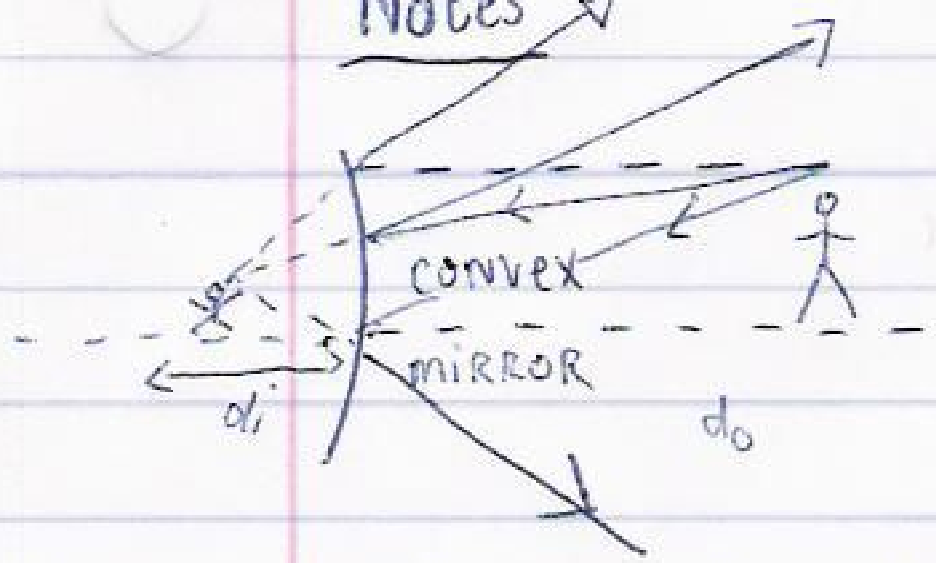
Notes



Negative b/c on other side of mirror.

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f} \quad \Big| \quad \frac{h_o}{d_o} = -\frac{h_i}{d_i}$$

f negative because focus in on other side of mirror.

e.g. $d_o = 4.0m$, $h_o = 1.6m$, $f = -2.0m$

$$\frac{1}{4.0m} + \frac{1}{d_i} = \frac{1}{-2.0m}$$

$$\frac{.25}{m} + \frac{1}{d_i} = \frac{-.5}{m}$$

$$\frac{1}{d_i} = \frac{-.75}{m}$$

$$d_i = -1.33m$$

$$h_i = \frac{-h_o d_i}{d_o} = .533$$

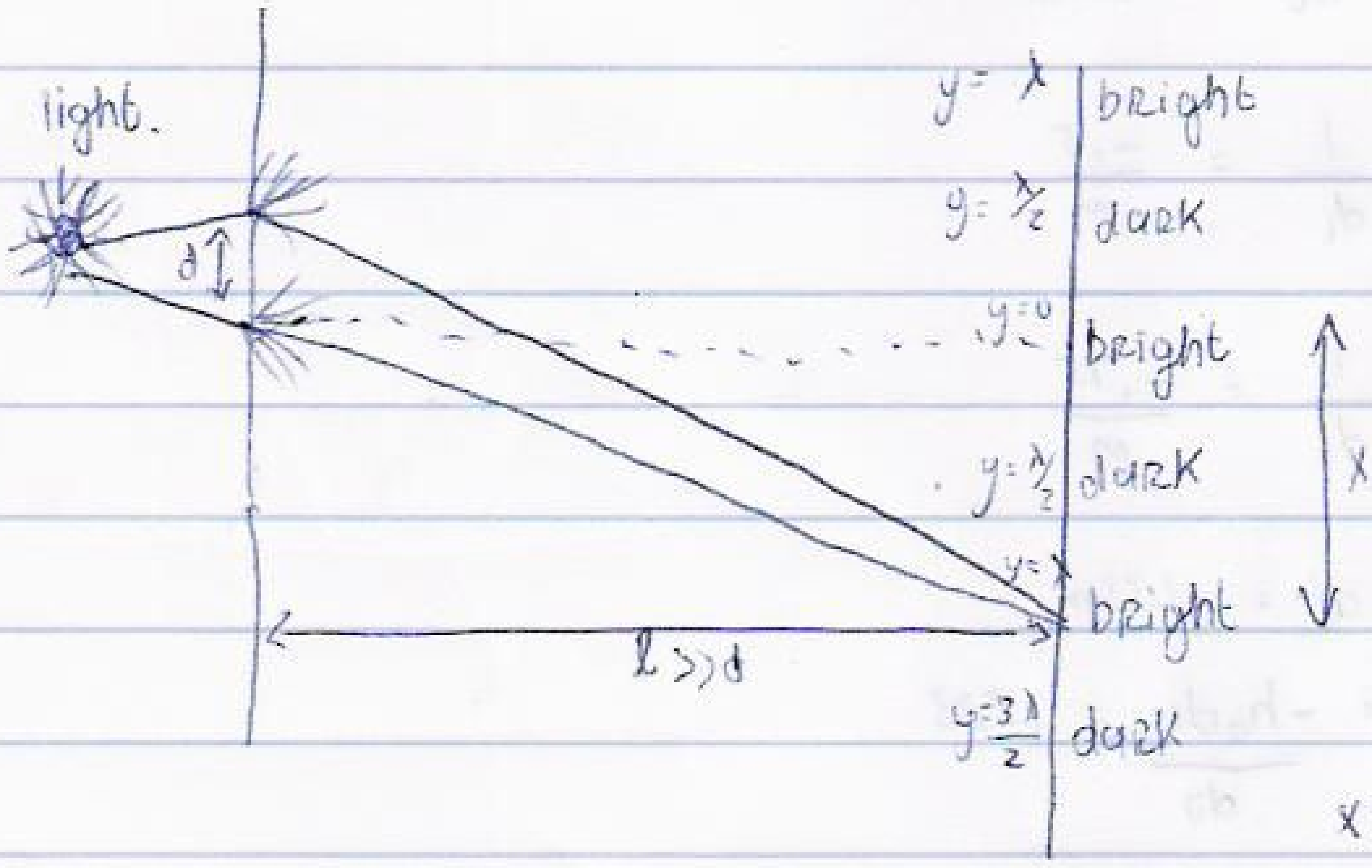
Magnification $m = \frac{h_i}{h_o} = -\frac{d_i}{d_o} = .33m$

Chapter 34

Reflection } 32. Diffraction } 34.
Refraction

Wavelengths

620 - 750 nm	Red light	To "see" this magnify by 10^4
590 - 620 nm	orange	$\lambda = 500 nm$
495 - 570 nm	yellow green	$10^4 \lambda = 5.00 \times 10^{-3} m = 500 mm.$
570 - 590 nm	yellow	
475 - 495 nm	cyan	
450 - 475 nm	blue	
380 - 450 nm	violet	



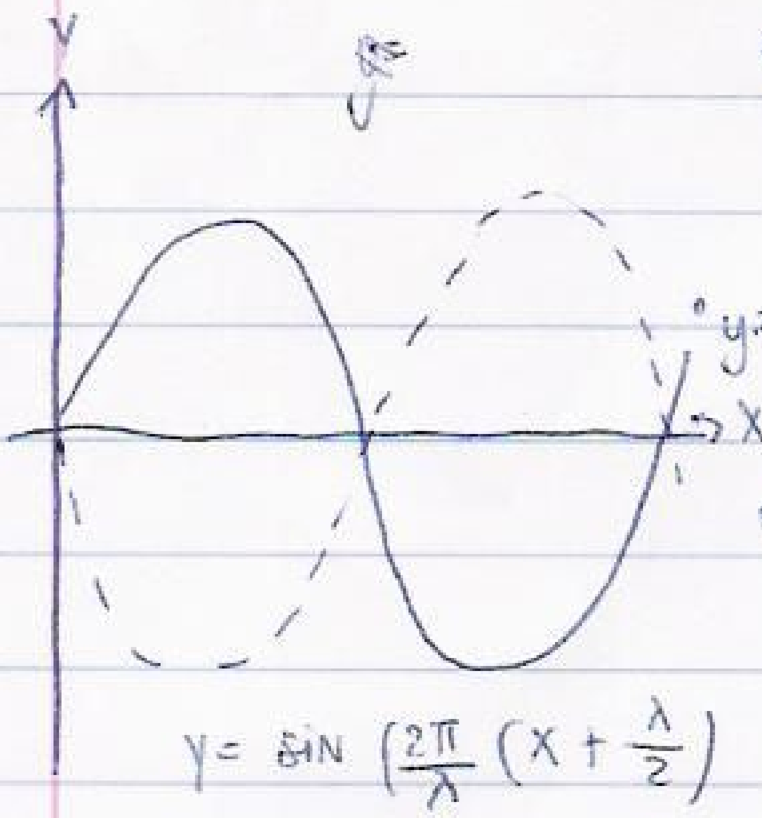
X_1 = distance between middle (primary) peak of brightness and the next (secondary) peak

$X_1 = \frac{l\lambda}{d}$

estimates assumes $l >> d$

Peak brightness at $x = 0, \frac{l\lambda}{d}, \frac{2l\lambda}{d}, \frac{3l\lambda}{d}$

Peak darkness at $x = \frac{l\lambda}{2d}, \frac{3l\lambda}{2d}, \frac{5l\lambda}{2d}$.



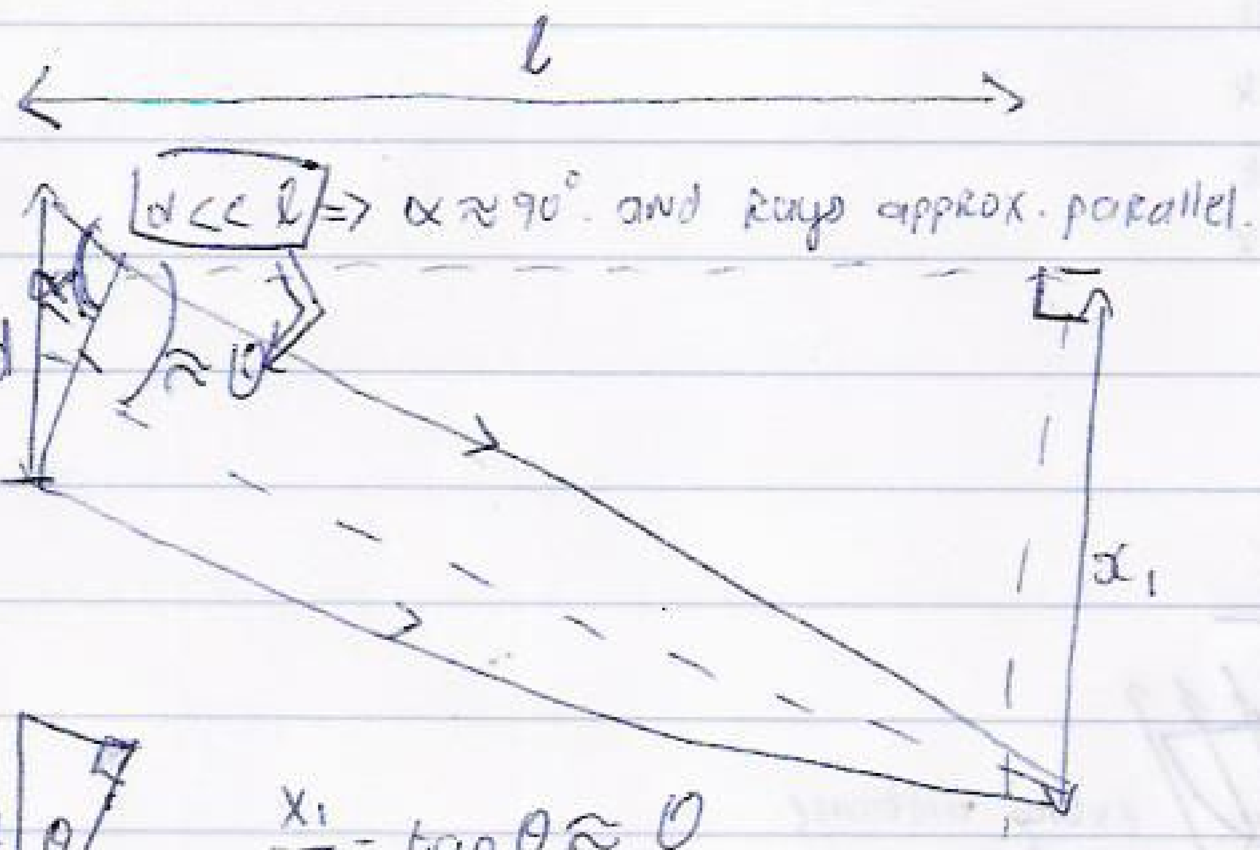
$\sin\left(\frac{2\pi x}{\lambda}\right) + \sin\left(\frac{2\pi}{\lambda}(x+2\lambda)\right) = 2\sin\left(\frac{2\pi x}{\lambda}\right) \leftarrow$ bright

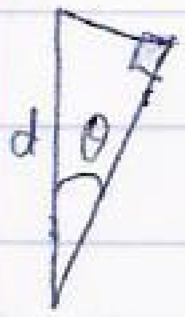
$y = \sin\left(\frac{2\pi x}{\lambda}\right) + \sin\left(\frac{2\pi}{\lambda}\left(x + \frac{\lambda}{2}\right)\right) = 0 \leftarrow$ dark

$\quad$ " " $= 2\sin\left(\frac{2\pi x}{\lambda}\right) \leftarrow$ brightness

$y = \sin\left(\frac{2\pi}{\lambda}\left(x + \frac{\lambda}{2}\right)\right)$ $\quad \sin\left(\frac{2\pi x}{\lambda}\right) + \sin\left(\frac{2\pi}{\lambda}\left(x + \frac{\lambda}{2}\right)\right) = 0 \leftarrow$ dark

$y = \sin\left(\frac{2\pi}{\lambda}x + \pi\right) = -\sin\left(\frac{2\pi x}{\lambda}\right)$





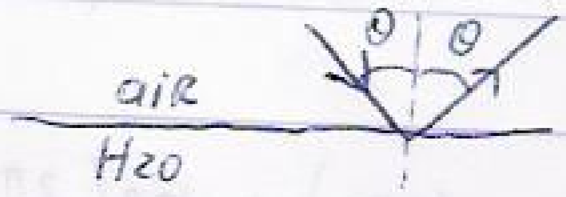
$\frac{x_1}{l} = \tan\theta \approx \theta$

$\sin\theta = \frac{y}{d}$

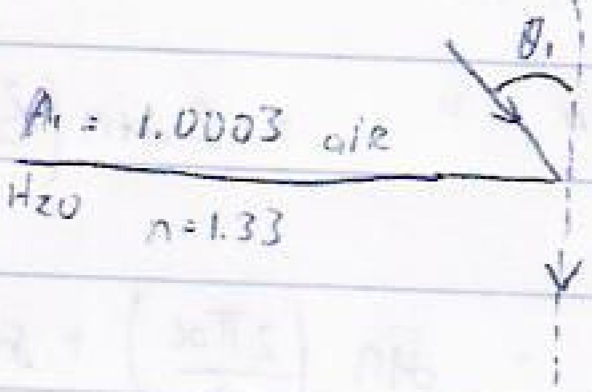
$d \ll l \Rightarrow \theta \approx 0 \Rightarrow \sin\theta \approx \theta \approx \tan\theta$

$\Rightarrow \frac{y}{d} \approx \frac{x_1}{l} \Rightarrow x_1 \approx \frac{yl}{d}$

Reflection

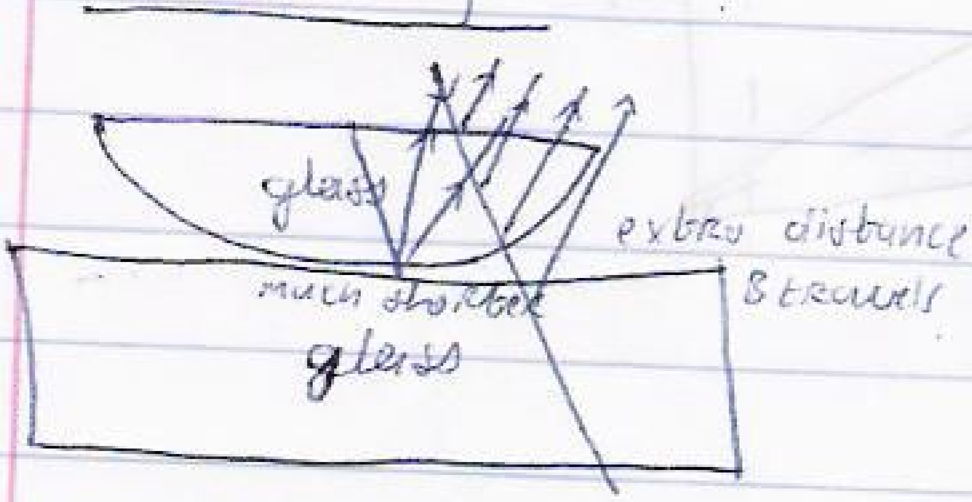


Refraction



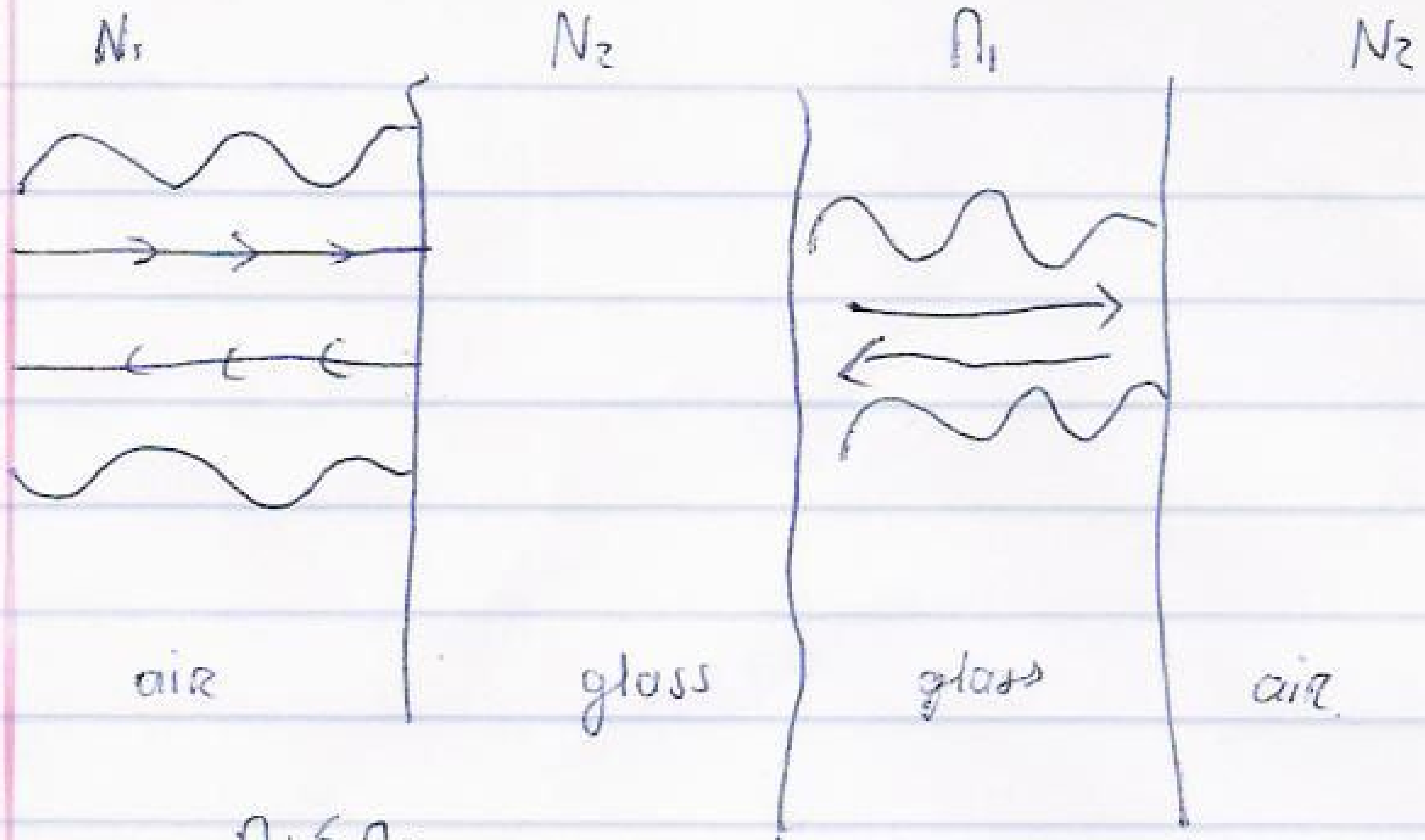
Diffraction

Newtons Rings



View from above:

Dark middle because reflections sometimes create a $\lambda/2$ shift



$n_1 < n_2$ ⇓ shift of $\lambda/2$ in reflected ray

$n_1 > n_2$ ⇓ no shift in reflected ray