RESOLUÇÃO DA PROVA

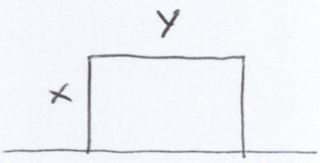
①

$$\lim_{x\to 0} \frac{x}{\left(\frac{1}{6}+\frac{1}{x-6}\right)}$$

$$= \lim_{x\to 0} \frac{x}{\left(\frac{1}{6}+\frac{1}{x-6}\right)} \times \frac{6(x-6)}{6(x-6)} = \lim_{x\to 0} \frac{6x(x-6)}{(x-6)+6}$$

$$= \lim \frac{6x(x-6)}{x} = \lim_{x\to 0} 6x-36 = -36$$

②



$$2x+y=18$$

$$y=18-2x$$

$$A=x\cdot y$$

$$A=x(18-2x)=18x-2x^2$$

$$\frac{dA}{dx}=18-4x$$

$$18-4x=0$$

$$4x=18 \rightarrow x=\frac{9}{2}=4{,}5m$$

$$y=18-2x=18-2\cdot\left(\frac{9}{2}\right)=18-9$$

$$y=9m$$

(3)

$$\int x \ln x \, dx$$

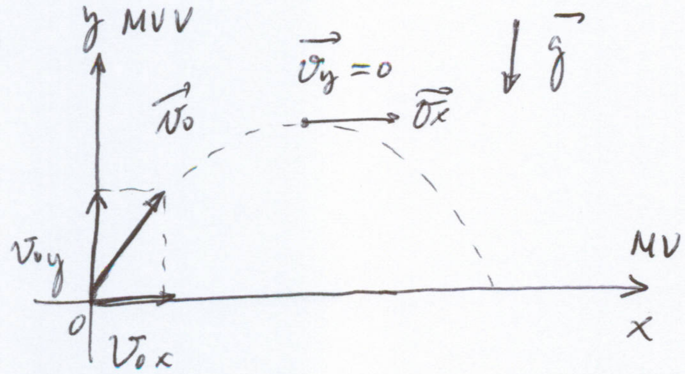
$$u = \ln x \; ; \quad dv = x\,dx$$

$$du = \frac{1}{x}\,dx \; ; \quad v = \int \cancel{x}\,dx = \frac{x^2}{2}$$

$$\int x \ln x \, dx = \ln x \cdot \frac{x^2}{2} - \int \frac{x^2}{2} \cdot \frac{1}{x}\,dx$$

$$= \frac{x^2}{2}\ln x - \int \frac{x}{2}\,dx = \frac{x^2}{2}\ln x - \frac{x^2}{4} + C$$

(4)



$$v_{0x} = v_0 \cos\theta$$

$$v_{0y} = v_0 \operatorname{sen}\theta$$

- DIREÇÃO OX – MV

$$x = (v_0 \cos\theta)\,t$$

- DIREÇÃO OY – MVV

$$y = (v_0 \operatorname{sen}\theta)\,t - \frac{g}{2}\,t^2$$

$$v_y = v_0 \operatorname{sen}\theta - g t$$

$$v_y^2 = v_0^2 \operatorname{sen}^2\theta - 2 g y$$

a.)

$$v_y = v_0 \operatorname{sen}\theta - g t$$

$$0 = v_0 \operatorname{sen}\theta - g t$$

$$g t = v_0 \operatorname{sen}\theta$$

$$t = \frac{v_0}{g} \operatorname{sen}\theta$$

b.) $y = (v_0 \operatorname{sen}\theta)t - \frac{g}{2}t^2$

$$y = v_0 \operatorname{sen}\theta \left(\frac{v_0}{g}\operatorname{sen}\theta\right) - \frac{g}{2}\left(\frac{v_0^2}{g^2}\operatorname{sen}^2\theta\right)$$

$$y = \frac{v_0^2}{g}\operatorname{sen}^2\theta - \frac{v_0^2}{2g}\operatorname{sen}^2\theta = \boxed{\frac{v_0^2}{2g}\operatorname{sen}^2\theta}$$

c.) $\boxed{E_c = \frac{1}{2} m v_0^2 \cos^2\theta}$

d.) $x = (v_0 \cos\theta)t$

$$x = v_0\cos\theta \cdot \frac{2v_0}{g}\operatorname{sen}\theta = \boxed{\frac{2v_0^2}{g}\operatorname{sen}\theta\cos\theta}$$

e.) $\boxed{E_c = \frac{1}{2} m v_0^2}$

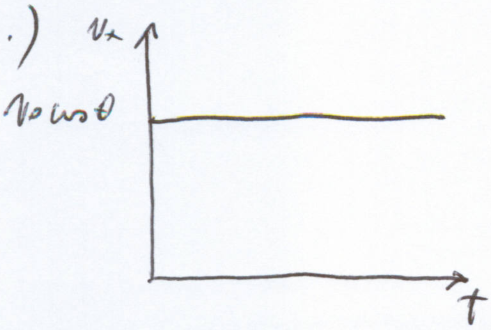
f.) $$\frac{dx}{d\theta} = \frac{d}{d\theta}\left[\frac{2v_0^2}{g}\operatorname{sen}\theta\right]\left[\cos\theta\right] + \frac{2v_0^2}{g}\operatorname{sen}\theta\,\frac{d(\cos\theta)}{dt}$$

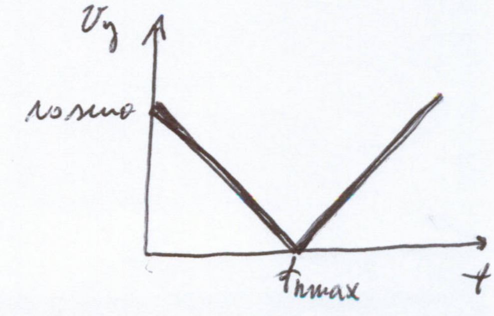
$$= \frac{2v_0^2}{g}\cos\theta\cos\theta - \frac{2v_0^2}{g}\operatorname{sen}\theta\operatorname{sen}\theta$$

$$= \frac{2v_0^2}{g}\cos^2\theta - \frac{2v_0^2}{g}\operatorname{sen}^2\theta = \frac{2v_0^2}{g}\left[\cos^2\theta - \operatorname{sen}^2\theta\right] = 0$$

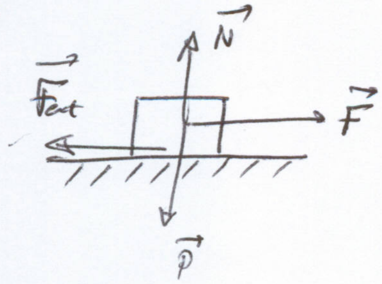
$$\cos^2\theta = \operatorname{sen}^2\theta \rightarrow \cos\theta = \operatorname{sen}\theta \rightarrow \boxed{\theta = 45^\circ}$$

g.)





(5)



$P = m \cdot g = 4 \cdot 10 \rightarrow P = 40N$

$N = P \rightarrow N = 40N$

$f_{atmax} = \mu \cdot N \Rightarrow f_{atmax} = 0,5 \cdot 40$

a.) $F < f_{atmax} \rightarrow$ Repouso $\qquad f_{atmax} = 20N$

$f_{AT} = F \rightarrow f_{AT} = 10N$ e $a = 0$

b.) $F > f_{atmax}$

$f_{at} = f_{atmax} = 20N$

$F - f_{at} = m \cdot a \Rightarrow 30 - 20 = 4a$

$4a = 10$

$a = 2,5 m/s^2$

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(6) $x = 4\cos\left(\frac{1}{2}\pi t + \pi\right)$

a.) $A = 4m$

$w = \frac{\pi}{2}$ rad/s

$\varphi_0 = \pi$ rad

b.) $w = \frac{2\pi}{T}$

$T = \frac{2\pi}{w} = \frac{2\pi}{\frac{\pi}{2}} = 4s$

$f = \frac{1}{T} \rightarrow f = \frac{1}{4} = 0,25 Hz$

c.) $v = \frac{dx}{dt} = \frac{d}{dt}\left[4\cos\left(\frac{1}{2}\pi t + \pi\right)\right]$

$v = -4 \cdot \frac{1}{2}\pi \operatorname{sen}\left(\frac{1}{2}\pi t + \pi\right)$

$v = -2\pi \operatorname{sen}\left(\frac{1}{2}\pi t + \pi\right)$

d.) $a = \frac{dv}{dt} = \frac{d}{dt}\left[-2\pi \operatorname{sen}\left(\frac{1}{2}\pi t + \pi\right)\right]$

$= -2\pi \cdot \frac{1}{2} \cdot \pi \cos\left(\frac{1}{2}\pi t + \pi\right) = -\pi^2 \cos\left(\frac{1}{2}\pi t + \pi\right)$

e.) $\operatorname{sen}\left(\frac{1}{2}\pi t + \pi\right) = 1$ $\qquad \cos\left(\frac{1}{2}\pi t + \pi\right) = 1$

$|v|_{MAX} = |-2\pi| = 2\pi\ m/s$ $\qquad |a|_{MAX} = |-\pi^2|$

$|a|_{MAX} = \pi^2\ m/s^2$

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7 $P_c = E$

$P_c = m_c \cdot g$ $\Rightarrow$ $P_c = d_c \cdot A \cdot h \cdot g$

$m_c = d_c \cdot V_c$ $\qquad E = d_e \cdot V_e \cdot g$

$V_c = A \cdot h$ $\qquad V_e = V_{imerso}$

$V_i = A \cdot h_{imerso} \rightarrow V_{imerso} = A \cdot \frac{3}{4} h$

$\therefore \ E = d_e \cdot A \cdot \frac{3}{4} \cdot h \cdot g$

$P_a = E$

$$d_c \cdot A \cdot h \cdot g = d_e \cdot A \cdot \frac{3}{4} \cdot h \cdot g$$

$$d_c = \frac{3}{4} d_e \Rightarrow \frac{d_c}{d_e} = \frac{3}{4} \rightarrow d_{c,e} = \frac{3}{4}$$

(8) a.) $\lambda = 4\,m$; b.) $A = 10\,m$

c.) $f = \frac{v}{\lambda} = \frac{200}{4} = 50\,Hz$ d.) $T = \frac{1}{f} = \frac{1}{50} = 0{,}02\,s$

(9)

$$t_{(x)} = \frac{2z}{v_1 \cos(i_c)} - \frac{2z \tan(i_c)}{v_2} + \frac{x}{v_2}$$

$$\operatorname{sen} i_c = \frac{v_1}{v_2}$$

$$= \frac{2z}{v_1 \cos(i_c)} - \frac{2z \operatorname{sen}(i_c)}{v_1} \cdot \frac{\operatorname{sen}(i_c)}{\cos(i_c)} + \frac{x}{v_2}$$

$$= \frac{2z}{v_1 \cos(i_c)} - \frac{2z \operatorname{sen}^2(i_c)}{v_1 \cos(i_c)} + \frac{x}{v_2}$$

$$= \frac{2z\left[1 - \operatorname{sen}^2(i_c)\right]}{v_1 \cos(i_c)} + \frac{x}{v_2}$$

$$= \frac{2z \cos^{\cancel{2}}(i_c)}{v_1 \cancel{\cos(i_c)}} + \frac{x}{v} = \frac{2z \cos(i_c)}{v_1} + \frac{x}{v_2}$$