

Consider the superposition of two traveling waves

1. $y_1 = A_0 \sin(kx - \omega t)$.

2. $y_2 = A_0 \sin(kx - \omega t - \phi)$.

The amplitude of the superposed wave is given by

A) A_0 .

B) $2A_0$.

C) $2A_0 \sin\left(\frac{\phi}{2}\right)$.

D) $2A_0 \cos\left(\frac{\phi}{2}\right)$.

Using

$$\sin \alpha + \sin \beta = 2 \sin \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2},$$

$$y = y_1 + y_2 = 2A_0 \cos \frac{\phi}{2} \sin \left(kx - \omega t - \frac{\phi}{2}\right).$$

By inspection, the amplitude is given by

$$2A_0 \cos \left(\frac{\phi}{2}\right).$$

Answer **D**