

ESTACIONARIAS

HOJA N°

FECHA

7) PÁG. 60

$$Y_1 = 0,15 \text{ Sen}(0,79x - 13t) \text{ [m, s]}$$

$$a) Y_2 = 0,15 \text{ Sen}(0,79x + 13t) \text{ [m, s]}$$

$$b) Y_r = [2A \text{ Sen}(kx)] \text{Cos}(\omega t)$$

$$Y_r = [0,30 \text{ Sen}(0,79 \cdot 2,3\text{m})] \text{Cos}(13 \cdot 0,16) \text{ [m, s]}$$

$$Y_r = [0,30 \text{ Sen}(104,10^\circ)] \text{Cos}(119,17^\circ)$$

$$Y_r = 0,30 \cdot 0,96 \cdot (-0,48)$$

$$Y_r = -0,138 \text{ m} \approx 0,14$$

$$8) Y_1 = 10^{-3} \text{ Sen}(0,7x - 10t) \text{ [m, s]}$$

$$a) Y_2 = 10^{-3} \text{ Sen}(0,7x + 10t) \text{ [m, s]}$$

$$b) x = 2 \text{ m}, t = 0,15$$

$$Y_r = [2 \cdot 10^{-3} \text{ Sen}(0,7 \cdot 2)] \text{Cos}(10 \cdot 0,1) \text{ [m, s]}$$

$$Y_r = [2 \cdot 10^{-3} \text{ Sen}(80,21^\circ)] \text{Cos}(57,29^\circ)$$

$$Y_r = 2 \cdot 10^{-3} \text{ m} \cdot 0,98 \cdot 0,54$$

$$Y_r = 1,06 \times 10^{-3} \text{ m}$$

9) PÁG. 61

$$L = n \cdot \frac{\lambda}{2} \Rightarrow L = \frac{\lambda}{2}$$

$$V = \sqrt{\frac{F}{\mu}}$$

$$F = \frac{n}{2L} \cdot V \Rightarrow F = \frac{V}{2L}$$

a) $2Lf_1 = V_1 \Rightarrow 2Lf_1 = \sqrt{\frac{F_1}{\mu}}$

$$2Lf_2 = V_2 \Rightarrow 2Lf_2 = \sqrt{\frac{2F_2}{\mu}}$$

$$F_1 = 2F_2$$

$$\frac{2Lf_1}{2Lf_2} = \frac{\sqrt{\frac{F_1}{\mu}}}{\sqrt{\frac{2F_2}{\mu}}} \Rightarrow \frac{f_1}{f_2} = \sqrt{\frac{1}{2}} \Rightarrow f_2 = f_1 \sqrt{2} \Rightarrow f_2 = f_1 \cdot 1,41$$

b) $\frac{2Lf_1}{2Lf_2} = \frac{\sqrt{\frac{F_1 L}{\mu}}}{\sqrt{\frac{F_1 L}{2\mu}}} \Rightarrow \frac{f_1}{f_2} = \sqrt{\frac{1}{\frac{1}{2}}} \Rightarrow \frac{f_1}{f_2} = \sqrt{2} \Rightarrow f_2 = f_1 \sqrt{\frac{1}{2}}$

$$f_2 = f_1 \cdot 0,707$$

10) PÁG. 61

$$m = 3g \quad L = 60cm \quad f = 20Hz \quad T = ?$$

$$F = \frac{n}{2L} \cdot V \Rightarrow 2Lf = V \Rightarrow 2 \cdot 60cm \cdot 20Hz = V \Rightarrow V = 2400 cm/s$$

$$V = \sqrt{\frac{F}{\mu}} \Rightarrow V^2 \cdot \mu = F \Rightarrow V^2 \frac{m}{L} = F \Rightarrow 2400^2 \cdot \frac{3g}{60cm} = T = 288000 \frac{g}{cm}$$

$$24^2 \frac{m^2}{s^2} \cdot 0,003kg = 2,8N = T$$

1000
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112) PÁG. 61

$$f_1 = 231 \text{ Hz} \quad f_2 = 224 \text{ Hz} \quad F_2 = 723 \text{ N}$$

$$f = \frac{n}{2L} \cdot V \Rightarrow V = f \cdot 2L$$

$$f_1 = \frac{n}{2L} \cdot \sqrt{\frac{E}{\mu}} \Rightarrow \frac{2L}{n} = \frac{1}{f_1} \sqrt{\frac{E}{\mu}} \Rightarrow \frac{n_1}{2L} = f_1 \sqrt{\frac{\mu}{E}} \quad \wedge \quad \frac{n_2}{2L} = f_2 \sqrt{\frac{\mu}{E}}$$

$$\frac{n_1}{2L} = \frac{n_2}{2L}$$

$$f_1 \sqrt{\frac{\mu}{E}} = f_2 \sqrt{\frac{\mu}{E}} \Rightarrow \frac{f_1}{\sqrt{F_1}} = \frac{f_2}{\sqrt{F_2}} \Rightarrow \frac{f_1^2}{F_1} = \frac{f_2^2}{F_2} \Rightarrow \frac{(f_1)^2}{(f_2)^2} F_2 = F_1$$

$$F_1 = 768,89 \text{ N}$$

$$\frac{\frac{2L}{n_1}}{\frac{2L}{n_2}} = \frac{f_1 \sqrt{\frac{\mu}{E}}}{f_2 \sqrt{\frac{\mu}{E}}} \Rightarrow 1 = \frac{f_1 \sqrt{F_2}}{f_2 \sqrt{F_1}} \Rightarrow \frac{f_2}{f_1} = \frac{\sqrt{F_2}}{\sqrt{F_1}} \Rightarrow \frac{f_2}{f_1} = \frac{\sqrt{F_1}}{\sqrt{F_2}} \Rightarrow \frac{f_2 \sqrt{F_2}}{f_1} = \sqrt{F_1}$$

113) PÁG. 61

$$f_2 = 240 \text{ Hz} \quad n_2 = 5$$

$$f = \frac{n}{2L} V \quad f_1 = \frac{n_1}{2L} V \quad \wedge \quad f_2 = \frac{n_2}{2L} V$$

$$f_1 \frac{2L}{n_1} = V \quad \wedge \quad f_2 \frac{2L}{n_2} = V$$

$$V = V$$

$$\frac{f_1 \cdot 2L}{n_1} = \frac{f_2 \cdot 2L}{n_2} \Rightarrow \frac{f_1}{n_1} = \frac{f_2}{n_2} \Rightarrow f_1 = \frac{f_2}{n_2} \cdot n_1 = f_1 = \frac{f_2}{n_2}$$

$$f = 48 \text{ Hz}$$

$$f = \frac{n}{2L} v$$

$$f' = \frac{1}{2L} \sqrt{\frac{F}{\mu}} \Rightarrow f' = \frac{1}{2L} \cdot \frac{1}{3} \sqrt{\frac{F}{\mu}} \Rightarrow f' = \frac{1}{3} f_1 \Rightarrow \boxed{F = 160 \text{ Hz}}$$

$$f_0 = 84$$

$$T = 635 \text{ N}$$

14 PÁG. 61

$$L = 3 \text{ m} \quad \mu = 2,53 (2,5 \times 10^{-3} \text{ kg}) \quad f_1 = 252 \text{ Hz} \quad f_2 = 336 \text{ Hz}$$

$$f_0 = ? \quad F = ?$$

$$a) f_1 = f_0 n \quad ; \quad f_2 = f_0 (n+1)$$

$$f_2 = f_0 n + f_0$$

$$336 - 252 = f_0 \Rightarrow \boxed{f_0 = 84 \text{ Hz}}$$

b)

$$f = \frac{n}{2L} \sqrt{\frac{F}{\mu}} \Rightarrow (f \cdot 2L)^2 \mu = F \Rightarrow \boxed{F = 635,04 \text{ N}}$$

15 PÁG. 61

$$Y = A \operatorname{Sen}(kx - \omega t)$$

HOJA N° 300. FI

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16) PAG. 61

0,8 m

0,2 m

0,001 m

$L = 80 \text{ cm}$

$T = 0,1 \text{ s}$

$X_t = 20 \text{ cm}$

$t = 0,02 \text{ s}$

$Y = 1 \text{ mm} (0,1 \text{ cm})$

$$T = \frac{2\pi}{\omega} \Rightarrow \omega = \frac{2\pi}{T} \Rightarrow \omega = 62,8 \frac{1}{\text{s}}$$

$$L = n \frac{\lambda}{2} \Rightarrow \frac{2L}{n} = \lambda \Rightarrow \lambda = 2L = 1,6 \text{ m}$$

$$k = \frac{2\pi}{\lambda} \Rightarrow k = 3,92$$

$$Y = A \operatorname{Sen}(kx - \omega t) \Rightarrow 0,001 \text{ m} = A \operatorname{Sen}(3,92 \cdot 0,2 - 62,8 \cdot 0,02) [m]$$

$$A = \frac{0,001}{\operatorname{Sen}(27,04^\circ)} \Rightarrow A = \frac{0,001}{0,45} \Rightarrow A = 2,22 \cdot 10^{-3}$$

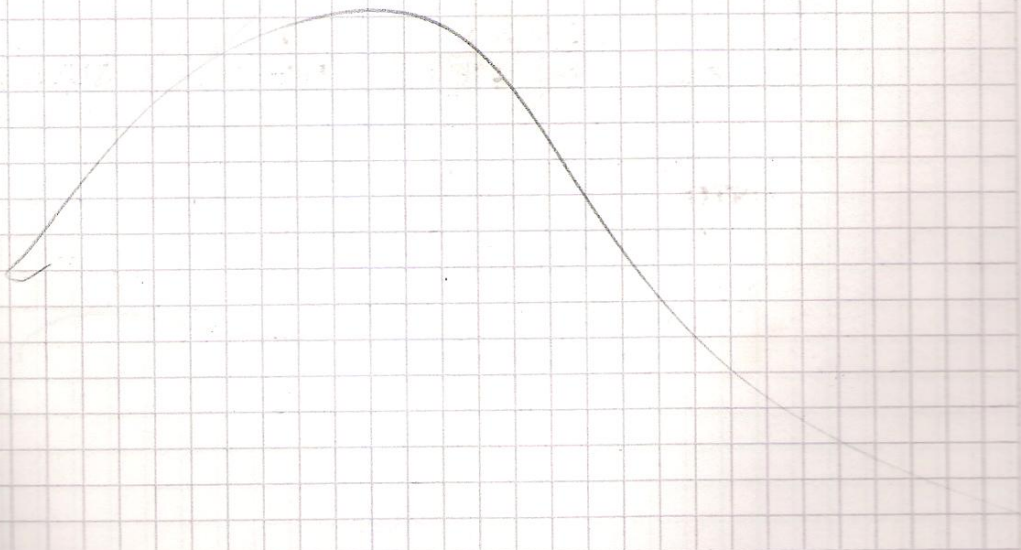
$$Y_1 = 2,22 \cdot 10^{-3} \text{ m} \operatorname{Sen}(3,92x - 62,8t) [m, s]$$

$$Y_2 = 2,22 \cdot 10^{-3} \text{ m} \operatorname{Sen}(3,92x + 62,8t) [m, s]$$

$$Y_r = 4,44 \cdot 10^{-3} \operatorname{Sen}(3,92x) \operatorname{Cos}(62,8t) [m, s]$$

e

$$Y_r = 4,44 \cdot 10^{-3} \operatorname{Sen}(1,25\pi x) \operatorname{Cos}(62,8t) [m, s]$$



17) PAB. 61 $F_1 = 512 \text{ Hz}$ $F_2 = 256 \text{ Hz}$

$$\rho = \frac{P}{v} \Rightarrow \rho = \frac{m a}{\pi d^2 L} \Rightarrow m_1 = \frac{\pi d^2 L}{4 g} \quad \wedge \quad m_2 = \frac{\pi d^2 L}{2 g}$$

$$F_1 = \frac{n_1}{2L} \sqrt{\frac{F_1}{\frac{\pi d^2 L}{4 g}}} \Rightarrow f_1 = \frac{n_1}{2L} \sqrt{\frac{F_1 4 g}{\pi d^2 L}} \quad \wedge \quad f_2 = \frac{n_2}{2L} \sqrt{\frac{F_2 2 g}{\pi d^2 L}}$$

$$n_1 = n_2$$

$$n_1 = \frac{f_1 \cdot 2L}{\sqrt{\frac{F_1 4 g}{\pi d^2 L}}}$$

$$\wedge \quad n_2 = \frac{f_2 \cdot 2L}{\sqrt{\frac{F_2 2 g}{\pi d^2 L}}}$$

$$\frac{f_1 \cdot 2L}{\sqrt{\frac{F_1 4 g}{\pi d^2 L}}} = \frac{f_2 \cdot 2L}{\sqrt{\frac{F_2 2 g}{\pi d^2 L}}} \Rightarrow \left(\frac{f_1}{\sqrt{F_1 2 g}} \right)^2 = \left(\frac{f_2}{\sqrt{F_2 g}} \right)^2 \Rightarrow$$

$$\frac{f_1^2}{F_1 \cdot 2} = \frac{f_2^2}{F_2} \Rightarrow \frac{F_1}{F_2} = \frac{f_1^2}{2 f_2^2} \Rightarrow \boxed{\frac{F_1}{F_2} = 1}$$

$$\frac{3}{2} = 1.5$$

$$\frac{16}{\pi} = 5.09$$

$$5.09 \pi$$