

13. (a) The wave speed is given by $v = \lambda/T = \omega/k$, where λ is the wavelength, T is the period, ω is the angular frequency ($2\pi/T$), and k is the angular wave number ($2\pi/\lambda$). The displacement has the form $y = y_m \sin(kx + \omega t)$, so $k = 2.0 \text{ m}^{-1}$ and $\omega = 30 \text{ rad/s}$. Thus $v = (30 \text{ rad/s})/(2.0 \text{ m}^{-1}) = 15 \text{ m/s}$.
- (b) Since the wave speed is given by $v = \sqrt{\tau/\mu}$, where τ is the tension in the string and μ is the linear mass density of the string, the tension is

$$\tau = \mu v^2 = (1.6 \times 10^{-4} \text{ kg/m}) (15 \text{ m/s})^2 = 0.036 \text{ N} .$$