HW7. Solutions

Problem 1.

Part A. $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1} = \frac{\sin\theta_3}{\sin\theta_2} \Rightarrow \theta_1 = \theta_3 \Rightarrow$ parallel.

Part B. Assume line $(x_1, y_1, z_1) \to (x_2, y_2, z_2)$.
reflected by x-z plane: $(x_1, -y_1, z_1) \to (x_2, -y_2, z_2)$.
Similarly, the corner makes: $-(x_1, y_1, z_1) \to -(x_2, y_2, z_2)$.
which opposite the initial direction.

Part C $n_L = n_p \frac{\sin 60^\circ}{\sin 90^\circ} = 1.403$.

Part D $\Delta X_{min} = \frac{1}{2n}\frac{\lambda}{2} = 109.72\,nm$.

Problem 2.

Part A. 1. 2

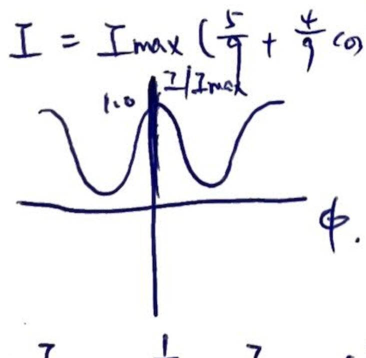
2. $\frac{I_T}{I_i} = \left(\cos^2\frac{\pi}{2n}\right)^n \geq 0.6 \Rightarrow n_{min} = 5$.

Part B. $|r_1 - r_2| = \frac{n\lambda}{2}$ which ~~is~~ are hyperbolas

Part C. 1. $E_0 = E_1 + E_2 = E(1+2\cos\phi)\cos(kr-\omega t) + 2E\sin\phi\sin(kr-\omega t)$

$I_{max} \propto (5E^2 + 4E^2\cos\phi)_{max} = 9E^2$

$I = I_{max}\left(\frac{5}{9} + \frac{4}{9}\cos\phi\right)$.

2. 

$I_{min} = \frac{1}{9} I_{max}$. at $\phi = (2n+1)\pi$.

Part D. $I = I_{max} \cdot \frac{1}{2} = I_{max} \cdot \cos^2\left(\frac{\lambda d y}{\lambda \ell}\right) \Rightarrow \begin{array}{l} \theta_m^+ = \frac{\lambda}{d}\left(m + \frac{1}{4}\right) \\ \theta_m^- = \frac{\lambda}{d}\left(m - \frac{1}{4}\right) \end{array}$

$\Delta\theta_m = \frac{\lambda}{2d}$.

Part E. $z = \frac{2n+1}{4}\lambda$ for bright. $z = \frac{n\lambda}{2}$ for dark.

$r = \begin{cases} \sqrt{\frac{2n+1}{4} d\lambda} & \text{bright} \\ \sqrt{\frac{n}{2} d\lambda} & \text{dark.} \end{cases}$ $n \in N$