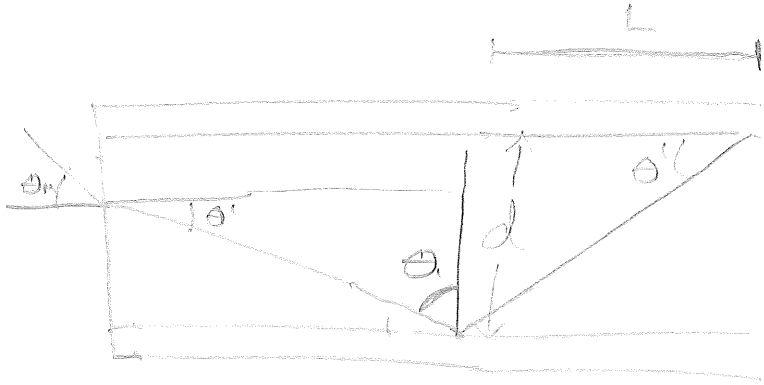
10.3

$$L = \frac{n_2 d}{\sqrt{n_1^2 - n_2^2}}$$



$$n_0 \cdot \sin\theta_m = n_1 \cdot \sin\theta'$$

- $\theta' = \operatorname{asin}\left(\frac{n_0}{n_1}\sin\theta_m\right)$
- $n_0 \sin\theta_m = \sqrt{n_1^2 - n_2^2}$

$$\Rightarrow \theta' = \operatorname{asin}\left(\frac{\sqrt{n_1^2 - n_2^2}}{n_1}\right)$$

- $\cot\theta' = \frac{L}{d} \Rightarrow L = d\cot\theta'$
- $L = d\cot\left(\operatorname{asin}\left(\frac{\sqrt{n_1^2 - n_2^2}}{n_1}\right)\right) =$

$$= \frac{d\left(1 - \frac{n_1 - n_2}{n_1}\right)}{\frac{\sqrt{n_1^2 - n_2^2}}{n_1}} = \boxed{\frac{n_2 d}{\sqrt{n_1^2 - n_2^2}}} \quad \#$$

10.4

$n_2 = 1,41$

$n_1 = 1,52$

$1 \cdot \sin\theta_m = \sqrt{1,52^2 - 1,41^2}$

c) $\Rightarrow \boxed{\theta_m = 34,6^\circ}$

a) $n_1 \sin\theta = n_2 \sin 90^\circ \Rightarrow \boxed{\theta = 68^\circ}$

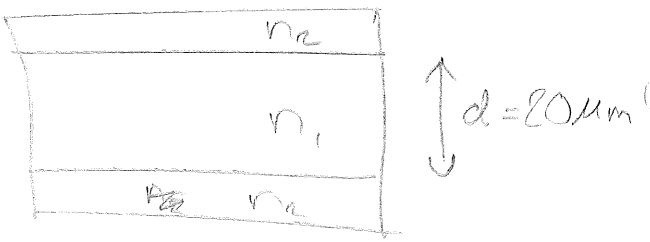
b) $N.A = \sqrt{n_1^2 - n_2^2} = \boxed{0,557}$

10.7

$n_1 = 1,460$

$n_2 = 1,456$

$\lambda = 850\,nm$



$$m_{MAX} = \frac{1}{2}\left(\frac{5d}{\lambda} N.A\right)^2 = \boxed{1,59}$$

$N.A = \sqrt{n_1^2 - n_2^2}$

10.8

$n_1 = 1{,}460$, $n_2 = 1{,}456$, $\lambda = 1250\,nm$

$d =$ [illegible]

$$1 = \frac{1}{2}\left(\frac{\pi d}{\lambda} NA\right)^2$$

En mod

$$\frac{d}{\lambda} < \frac{2{,}4}{\pi (N.A)}$$

$$\Rightarrow d = \frac{2{,}4 \cdot \lambda}{\pi \sqrt{n_1^2 - n_2^2}} =$$

$$\Downarrow$$

$$\boxed{d < 10{,}2\,\mu m}$$

10.11

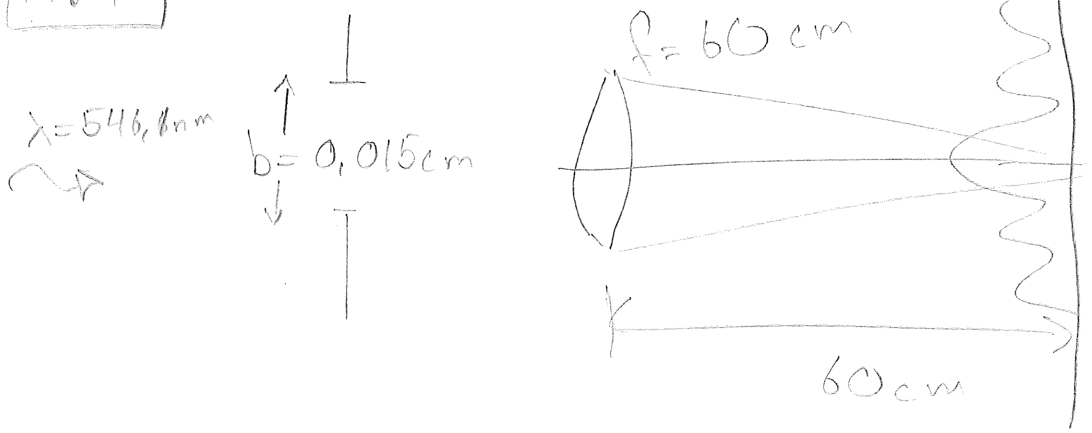
$$4 \cdot \frac{1}{10^{0,5}} \cdot \frac{1}{10^{0,1}} \cdot \frac{1}{10^{0,5}} \cdot \frac{1}{10^{0,1}} \cdot \frac{1}{10^{0,5}} = \boxed{0{,}08\,mW}$$

$$\alpha_{db} = (10\ [db/km])\, lg\left(\frac{P_1}{P_2}\right)$$

totalt 17 dB förlust

$$-17 = 10\, lg\left(\frac{I}{I_0}\right),\ I_0 = 4mW \Rightarrow \boxed{I = 0{,}08m}$$

11.1



~~d ≫ λ Fraunhofer~~

~~d ≪ λ Fresnel~~

~~[illegible] $d \gg \lambda$ ... $\frac{D^2}{\lambda z}$~~

a) $y_m = \dfrac{m\lambda f}{b} = \boxed{0{,}218\,cm}$

b) $y_2 - y_1 = \dfrac{2\lambda f}{b} - \dfrac{\lambda f}{b} = \dfrac{\lambda f}{b} = \boxed{0{,}218\,cm}$