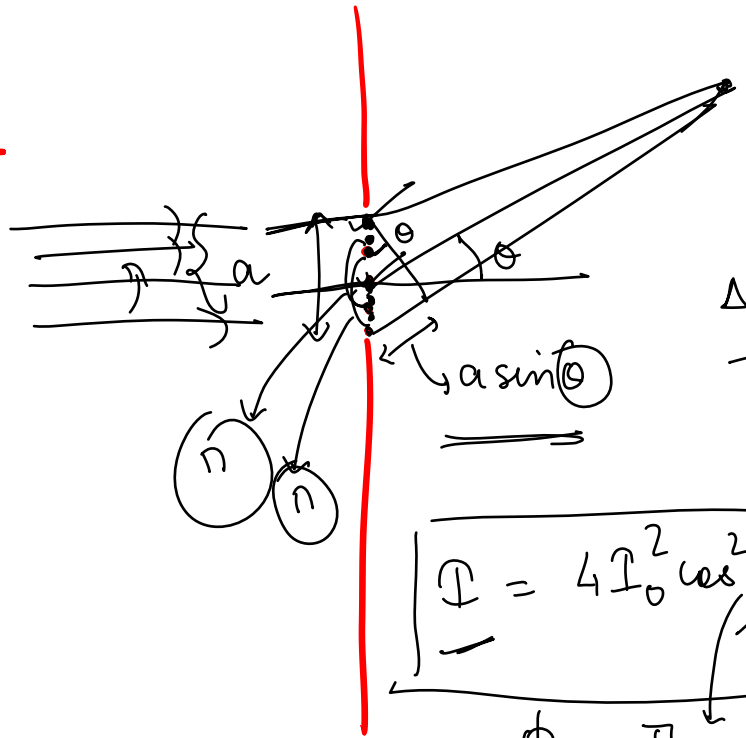
$= \frac{\lambda D}{d}$



λ

$\Delta\phi = a\sin\theta = 2n\pi$

$K\Delta x = 2n\pi.$

$\frac{2\pi}{\lambda} \times \Delta x = 2n\pi.$

$\Delta x \Rightarrow$

$a\sin\theta = \lambda$ Maxima

Minima.

$I = 4I_0^2\cos^2\frac{\phi}{2}$

$\phi = \pi$, $I = 0$. $\theta = \frac{\lambda}{a}$.

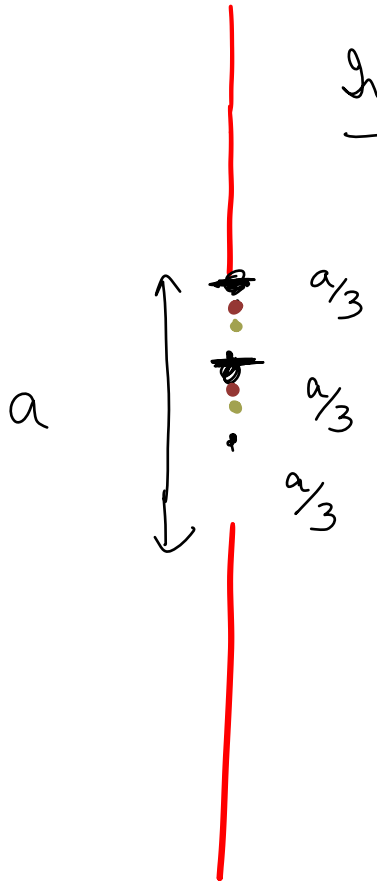
$I = 0$

$\Delta\phi = 2n\pi$

→ Condition for Minima in diffraction.

$$\theta = \frac{\lambda}{a}.$$

In Diffraction:



$$\theta = (n+1)\frac{\lambda}{2}\frac{1}{a}.$$

$n = 1$

$$\theta = \frac{3\lambda}{a}.$$

$$\Delta x = \frac{a}{3}\sin\theta$$

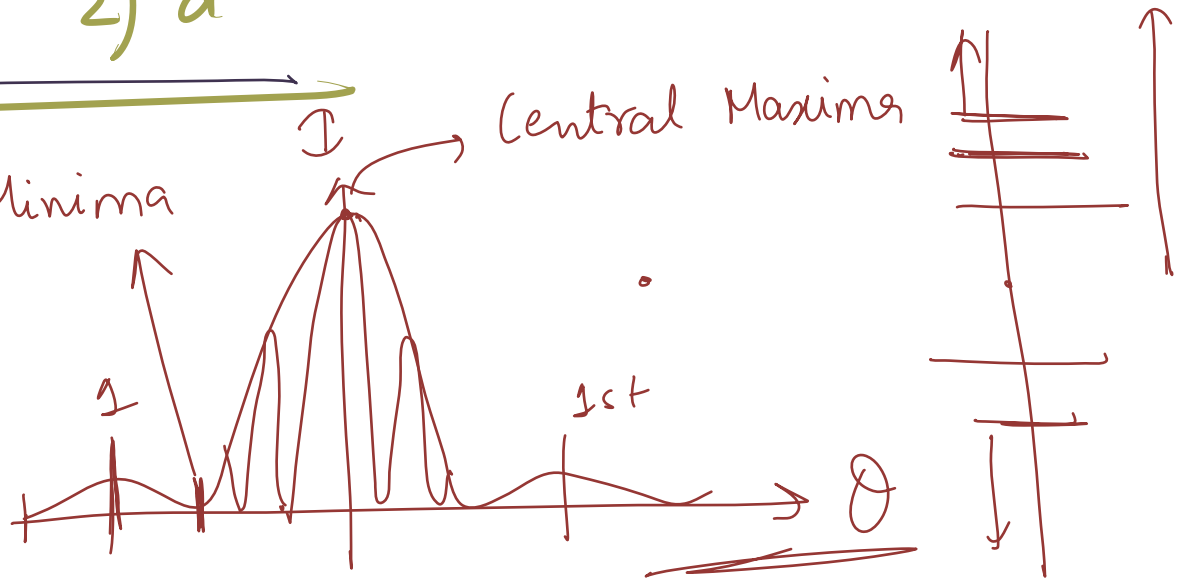
$$= \frac{a}{3}\left(\frac{3\lambda}{a}\right) = \lambda.$$

$$\Delta\phi = K\Delta x \Rightarrow \frac{2\pi}{\lambda} \times \lambda \Rightarrow 2\pi$$

Condition for Maxima

→ $\theta = n\lambda/a$ ⟶ Condition for Minima.

→ $\theta = \left(n + \frac{1}{2}\right)\lambda/a$ ⟶ Condition for Maxima



Ques Calculate the width of slit if the first maxima in single slit experiment is formed at $\theta = 0.5^{\circ}$.

$$\lambda = 500 \text{ nm}.$$

Ans

$$\theta = \left(n + \frac{1}{2}\right)\frac{\lambda}{a}.$$

$n = 0 \longrightarrow$ Central

$$\theta = \left(1 + \frac{1}{2}\right) \times \frac{500 \times 10^{-9}}{a}. \Rightarrow a = \frac{3}{2} \times \frac{500 \times 10^{-9}}{0.5}$$

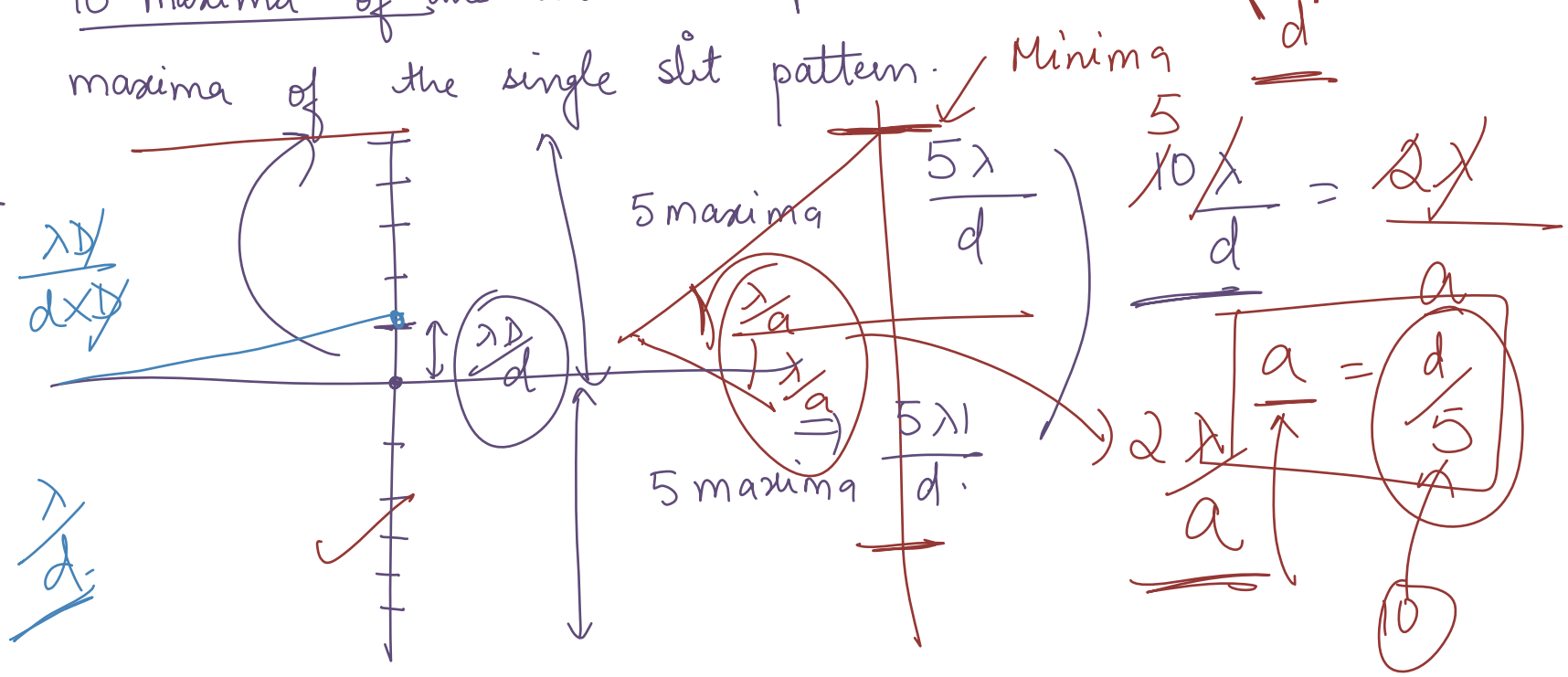
$$0.5 = \left(\frac{3}{2}\right) \times \frac{500 \times 10^{-9}}{a}$$

$$a = 1500 \times 10^{-9} \text{ m}.$$

$$= 1500 \text{ nm}.$$

Ques What should be the width of each slit be to obtain 10 maxima of the double slit pattern within the central maxima of the single slit pattern.

Ans



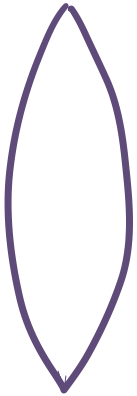
Resolving power:

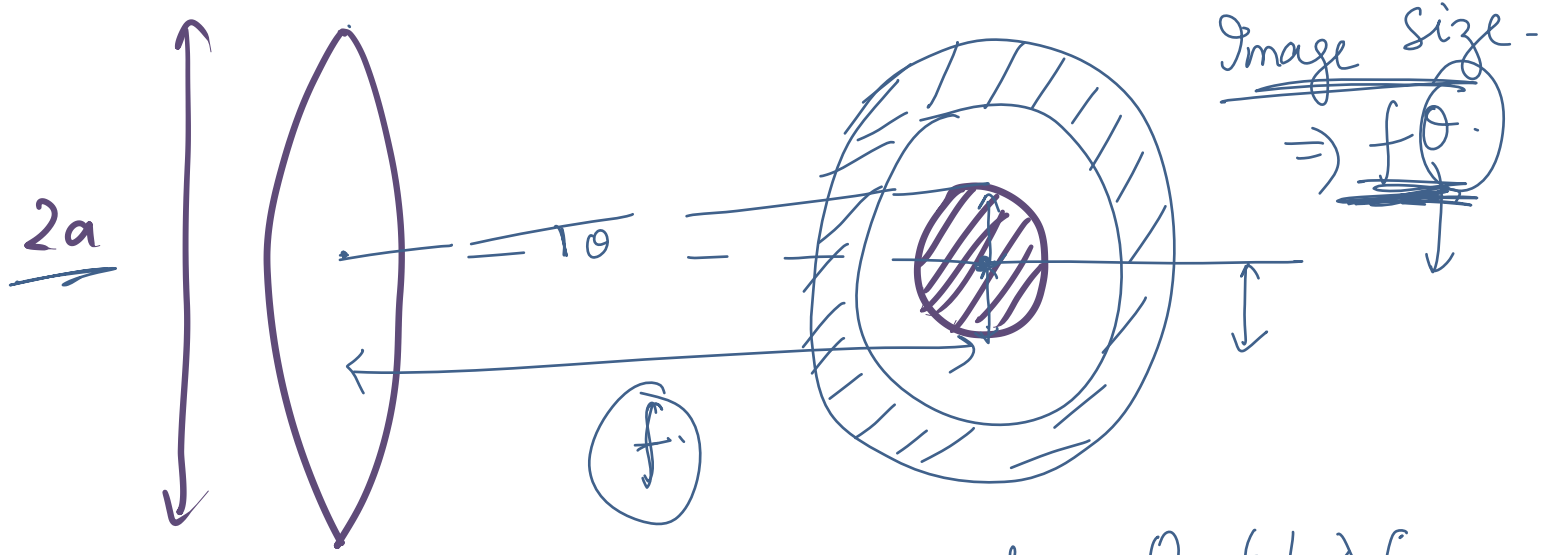
It is the ability of an optical instruments or films to distinguish or separate small / closed image.

Objective ½ → near to the object

Eyepiece → near Eye.

Aperture





Objective lens.

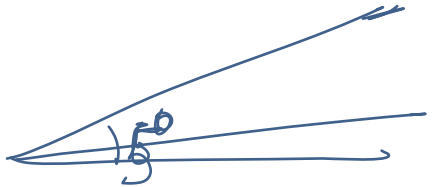
$$r = \frac{0.61\lambda f}{a}$$

$$r_0 \Rightarrow \frac{1.22\lambda f}{2a}$$

$$f\theta = y_0$$

$$f \times \Delta\theta = 0.61\lambda f$$

$$\Delta\theta = \frac{0.61\lambda}{a}$$



$a \uparrow, \theta \downarrow$.

Aperture $\uparrow$, $\theta \downarrow$ $\longrightarrow$ Resolving power is Better.