2} = 19.3\times10^3\,km/h^2$$