



$$\sin(-\phi) > 0$$

$$y_m \sin(-\phi) > 0$$

$$0 < y(x,t) = y_m \sin(kx - \omega t - \phi)$$

$$0 = \frac{dy}{dt} = -\omega y_m \cos(kx - \omega t - \phi)$$

$$\cos(-\phi) = 0 \Leftrightarrow \cos\phi = 0$$

$$\cos(\theta) = \cos(-\theta)$$

$$\sin\phi = -\sin(-\phi)$$

$$\sin(-\phi) = -\sin\phi$$

$$\phi = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}$$

$90^\circ, 270^\circ, 450^\circ$

$$-\sin\phi > 0$$

$$\sin\phi < 0$$

$$\sin\frac{\pi}{2} = 1$$

$$\sin\frac{3\pi}{2} = -1$$

$$\phi = \frac{3\pi}{2} = 270^\circ$$