

Q: Two waves moving together on the same line are described by the following functions

$$y_1 = 5 \sin\left(\omega t + \frac{\pi}{2}\right)$$

$$y_2 = 7 \sin\left(\omega t + \frac{\pi}{3}\right)$$

Write Briand's wave function.

Sol:

$$E_T = E_1 + E_2 = E_{o1} \sin(\omega t + a_1) + E_{o2} \sin(\omega t + a_2)$$

$$= (E_{o1} \cos(a_1) + E_{o2} \cos(a_2)) \sin(\omega t) + (E_{o1} \sin(a_1) + E_{o2} \sin(a_2)) \cos(\omega t)$$

$$= 5 \sin\left(\omega t + \frac{\pi}{2}\right) + 7 \sin\left(\omega t + \frac{\pi}{3}\right)$$

$$= \left(5 \cos\left(\frac{\pi}{2}\right) + 7 \cos\left(\frac{\pi}{3}\right)\right) \sin(\omega t) + \left(5 \sin\left(\frac{\pi}{2}\right) + 7 \sin\left(\frac{\pi}{3}\right)\right) \cos(\omega t)$$

$$= \frac{7}{2} \sin(\omega t) + \left(5 + \frac{7\sqrt{3}}{2}\right) \cos(\omega t)$$

$$E_T = E_o \sin(\omega t + a)$$

$$\begin{cases} |E_T| = \sqrt{\left(\frac{7}{2}\right)^2 + \left(5 + \frac{7\sqrt{3}}{2}\right)^2} = 11.6 \\ a = \arctan\left(\frac{5 + \frac{7\sqrt{3}}{2}}{\frac{7}{2}}\right) = 72.44 \end{cases}$$

which is the same as simulation 😊

