Two waves with equal amplitude but with slightly different frequencies are traveling in the same direction. At a given point their displacements are described by $y_1 = A_0 \cos \omega_1 t$ and $y_2 = A_0 \cos \omega_2 t$.

Evaluate $y = y_1 + y_2$. Identify the factor which is responsible for the beats

A) $\sin \left[\dfrac{(\omega_1 - \omega_2)\, t}{2} \right]$.

B) $\cos \left[\dfrac{(\omega_1 - \omega_2)\, t}{2} \right]$.

C) $\sin \left[\dfrac{(\omega_1 + \omega_2)\, t}{2} \right]$.

D) $\cos \left[\dfrac{(\omega_1 + \omega_2)\, t}{2} \right]$.

Using

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

$$y = y_1 + y_2 = 2\, A_0 \cos \left(\frac{\omega_1 - \omega_2}{2} t \right) \cos \left(\frac{\omega_1 + \omega_2}{2} t \right).$$

Since the difference between ω_1 and ω_2 is small, the first cosine factor corresponds to a low frequency oscillation term.

Its maxima give rise to beats.

Answer **B**