Física mecânica, Lista 1 - MRV

1) $\Delta t = 15\ s$ $\quad \Delta x = 50\ m$ $\quad v_m = ?$

$$v_m = \frac{\Delta x}{\Delta t} = \frac{50}{15} = 3{,}33\ m/s$$

2) $\Delta t = 20\ s$ $\quad v = 50\ m/s$ $\quad x_1 = 300\ m$ $\quad x_2 = ?$

$$x_2 = x_1 + v\,\Delta t \Rightarrow x_2 = 300 + 50 \times 20 \Rightarrow x_2 = 1300\ m$$

3) $x_1 = 5\ km$ $\quad v = cte$ $\quad x_2 = 75\ km$ $\quad v_m = ?$
$\Delta t = 1h30\ min$

$x_1 = 5000\ m$; $x_2 = 75000\ m$

$\Delta t = 3600 + 1800 = 5400\ s$

$$v_m = \frac{\Delta x}{\Delta t} \Rightarrow v_m = \frac{75000 - 5000}{5400} = 12{,}96\ m/s$$

$$v_m = 12{,}96 \times 3{,}6 \Rightarrow v_m = 46{,}7\ km/h$$

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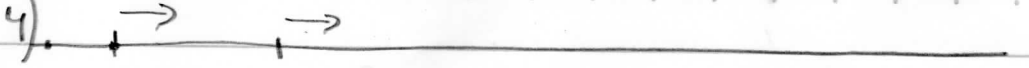
4) 

$V = 5\,m/s$ $V = 2\,m/s$ (c/s)

(B) (A)

(A) $x_{2_A} = x_{1_A} + V_A \Delta t$

(B) $x_{2_B} = x_{1_B} + V_B \Delta t$ $\Rightarrow x_{2A} = x_{2B}$

(a) $x_{1A} + V_A \Delta t = x_{1B} + V_B \Delta t$

$4 + 2\Delta t = 1 + 5\Delta t$

$4 - 1 = 5\Delta t - 2\Delta t$

$3 = 3\Delta t \Rightarrow \Delta t = 1\,s$

(b) $x_{2A} = 4 + 2 \times 1 = 6\,m$ OU $x_{2B} = 1 + 5.1 = 6\,m$

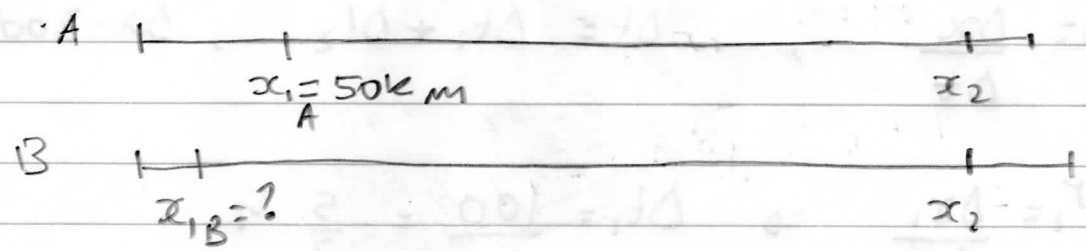
(c) $\Delta x_A = x_{2A} - x_{1A}$ $\Delta x_B = x_{2B} - x_{1B}$

$\Delta x_A = 6 - 4$ $\Delta x_B = 6 - 1$

$\Delta x_A = 2\,m$ $\Delta x_B = 5\,m$

⑤ // Carro A e B $x_2 = 170\ km$

$V_A = 30\ km/h$ $V_B = 40\ km/h$ cte's



(A) → $x_{2A} = x_{1A} + V_A \cdot \Delta t$

(B) → $x_{2B} = x_{1B} + V_B \cdot \Delta t$

$\Big\rangle \; x_{2A} = x_{2B} = 170km$

De (A)
$$\begin{cases} x_{2A} = x_{1A} + V_A \Delta t \\ 170 = 50 + 30\,\Delta t \\ 170 - 50 = 30\,\Delta t \Rightarrow \Delta t = \frac{120}{30} = 4\ h \end{cases}$$

Em (B)
$$x_{2B} = x_{1B} + V_B \cdot \Delta t$$
$$170 = x_{1B} + 40 \cdot 4$$
$$170 - 160 = x_{1B} \Rightarrow x_{1B} = 10\ km$$

⑥ $\Delta x_1 = 100\ km$ $\quad v_1 = 60\ km/h$

$\Delta x_2 = 200\ km$ $\quad v_2 = 80\ km/h$

$v_m = \frac{\Delta x}{\Delta t}$; $\Delta t = \Delta t_1 + \Delta t_2$, $\Delta x = 300\ km$

$v_1 = \frac{\Delta x_1}{\Delta t_1} \Rightarrow \Delta t_1 = \frac{100}{60} = \frac{5}{3}\ h$

$v_2 = \frac{\Delta x_2}{\Delta t_2} \Rightarrow \Delta t_2 = \frac{200}{80} = \frac{5}{2}\ h$

$\Delta t = \frac{5}{3} + \frac{5}{2} = \frac{10+15}{6} = \frac{25}{6}\ h$

$v_m = \frac{\Delta x}{\Delta t} = \frac{300}{\frac{25}{6}} = \frac{\cancel{300}^{12} \times 6}{\cancel{25}_{1}}$

$v_m = 72\ km/h$

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(7) $A \Rightarrow \begin{cases} v_1 = 40\ km/h & \Delta t_1 = 2\ h \\ v_2 = 60\ km/h & \Delta t_2 = 3\ h \end{cases}$

$v_1 = \frac{\Delta x_1}{\Delta t_1} \Rightarrow \Delta x_1 = 40 \times 2 = 80\ km$

$v_2 = \frac{\Delta x_2}{\Delta t_2} \Rightarrow \Delta x_2 = 60 \times 3 = 180\ km$

$\Delta x_A = \Delta x_1 + \Delta x_2 \Rightarrow \Delta x_A = 80 + 180 = 260\ km$

$v_{m_A} = \frac{\Delta x_A}{\Delta t_A} = \frac{260}{5} = 52\ km/h$

$B \Rightarrow \begin{cases} v_1 = 50\ km/h & \Delta t_1 = 3\ h \\ v_2 = 40\ km/h & \Delta t_2 = 2\ h \end{cases}$

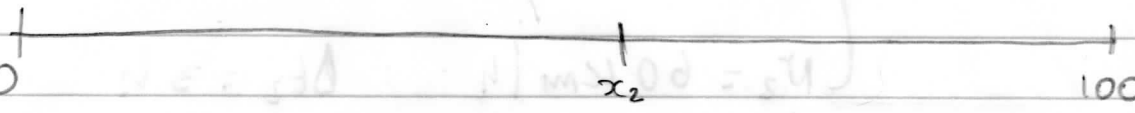
$v_1 = \frac{\Delta x_1}{\Delta t_1} \Rightarrow \Delta x_1 = 50 \times 3 \Rightarrow \Delta x_1 = 150\ km$

$v_2 = \frac{\Delta x_2}{\Delta t_2} \Rightarrow \Delta x_2 = 40 \times 2 \Rightarrow \Delta x_2 = 80\ km$

$\Delta x_B = \Delta x_1 + \Delta x_2 = 150 + 80 = 230\ km$

$v_{mB} = \frac{\Delta x_B}{\Delta t_B} = \frac{230}{5} = 46\ km/h$

(8)



A ⇒ $v = 70$ km/h

← B

$v = -80$ km/h

A ⇒ $x_2 = x_1 + v_A \Delta t$

$x_2 = 0 + 70 \cdot \Delta t$

B ⇒ $x_2 = x_1 + v_B \Delta t$

$x_2 = 100 - 80 \Delta t$

∴

$0 + 70\Delta t = 100 - 80\Delta t$

$70\Delta t + 80\Delta t = 100$

$150\Delta t = 100$

$\Delta t = \frac{100}{150} = \frac{10}{15} = \frac{2}{3}$ h

$x_2 = 0 + 70 \times \frac{2}{3} = \frac{140}{3}$

ou

$x_2 = 100 - 80 \cdot \frac{2}{3} = 100 - \frac{160}{3} = \frac{300-160}{3} = \frac{140}{3}$

$x_2 = \frac{140}{3} = 46{,}7$ km

(7) $A \Rightarrow \begin{cases} v_1 = 40\ km/h & \Delta t_1 = 2\ h \\ v_2 = 60\ km/h & \Delta t_2 = 3\ h \end{cases}$ (8)

$v_1 = \frac{\Delta x_1}{\Delta t_1} \Rightarrow \Delta x_1 = 40 \times 2 = 80\ km$

$v_2 = \frac{\Delta x_2}{\Delta t_2} \Rightarrow \Delta x_2 = 60 \times 3 = 180\ km$

$\Delta x_A = \Delta x_1 + \Delta x_2 \Rightarrow \Delta x_A = 80 + 180 = 260\ km$

$v_{m_A} = \frac{\Delta x_A}{\Delta t_A} = \frac{260}{5} = 52\ km/h$

$B \Rightarrow \begin{cases} v_1 = 50\ km/h & \Delta t_1 = 3\ h \\ v_2 = 40\ km/h & \Delta t_2 = 2\ h \end{cases}$

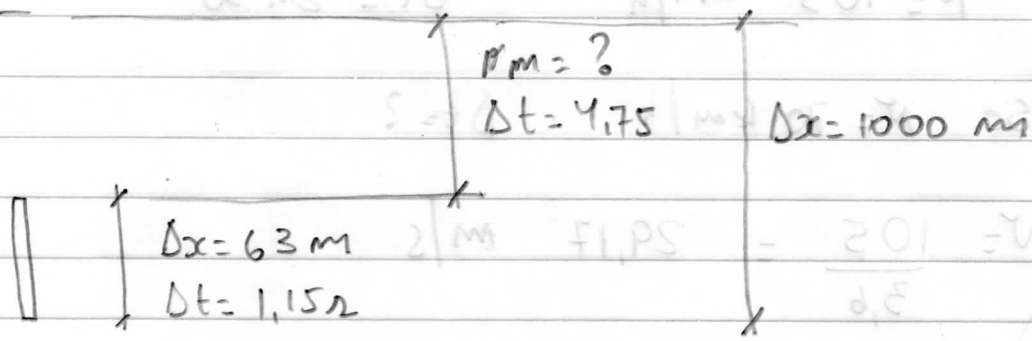
$v_1 = \frac{\Delta x_1}{\Delta t_1} \Rightarrow \Delta x_1 = 50 \times 3 \Rightarrow \Delta x_1 = 150\ km$

$v_2 = \frac{\Delta x_2}{\Delta t_2} \Rightarrow \Delta x_2 = 40 \times 2 \Rightarrow \Delta x_2 = 80\ km$

$\Delta x_B = \Delta x_1 + \Delta x_2 = 150 + 80 = 230\ km$

$v_{mB} = \frac{\Delta x_B}{\Delta t_B} = \frac{230}{5} = 46\ km/h$

(9)



a) $v_m = \frac{\Delta x}{\Delta t} = \frac{1000 - 63}{4{,}75} = 197$ m/s

b) $v_m = \frac{1000}{5{,}9} = 169$ m/s

(10) $\Delta x = 5150$ km $= 5{,}15 \times 10^6$ m

$\Delta t = 13{,}5$ dias $\Rightarrow$

$\Delta t = 13{,}5 \times 24 \times 3600 \Rightarrow \Delta t = 1{,}16 \times 10^6$ s

$v_m = \frac{5{,}15 \times 10^6}{1{,}16 \times 10^6} \Rightarrow v_m = 4{,}42$ m/s

(11) $v = 105$ km/h $\quad \Delta t = 2h\,20$

Se $v = 70$ km/h $\quad \Delta t = ?$

$$v = \frac{105}{3,6} = 29,17 \text{ m/s}$$

$\Delta t = 120 + 20 = 140$ min $\Rightarrow \Delta t = 140 \times 60 = 8400$ s

$$v_m = \frac{\Delta x}{\Delta t} \Rightarrow 29,17 = \frac{\Delta x}{8400} \Rightarrow \Delta x = 2,45 \times 10^5 \text{ m}$$

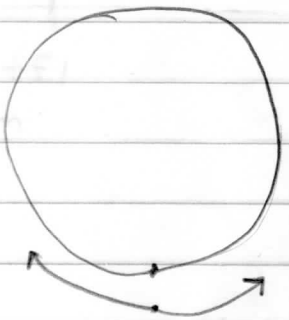
P/ $v = 70$ km/h

$$v = \frac{70}{3,6} \Rightarrow v = 19,4 \text{ m/s}$$

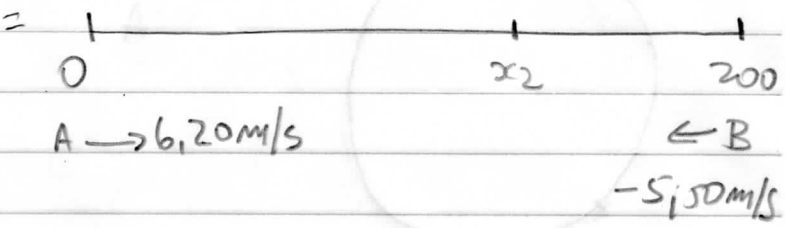
$$v_m = \frac{\Delta x}{\Delta t} \Rightarrow \Delta t = \frac{2,45 \times 10^5}{19,4} = 1,26 \times 10^4 \text{ s}$$

$$\Delta t = \frac{1,26 \times 10^4}{60} = 210 \text{ min} = 3h\,30'$$

(12)



5,50 m/s 6,20 m/s



$A \Rightarrow x_2 = x_1 + v_A \Delta t \Rightarrow x_2 = 0 + 6,20\,\Delta t$

$B \Rightarrow x_2 = x_1 + v_B \Delta t \Rightarrow x_2 = 200 - 5,50\,\Delta t$

$6,2\,\Delta t = 200 - 5,50\,\Delta t$

$6,2\,\Delta t + 5,50\,\Delta t = 200$

$11,7\,\Delta t = 200$

$\Delta t = \frac{200}{11,7} \Rightarrow \Delta t = 17,1\ s$

$A \Rightarrow v_m = \frac{\Delta x}{\Delta t} \Rightarrow \Delta x_A = 6,20 \times 17,1 = 106\ m$

$B \Rightarrow v_m = \frac{\Delta x}{\Delta t} \Rightarrow \Delta x_B = 5,5 \times 17,1 = 94\ m$

OBS: De fato $106 + 94 = 200\ m$

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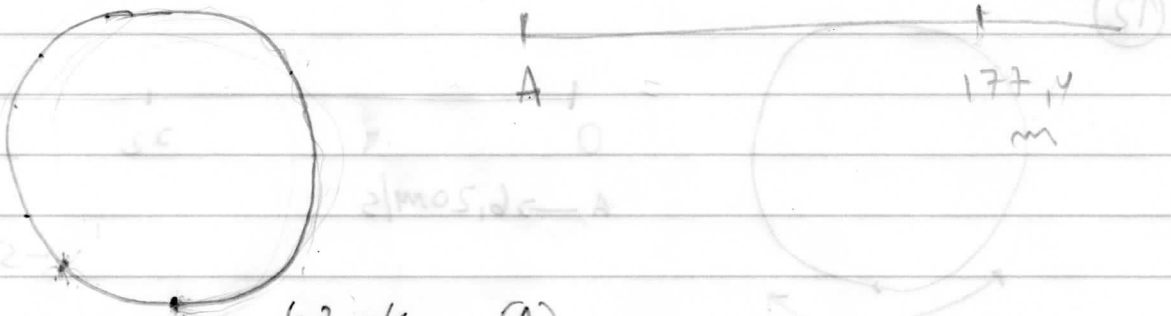
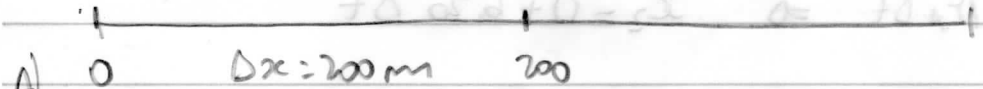


→ 6,2 m/s (A)

→ 5,5 m/s (B)

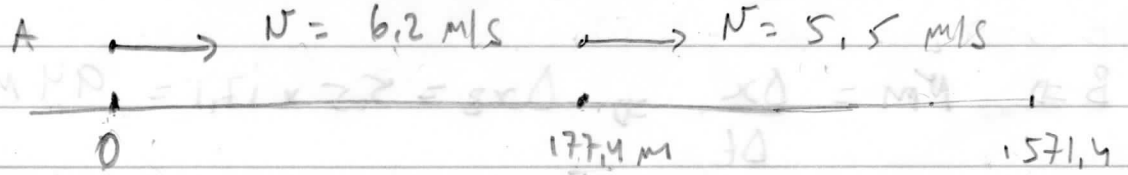


$V = \frac{\Delta x}{\Delta t} \Rightarrow \Delta t = \frac{200}{6,2} = 32,26\ s$ p/ A dar 1 volta

B ⇒ $V = \frac{\Delta x}{\Delta t} \Rightarrow \Delta x = 5,5 \times 32,26$

$\Delta x = 177,4\ m$ Posição de B

Segunda volta



A⇒ $x_2 = 0 + 6,2\,\Delta t$

B⇒ $x_2 = 177,4 + 5,5\,\Delta t$

$6,2\,\Delta t = 177,4 + 5,5\,\Delta t$

$(6,2 - 5,5)\,\Delta t = 177,4$

$\Delta t = 253,5\ s$

$x_{2A} = 0 + 6,2 \times 253,5 = 1571\ m = \Delta x_A$

$\Delta x_B = 1571 - 400 = 1171\ m$

14)

$x_1 = 0$ km $\qquad x_2 = ?$

P ⇒ $v = 6,5$ km/s $\qquad t_1 = 0 \qquad t_2$

S ⇒ $v = 3,5$ km/s $\qquad t_2 + 33$

$$P \Rightarrow x_2 = x_1 + v_p (t_2 - t_1)$$
$$x_2 = 0 + 6,5\, t_2$$

$$S \Rightarrow x_2 = x_1 + v_s (t_2 + 33 - 0)$$
$$x_2 = 0 + 3,5\, (t_2 + 33)$$

$$6,5\, t_2 = 3,5\, (t_2 + 33)$$

$$6,5\, t_2 = 3,5\, t_2 + 115,5$$
$$6,5\, t_2 - 3,5\, t_2 = 115,5$$
$$3\, t_2 = 115,5 \rightarrow t_2 = \frac{115,5}{3} = 38,5 \text{ h}$$

$x_2 = 6,5 \times 38,5 \Rightarrow x_2 = 250$ km

OU

$x_2 = 3,5\, (38,5 + 33) \Rightarrow x_2 = 250$ km

(15) $x(t) = 1,5t^2 - 0,05t^3$

$x(0) = 1,5 \cdot 0^2 - 0,05 \cdot 0^3 = 0 \text{ m}$

$x(2) = 1,5 \times 2^2 - 0,05 \times 2^3 = 6 - 0,4 = 5,6 \text{ m}$

$x(4) = 1,5 \times 4^2 - 0,05 \times 4^3 = 20,8 \text{ m}$

$v_{m(0a2)} = \frac{5,6 - 0}{2} = 2,8 \text{ m/s}$

$v_{m(0a4)} = \frac{20,8 - 0}{4} = 5,2 \text{ m/s}$

$v_{m(2a4)} = \frac{20,8 - 5,6}{2} = 7,6 \text{ m/s}$

(16) $x(t) = 2,4t^2 - 0,12t^3$

$x(0) = 2,4 \times 10^2 - 0,12 \times 10^3 = 0$

$x(10) = 2,4 \times 10^2 - 0,12 \times 10^3 = 240 - 120 = 120$

a) $v_{m(0a10)} = \frac{120 - 0}{10} = 12 \text{ m/s}$

b) $v = \frac{dx}{dt} \Rightarrow v(t) = 4,8t - 0,36t^2$

$v(0) = 4,8 \times 0 - 0,36 \times 10^2 = 0$

$v(5) = 4,8 \times 5 - 0,36 \times 5^2 = 15 \text{ m/s}$

$v(10) = 4,8 \times 10 - 0,36 \times 10^2 = 12 \text{ m/s}$

c) $0 = 4,8t - 0,36t^2$

$0 = t(4,8 - 0,36t)$

Soluções: $t = 0$ ou

$4,8 - 0,36t = 0$

$4,8 = 0,36t$

$t = \frac{4,8}{0,36} \Rightarrow t = 13,3 \text{ s}$