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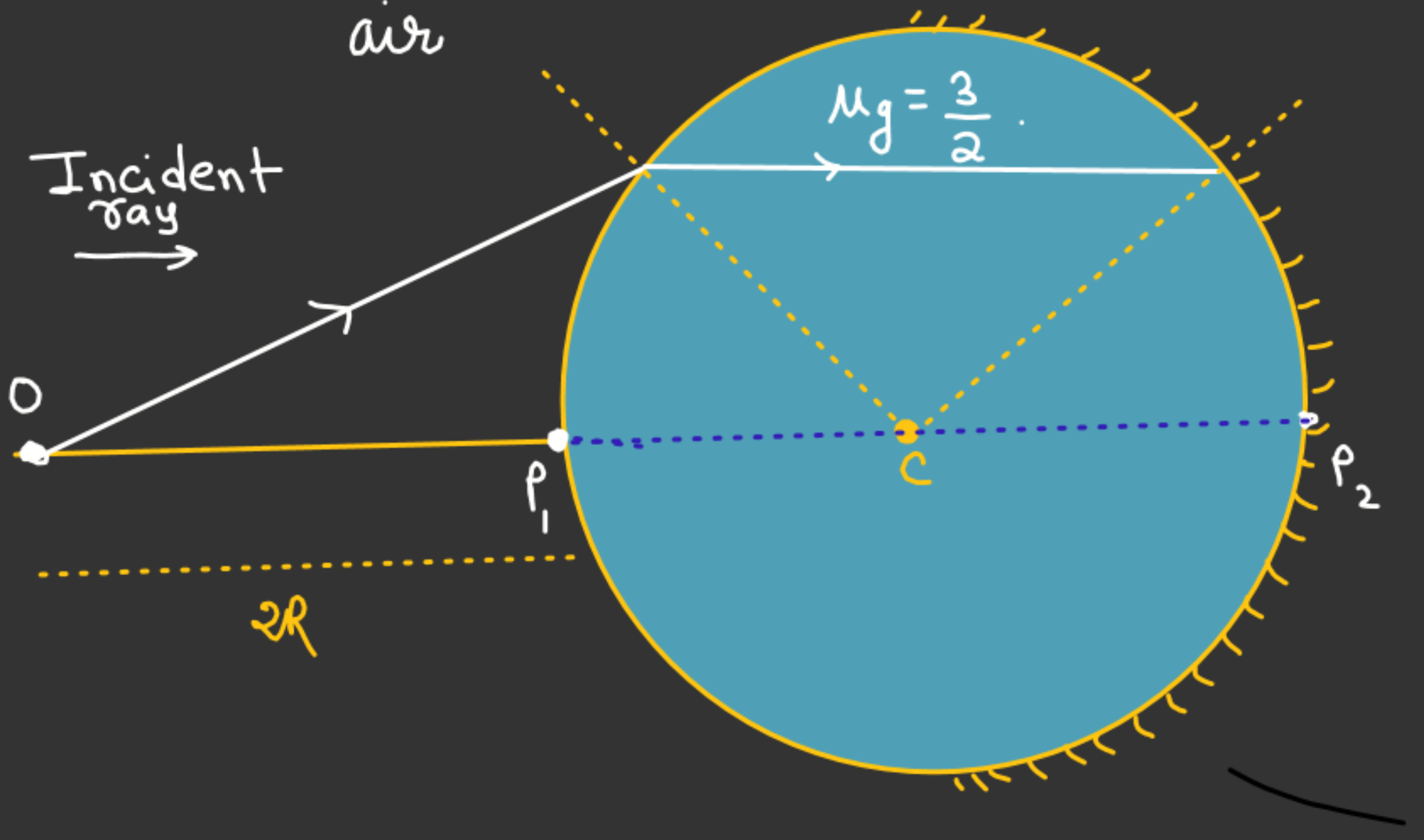
REFRACTION FROM CURVED SURFACE

\# Find location of final image from center of sphere

Sol^n Considering all refraction and reflection



Refraction from air to glass

$$\frac{3/2}{v_1} - \frac{1}{(-2R)} = \frac{\frac{3}{2}-1}{+R}$$

$$\frac{3}{2v_1} + \frac{1}{2R} = \frac{+1}{2R}$$

$\underline{v_1 = 0}$ ✓ $\Rightarrow$ image at infinity

i.e refracted ray parallel to principal axis.

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Since after refraction ray become parallel to principal axis so for Mirror after reflection ray pass through the focus.

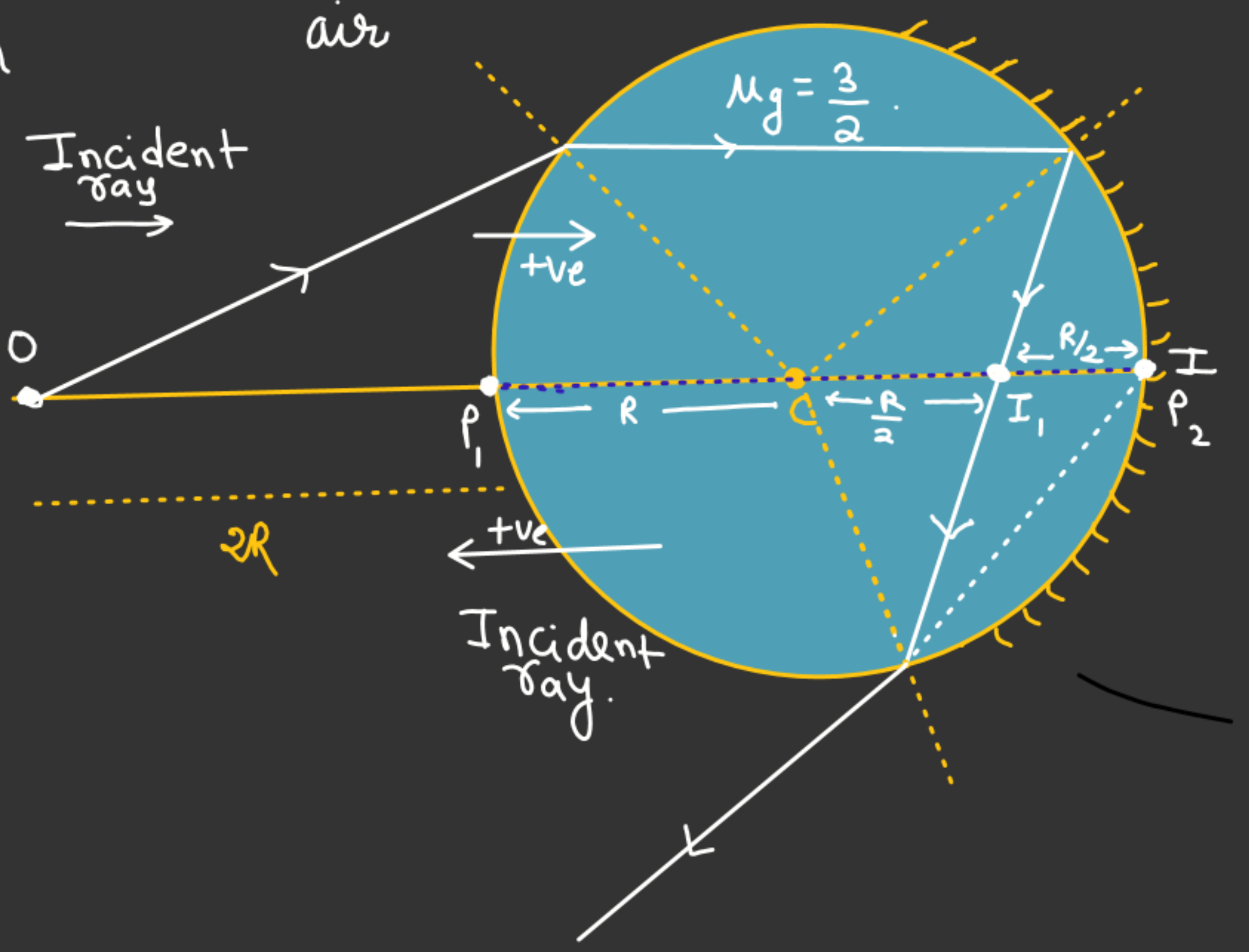
I_1 is the image after reflection which will acts as a real object for glass-air refraction.

glass- air refraction

$$\frac{1}{v} - \frac{3/2}{\left(-\frac{3R}{2}\right)} = \frac{1-3/2}{(-R)}$$

$$\frac{1}{v} + \frac{1}{R} = \frac{1}{2R}$$

$$\frac{1}{v} = \frac{-1}{2R} \Rightarrow v = -2R$$



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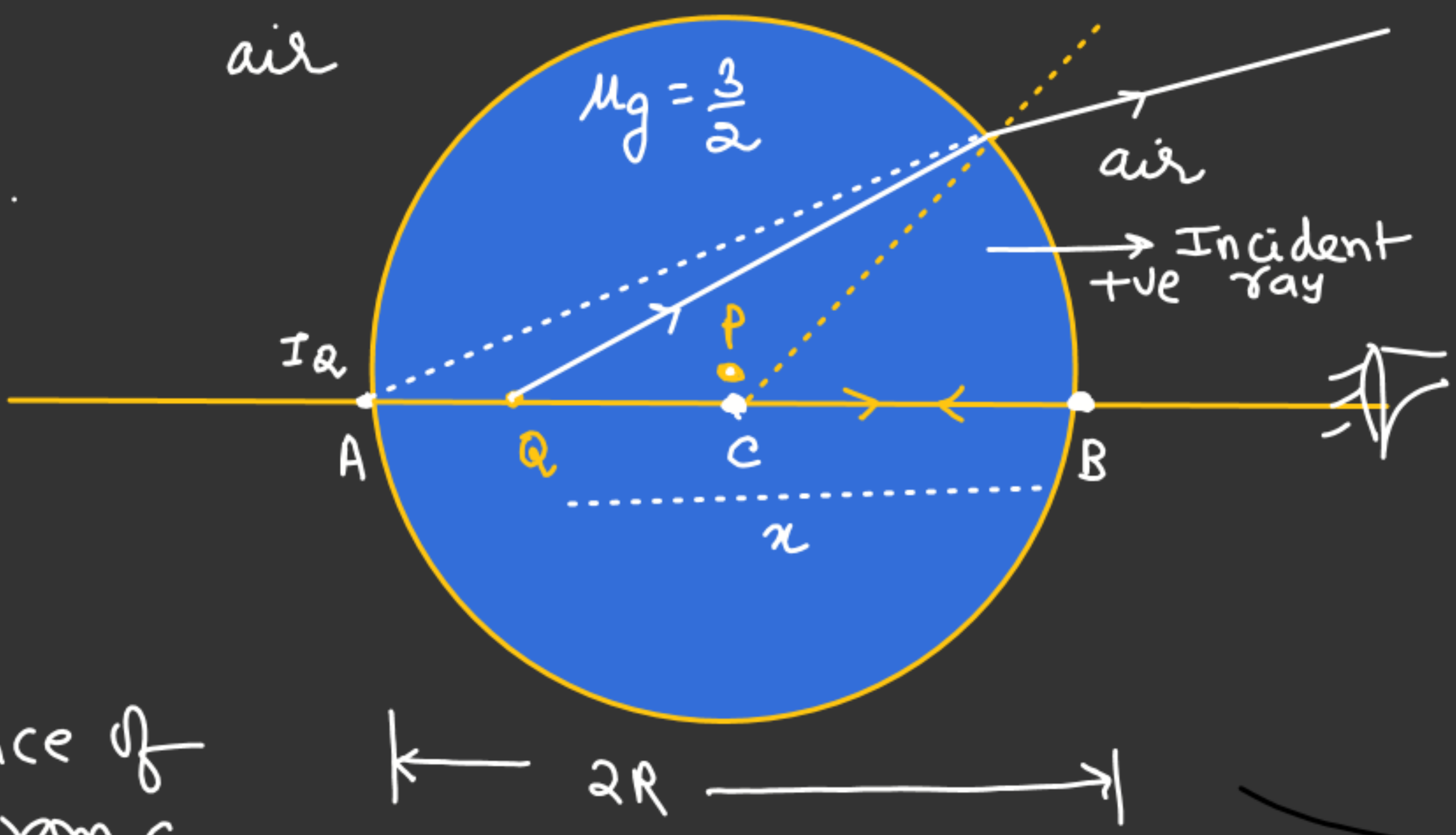
Q4. # Find the distance b/w two objects P & Q from C so that their corresponding image at C and A.



One point at C itself, let P at C.

Refraction from glass to air

$$\frac{1}{-2R} - \frac{3/2}{(-x)} = \frac{1-3/2}{(-R)}$$

$$-\frac{1}{2R} + \frac{3}{2x} = \frac{1}{2R}$$

$$\frac{3}{2x} = \frac{1}{2R} + \frac{1}{2R} = \frac{1}{R}$$

$$x = \left(\frac{3R}{2}\right) \checkmark$$

Distance of Q from C

$$= \frac{3R}{2} - R = \frac{R}{2}$$

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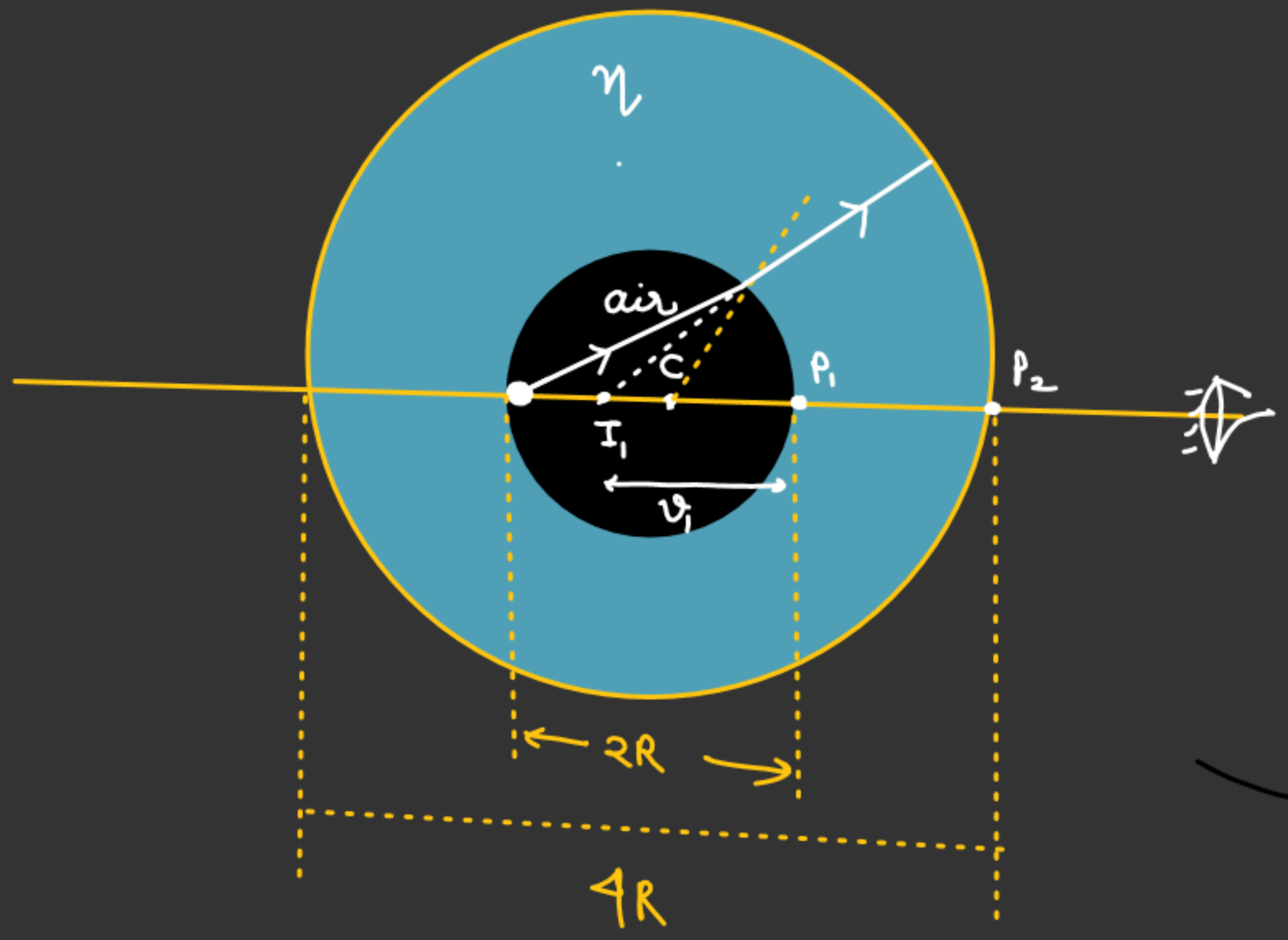
Q5: Find Apparent Shift of the object.

η = Refractive index.



Refraction from air to glass.

$$\frac{\eta}{v_1} - \frac{1}{(-2R)} = \left(\frac{\eta-1}{-R}\right)$$

$$\frac{\eta}{v_1} + \frac{1}{2R} = -\frac{(\eta-1)}{R}$$

$$\frac{\eta}{v_1} = -\left[\frac{1}{2R} + \frac{(\eta-1)}{R}\right]$$

$$\frac{\eta}{v_1} = -\left[\frac{1+2\eta-2}{2R}\right]$$

$$\frac{\eta}{v_1} = -\left[\frac{2\eta-1}{2R}\right]$$

$$v_1 = -\frac{2\eta R}{(2\eta-1)}$$

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REFRACTION FROM CURVED SURFACE

$$V_1 = \ominus \frac{2\eta R}{(2\eta-1)}$$

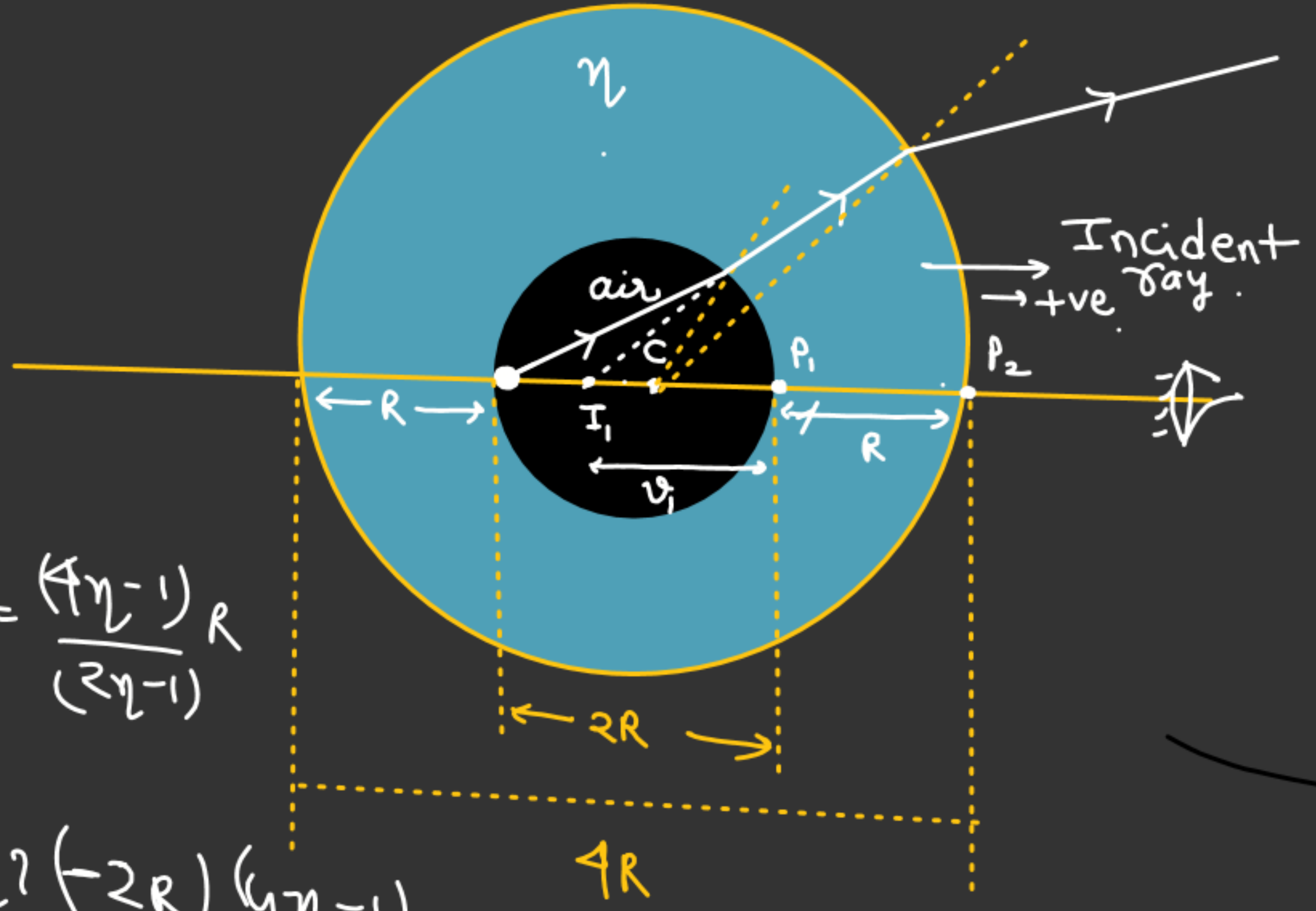
Refraction from glass to air

From P_2

$$|u| = (v_1 + R)$$

$$= \left[\frac{2\eta R}{2\eta-1} + R\right]$$

$$= \frac{2\eta R + 2\eta R - R}{2\eta - 1} = \frac{4\eta R - R}{2\eta-1} = \frac{(4\eta-1)}{(2\eta-1)}R$$



$$\frac{1}{v} - \frac{\eta}{-\left[\frac{(4\eta-1)R}{2\eta-1}\right]} = \frac{1-\eta}{(-2R)} \Rightarrow v = ??\ (-2R)\frac{(4\eta-1)}{(3\eta-1)}\ ??$$

Check

$$\text{Shift} = (3R) - |u|$$

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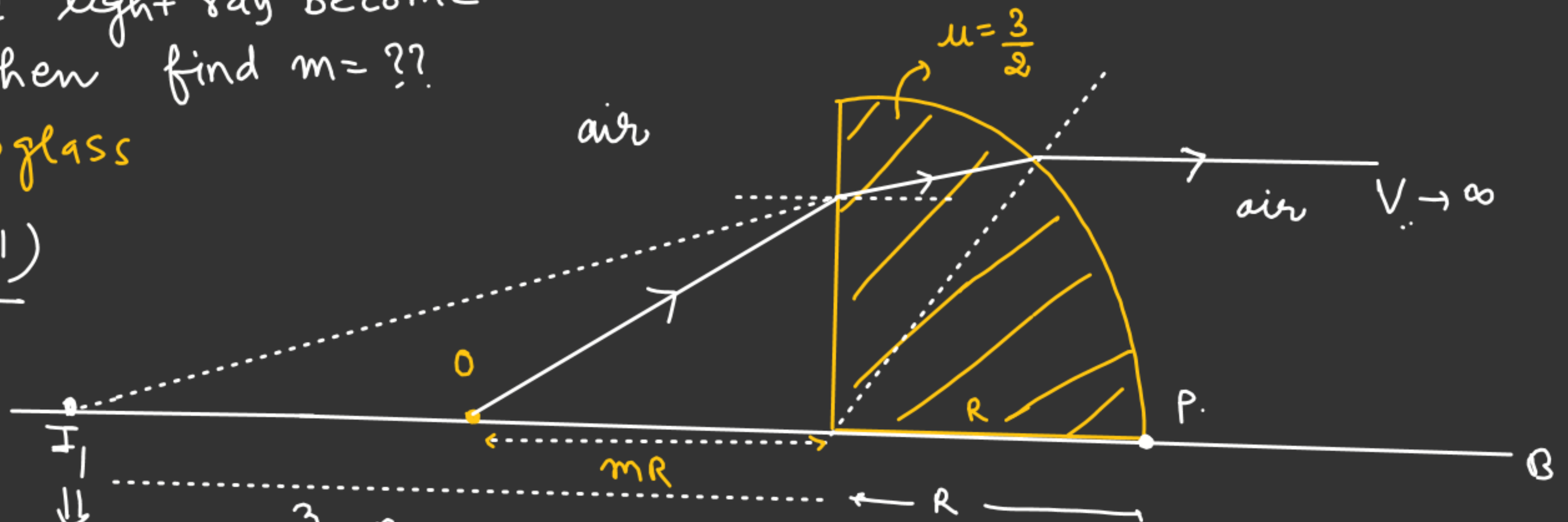
REFRACTION FROM CURVED SURFACE

After Refraction from Curved refracting surface light ray become parallel to AB then find m= ??



Refraction from air to glass

$$\frac{3/2}{v_1} - \frac{1}{(-mR)} = \frac{(3/2 - 1)}{\infty}$$

$$v_1 = -\left(\frac{3mR}{2}\right)$$

I_1 $\Downarrow$ Acts as a object for glass air refraction $\frac{3}{2}mR$

Refraction from glass to air

$$\frac{1}{\infty} - \frac{3/2}{-\left(\frac{3}{2}mR + R\right)} = \frac{1 - 3/2}{(-R)}$$

$$\left(\frac{3}{3mR + 2R}\right) = \frac{1}{2R}$$

$$6R = 3mR + 2R$$

$$4R = 3mR$$

$$m = \left(\frac{4}{3}\right) \text{ Ans}$$

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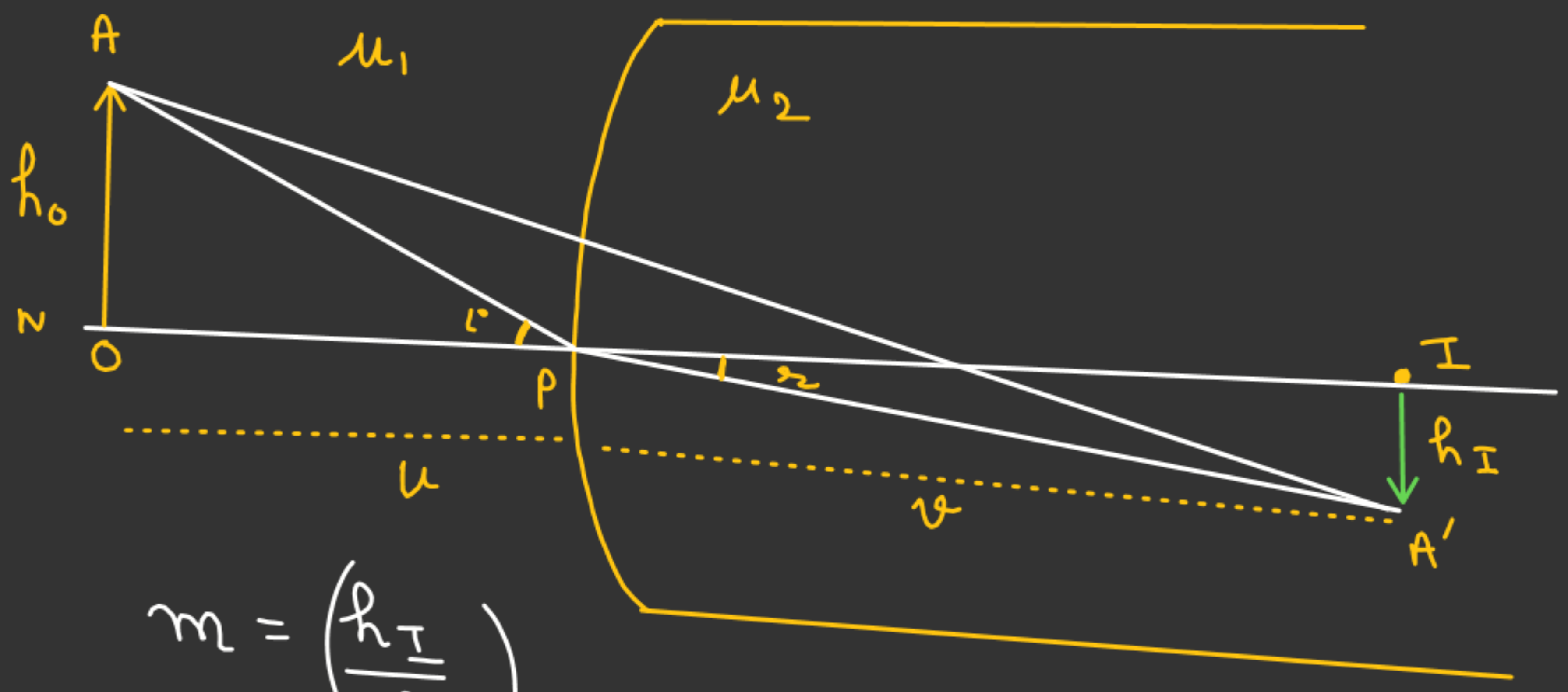
REFRACTION FROM CURVED SURFACE

Transverve Magnification for refraction from Curved surface.



By Snell's law.

$$\mu_1 \sin i = \mu_2 \sin r$$

$$\sin i \simeq \tan i = \left(\frac{h_o}{u}\right)$$

$$\sin r \simeq \tan r \simeq \left(\frac{h_I}{v}\right)$$

$$\mu_1\left(\frac{h_o}{u}\right) = \mu_2\left(\frac{h_I}{v}\right)$$

$$\frac{h_I}{h_o} = \left(\frac{\mu_1}{\mu_2}\right)\left(\frac{v}{u}\right)$$

$$m = \left(\frac{h_I}{h_o}\right)$$

$$\boxed{m = \frac{v}{u}\left(\frac{\mu_1}{\mu_2}\right)}$$

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REFRACTION FROM CURVED SURFACE

⁂: Relation b/w Longitudinal & transverse Magnification in Case of Refraction from Curved Surface.

$$m_\ell = \left(\frac{dv}{du}\right)$$

$$\frac{\mu_2}{v} - \frac{\mu_1}{(-u)} = \frac{(\mu_2-\mu_1)}{(+R)}$$

Differentiating both side w.r.t u

$$-\frac{\mu_2}{v^2}\left(\frac{dv}{du}\right) - \frac{\mu_1}{u^2} = 0$$

$$-\frac{\mu_2}{v^2}\left(\frac{dv}{du}\right) = \frac{\mu_1}{u^2}$$

$$\frac{dv}{du} = -\frac{\mu_1}{\mu_2}\times\left(\frac{v}{u}\right)^2$$

$$\frac{dv}{du} = -\left(\frac{\mu_1}{\mu_2}\times\frac{v_1}{v_2}\right)^2\times\frac{\mu_2}{\mu_1}$$

$\Downarrow$

$$\boxed{m_\ell = -m^2\left(\frac{\mu_2}{\mu_1}\right)}$$ ⁂