Q: Write the following plane waves in mixed representation. Using this representation, show that the summation of these waves is a standing wave given by the relation $E_R = (2E_0 \sin(kx)) \cos(\omega t)$.

$$E_1 = E_0 \sin(kx - \omega t)$$

$$E_2 = E_0 \sin(kx + \omega t)$$

Sol:

$$E_1 = E_0 \sin(kx - \omega t) = lm\{E_o e^{i(kx-\omega t)}\}$$

$$E_2 = E_0 \sin(kx + \omega t) = lm\{E_o e^{i(kx+\omega t)}\}$$

$$\begin{aligned} E_T = E_1 + E_2 &= lm\{E_o e^{i(kx-\omega t)} + E_o e^{i(kx+\omega t)}\} = lm\{E_o e^{ikx}(e^{-i\omega t} + e^{i\omega t})\} \\ &= lm\{E_o e^{ikx} \times 2\cos(\omega t)\} = 2E_o lm\{(\cos(kx) + isin(kx)) \times \cos(\omega t)\} \\ &= 2E_o lm\{\cos(kx)\cos(\omega t) + isin(kx)\cos(\omega t)\} = 2E_0 sin(kx)\cos(\omega t) \end{aligned}$$