The wave $y(x, t) = 0.12 \sin \pi/3(5x + 200t - 1)$ propagates on a string of linear density $\mu = 0.02$ kg/m. Calculate the average power transmitted.

Solution:

The average power transmitted by string wave

$$P = \frac{1}{2}\mu\omega^2 A^2 v$$

Where μ is a linear density of a string, ω is angular frequency of the wave, A is an amplitude of the wave, v is a speed of wave.

Since

$$y(x, t) = A \sin(kx + \omega t - \varphi)$$

We get

$$A = 0.12 \text{ m}$$

$$\omega = \frac{200\pi}{3} \text{ s}^{-1}$$

$$k = \frac{5\pi}{3} \text{ m}^{-1}$$

The speed of wave

$$v = \frac{\omega}{k} = \frac{\frac{200\pi}{3}}{\frac{5\pi}{3}} = 40 \frac{\text{m}}{\text{s}}$$

Finally

$$P = \frac{1}{2} \times 0.02 \times \left(\frac{200\pi}{3}\right)^2 \times 0.12^2 \times 40 = 253 \text{ W}$$

Answer: 253 W