

NCERT 11.15. Q10

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Question: For the travelling harmonic wave $y(x, t) = 2.0 \cos 2\pi(10t - 0.0080x + 0.35)$ where x and y are in cm and t in s. Calculate the phase difference between oscillatory motion of two points separated by a distance of

- (a) 4 m
- (b) 0.5 m
- (c) $\lambda/2$
- (d) $3\lambda/4$

Solution:

Parameter	Description	Value
k	angular wave number	$2\pi(0.008)$
$\lambda = \frac{2\pi}{k}$	wavelength	125 cm
f	frequency	10
A	amplitude	2.0
ϕ	phase constant	$2\pi(0.35)$
$x_2 - x_1$	path difference	400 cm
		50 cm
		$\frac{\lambda}{2}$
		$\frac{3\lambda}{4}$

General form of harmonic wave :

$$y(x, t) = A \cos(2\pi ft - kx + \phi) \quad (1)$$

$$y(x, t) = 2.0 \cos 2\pi(10t - 0.0080x + 0.35) \quad (2)$$

Phase of harmonic wave (at x):

$$= (2\pi ft - kx + \phi) \quad (3)$$

$$\text{Phase difference } (\Delta\theta) = \theta_1 - \theta_2 \quad (4)$$

$$= (2\pi ft - kx_1 + \phi) - (2\pi ft - kx_2 + \phi) \quad (5)$$

$$= k(x_2 - x_1) \quad (6)$$

Parameter	Description	subquestion	Value
$\Delta\theta$	phase difference	(a)	6.4π radians
		(b)	0.8π radians
		(c)	π radians
		(d)	$\frac{3\pi}{2}$ radians