EJERCICIO F2BE2097:

$v = 0{,}5\ m/s$

$T = 4\ s$ (tiempo mínimo 2 puntos en fase)

$x = 0\ m$, $t = 1\ s$ $\Rightarrow y = 0$; v es negativa

$t = 3\ s$, $x = 0{,}5\ m$ $\Rightarrow y = -0{,}2\ m$

Ecuación de onda:

$$y(x,t) = A\ \text{sen}(\omega t - kx + \varphi_0)$$

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

$$k = \frac{2\pi}{\lambda}; \quad v = \frac{\lambda}{T} \Rightarrow \lambda = v \cdot T \Rightarrow \lambda = 0{,}5 \cdot 4 = 2\ m$$

$$k = \frac{2\pi}{\lambda} = \frac{2\pi}{2} = \pi\ rad/m$$

$$y(x,t) = A \cdot \text{sen}\left(\frac{\pi}{2}t - \pi x + \varphi_0\right) \quad (m)$$

En $x = 0\ m$, $t = 1\ s$ $\Rightarrow y = 0\ m$.

$$y(0,1) = A \cdot \text{sen}\left(\frac{\pi}{2} \cdot 1 - \pi \cdot 0 + \varphi_0\right)$$

$$0 = A \cdot \text{sen}\left(\frac{\pi}{2} + \varphi_0\right)$$

$$\text{sen}\left(\frac{\pi}{2} + \varphi_0\right) = 0 \rightarrow \begin{cases} \frac{\pi}{2} + \varphi_0 = 0\ rad\ ? \\ \frac{\pi}{2} + \varphi_0 = \pi\ rad\ ? \end{cases}$$

$\frac{\pi}{2} + \varphi_0 = 0 \Rightarrow \varphi_0 = -\frac{\pi}{2}$??

$\frac{\pi}{2} + \varphi_0 = \pi \Rightarrow \varphi_0 = \pi - \frac{\pi}{2} = \frac{\pi}{2}$??

¿Cuál será?

$$v(x,t) = \frac{d[y(x,t)]}{dt}$$

$$\boxed{v(x,t) = A \cdot \frac{\pi}{2} \cdot \cos\left(\frac{\pi}{2}t - \pi x + \varphi_0\right)} \ (m/s)$$

Em $\begin{matrix} x=0 \\ t=1 \end{matrix}\Big\}$ v é negativa

$$v(x,t) = A \cdot \frac{\pi}{2} \cdot \cos\left(\frac{\pi}{2}\cdot 1 - \pi \cdot 0 + \varphi_0\right)$$

$$v(x,t) = A \cdot \frac{\pi}{2} \cdot \cos\left(\frac{\pi}{2} + \varphi_0\right)$$

Para que v seja negativa, o $\cos\left(\frac{\pi}{2} + \varphi_0\right)$ tem que ser negativo;

Se $\varphi_0 = -\frac{\pi}{2} \Rightarrow \cos\left(\frac{\pi}{2} - \frac{\pi}{2}\right) = \cos 0 \Rightarrow$ Não negativo!

Se $\boxed{\varphi_0 = \frac{\pi}{2}} \Rightarrow \cos\left(\frac{\pi}{2} + \frac{\pi}{2}\right) = \cos \pi \Rightarrow$ **SIM NEGATIVO**

Para a amplitude:

$\begin{matrix} t = 3\,s \\ x = 0{,}5\,m \end{matrix}\Big\}$ $y = -0{,}2\,m$

$$y(x,t) = A \cdot \operatorname{sen}\left(\frac{\pi}{2}t - \pi x + \frac{\pi}{2}\right)$$

$$-0{,}2 = A \cdot \operatorname{sen}\left(\frac{\pi}{2}\cdot 3 - \pi \cdot 0{,}5 + \frac{\pi}{2}\right)$$

$$-0{,}2 = A \cdot \operatorname{sen}\frac{3\pi}{2}$$ $^{-1}$

$$-0{,}2 = A(-1) \Rightarrow \boxed{A = 0{,}2\,m}$$

$$\boxed{y(x,t) = 0{,}2 \cdot \operatorname{sen}\left(\frac{\pi}{2}t - \pi x + \frac{\pi}{2}\right)} \ (m)$$