Q- Two waves traveling in same direction are present at a point in space have amplitudes $d_1(t)=4\sin(wt)$ and $d_2(t)=4\cos(wt)$. Determine the resultant amplitude at that point.

Using superposition principal the resultant amplitude is given by

$$d(t) = d_1(t) + d_2(t)$$

Or

$$d(t) = 4\sin\omega t + 4\cos\omega t = 4\sin\omega t + 4sin(\omega t + \frac{\pi}{2}) = 4\left[\sin\omega t + sin(\omega t + \frac{\pi}{2})\right]$$

Gives

$$d(t) = 4*2*\sin\left(\frac{\omega t + \omega t + \frac{\pi}{2}}{2}\right)\cos\left(\frac{\omega t - \omega t - \frac{\pi}{2}}{2}\right)$$

Or

$$d(t) = 8\sin\left(\omega t + \frac{\pi}{4}\right)\cos\left(-\frac{\pi}{4}\right)$$

Or

$$d(t) = 8\sin\left(\omega t + \frac{\pi}{4}\right)\frac{1}{\sqrt{2}} = 4\sqrt{2}\sin\left(\omega t + \frac{\pi}{4}\right)$$

Hence the resulting amplitude will be $4\sqrt{2} = 5.657$ units.