

A wave on a string is described by

$$y(x, t) = 15.0 \text{ cm} \cos(\pi x - 15\pi t)$$

What is the transverse speed when the point is at a displacement of +12.0 cm?

$$12.0 \text{ cm} = 15.0 \text{ cm} \cos(\pi x - 15\pi t)$$

$$\begin{aligned} v(x, t) &= 15\pi \frac{\text{rad}}{\text{s}} (15.0 \text{ cm}) \sin(\pi x - 15\pi t) \\ &= 225 \text{ cm/s} \sin(\pi x - 15\pi t) \end{aligned}$$

Note: $\sin^2 A + \cos^2 A = 1$

$$\sin A = \sqrt{1 - \cos^2 A}$$

(2)

$$\sin(\pi x - 15\pi t) = \sqrt{1 - \cos^2(\pi x - 15\pi t)}$$

$$\cos(\pi x - 15\pi t) = \frac{12.0 \text{ cm}}{15.0 \text{ cm}}$$

$$V(x, t) = \pi \left(\frac{225 \text{ cm}}{5} \right) \sqrt{1 - \left(\frac{12.0}{15.0} \right)^2}$$

$$= 424.1 \text{ cm/s}$$

$$\boxed{424 \text{ cm/s}}$$