59. The transverse displacement at position x and time t in a string due to a travelling wave is given by $y(x,t) = 3.0\cos(\pi x - 4\pi t)$ cm, where x is in centimeters and t is in seconds. Which of the following statements is wrong?

A Maximum value of transverse velocity of any point is 12π cm/s and wavelength is 0.2 m.

B Speed of wave propagation in the +ve x-direction is 4π cm/s.

C Transverse velocity at $t = 0$ and $x = 0.25$ cm is $6\sqrt{2}\pi$ cm/s.

D Maximum value of transverse acceleration of any point is $48\pi^2$ cm/s^2.

$y(x,t) = A\cos(kx - \omega t)$, $k = \frac{2\pi}{\lambda}$ A = amplitude.

Transverse Velocity $\left(\frac{dy}{dt}\right) = \frac{\partial y}{\partial t} = A \times -\sin(kx - \omega t) \times -\omega$

x as a constant

$= A\omega\sin(kx - \omega t)$

$\therefore \left(V_{trans}\right)_{max} = A\omega$.

Transverse Acceleration $= \frac{\partial^2 y}{\partial t^2} = -A\omega^2\cos(kx - \omega t)$

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$3.0\cos(\pi x - 4\pi t)$ cm,

$A = 3$ cm

$\pi = k = \frac{2\pi}{\lambda}$.

$\therefore \lambda = 2$ cm

$\omega = 4\pi$ rad/s

$f = \frac{\omega}{2\pi} = 2$ Hz.

(D) $A\omega^2 = 3 \times (4\pi)^2 = 3 \times 16 \times \pi^2 = 48\pi^2$ ✓

(C) $A\omega\sin(kx - \omega t)$ ✓

$v_1 = 3 \times 4\pi \times \sin(\pi x - 4\pi t)$

$= 12\pi \times \sin\left(\frac{\pi}{4} - 0\right) = \frac{12\pi}{\sqrt{2}}$

$= 6\sqrt{2}\pi$ cm/s.

(B) $v = \lambda f = 2 \times 2 = 4$ cm/s. NOT 4π cm/s.

A Maximum value of transverse velocity of any point is 12π cm/s and wavelength is 0.2 m. ×

$\lambda = 0.02$ m.

$\left(V_{trans}\right)_{max} = A\omega = 3 \times 4\pi = 12\pi$ cm/s.