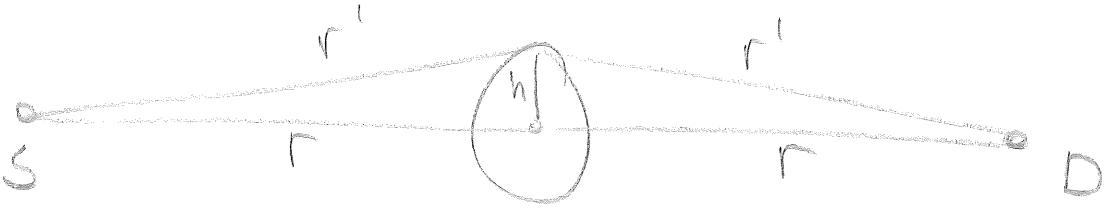
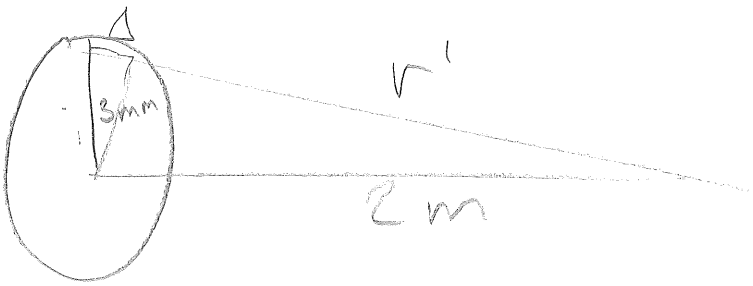
13.1



$$2r + \frac{\lambda}{2} = 2r' \Rightarrow r' = r + \frac{\lambda}{4}$$

$$r^2 + h^2 = (r')^2 \Rightarrow h = \sqrt{\left(r + \frac{\lambda}{4}\right)^2 - r^2} = 1{,}17$$

13.2



$$\sqrt{(3\,mm)^2 + (2\,m)^2} = r'$$

$$\Delta + 2 = r' \Rightarrow \underline{\Delta = r' - 2}$$

$$\boxed{\Delta \approx 4{,}5\lambda} \Rightarrow \boxed{n \cdot \frac{\lambda}{2} = 4{,}5\lambda}$$

antal fresnelzoner

$$\boxed{n = 9\,st}$$

a) Alla pilar är ~ lika stora.

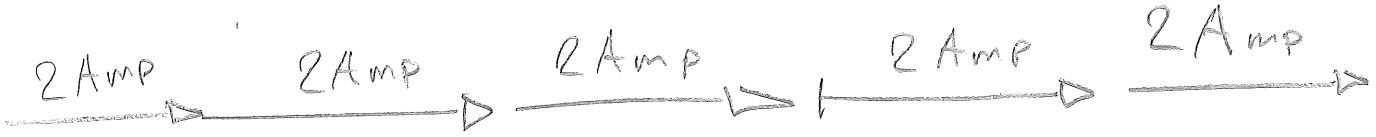
De åtta första tar ut varandra.

Amplituden på pil nio är lika med amplitud på pil 1, som är 2·Amp utan blandare

$$I = (\underbrace{2 \cdot Amp}_{enpil})^2 = \boxed{4 \cdot I_0} \rightarrow 2\,I_0$$

b) ~~A~~ $A = (5 \cdot 2 Amp)$

$$I = (\underbrace{5}_{fem\ st} \cdot \underbrace{2Amp}_{dubbel\ amp})^2 = \boxed{100\,I_0}$$



eller

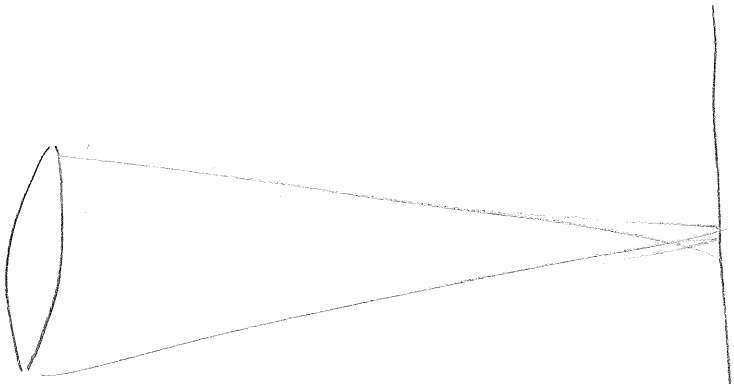
$$I_2 = (4 \cdot 2Amp)^2 = \boxed{64\,I_0}$$

c)

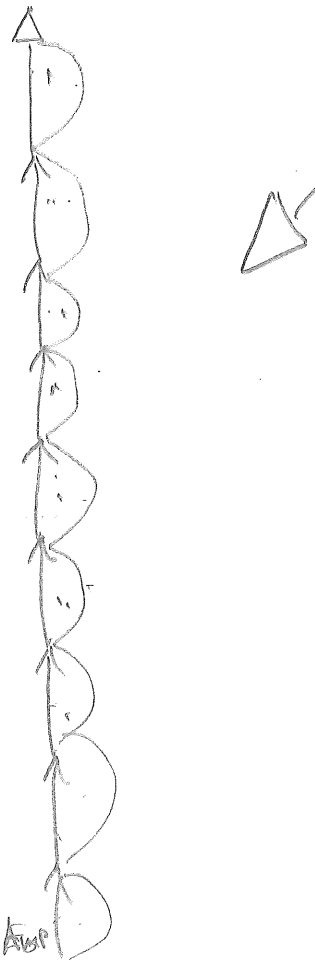
Alla pilar är konstruktiva nu.

$$I = (9.2\,\text{Amp})^2 = \boxed{324\,I_0}$$

d)



Alla strålar är i fas eftersom de gått samma optiska väg.



N10 Halvcirklar.

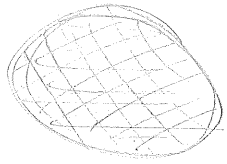
med radie

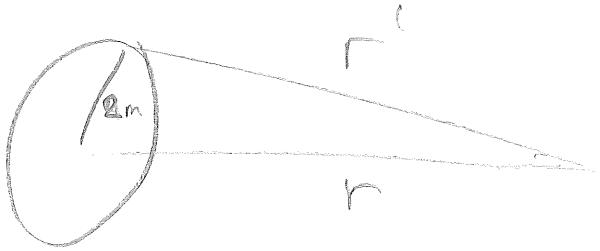
$a_1/2 = E_0$

$$A_{tot} = \frac{9}{2} 2\pi \frac{a}{2} = 9\pi\,\text{Amp}$$

$$\boxed{I = 81\pi^2 I_0}$$

13.3





Total fasförskjutning: $2 \cdot \frac{\lambda}{2}$ (2 fresnelzoner)

$n = 2$

$(0,004)^2 + r^2 = (r')^2$

$r + 2\frac{\lambda}{2} = r' \Rightarrow r' = r + \lambda$

$0,004^2 + r^2 = (r+\lambda)^2 = r^2 + 2r\lambda + \lambda^2$

$\Rightarrow r = \frac{0,002^2 - \lambda^2}{2\lambda} = 3,16$

n

Gör samma sak för $n=4$
$n=6$

13.3

$$R_n = \sqrt{n r_0 \lambda}$$

$$\Rightarrow r_0 = \frac{R_n^2}{n\lambda}$$

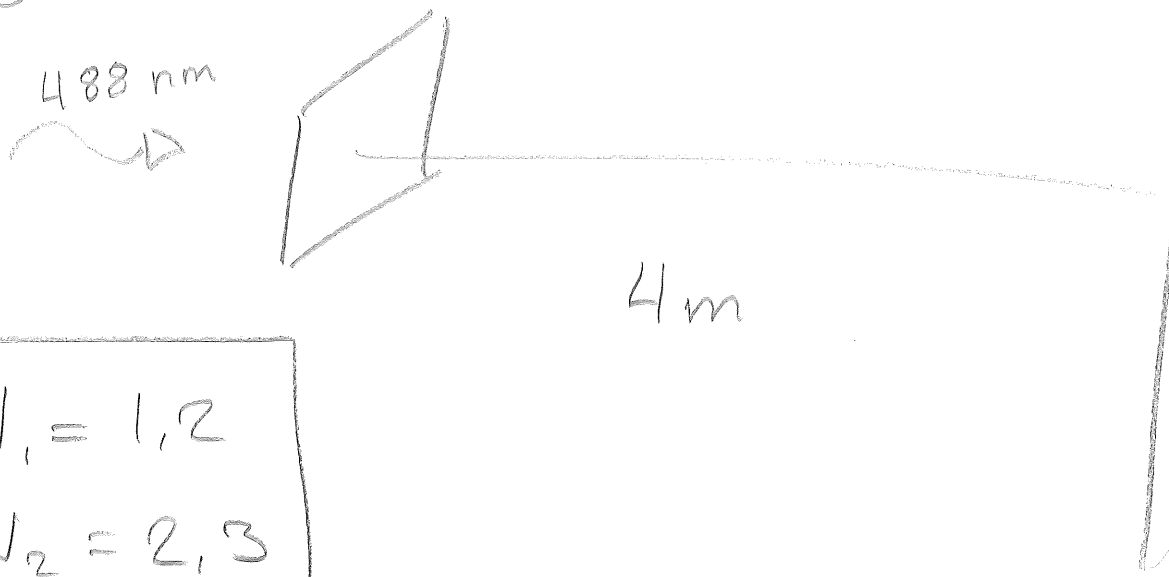
$$r_0 = \frac{0{,}002^2}{633E-9} \cdot \frac{1}{n} = \frac{6{,}32}{n}$$

$n = 2 \Rightarrow r_0 = 3{,}16$

$n = 4 \Rightarrow r_0 = 1{,}58$

$n = 6 \Rightarrow r_0 = 1{,}05$

13.4



$V_1 = 1,2$

$V_2 = 2,3$

$C_1 = 0,7154$, $S_1 = 0,6234$

$C_2 = 0,6266$, $S_2 = 0,5531$

$$I_1 = I_0 \left(\left(C(\infty) + C(V_1) \right)^2 + \left(S(\infty) + S(V_1) \right)^2 \right)$$

$I_1 = 2,74 I_0$ dela med 2

inte grundintensitet

$$I_0 = \frac{I_0}{2}$$

$$I_1 = \frac{I_0}{2} \cdot 2,74 = \boxed{1,37 I_0}$$

$$z = v_1 \sqrt{\frac{2\lambda}{L}}$$

$$y = z\left(\frac{p+q}{p}\right)$$

$$y = z \quad d\Sigma \quad p \to \infty$$

$$dy = dz$$

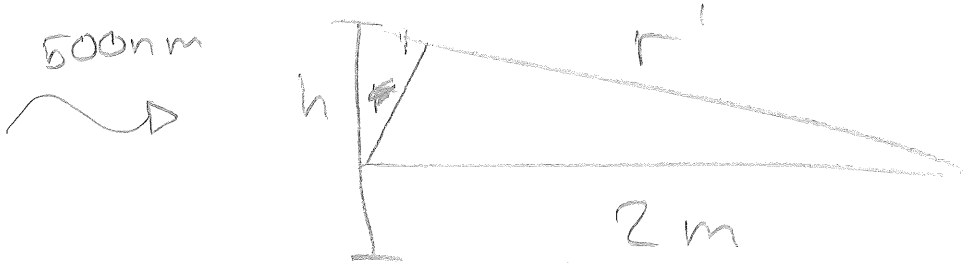
$$z_1 = v_1 \sqrt{\frac{\lambda}{2\left(\frac{1}{p}+\frac{1}{q}\right)}} \to v_1 \sqrt{\frac{\lambda q}{2}} \quad d\Sigma \; p \to \infty$$

$$\boxed{z_1 = 1{,}2\ mm}$$

$$\boxed{z_2 = 2{,}3\ mm}$$

$$\boxed{dy = dz = 1{,}1\ mm}$$

13.5



$$h^2 + 2^2 = |r'|^2$$

$$2 + \Delta = r'$$

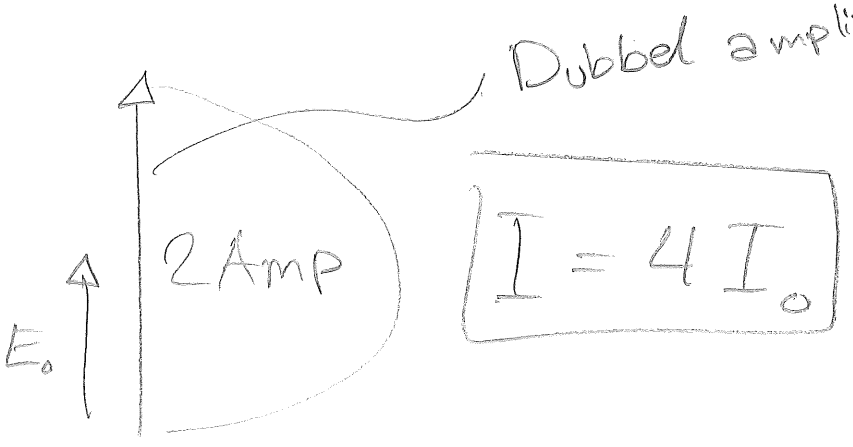
$$\Delta = \frac{\lambda}{2}$$

$$\Rightarrow r' = 2 + \frac{\lambda}{2}$$

$$h^2 = \left(2 + \frac{\lambda}{2}\right)^2 - 4 = 10^{-6}\,m^2$$

a) $h = 0{,}001\,m = \boxed{1\,mm}$

b)

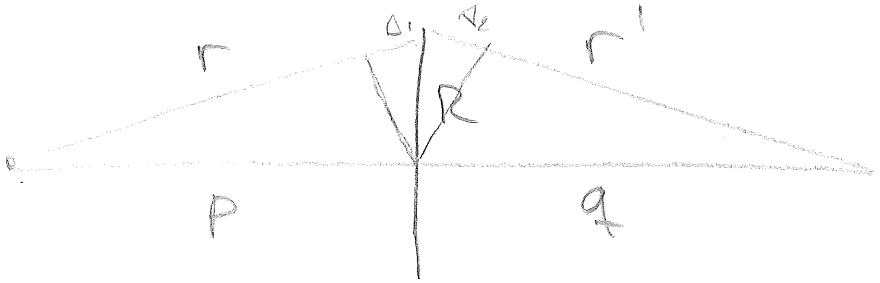


$$\boxed{I = 4I_0}$$

c)

$$I = \left(\frac{1}{2} \cdot 2 E_0 \sigma_1\right)^2 = \boxed{\sigma^2 I_0}$$

13.6



$$r^2 - p^2 = R^2 = r'^2 - q^2$$

$$p + \Delta_1 = r$$
$$q + \Delta_2 = r'$$
$$\Rightarrow \boxed{p + q + \Delta_1 + \Delta_2 = r + r'}$$

$$\boxed{\Delta_1 + \Delta_2 = n\frac{\lambda}{2}}$$

$$q^2 + R^2 = (q + \Delta_2)^2$$

$$\boxed{\Delta_2 = \sqrt{q^2 + R^2} - q}$$

$$\boxed{\Delta_1 = \sqrt{p^2 + R^2} - p}$$

$$\sqrt{p^2+R^2}-p+\sqrt{q^2+R^2}-q=n\frac{\lambda}{2}$$

$$\Leftrightarrow\quad p+\frac{R^2}{2p}-p+q+\frac{R^2}{2q}-q=n\frac{\lambda}{2}$$

$$\frac{R^2}{2}\left(\frac{1}{p}+\frac{1}{q}\right)=n\frac{\lambda}{2}$$

$$\frac{R^2}{2}\cdot\frac{1}{L}=n\frac{\lambda}{2}$$

$$\Leftrightarrow\quad \boxed{R=\sqrt{n\lambda L}}$$

ecpz.