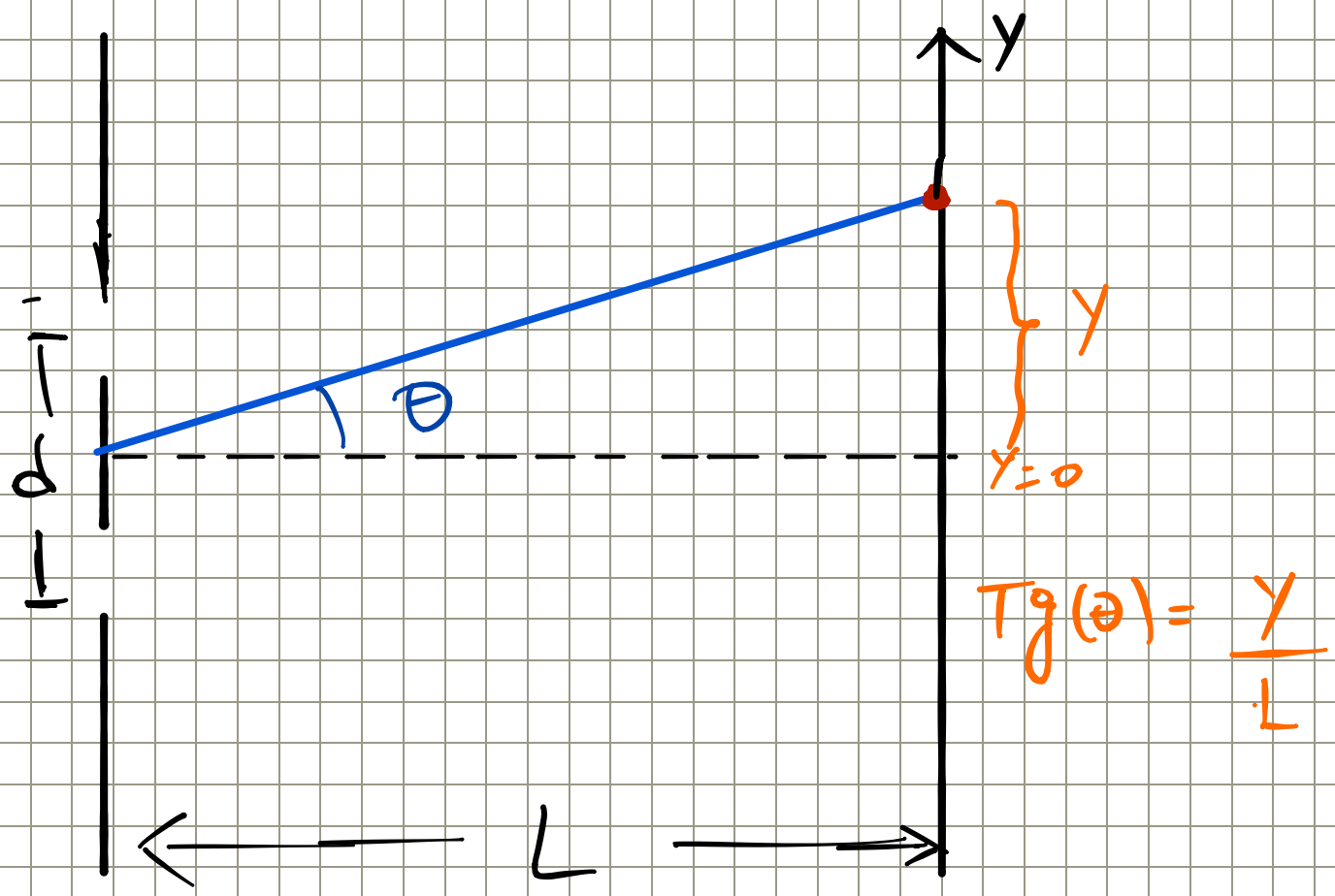
Interferencia y Difracción



$$Tg(\theta) = \frac{Y}{L}$$

$$\Rightarrow d \cdot \operatorname{sen}(\theta) = n\lambda \qquad n = 0; \pm 1; \pm 2 \ldots$$

↑ Condición de máximo

$$\Rightarrow d \cdot \operatorname{sen}(\theta) = \left(n + \frac{1}{2}\right)\lambda \qquad n = 0; \pm 1;$$

↑ Condición de mínimo

$n = 0 \Rightarrow \operatorname{sen}(\theta) = 0 \Rightarrow \theta = 0$

$n = 0 \Rightarrow d \cdot \operatorname{sen}(\theta) = \frac{\lambda}{2} \Rightarrow \theta = \ldots\ldots$

Ángulos pequeños: $\text{Sen}(\theta) \simeq \text{Tg}(\theta)$

Máximos: $d \cdot \text{Tg}(\theta) = n \cdot \lambda$

$$\text{Tg}(\theta) = \frac{Y}{L}$$

$$\Rightarrow d\frac{Y}{L} = n\lambda \Rightarrow \boxed{Y_{max}^{(n)} = \frac{n \cdot L\lambda}{d}}$$

Mínimos: $d \cdot \text{Tg}(\theta) = \left(n + \frac{1}{2}\right)\lambda$

$$\text{Tg}(\theta) = \frac{Y}{L}$$

$$\Rightarrow \frac{dY}{L} = \left(n + \frac{1}{2}\right)\lambda \Rightarrow \boxed{Y_{min}^{(n)} = \frac{L\lambda\left(n + \frac{1}{2}\right)}{d}}$$

$n = 0; \pm 1 \ldots$

Ejercicio 6.1: $\Rightarrow L = 1{,}2\,m$

$\Rightarrow d = 0{,}030\,mm$

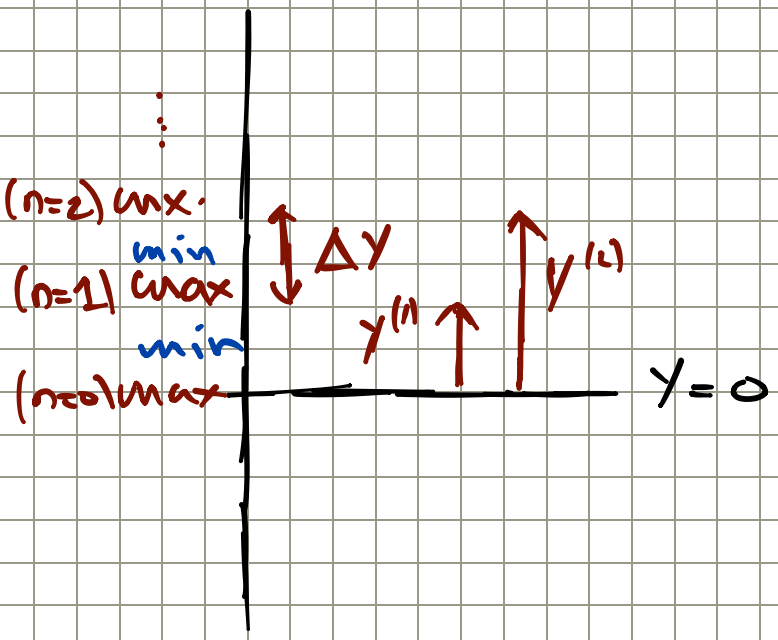
$\Rightarrow Y_{max}^{(2)} = 0{,}045\,m \quad (n=2)$

$\Rightarrow$ Queremos λ!

$$y_{max}^{(2)} = \frac{2 \cdot L\lambda}{d} \Rightarrow \lambda = \frac{d \cdot y_{max}^{(2)}}{2L}$$

$$= 563\ nm$$

Parte b:



$$\Rightarrow \Delta Y = y_{max}^{(2)} - y_{max}^{(1)}$$

$$\Downarrow$$

$$0{,}045\ m - \frac{1 \cdot L \cdot \lambda}{d}$$

$$\Delta Y = 2{,}25\ cm$$

Ejercicio 6.2: $\Rightarrow d = 0{,}15\ mm$

$\Rightarrow L = 0{,}5\ m$

$$\Rightarrow \Delta Y_{min} = y_{min}^{(9)} - y_{min}^{(0)}$$

$$\Delta Y_{min} = 18\ mm$$

$$\Rightarrow \Delta Y_{min} = \frac{L\lambda\left(9+\frac{1}{2}\right)}{d} - \frac{L\lambda\left(0+\frac{1}{2}\right)}{d}$$

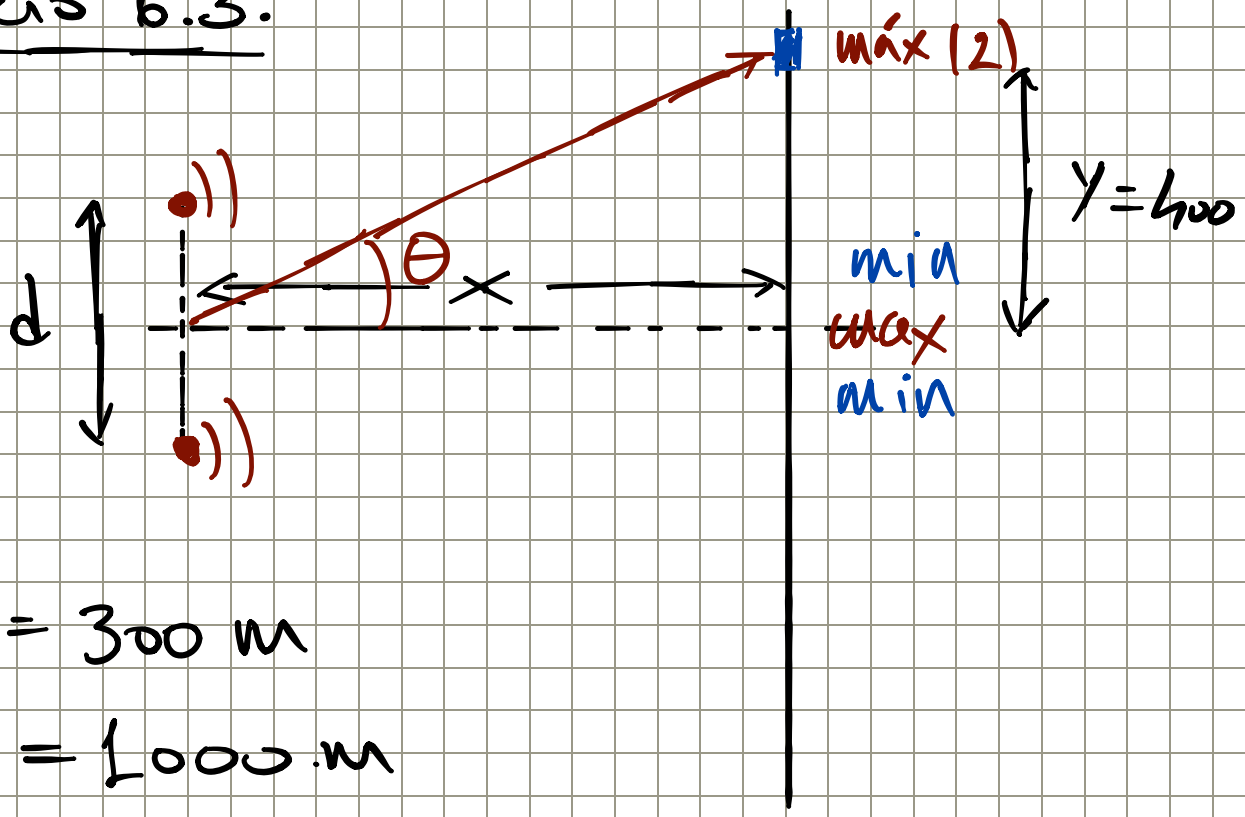
$$\Delta Y_{min} = \frac{L\lambda}{d}\left[\left(9+\frac{1}{2}\right) - \left(0+\frac{1}{2}\right)\right]$$

$$\Delta Y_{min} = \frac{L \cdot \lambda}{d} \quad (9)$$

$$\Rightarrow \lambda = \frac{\Delta Y_{min} \cdot d}{L \cdot 9}$$

$$= \frac{(18\,mm) \cdot (0{,}15\,mm)}{9 \cdot (0{,}5\,m)} = \underline{600\,nm}$$

Ejercicio 6.3:



$$\Rightarrow d = 300\,m$$

$$\Rightarrow x = 1000\,m$$

$$\Rightarrow \text{Queremos } \lambda$$

$$d \cdot \sin(\theta) = n\lambda \Rightarrow \lambda = \frac{d \cdot \sin(\theta)}{n}$$

$$n = 2 \Rightarrow \lambda = \frac{d \cdot \sin(\theta)}{2}$$

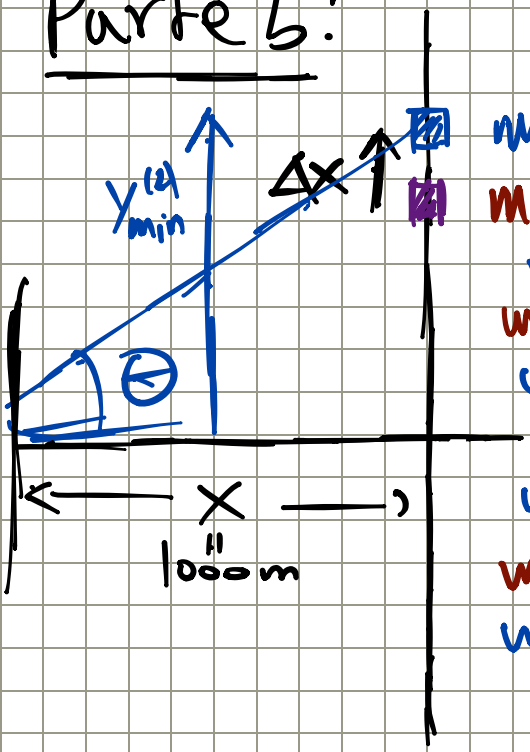
$$Tg(\theta) = \frac{Y}{X} \Rightarrow \theta = Arctg\left(\frac{Y}{X}\right)$$

$$\Rightarrow \lambda = \frac{d \cdot \sin\left[Arctg\left(\frac{Y}{X}\right)\right]}{2}$$

$$= \frac{300m \cdot \sin\left(Arctg\left(\frac{400}{1000}\right)\right)}{2}$$

$$\lambda = 55{,}7\ m$$

Parte b:



mín (n=2)
máx (2)
mín (n=1)
máx (n=1)
mín (n=0)
máx (n=0)
mín (n=0)
máx (n=-1)
mín (n=-1)

$$\Rightarrow \Delta x = Y^{(2)}_{min} - Y^{(2)}_{max}$$

$$Y^{(2)}_{min} - 400m$$

Queremos $Y^{(2)}_{min}$

mínimos $d \cdot \sin(\theta) = \left(n + \frac{1}{2}\right)\lambda$

$$Tg(\theta) = \frac{Y^{(2)}_{min}}{X} \Rightarrow Y^{(2)}_{min} = X \cdot Tg(\theta) \leftarrow$$

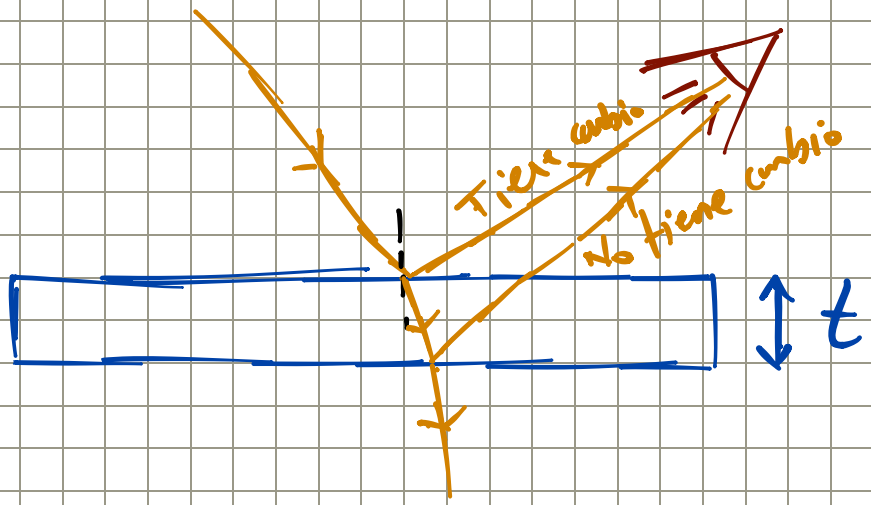
$$\operatorname{Sen}(\theta) = \frac{(2+\frac{1}{2})\lambda}{d} = \frac{5\lambda}{2d}$$

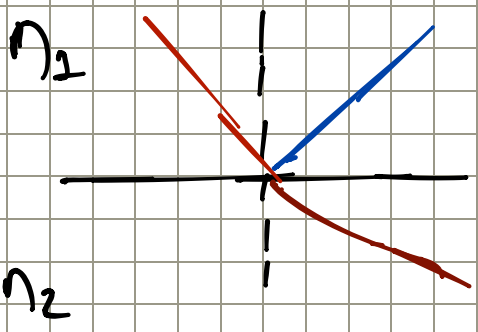
$$\Rightarrow \theta = \operatorname{Arcsen}\left(\frac{5\lambda}{2d}\right)$$

$$Y_{min}^{(2)} = X \cdot Tg\left(\operatorname{Arcsen}\left(\frac{5\lambda}{2d}\right)\right)$$

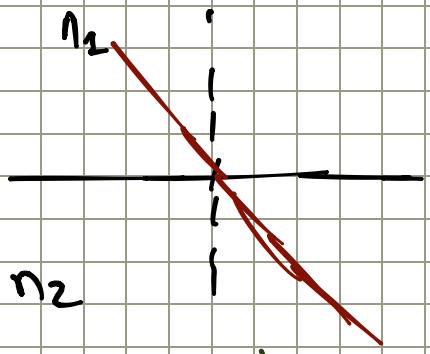
$$Y_{min}^{(2)} = 524\ m$$

✱ $\Delta X = 524 - 400 = 124\ m$

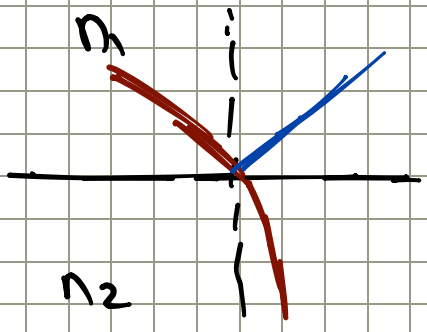




$n_1 > n_2$: No hay cambio de fase



$n_1 = n_2$ No hay reflexión



$n_1 < n_2$: Tiene un cambio de fase

Reflexión constructiva $2 \cdot t = n \lambda_m$ $m = 0; \pm 1$

Reflexión destructiva $2t = \left(m + \frac{1}{2}\right) \lambda_m$

$\Rightarrow$ Si ninguna o ambas ondas reflejadas tienen cambio en fase.

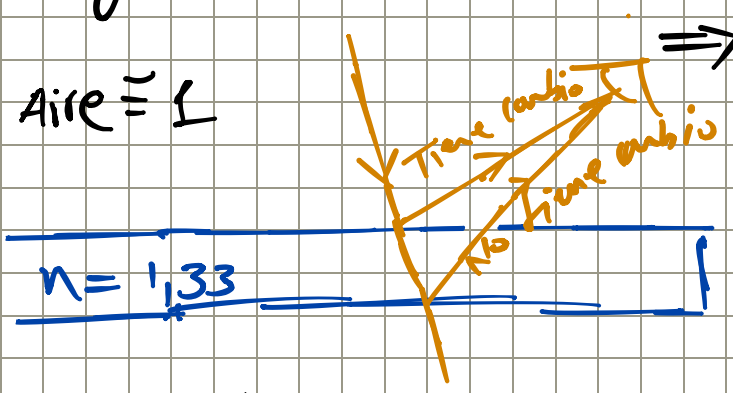
Reflexión Constructiva: $2t = \left(m + \frac{1}{2}\right) \lambda_m$

Reflexión Destructiva: $2t = m \lambda_m$

$\Rightarrow$ Una de las ondas tiene un cambio en la fase

Ejercicio 6.1.6: $\Rightarrow n = 1{,}33$

$\Rightarrow t = 320$ nm



$\Rightarrow$ Quereno λ reflejada para comparar.

$\Rightarrow 2t = \left(m + \frac{1}{2}\right) \lambda_m$

$2t = \left(m' + \frac{1}{2}\right) \frac{\lambda_0}{n}$ $m' = 0; \pm 1; \pm 2 \ldots$

$n = \frac{\lambda_0}{\lambda_m}$

λ_0 ← Longitud de onda en el vacío

λ_m ← Longitud de onda en el medio

n ← Indice de refracción

$$\Rightarrow \lambda_0 = \frac{2t.n}{m+\frac{1}{2}}$$

$$\Rightarrow \lambda_0(m=0) =$$

$$\lambda_0(m=1) =$$

$$\vdots$$

1700 nm

567 nm ← m

340 nm

243 nm