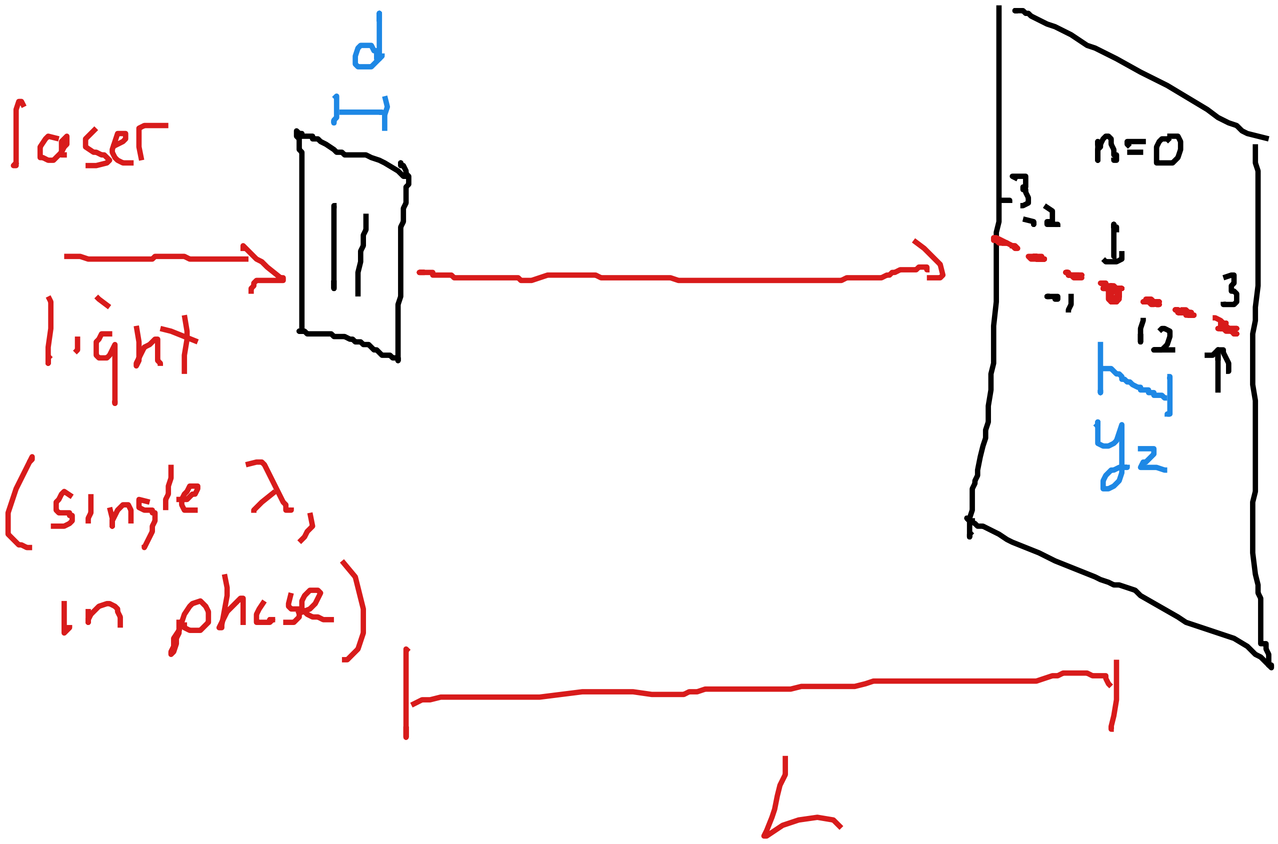


Central bright spot (n=0)

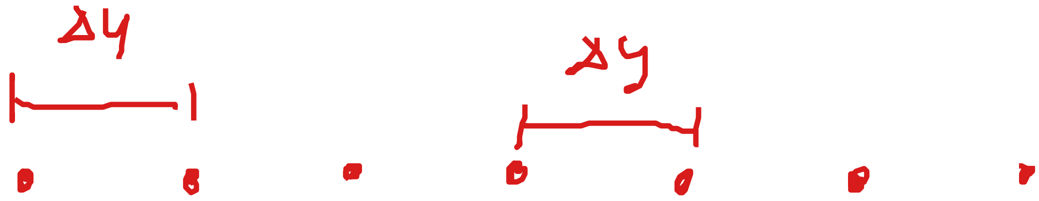
$$y_n = \frac{n \lambda L}{d}$$

for smallish angles

$\theta \lesssim 20^\circ$

$$\Delta y = \frac{\lambda L}{d}$$

A)

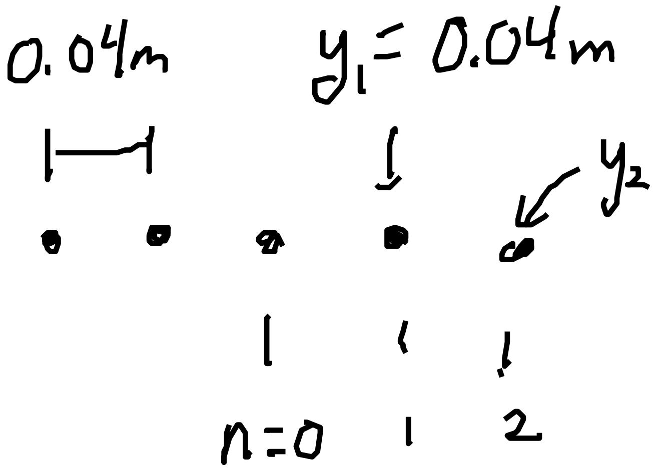


B)

Which has a larger Δy? A

If L and λ are same for both, for which pattern were the slits farther apart?
i.e. for which is d bigger?

B: smaller Δy, bigger d



$\lambda = 500\,nm$

$= 500 \times 10^{-9}\,m$

$L = 2m$

Find d.

$$\Delta y = \frac{\lambda L}{d}$$

$$d = \frac{\lambda L}{\Delta y} = \frac{(500 \times 10^{-9})(2)}{(0.04)}$$

$$= 2.5 \times 10^{-5}\,m$$

$$= 25\,\mu m$$

$$y_n = \frac{n\lambda L}{d}$$

$$= n\Delta y$$

Diffraction Grating

(really interference)

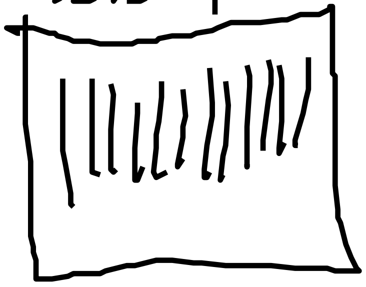
multi-slit interference

Same basic pattern as double-slit interference,

$$\Delta y = \frac{\lambda L}{d}$$

d: distance between two neighboring slits

plastic with lots of scores



4000 slits/cm

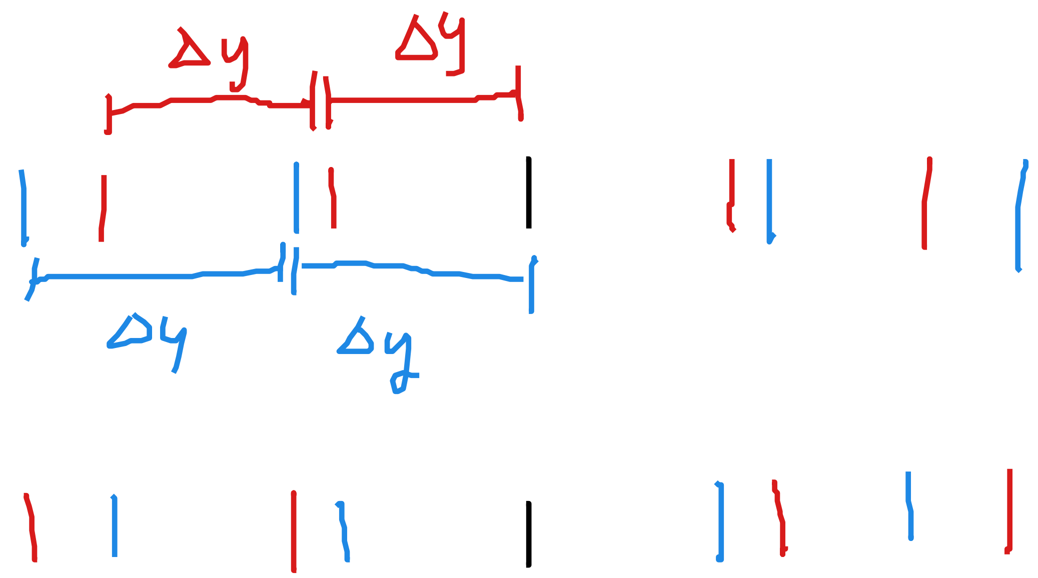
$$\frac{1}{4000}\ \frac{cm}{slit} = d$$

$$= 2.5\,\mu m$$

narrower, brighter dots
and wider dark regions

Useful for spectroscopy
(determining which
wavelengths are present in light)

A)



blue lines are spread out more

B)

red lines spread out more

red: 650 nm

blue: 450 nm

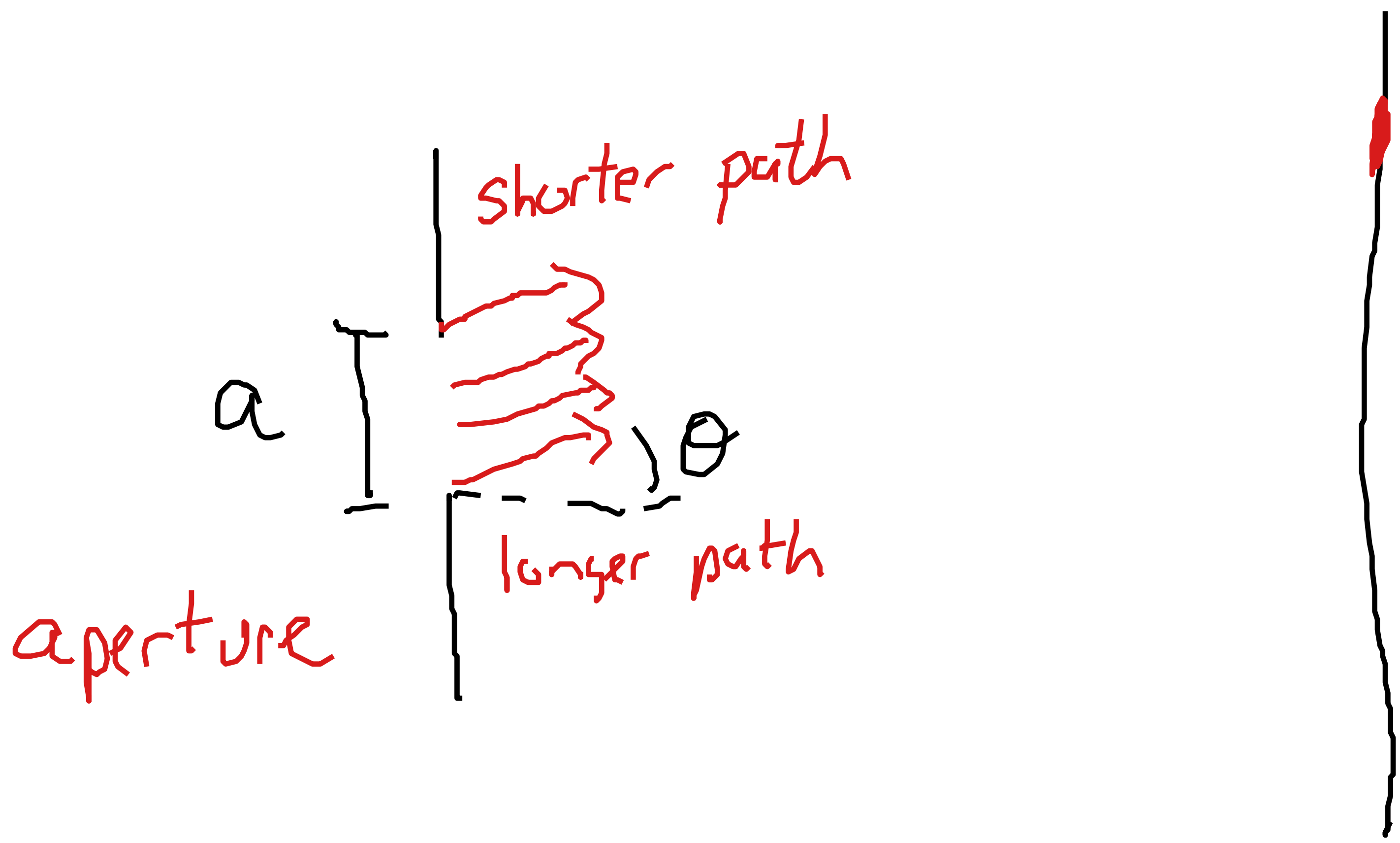
Which is correct?

$$\Delta y = \frac{\lambda L}{d}$$

$$\Delta y \sim \lambda$$

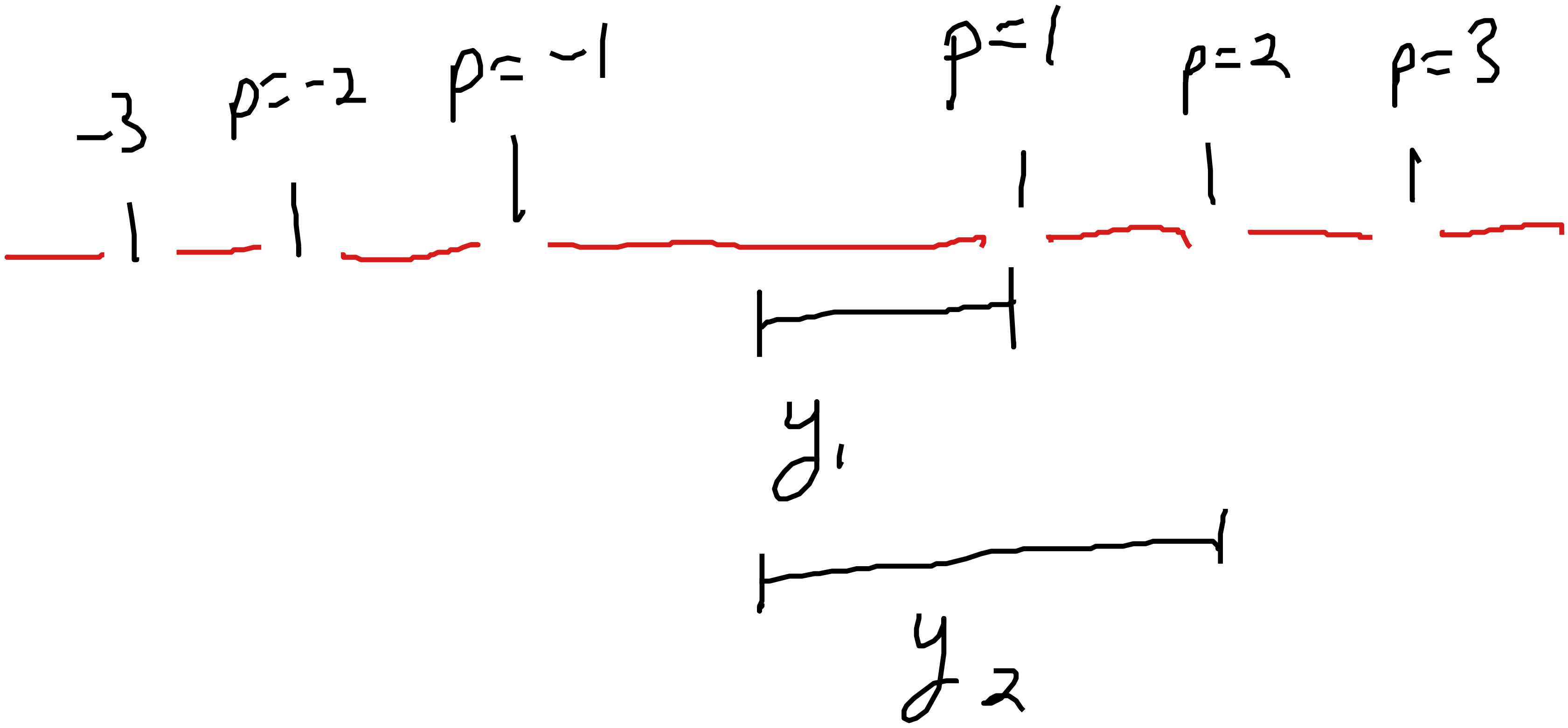
bigger wavelength, bigger spread

Single narrow slit Diffraction



Diffraction Pattern

Dark spots



y_p = distance from center to the pth <u>dark</u> spot

$p = \pm 1, \pm 2, \pm 3, \ldots$

$p \neq 0$

$$y_p = \frac{p \lambda L}{a}$$

- p: order of <u>dark</u> spot
- λ: wavelength of light
- L: distance to screen
- a: width of slit
- y_p: distance from center to pth dark spot

$$\theta_p \simeq \frac{p\lambda}{a} \qquad \theta_p \lesssim 20^\circ$$

in radians

Central bright spot has width $= 2\frac{\lambda L}{a}$