Problema N° 7. Ondas sobre cuerdas

Ondas transversales sobre una cuerda

$F = cte$ $\qquad P = \frac{1}{2}\mu\omega^2 A^2 v = \frac{1}{2}\frac{m}{L}(2\pi f)^2 A^2 \sqrt{\frac{FL}{m}}$

a) Se duplica la longitud $L \longrightarrow L' = 2L$ y $f = cte$

si $L' = 2L \Rightarrow m' = 2m$

$$P' = \frac{1}{2}\frac{m'}{L'}(2\pi f)^2 A^2 \sqrt{\frac{FL'}{m'}}$$

$$P' = \frac{1}{2}\frac{2m}{2L}(2\pi f)^2 A^2 \sqrt{\frac{F.2L}{2m}} = P$$

$$P' = P$$

b) $A' = 2A \quad ; \quad f' = \frac{f}{2}$

$$P' = \frac{1}{2}\frac{m}{L}(2\pi f')^2 A'^2 \sqrt{\frac{Fl}{m}}$$

$$P' = \frac{1}{2}\frac{m}{L}\left(2\pi \frac{f}{2}\right)^2 (2A)^2 \sqrt{\frac{Fl}{m}}$$

$$P' = \frac{1}{2}\frac{m}{L}(2\pi f)^2 \frac{1}{4}\cdot 4A^2 \sqrt{\frac{Fl}{m}} = P$$

$$P' = P$$

c) $A' = 2A \quad ; \quad \lambda' = 2\lambda$ como $v = \lambda \cdot f \rightarrow f = \frac{v}{\lambda}$

$$f' = \frac{v}{\lambda'} = \frac{v}{2\lambda}$$

$$P' = \frac{1}{2}\frac{m}{L}(2\pi f')^2 A'^2 \sqrt{\frac{Fl}{m}}$$

$$P' = \frac{1}{2}\frac{m}{L}\left(2\pi \frac{v}{2\lambda}\right)^2 (2A)^2 \sqrt{\frac{Fl}{m}}$$

$$P' = \frac{1}{2}\frac{m}{L}\left(2\pi \frac{v}{\lambda}\right)^2 \frac{1}{4}\cdot 4A^2 \sqrt{\frac{Fl}{m}} = P$$

$$P' = P$$

d) $L' = \frac{L}{2}$; $\lambda' = \frac{\lambda}{2}$ si $L' = \frac{L}{2} \Rightarrow m' = \frac{m}{2}$

$P' = \frac{1}{2} \frac{m'}{L'} (2\pi f')^2 . A^2 \sqrt{\frac{FL'}{m'}}$ si $\lambda' = \frac{\lambda}{2} \Rightarrow f' = \frac{v}{\lambda'}$

$P' = \frac{1}{2} \frac{m}{2 . \frac{L}{2}} \left(2\pi \frac{v}{\lambda'}\right)^2 . A^2 \sqrt{\frac{F . L}{2 \frac{m}{2}}}$

$P' = \frac{1}{2} \frac{m}{L} \left(2\pi \frac{v}{\frac{\lambda}{2}}\right)^2 A^2 \sqrt{\frac{FL}{m}}$

$P' = \frac{1}{2} \frac{m}{L} (2\pi \frac{v}{\lambda})^2 4 . A^2 \sqrt{\frac{FL}{m}} = 4P$

$P' = 4P$ //