EXAME 1 – TG2 – 2017.06.06

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(1) (i) $y = v_{iy}t + \frac{1}{2}a_y t^2$; $-80 = 0 + \frac{1}{2}(-9.81)t^2$ → $t = 4.0\ s$ (vertical) — 25%

(ii) (horizontal) $a = 0$ $v_2 = v_{ix} = v_{fx} = 30 = \text{const.}$ — 25%

$x = v_x t = 120\ m$

(iii) v_{final} → $v_{fx} = 30\ m/s$ — 30%

$v_{fy} = v_{iy} + a_y t = -40\ m/s$ ($v_{iy} = 0$)

$\vec{v}_f = 30\hat{i} - 40\hat{j}\ m/s$

(iv) $|\vec{v}_f| = \sqrt{v_{fx}^2 + v_{fy}^2} = 50\ m/s$ — 20%

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(2) Cons. $\vec{p}$ (sistema isolado!)

$0.50\ m + 1.00\ m = m(v_1 + v_2)$ — 30%

choque elástico

$\frac{1}{2}m(0.50)^2 + \frac{1}{2}m(1.00)^2 = \frac{1}{2}m(v_1^2 + v_2^2)$ — 30%

$\begin{cases} v_1 + v_2 = 1.50 \\ v_1^2 + v_2^2 = 1.25 \end{cases}$ → $v_1 = 1.50 - v_2$

$(1.50 - v_2)^2 + v_2^2 = 1.25$

$2v_2^2 - 3.00 v_2 + 1.00 = 0$

$v_2 = \frac{1.50 \pm \sqrt{2.25 - 4 \times 0.50}}{2} = \frac{1.50 \pm \sqrt{0.25}}{2} = \frac{1.50 \pm 0.50}{2}$

(era porque nem chocavam! ($v_1 = 0.50$)) — 20%

$v_2 = 1.00$ ou $v_2 = 0.50$ ($v_1 = 1.00$)

$\vec{v}_2 = 0.50\hat{i}$ $\quad v_1 = 1.00\hat{i}$ — 20%

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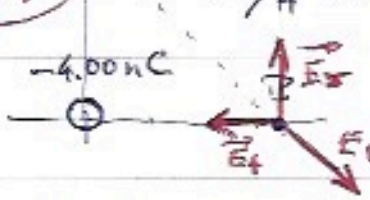
(3) (i) 8.00 nC, −5.00 nC, −4.00 nC

$\theta = \pi/4 = 45°$ (diagonal de um quadrado) — 10%

Diagonal → $0.3 \times \sqrt{2}$ — 10%



(ii) Somando (p/x): — 20%

$E_x = E_8 \cos 45° - E_4 = \frac{10^{-9}}{4\pi\varepsilon_0}\left[\frac{8\sqrt{2}}{2\times(0.3\sqrt{2})^2} - \frac{4}{(0.3)^2}\right]$

(p/y): $E_5 - E_8 \sin 45° = E_y$

$|\vec{E}| = \sqrt{E_x^2 + E_y^2}$

$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{d^2}$

$E_y = \frac{10^{-9}}{4\pi\varepsilon_0}\left[\frac{5}{(0.3)^2} - \frac{8\sqrt{2}}{2\times(0.3\sqrt{2})^2}\right]$

$\vec{E} = -117\hat{i} + 217\hat{j}$ — 25%

$|\vec{E}| = 247\ N/C$ — 10%

$\tan\alpha = \frac{217}{-117} = -1.85$; $\alpha = 61.7°$