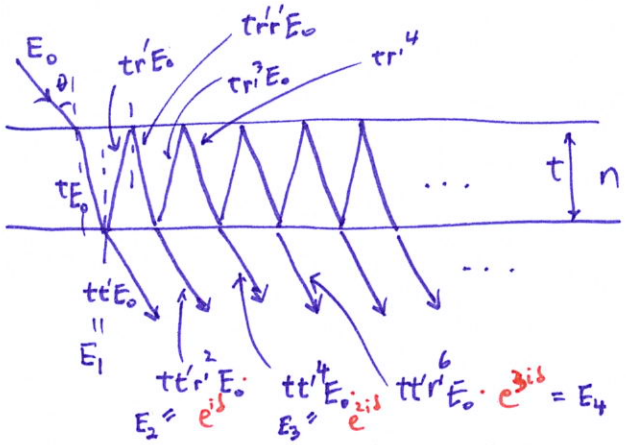
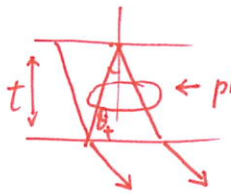
501)

4.





← phase difference δ :

$2t\cos\theta_t \cdot n \equiv \delta$

(a)

The total transmitted light is

$$E_T = \sum_{j=1}^{N} E_i = E_0 tt' \left(1 + r'^2 e^{i\delta} + r'^4 e^{2i\delta} + r'^6 e^{3i\delta} + \cdots\right)$$

$$= E_0 tt' \sum_{j=0}^{N} \left(r'^{2j} e^{ij\delta}\right) = E_0 tt' \left(1 + x + x^2 + \cdots\right),$$

where $x = r'^2 e^{i\delta}$

Here, $1 + x + x^2 + \cdots = \dfrac{1}{1-x}$.

$$\therefore E_T = E_0 tt' \left(\frac{1}{1 - r'^2 e^{i\delta}}\right) e^{i\omega t}.$$

The total transmitted light is $I_T = |E_T|^2 = E_T \cdot E_T^*$.

$$I_T = I_0 (1-r^2)^2 \left(\frac{1}{1 - r'^2 e^{i\delta}} \cdot \frac{1}{1 - r'^2 e^{-i\delta}}\right); \quad tt' = 1 - r^2, \; r'^2 = r^2$$

$$= I_0 \frac{(1-r^2)^2}{1 + r^4 - 2r^2 \cos\delta}$$

corrected!

(b)

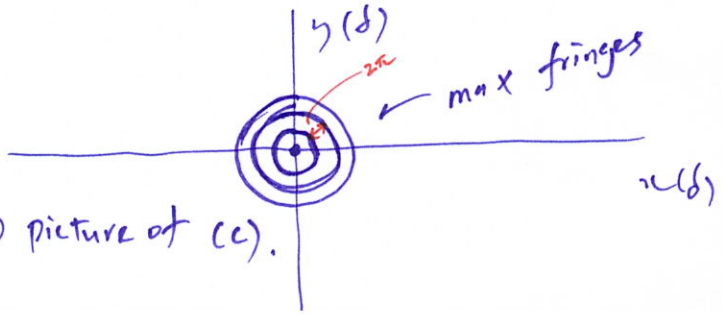
$\delta = 2t\cos\theta_t \cdot n$. For maximum I_T, $\cos\delta = 1$ $\therefore \delta = 2m\pi$.

$= 2m\pi$ $\therefore$ $\boxed{t = \dfrac{2m\pi}{2n\cos\theta_t} = \dfrac{m\lambda}{2n}}$ $\boxed{I_T = I_0}$ $(m = 0, 1, 2, \cdots)$

(d)

$\cos\theta_t = \dfrac{2m\pi}{2nt}$ for max I_T.

$\rightarrow \theta_t = \cos^{-1}\left(\dfrac{2m\pi}{2nt}\right)$: $\sin\theta = n\sin\theta_t$



why: A 2D picture of (c).

(c) $\delta = \pi$ (i) $r = 0.9$, $I_T = \dfrac{(1-r^2)^2}{(1+r^2)^2}$

(ii) $r = 0.5$

$I_T = \dfrac{0.75^2}{1.25^2} = \dfrac{0.1}{1.8}$

$= 0.36 I_0 = 0.$