

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

**Solution:**

Parameter	Description	Value
$y(x_i, t)$	equation of harmonic wave	$A \cos(2\pi ft - kx_i + \phi)$
$k$	angular wave number	$2\pi(0.008)$
$\lambda = \frac{2\pi}{k}$	wavelength	$125 \text{ cm}$
$f$	frequency	$10$
$A$	amplitude	$2.0$
$\phi$	phase constant	$2\pi(0.35)$
$\theta_i$	phase of $i^{th}$ harmonic wave	$(2\pi ft - kx + \phi)$
$x_i$	position of $i^{th}$ harmonic wave	
$t$	time	
$x_2 - x_1$	path difference	$400 \text{ cm}$
		$50 \text{ cm}$
		$\frac{\lambda}{2}$
		$\frac{3\lambda}{4}$

TABLE 1: Given parameters list

$$(\Delta\theta) = (2\pi ft - kx_1 + \phi) - (2\pi ft - kx_2 + \phi) \quad (1)$$

$$= k(x_2 - x_1) \quad (2)$$

Parameter	Description	subquestion	Value
$\Delta\theta$	$\theta_1 - \theta_2$	(a)	$6.4\pi$ radians
		(b)	$0.8\pi$ radians
		(c)	$\pi$ radians
		(d)	$\frac{3\pi}{2}$ radians

TABLE 2: Phase differences

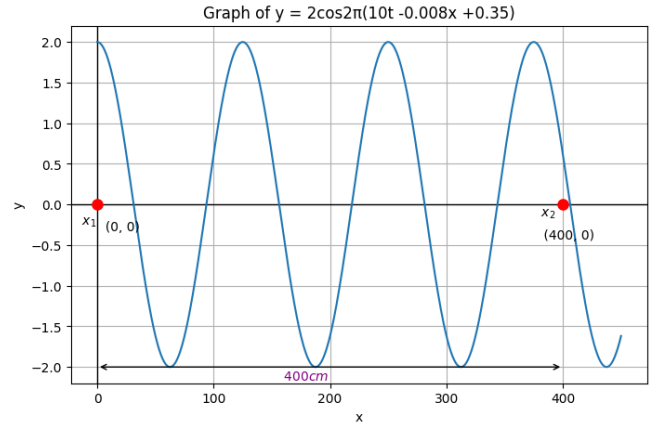


Fig. 1

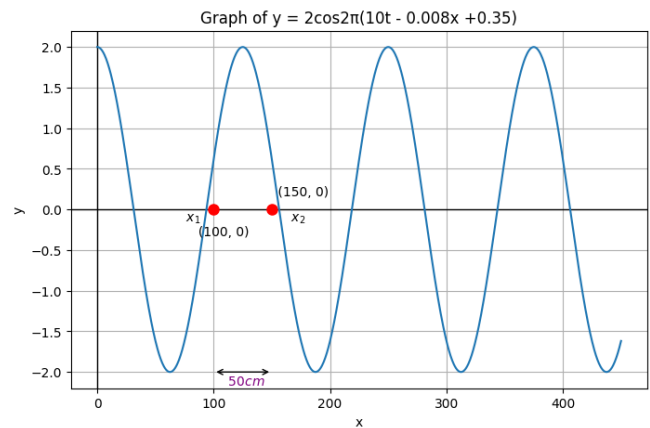


Fig. 2

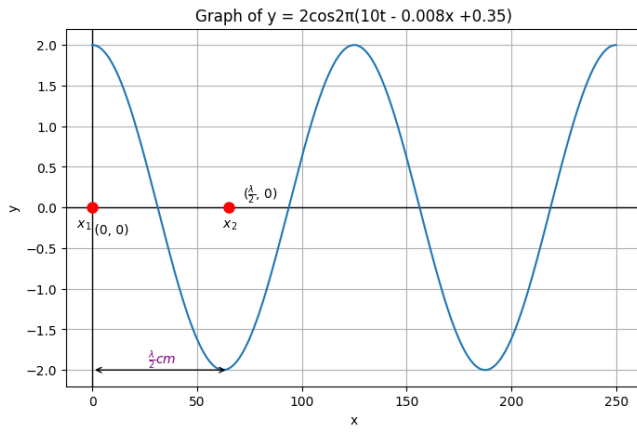


Fig. 3

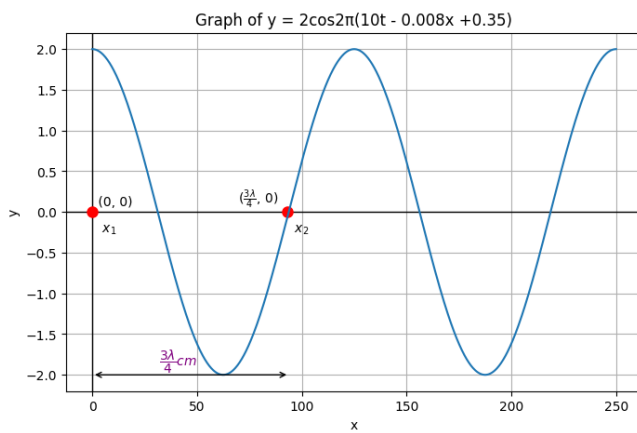


Fig. 4