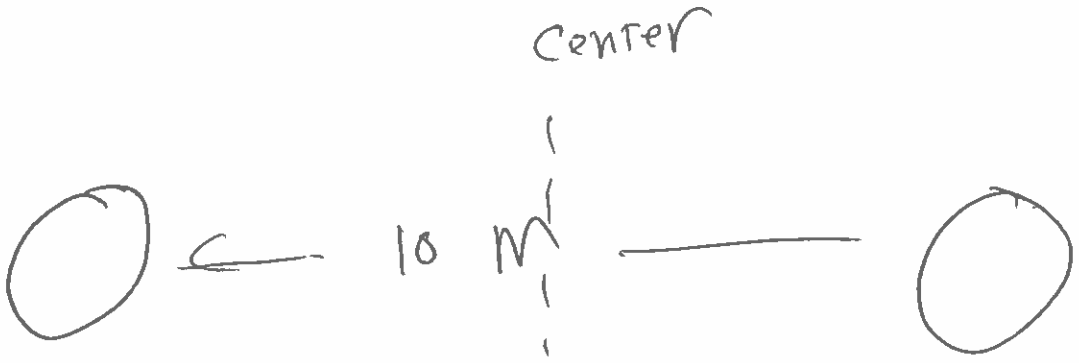
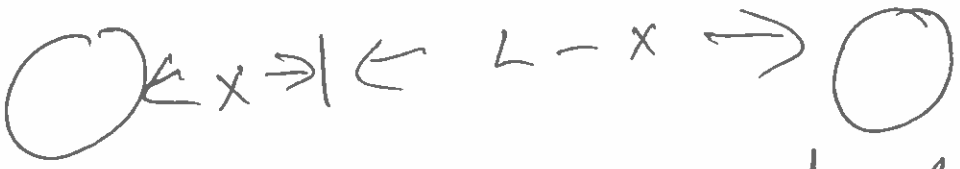


$f = 200hz \Rightarrow \lambda = \frac{340\,m/s}{200hz} = 1.70m$

AT center Both speaker sounds Travel same distance $\Rightarrow$ constructive interference



Points X where sounds cancel.

Path difference $= (m + \frac{1}{2})\lambda$ for Destructive interference $m = 0, 1, 2, \ldots$

Path difference $= |(L - x) - x|$

$|L - 2x| = (m + \frac{1}{2})\lambda$ destructive interference or sounds cancel.

$$L - 2x = (m + \tfrac{1}{2})\lambda$$

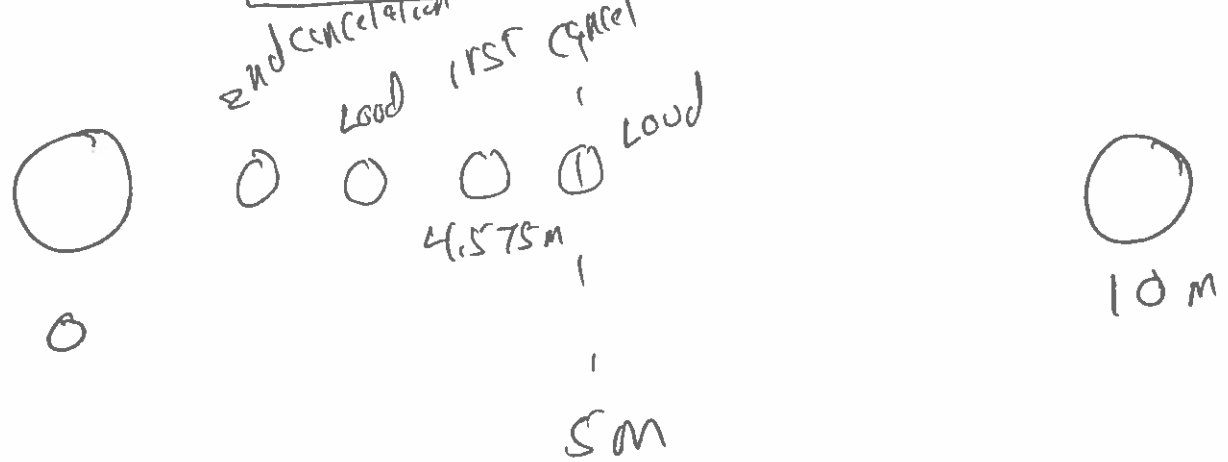
$$2x = L - (m + \tfrac{1}{2})\lambda$$

$$x = \tfrac{1}{2}L - \tfrac{1}{2}(m + \tfrac{1}{2})\lambda$$

$m = 0$

$$x_0 = \tfrac{1}{2}(10\,m) - \tfrac{1}{2}(\tfrac{1}{2})(1.7\,m)$$

$$\boxed{x_0 = 4.575\,m}$$

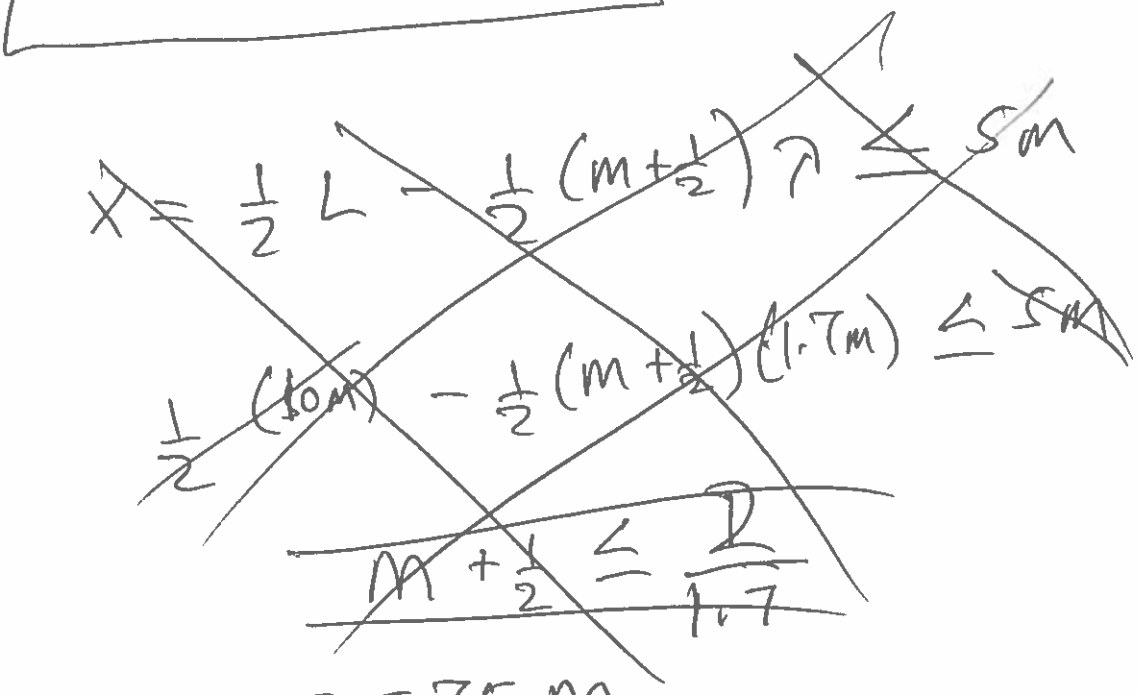


$$x = \tfrac{1}{2}L - \tfrac{1}{2}(m + \tfrac{1}{2})\lambda$$ Cancel condition

$$x = \tfrac{1}{2}L - \tfrac{1}{2}m\lambda$$ Loud condition

$$X_1 = \frac{1}{2}(10m) - \frac{1}{2}\left(1+\frac{1}{2}\right)(1.7m)$$

$$\boxed{X_1 = 3.725\ m}$$



$$X_2 = 2.875\ m$$

$$X_3 = 2.025\ m$$

$$X_4 = 1.175\ m$$

$$X_5 = 0.325\ m$$

$$X_6 = -0.525m$$ cannot be

Phase diff $= \left|$ path diff $\right| = m\lambda \Rightarrow$ constructive

Phase diff $= |$ path diff $| = (m+\frac{1}{2})\lambda \Rightarrow$ destructive

m is integers

usually $0, 1, 2, 3, \ldots$

occasionally 0 is not allowed.

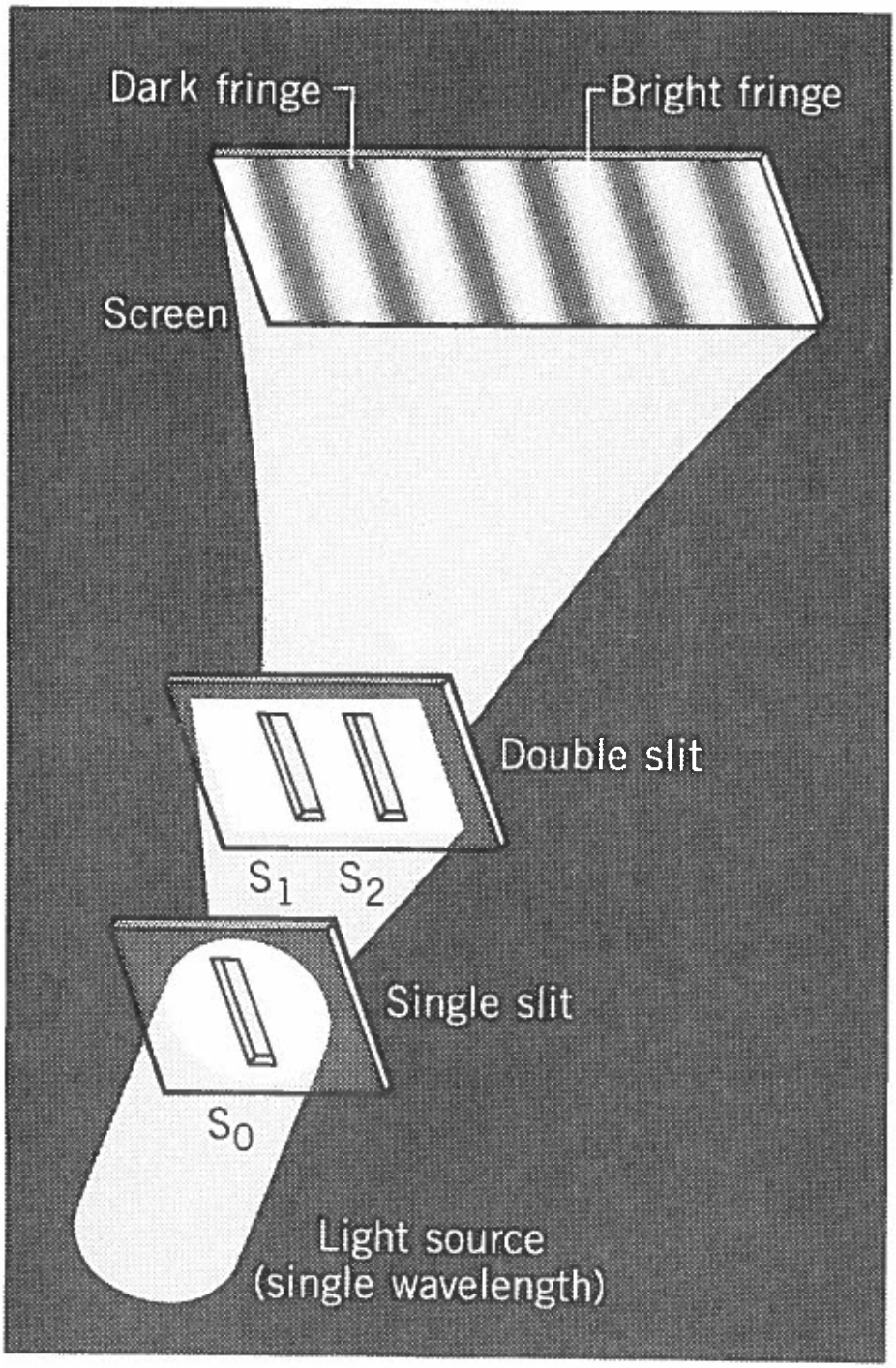


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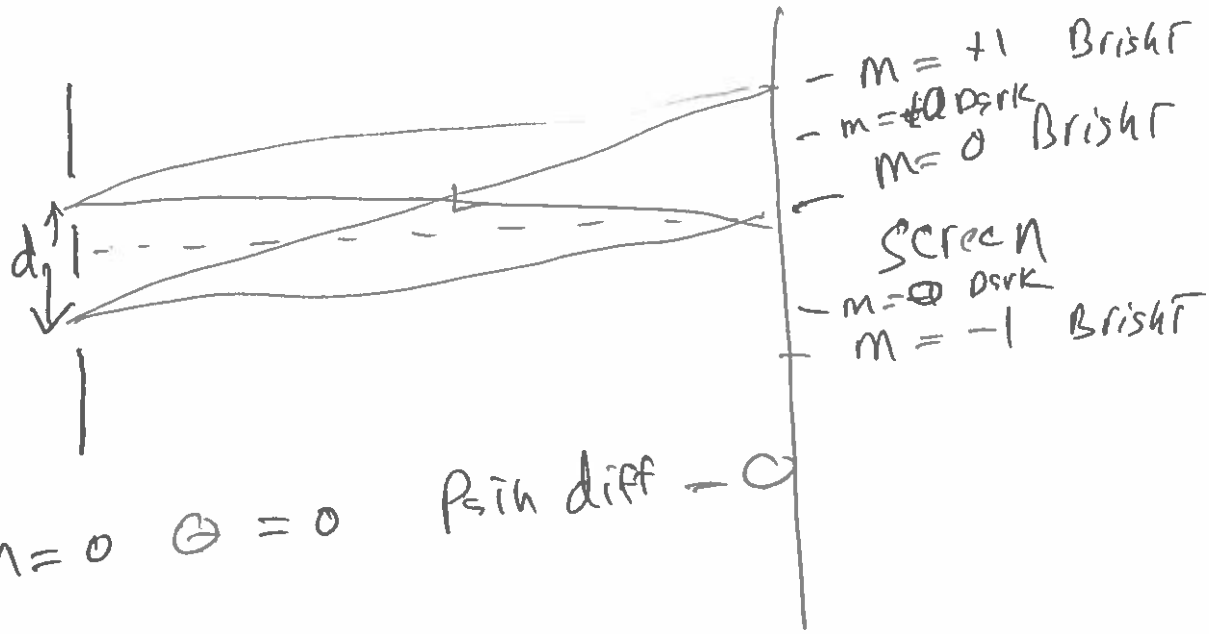
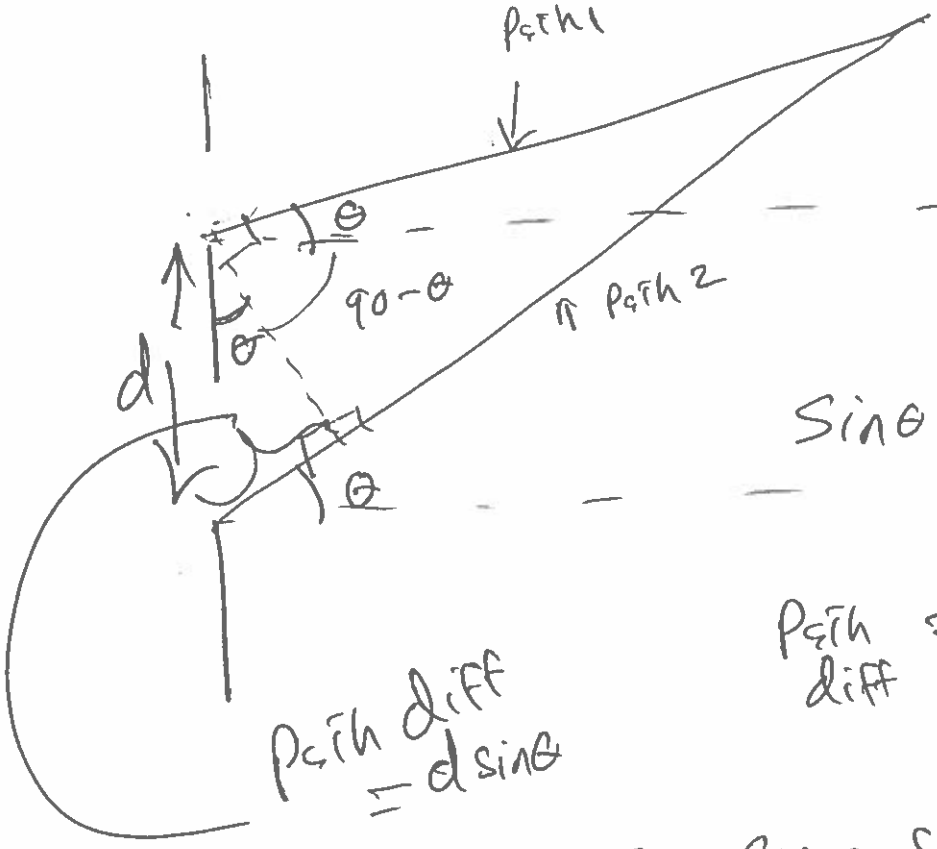
FIGURE 27.4 208



$m = 0 \quad \theta = 0$ Path diff = 0



$$\sin\theta = \frac{opp}{Hyp} = \frac{opp}{d}$$

Path diff $= opp = d\sin\theta$

Path diff $= d\sin\theta$

conditions for fringes for 2 slits

bright $\Rightarrow d\sin\theta = m\lambda$

dark $\Rightarrow d\sin\theta = (m+\frac{1}{2})\lambda$

Path diff

eg/ $d = 5.6 \times 10^{-6}\ m \quad \lambda = 546\ nm$

θ's of First 3 bright fringes

For Bright $d\sin\theta = m\lambda$

$$\sin\theta = \frac{m\lambda}{d}$$

$$\sin\theta_1 = \frac{\lambda}{D} = \frac{546 \times 10^{-9}\ m}{5.6 \times 10^{-6}\ m} \Rightarrow \theta_1 = 5.6^\circ$$

$$\sin\theta_2 = \frac{2\lambda}{D} = \frac{2(546 \times 10^{-9}\ m)}{5.6 \times 10^{-6}\ m} \Rightarrow \theta_2 = 11.2^\circ$$

$$\sin\theta_3 = \frac{3\lambda}{D} = \frac{3(546 \times 10^{-9}\ m)}{5.6 \times 10^{-6}\ m} \Rightarrow \theta_3 = 17.0^\circ$$

How many bright fringes?

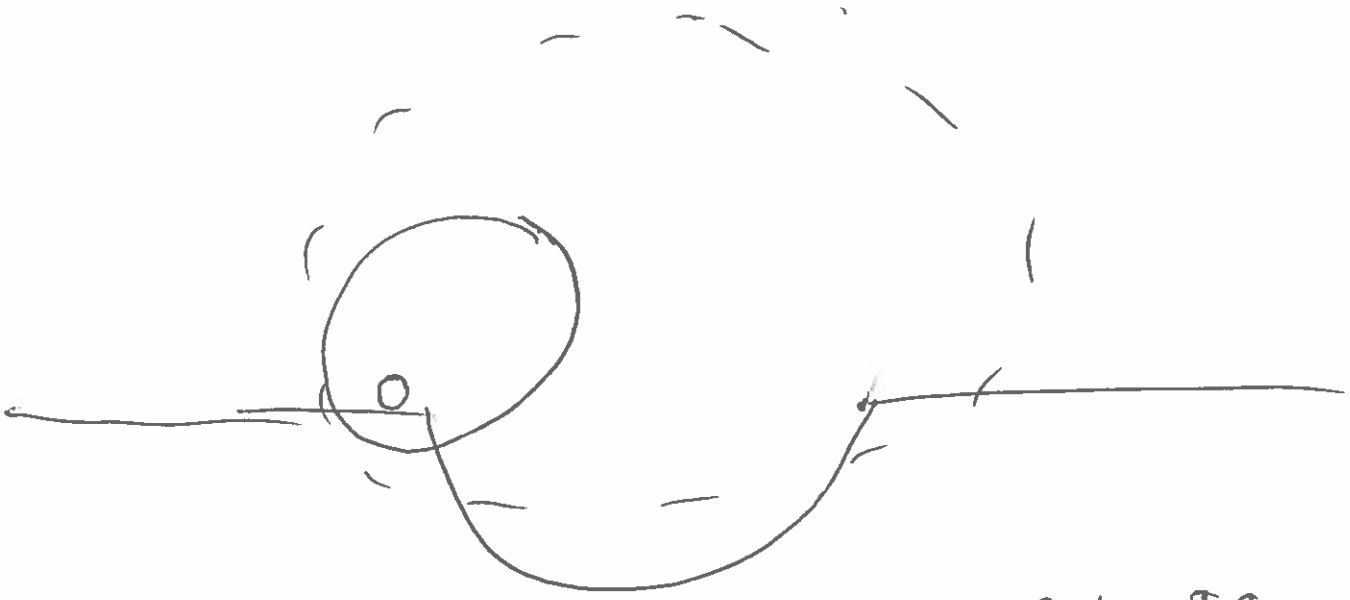
Largest $\theta \Rightarrow 90^\circ$

$$m\lambda = d\sin\theta \Rightarrow m = \frac{d\sin\theta}{\lambda}$$

$$m = \frac{d}{\lambda}\sin 90 = \frac{d}{\lambda} = \frac{5.6 \times 10^{-6}\ m}{546 \times 10^{-9}\ m}$$

$$m = 10.2 \Rightarrow m \leq 10$$

So total fringes $= 2(10) + 1 = 21$



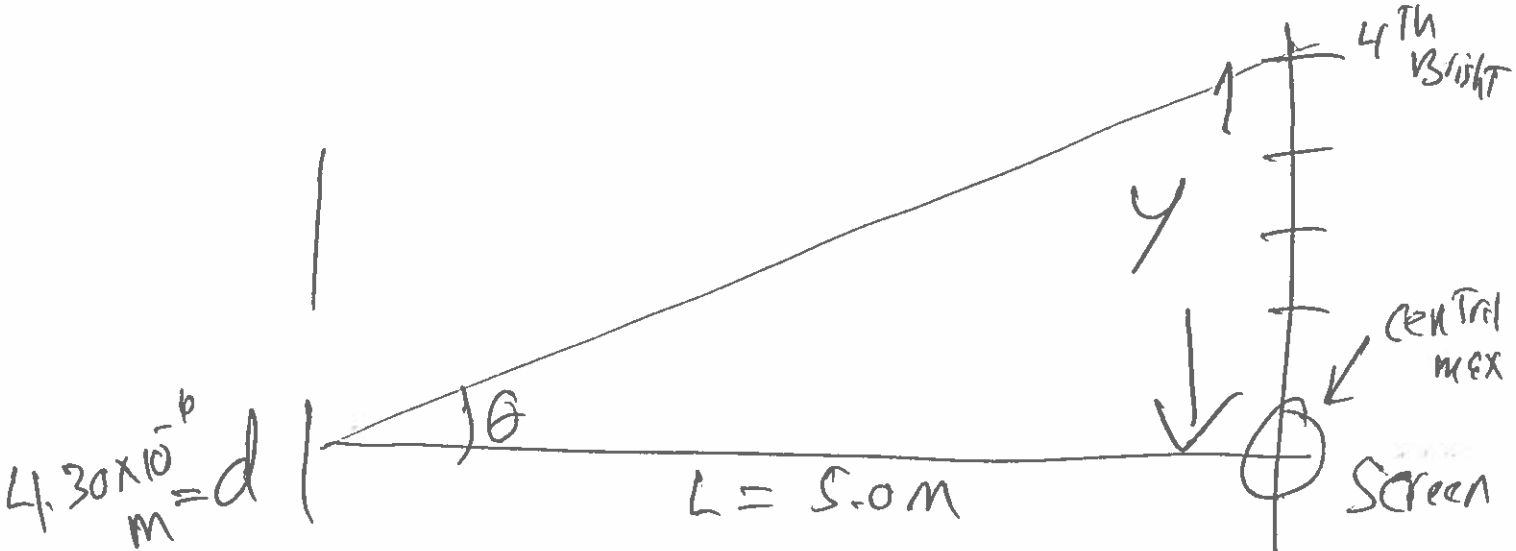
Noticing disruptions require probes to be about same size.

λ – visible light are 400nm – 700nm

4.0×10^{-7} m – 7.0×10^{-7} m

Slit widths ~ 10^{-7} m (10^{-5} – 10^{-8})

eg/ Two slits seperated by 4.30×10^{-6} m
Red light $\lambda = 690$ nm Screen 5.0 m
away how far is 4th bright fringe
from center maximum



2 slits $d \sin\theta = m\lambda$

$$\sin\theta = \frac{m}{d}\lambda$$

$$\theta = \sin^{-1}\left(\frac{4}{(4.30\times10^{-6}\,m)}\right)(690\times10^{-9}\,m)$$

$$\tan\theta = \frac{y}{L} \Rightarrow y = L\tan\theta$$

$$y = 5.00\,m \tan\left(\sin^{-1}\left(\frac{4}{4.30\times10^{-6}\,m}\right)(690\times10^{-9}\,m\right)$$

$$y = 4.19\,m$$

$d = 7.3 \times 10^{-6}\ m \qquad \lambda = 480\ nm$

at what angle is 2nd dark fringe?

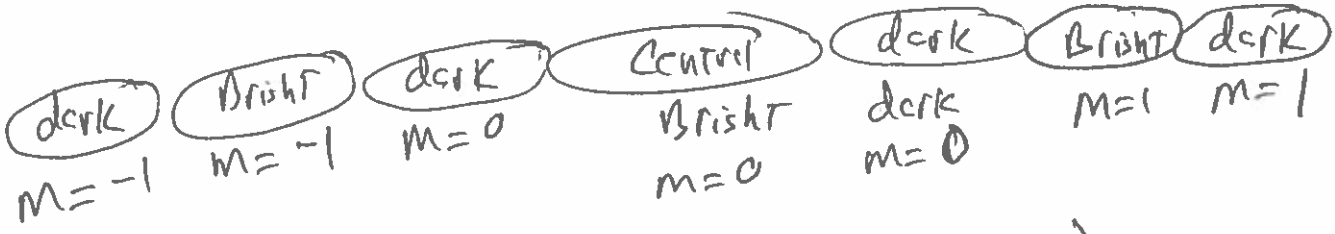
dark fringes

$$d \sin\theta = \left(m + \tfrac{1}{2}\right)\lambda$$

$$\sin\theta = \frac{\left(m + \tfrac{1}{2}\right)\lambda}{d}$$

1rst dark fringe $m = 0$

2nd dark fringe $m = 1$



$$\sin\theta = \frac{\left(1 + \tfrac{1}{2}\right)(480 \times 10^{-9}\ m)}{7.3 \times 10^{-6}\ m} = \frac{3}{2}\frac{(480 \times 10^{-9})}{(7.3 \times 10^{-6})}$$

$$\sin\theta = .0986 \qquad \theta = \sin^{-1}(.0986)$$

$$\boxed{\theta = 5.6^0}$$