Lançamento oblíquo - Resolução da lista

① $h_0 = 50\ m$ $\quad\quad$ $\sin\theta = 0{,}80$

$V_0 = 20\ m/s$ $\quad\quad$ $\cos\theta = 0{,}60$

a) Tempo p/ atingir o solo

$V_{0x} = V_0 . \cos\theta \Rightarrow V_{0x} = 20 . 0{,}60 \Rightarrow V_{0x} = 12\ m/s$

$V_{0y} = V_0 . \sin\theta \Rightarrow V_{0y} = 20 . 0{,}80 \Rightarrow V_{0y} = 16\ m/s$

Equações horárias

$x = V_x . t \Rightarrow x = 12 . t$

$h = h_0 + V_{0y} t - \frac{g t^2}{2} \Rightarrow h = 50 + 16t - 5t^2$

P/ atingir o solo $\Rightarrow h = 0$

$0 = 50 + 16t - 5t^2$ ou $5t^2 - 16t - 50 = 0$

$\Delta = b^2 - 4.a.c \Rightarrow \Delta = (-16)^2 - 4.5.(-50) = 1256$

$t = \frac{-b \pm \sqrt{\Delta}}{2a} \Rightarrow t = \frac{16 \pm \sqrt{1256}}{2.5}$

$\boxed{t' = 5{,}14\ s}$ $\quad\quad$ $t'' = -1{,}94\ s$ (não convém)

b) Alcance

$x = 12 . t \Rightarrow x = 12 . 5{,}14 \Rightarrow x = 61{,}7\ m$

c) V_y p/ $t = 5{,}14 \Rightarrow V_y = V_{0y} - g t \Rightarrow V_y = 16 - 10 . 5{,}14$

$V_{y(5{,}14)} = -35{,}4\ m/s$

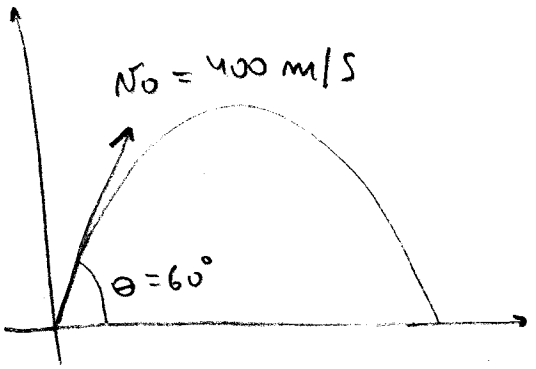
⑧ Cont.

d) $V_x = V_{0x} = 12\ m/s$

e) $V = \sqrt{V_x^2 + V_y^2} \Rightarrow V = \sqrt{12^2 + (-35{,}4)^2}$

$V \cong 37\ m/s$

⑨



$g = 10\ m/s^2$

$V_{0x} = 400 \cdot \cos 60°$

$V_{0x} = 200\ m/s$

$V_{0y} = 400 \cdot \operatorname{sen} 60°$

$V_{0y} = 348\ m/s$

$x = x_0 + V_x t \Rightarrow x = 0 + 200t \Rightarrow x = 200t$

$h = h_0 + V_{0y} t - \frac{gt^2}{2} \Rightarrow h = 0 + 348t - \frac{10 \cdot t^2}{2}$

$h = 348t - 5t^2$

$V_y = V_{0y} - gt \Rightarrow V_y = 348 - 10t$

a) Toca o solo quando $h = 0$

$h = 348t - 5t^2 \Rightarrow 0 = 348t - 5t^2$

$t(348 - 5t) \Rightarrow t = 0$ (não convém)

$348 - 5t = 0 \Rightarrow t = \frac{348}{5} \Rightarrow t = 70\ s$

(9) cont.

b) Maior altura $\Rightarrow$ $V_y = 0$

$$V_y^2 = V_{oy}^2 - 2gh$$

$$0^2 = 348^2 - 2.10.h_{máx}$$

$$h_{max} = \frac{-348^2}{-2.10} \Rightarrow \boxed{h_{máx} = 6{,}1 \times 10^3 \text{ m}}$$

c) Alcance horizontal

$$x = V_x.t \Rightarrow x = 200 \times 70 \Rightarrow \boxed{x = 1{,}4 \times 10^4 \text{ m}}$$

(10) $V_0 = 100 \text{ m/s}$ $\quad \sin\theta = 0{,}60$ $\quad \cos\theta = 0{,}80$

$$V_{ox} = V_0 \cos\theta \Rightarrow V_{ox} = 100.0{,}8 \Rightarrow V_{ox} = 80 \text{ m/s}$$
$$V_{oy} = V_0 \sin\theta \Rightarrow V_{oy} = 100.0{,}6 \Rightarrow V_{oy} = 60 \text{ m/s}$$

a) $x = x_0 + V_{ox}t \Rightarrow x = 0 + 80t \Rightarrow \boxed{x = 80t}$

$$h = h_0 + V_{oy}t - \frac{gt^2}{2} \Rightarrow h = 0 + 60t - \frac{10t^2}{2}$$

$$\boxed{h = 60t - 5{,}0t^2}$$

b) $V_y = V_{oy} - gt \Rightarrow \boxed{V_y = 60 - 10t}$

c) coordenadas em $t = 3{,}0$ s

$x = 80t \Rightarrow x = 80.3 \Rightarrow x = 240 \text{ m}$

$h = 60t - 5{,}0t^2 \Rightarrow h = 60.3 - 5{,}0.3^2 \Rightarrow h = 135 \text{ m}$

(240 m, 135 m)

(10) cont. d) módulo de v p/ $t=3,0\,s$

$$v_x = v_{0x} = 80\ m/s$$

$$v_y = v_{0y} - gt \Rightarrow v_y = 60 - 10 \cdot 3 \Rightarrow v_y = 30\ m/s$$

$$v = \sqrt{80^2 + 30^2} \Rightarrow \boxed{v = 85\ m/s}$$

(11) $v_0 = 200\ m/s$ $\quad \operatorname{sen}\theta = 0,80$ $\quad \cos\theta = 0,60$

$$v_{0x} = 200 \times 0,60 \Rightarrow v_{0x} = 120\ m/s \quad (= v_x)$$

$$v_{0y} = 200 \times 0,80 \Rightarrow v_{0y} = 160\ m/s$$

$$x = x_0 + v_x t \Rightarrow x = 120t$$

$$h = h_0 + v_{0y}t - \frac{gt^2}{2} \Rightarrow h = 0 + 160t - \frac{10t^2}{2}$$

$$h = 160t - 5t^2$$

$$v_y = v_{0y} - gt \Rightarrow v_y = 160 - 10t$$

a) No vértice $v_y = 0$

$$0 = 160 - 10t \Rightarrow t = -\frac{160}{-10} \Rightarrow \boxed{t = 16\ s}$$

b) Tempo de voo $\Rightarrow t_t = 16 \times 2$ $\quad \boxed{t_t = 32\ s}$

c) Alcance $\quad x = v_x t \Rightarrow x = 120 \cdot 32$

$$\boxed{x = 3840\ m}$$

(11) cont. d) $h_{máx}$

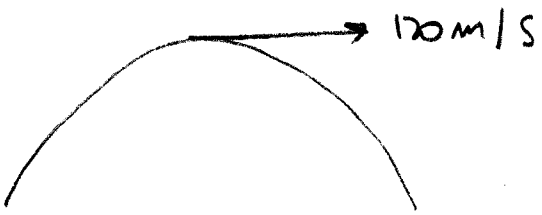
$$h = h_0 + v_{0y}t - \frac{gt^2}{2}$$

$$h_{máx} = 160 \cdot 16 - \frac{10 \cdot 16^2}{2} \Rightarrow \boxed{h_{máx} = 1280\ m}$$

e) $v_x = v_{0x} = 120\ m/s$

$v_y = 0\ m/s$

$\therefore\ v = 120\ m/s$



(12) $v_0 = 100\ m/s \qquad \theta = 30°$

$$v_{0x} = 100 \cdot \cos 30° \Rightarrow v_{0x} = 87\ m/s$$
$$v_{0y} = 100 \cdot \operatorname{sen} 30° \Rightarrow v_{0y} = 50\ m/s$$

$$h = h_0 + v_{0y}t - \frac{gt^2}{2}$$

$$h = 0 + 50t - \frac{10 \cdot t^2}{2} \Rightarrow h = 50t - 5t^2$$

p/ $h = 80 \Rightarrow 80 = 50t - 5t^2 \Rightarrow 5t^2 - 50t + 80 = 0$

$\div 5 \Rightarrow t^2 - 10t + 36 = 0$

$\Delta = (-10)^2 - 4 \cdot 1 \cdot 36$

$\Delta = 36$

$$t = \frac{-(-10) \pm \sqrt{36}}{2} = \frac{10 \pm 6}{2}$$

$t' = 2,0\ s \quad e \quad t'' = 8,0\ s$

(13) $\theta = 45°$ $\quad x_{máx} = 40\ m$

$h = h_0 + v_{0y}t - \frac{gt^2}{2}$ $\quad$ Chegada e saída, $h = 0$

$0 = 0 + v_{0y}t - \frac{10t^2}{2}$

$0 = 0 + v_0 . \text{sen}45° t - 5t^2$

$t\left(\frac{v_0\sqrt{2}}{2} - 5t\right) = 0 \Rightarrow t = 0$

$\frac{v_0\sqrt{2}}{2} - 5t = 0$

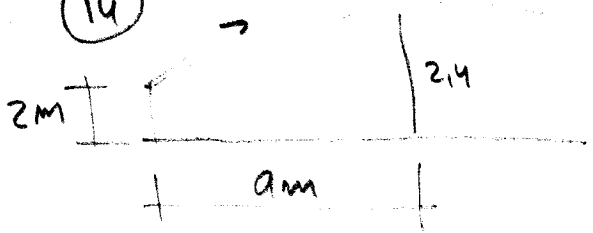
$t = \frac{v_0\sqrt{2}}{10}$ (tempo p/ chegada)

$x = x_0 + v_{0x} . t$

$x = 0 + v_0 \cos\theta . t$

$40 = \frac{v_0\sqrt{2}}{2} . \frac{v_0\sqrt{2}}{10} \Rightarrow v_0^2 = 400 \Rightarrow \boxed{v_0 = 20\ m/s}$

(14) $v_0 = 15\ m/s$



$\theta = 15°$

$v_x = 15 . \cos 15° = 14,5\ m/s$

$v_{0y} = 15 . \text{sen}15° = 3,88\ m/s$

(a) $x = x_0 + v_x t$

$9 = 0 + 14,5t \Rightarrow t = 0,62\ s$

$h = h_0 + v_{0y}t - \frac{gt}{2} \Rightarrow h = 2,0 + 3,88 \times 0,62 - \frac{10 . 0,62^2}{2}$

$h = 2,48\ m$ ∴ passa sobre a rede

(14) cont (b)

Tempo p/ chegar ao solo:

$$h = h_0 + V_{0y} t - \frac{g t^2}{2}$$

$$0 = 2{,}0 + 3{,}88 \cdot t - \frac{9{,}8 t^2}{2}$$

$$-4{,}9 t^2 + 3{,}88 t + 2{,}0 = 0$$

$$\Delta = (3{,}88)^2 - 4 \cdot (-4{,}9) \cdot 2{,}0$$

$$\Delta = 54{,}25$$

$$t = \frac{-3{,}88 \pm \sqrt{54{,}25}}{2 \cdot (-4{,}9)}$$

$t' = -0{,}355$ (não convém)

$t'' = 1{,}15$ s

Distância percorrida em x

$$x = V_x t \Rightarrow x = 14{,}5 \cdot 1{,}15 \Rightarrow x = 16{,}7 \text{ m}$$

A quadra tem 18 m

∴ cai dentro da quadra