HW#5 Jesus Gil Gil

5.3. Wave superposition.

$$E_x = A\cos(\omega t - kx + \delta)$$

$$E_x = A_1\cos(\omega t - kx + \delta_1) + A_2\cos(\omega t - kx + \delta_2)$$

$$E_x = A_3\cos(\omega t - kx + \delta_3)$$

$$\tilde{A}_3 e^{i(\omega t - kx)} = \tilde{A}_1 e^{i(\omega t - kx)} + \tilde{A}_2 e^{i(\omega t - kx)}$$

$$\tilde{A}_3 = \tilde{A}_1 + \tilde{A}_2 \rightarrow A_3 e^{i(\delta_3)} = A_1 e^{i(\delta_1)} + A_2 e^{i\delta_2}$$

$$A_3 = \sqrt{(A_3 e^{i\delta_3})(A_3 e^{-i\delta_3})} = \sqrt{(A_1 e^{i\delta_1} + A_2 e^{i\delta_2})(A_1 e^{-i\delta_1} + A_2 e^{-i\delta_2})} =$$

$$= \sqrt{A_1^2 + A_2^2 + A_1 A_2 (e^{i\delta_1 - i\delta_2} + e^{-i\delta_1} e^{i\delta_2})} =$$

$$= \sqrt{A_1^2 + A_2^2 + A_1 A_2\, 2\cos(\delta_1 - \delta_2)} \quad \checkmark$$

$$\tan\delta_3 = \frac{A_3\sin\delta_3}{A_3\cos\delta_3} = \frac{A_1\sin\delta_1 + A_2\sin\delta_2}{A_1\cos\delta_1 + A_2\cos\delta_2}$$

$$\delta_3 = \tan^{-1}\left(\frac{A_1\sin\delta_1 + A_2\sin\delta_2}{A_1\cos\delta_1 + A_2\cos\delta_2}\right) \quad \checkmark$$