The linear density of a vibrating string is $\mu = 1.3 \times 10^{-4}$ kg/m. A transverse wave is propagating on the string and is described by the equation $y(x, t) = 0.021 \sin(30t - x)$ where x and y are in metres and t is in seconds. Calculate the tension in the string.

Solution:

The tension in the string

$$T = \mu v^2$$

where v is the velocity of propagation of a wave in a string.

Because wave is described by the equation

$$y(x, t) = 0.021 \sin(30t - x) = A \sin(\omega t - kx)$$

velocity is

$$v = \frac{\omega}{k} = \frac{30}{1} = 30 \frac{m}{s}.$$

Thus

$$T = 1.3 \times 10^{-4} \times 30^2 = 0.117 \text{ N}.$$

Answers: 0.117 N