

$$y(x, t) = 0.040 \sin(5\pi x) \cos(40\pi t)$$

A standing wave is described by the equation above where x and y are in meters and t is in seconds.

For $x \geq 0$ locate the node with the

- (1) smallest
- (2) 2nd smallest
- (3) 3rd smallest

value of x .

(4) what is the period of any antinode?

(5) $v_{\text{wave}} = ?$

(6) $y_m = ?$

For $t \geq 0$ what is the

(7) 1st

(8) 2nd

(9) 3rd

time that all points on the string have zero transverse velocities?

$$0.040 \sin(5\pi x) = \text{amplitude}$$

* Smallest amplitude is zero

* sin is zero at

$$0, \pi, 2\pi, 3\pi, \dots$$

$$(1) \quad 5\pi x = 0$$

$$\boxed{x = 0}$$

$$(2) \quad 5\pi x = \pi$$

$$\boxed{x = 0.2 \text{ m}}$$

$$(3) \quad 5\pi x = 2\pi$$

$$\boxed{x = 0.4 \text{ m}}$$

$$(4) \quad \omega = \frac{2\pi}{T}$$

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{40\pi} = \boxed{5 \times 10^{-2} \text{ s}}$$

$$(5) \quad v = \frac{\omega}{k} = \frac{40\pi}{5\pi} = \boxed{8 \text{ m/s}}$$

$$(6) \quad 2y_m = 0.040 \text{ m}$$

$$\boxed{y_m = 0.02 \text{ m}}$$

(7) Transverse speed $\left(\frac{dy}{dt}\right)$

$$u(t) = \frac{dy}{dt} = (0.040) - 40\pi \sin(5\pi x) \sin(40\pi t)$$

Sin is zero for $0, \pi, 2\pi, \dots$

(7) $40\pi t = 0$

$$\boxed{t = 0.5}$$

(8) $40\pi t = \pi$

$$\boxed{t = 0.0255}$$

(9) $40\pi t = 2\pi$

$$\boxed{t = 0.0505}$$