H.W.

$S_2P - S_1P = \frac{\lambda}{3}$ (given)

Find resultant intensity at P.

$S_2P - S_1P = \frac{\lambda}{3}$.

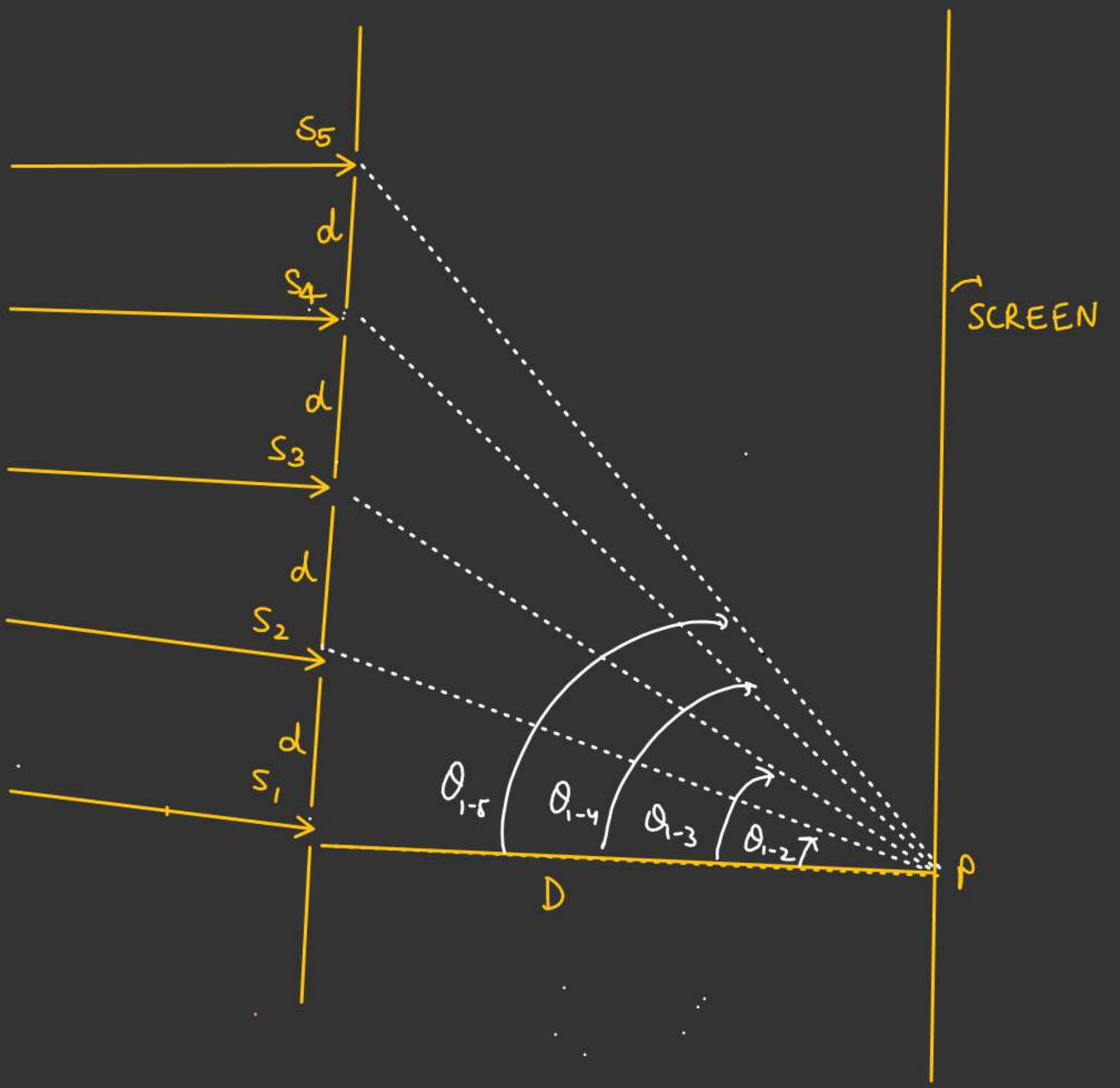
$d \tan\theta_{1-2} = \frac{\lambda}{3}$

$d\left(\frac{d}{2D}\right) = \frac{\lambda}{3}$.

$$\boxed{\frac{d^2}{2D} = \frac{\lambda}{3}}$$

$\Delta x_{1-2} = \frac{\lambda}{3}$.

$\Delta\phi_{1-2} = \frac{2\pi}{\lambda} \times \frac{\lambda}{3} = \left(\frac{2\pi}{3}\right)$.



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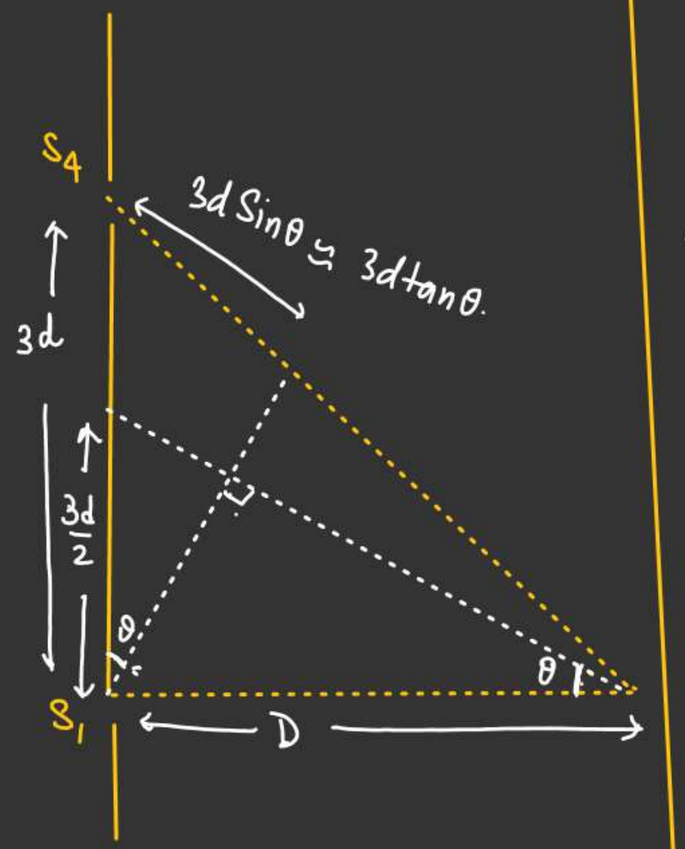
$$\Delta x_{1-4} = 3d \tan(\theta_{1-4})$$
$$= 3d\left(\frac{3d}{2D}\right)$$
$$= 9\left(\frac{d^2}{2D}\right)$$
$$= 9\frac{\lambda}{3} = 3\lambda.$$

$$\Delta\phi_{1-4} = \frac{2\pi}{\lambda} \times 3\lambda = \underline{6\pi}$$

$$\Delta x_{1-5} = 4d \tan(\theta_{1-5})$$
$$= 4d\left(\frac{2d}{D}\right)$$
$$= 8\left(\frac{d^2}{D}\right) = 8 \times \frac{2\lambda}{3}$$
$$= \frac{16\lambda}{3}.$$

$$\Delta\phi_{1-5} = \frac{2\pi}{\lambda} \times \frac{16\lambda}{3}$$
$$= \frac{32\pi}{3} = \left(11\pi - \frac{\pi}{3}\right)$$



$$\Delta x_{1-3} = 2d \tan\theta_{1-3}.$$
$$2d\left(\frac{d}{D}\right)$$
$$= \frac{2d^2}{D}. \qquad \left(\frac{d^2}{2D} = \frac{\lambda}{3}\right)$$
$$= 2\left(\frac{2\lambda}{3}\right) = \frac{4\lambda}{3}$$

$$\Delta\phi_{1-3} = \frac{2\pi}{\lambda} \times \frac{4\lambda}{3} = \frac{8\pi}{3}.$$
$$= \left(2\pi + \frac{2\pi}{3}\right) \checkmark$$

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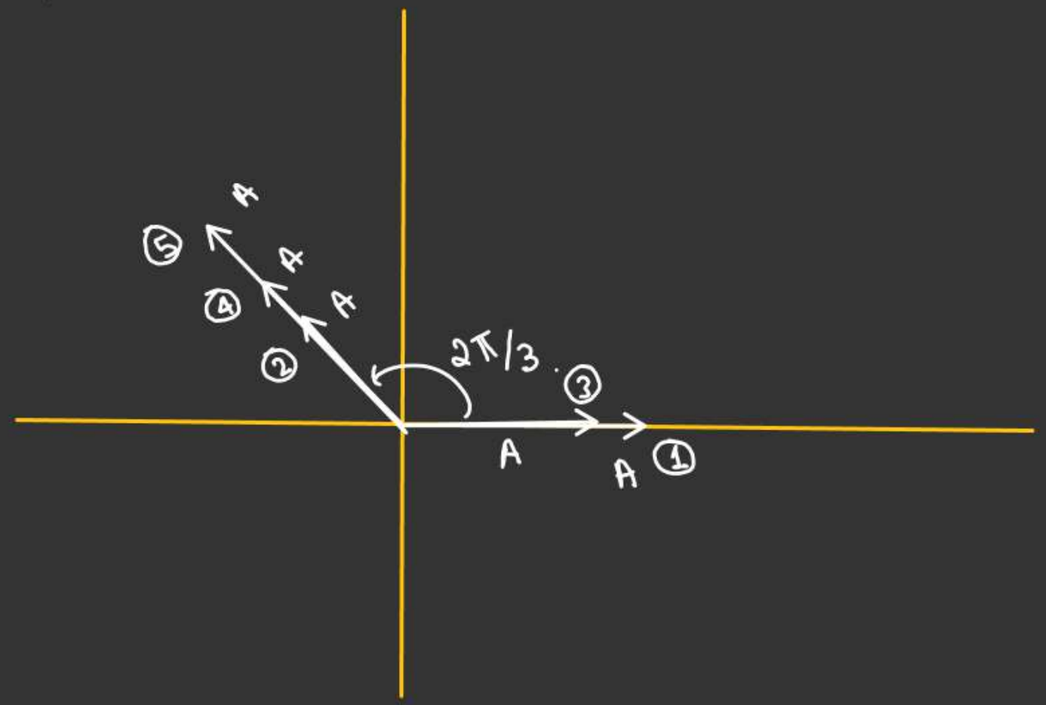
$$A_R = \sqrt{4A^2 + 9A^2 + 2\cdot(2A)(3A)\cos\frac{2\pi}{3}}$$

$$A_R = \sqrt{13A^2 - 6A^2}$$

$$A_R = \sqrt{7A^2}$$

$$I_R = 7I_0$$



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O & O' Symmetrically located to Center of Screen.

I_0 = Intensity of light.

$\lambda \rightarrow$ wavelength of light.

Path difference at S_3 b/w light ray from S_1 & S_2

$$\Delta x_{1-2} = d_1 \sin\theta \simeq d_1 \tan\theta.$$

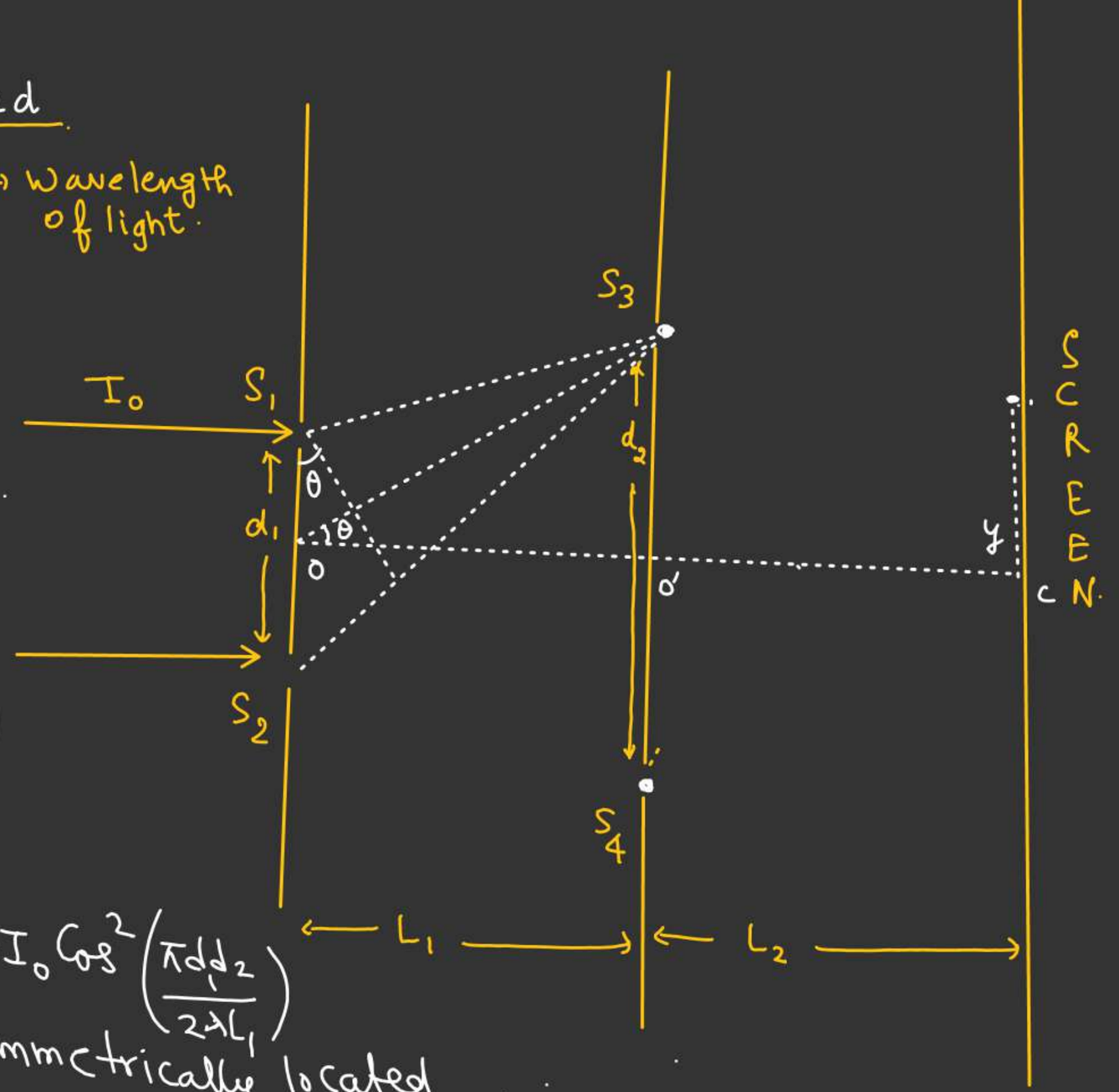
$$\Delta x_{1-2} = d_1 \left(\frac{d_2}{2L_1}\right)$$

$$\Delta\phi_{1-2} = \left(\frac{2\pi}{\lambda}\frac{d_1 d_2}{2L_1}\right) = \left(\frac{\pi d_1 d_2}{\lambda L_1}\right)$$

Let, Intensity at 3 be I

$$I = 4I_0 \cos^2\left(\frac{\Delta\phi_{1-2}}{2}\right) = 4I_0 \cos^2\left(\frac{\pi d_1 d_2}{2\lambda L_1}\right)$$

Intensity at S_4 is also I_1 as Symmetrically located.



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Interference at Screen at a distance y from Center of Screen:—

Light ray Coming from S_3 and S_4 having intensity I interfere at y.

$$\Delta x_{3-4} = \left(\frac{d_2 y}{L_2}\right)$$

$$\Delta\phi_{3-4} = \frac{2\pi}{\lambda}\left(\frac{dy}{L_2}\right)$$

$$I_R = 4I\cos^2\left(\frac{\Delta\phi_{1-3}}{2}\right) = 4I\cos^2\left(\frac{2\pi dy}{\lambda L_2}\right)$$

$$I = 4I_0\cos^2\left(\frac{\pi d_1 d_2}{2\lambda L_1}\right)$$

$$I_R = 16I_0\cos^2\left(\frac{\pi d_1 d_2}{2\lambda L_1}\right)\cdot\cos^2\left(\frac{2\pi dy}{\lambda L_2}\right)$$

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S_1 & S_2 Equidistance from O

S_3 & S_4 Equai distance from O'

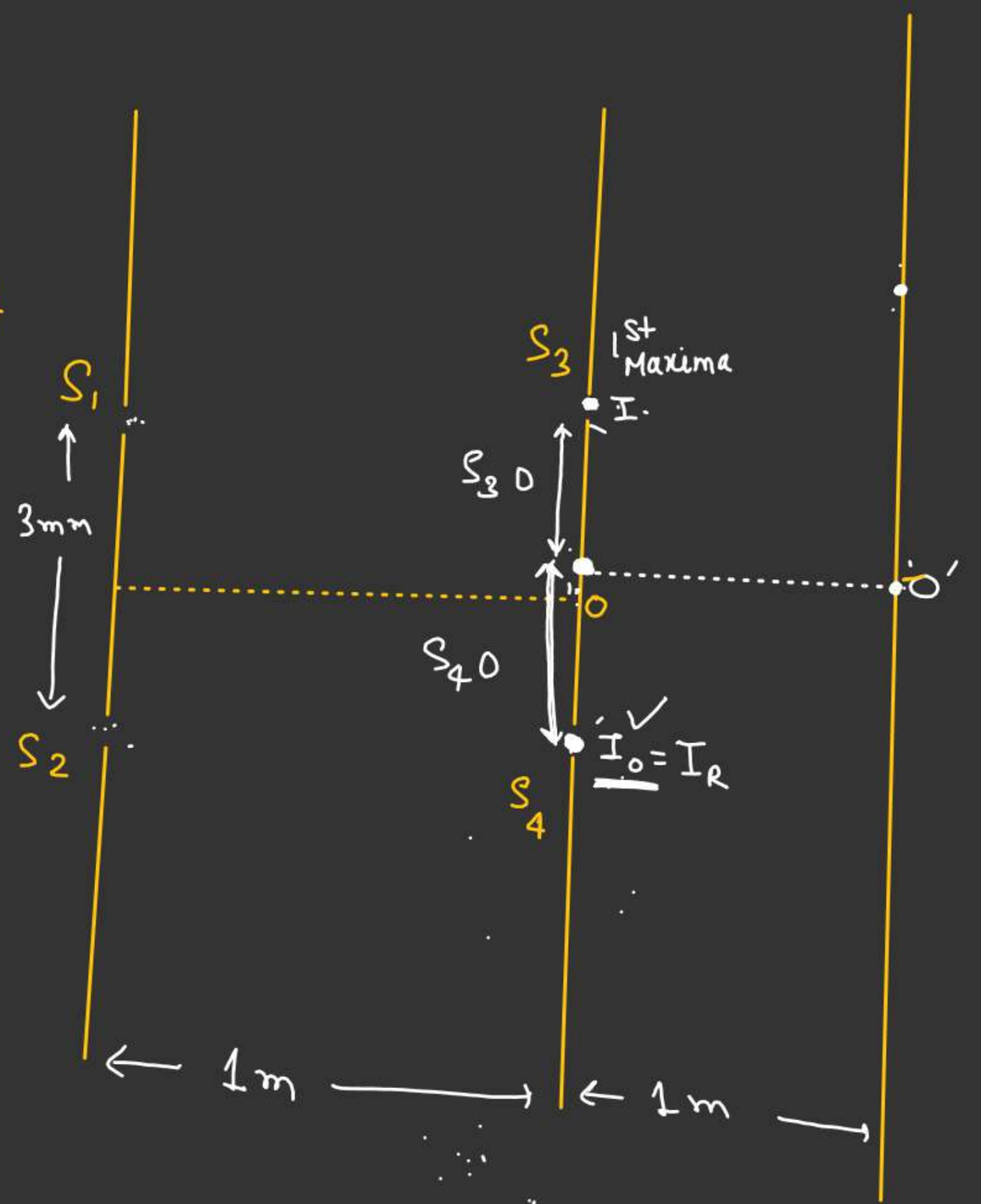
D → Mid point of distance b/w S_3 & S_4

O' → Center of Screen

$\lambda = 6000 \text{ Å}$

1. Find the Intensity at O'. ✓
2. Find the Intensity of bright fringe.

[S_3 is the position of 1st Maxima
At S_4 Intensity is Same as of light source. ✓



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For 1st Maxima at S_3.

$$\frac{dy}{D} = (n)\lambda \quad \downarrow 1.$$

$$y = \left(\frac{D\lambda}{d}\right) = \frac{1 \times 6000 \times 10^{-10}}{3 \times 10^{-3}}$$

$$OS_3 = y = (2 \times 10^{-4})\,m \checkmark$$

$$\Delta\phi = \frac{2\pi}{\lambda}(\Delta x) \checkmark$$

$$\Delta\phi = 2\pi$$

$$I_R = 4I_0 \cos^2\left(\frac{\Delta\phi}{2}\right)$$

$$I_R = (4I_0) \checkmark$$

(At 4). $I_R = I_0$.

$$I_0 = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$$

$$\frac{1}{4} = \cos^2(\phi/2)$$

$$\cos(\phi/2) = \frac{1}{2}$$

$$\frac{\phi}{2} = \frac{\pi}{3}$$

$$\phi = \left(\frac{2\pi}{3}\right) \checkmark \Rightarrow \frac{2\pi}{\lambda}\cdot\Delta x = \frac{2\pi}{3}$$

$$\Delta x = \left(\frac{\lambda}{3}\right) \checkmark$$

$$\frac{(OS_4)\,d}{D} = \left(\frac{\lambda}{3}\right)$$

$$OS_4 = \left(\frac{D\lambda}{3d}\right) = \frac{1 \times 6000 \times 10^{-10}}{3 \times 3 \times 10^{-3}}$$

$$= \frac{2}{3} \times 10^{-4}$$

Slit Seperation b/w S_3 and S_4.

$$= OS_3 + OS_4$$

$$= 2\times10^{-4} + \frac{2}{3}\times10^{-4}$$

$$= \frac{8}{3}\times10^{-3}$$ ✓