

EJERCICIO F2BE2586:

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$$y(x,t) = 0,4 \sin(8t + 12x - \frac{\pi}{6})$$

a) λ , T y d ?

b) $V_{\text{propagación}} = ?$; $V_{\text{máxima vibración}} = ?$

c) $\Delta\varphi$ en un instante entre dos puntos $d = 50 \text{ cm}$

a) Periodo y longitud de onda:

$$y(x,t) = 0,4 \cdot \sin(8t + 12x - \frac{\pi}{6})$$

$$y(x,t) = A \cdot \sin(\omega t + kx + \varphi) \quad \text{Ec. General}$$

$\uparrow$ en sentido negativo ox

Comparando:

$$A = 0,4 \text{ m}$$

$$\omega = 8 \text{ rad/s} \Rightarrow \omega = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi}{\omega} = \frac{2\pi}{8} = \frac{\pi}{4} \text{ s}$$

$$k = 12 \text{ rad/m} \Rightarrow k = \frac{2\pi}{\lambda} \Rightarrow \lambda = \frac{2\pi}{k} = \frac{2\pi}{12} = \frac{\pi}{6} \text{ m}$$

b) V_{prop} , $V_{\text{máx}}$ (vibración):

$$V_{\text{prop}} = \frac{\lambda}{T} \Rightarrow v = \frac{\frac{\pi}{6}}{\frac{\pi}{4}} = \frac{4}{6} = 0,67 \text{ m/s} = v$$

$$V(x,t) = \frac{dy(x,t)}{dt} = \frac{d[0,4 \cdot \sin(8t + 12x - \frac{\pi}{6})]}{dt}$$

$$V(x,t) = 0,4 \cdot 8 \cdot \cos(8t + 12x - \frac{\pi}{6})$$

Si $V_{\text{máx}} \rightarrow \cos \varphi = |1|$

$$V_{\text{máx}} = 0,4 \cdot 8 = 3,2 \text{ m/s}$$

c) $\Delta\varphi$ si en el mismo instante $d=50\text{cm}$:

$$\left. \begin{array}{l} \text{Si } \lambda = \frac{\pi}{6} \text{ implica una } \Delta\varphi = 2\pi \text{ rad} \\ 0.5 \text{ m} \longrightarrow \Delta\varphi = ? \end{array} \right\}$$

$$\Delta\varphi = \frac{0.5 \cdot 2\pi}{\frac{\pi}{6}} = \boxed{6 \text{ rad} = \Delta\varphi}$$

Otra forma:

$$\Delta\varphi = \varphi_2 - \varphi_1 = \overset{\text{mismo instante } (t_2=t_1)}{(8t+12x-\frac{\pi}{6})_2 - (8t+12x-\frac{\pi}{6})_1}$$

$$\Delta\varphi = 12x_2 - 12x_1 = 12(x_2 - x_1) = 12 \cdot 0.5 = \boxed{6 \text{ rad} = \Delta\varphi}$$