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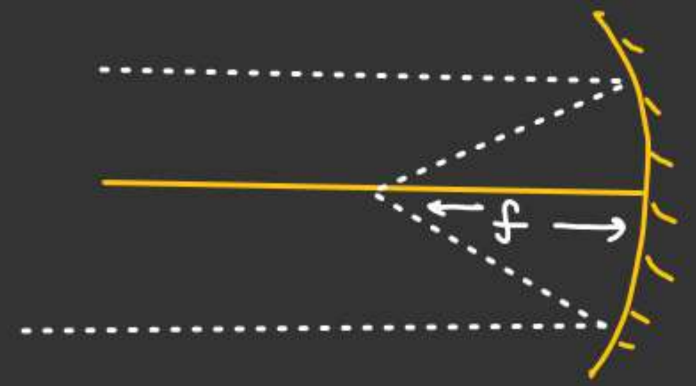
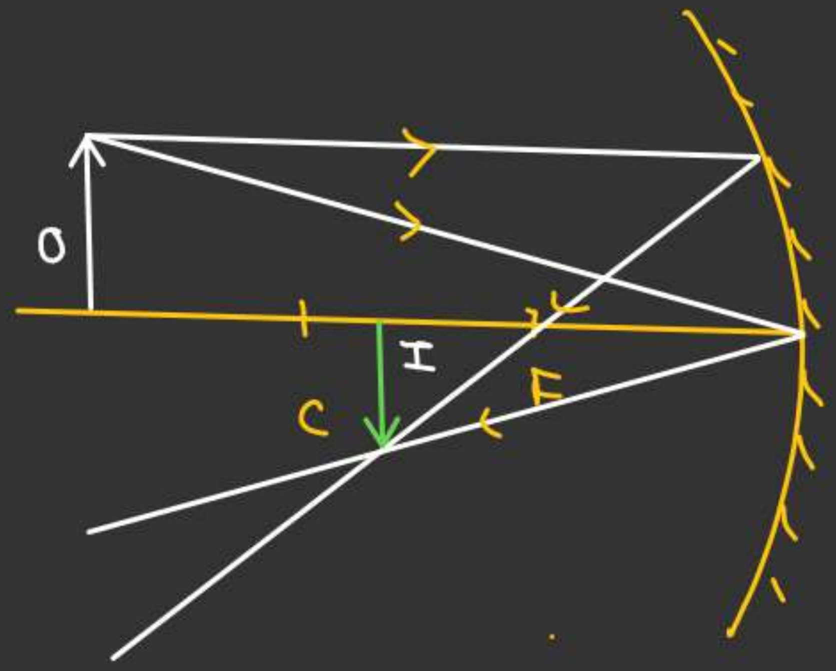
☆☆ Location of image and its Nature in Case of Concave Mirror

Location of object	Location of Image	Nature of Image	Ray diagram.
$u \to \infty$.	$v = f$	Real	
u beyond Center of Curvature	Image b/w C & F	Real, inverted and diminished.	

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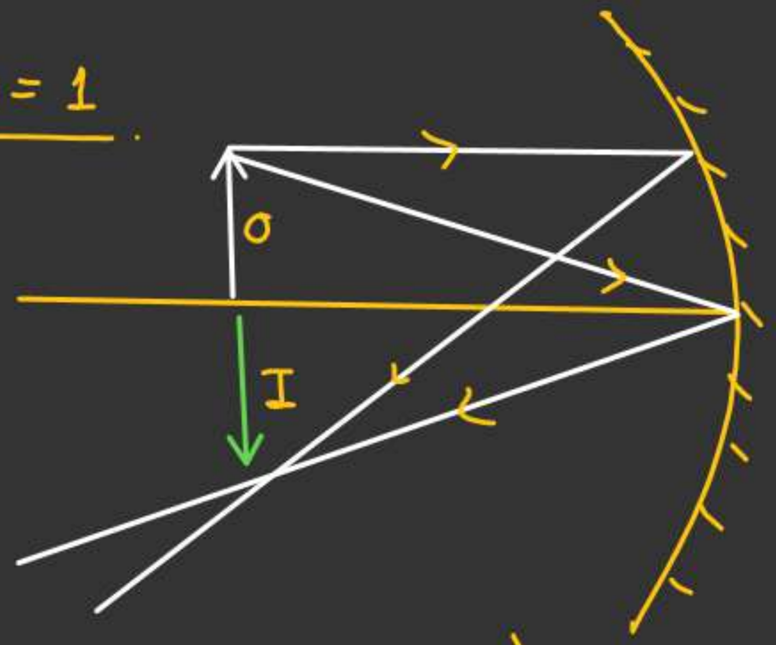
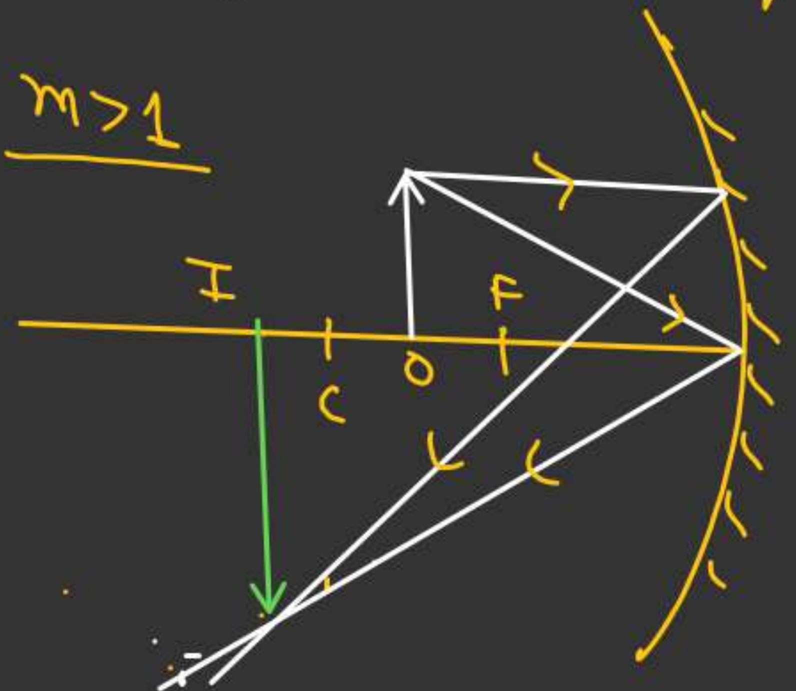
** Location of Image and its Nature in Case of Concave Mirror

	Location of object	Location of Image	Nature of Image	Ray diagram.
③	At C.	Image at C	Real, inverted & Same size.	$m = 1$ 
④	b/w C & F	Image beyond C	Real, inverted & Magnified.	$m > 1$ 

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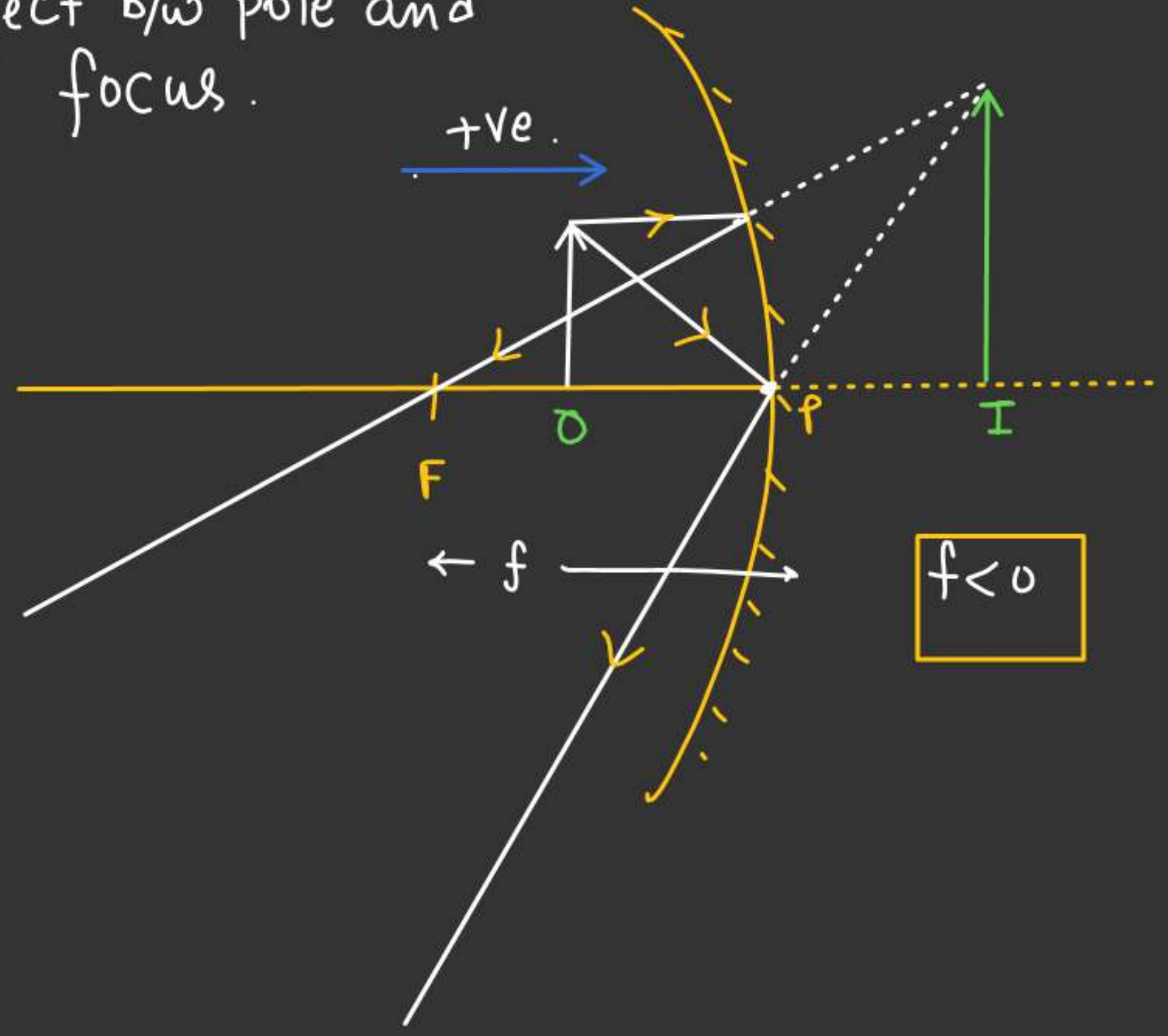
Virtual Image by Concave Mirror

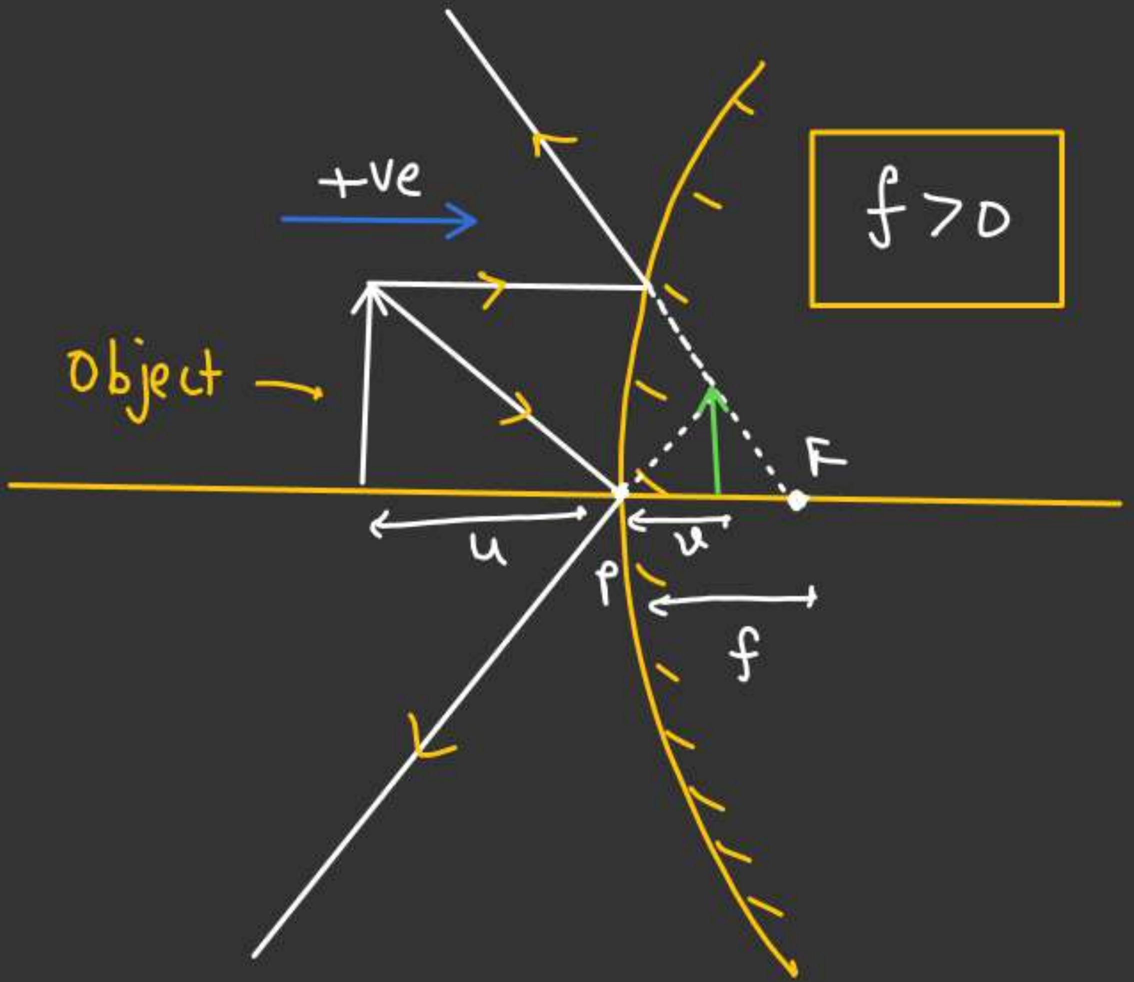
⇒ Object b/w pole and focus.



Convex Mirror

↳ Diverging Mirror

↳ Always formed Virtual & diminished



I Splitting of Mirror

① Splitting perpendicular to principal axis.

$$m = \frac{h_I}{h_o}$$

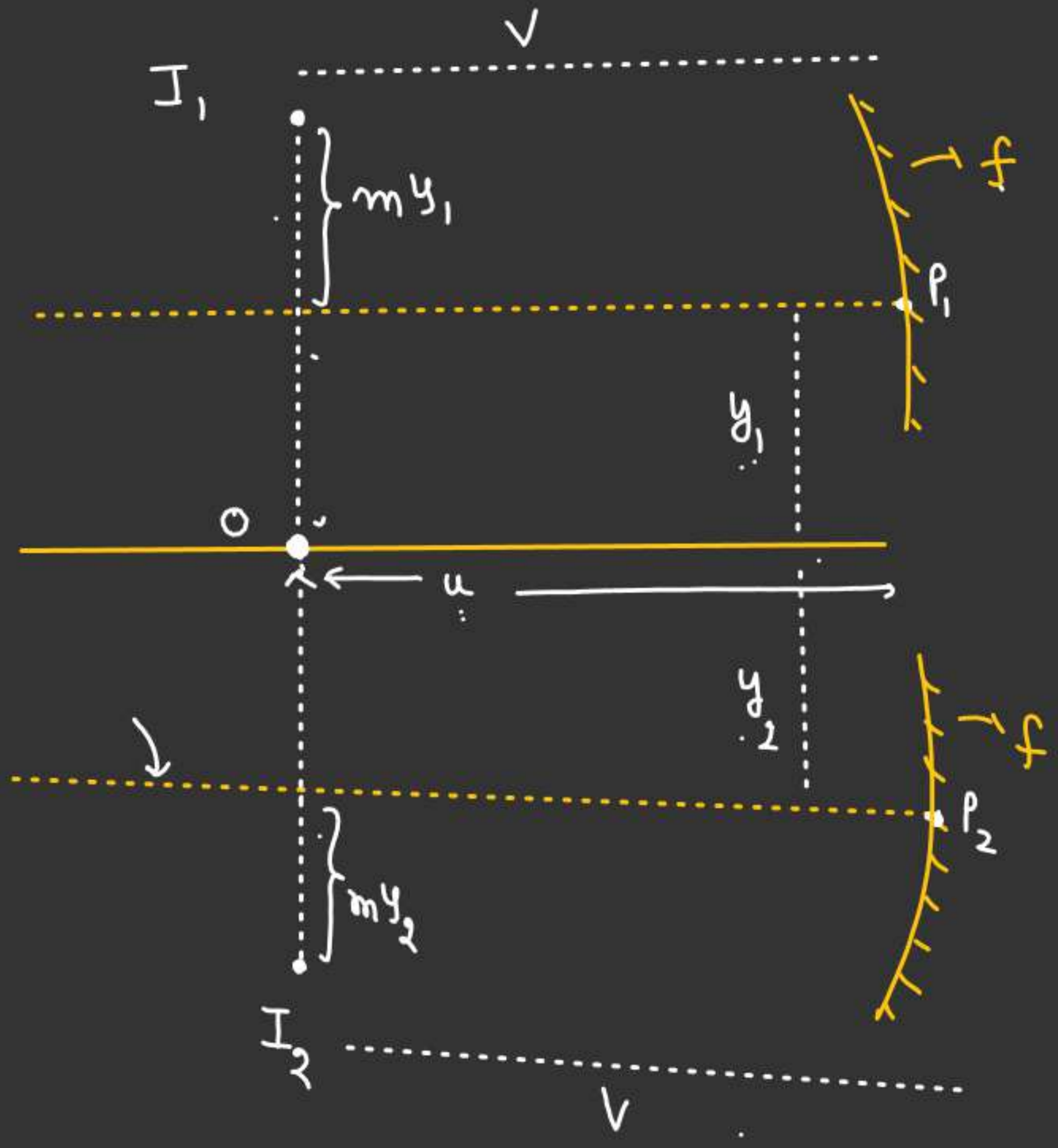
$$h_I = m h_o$$

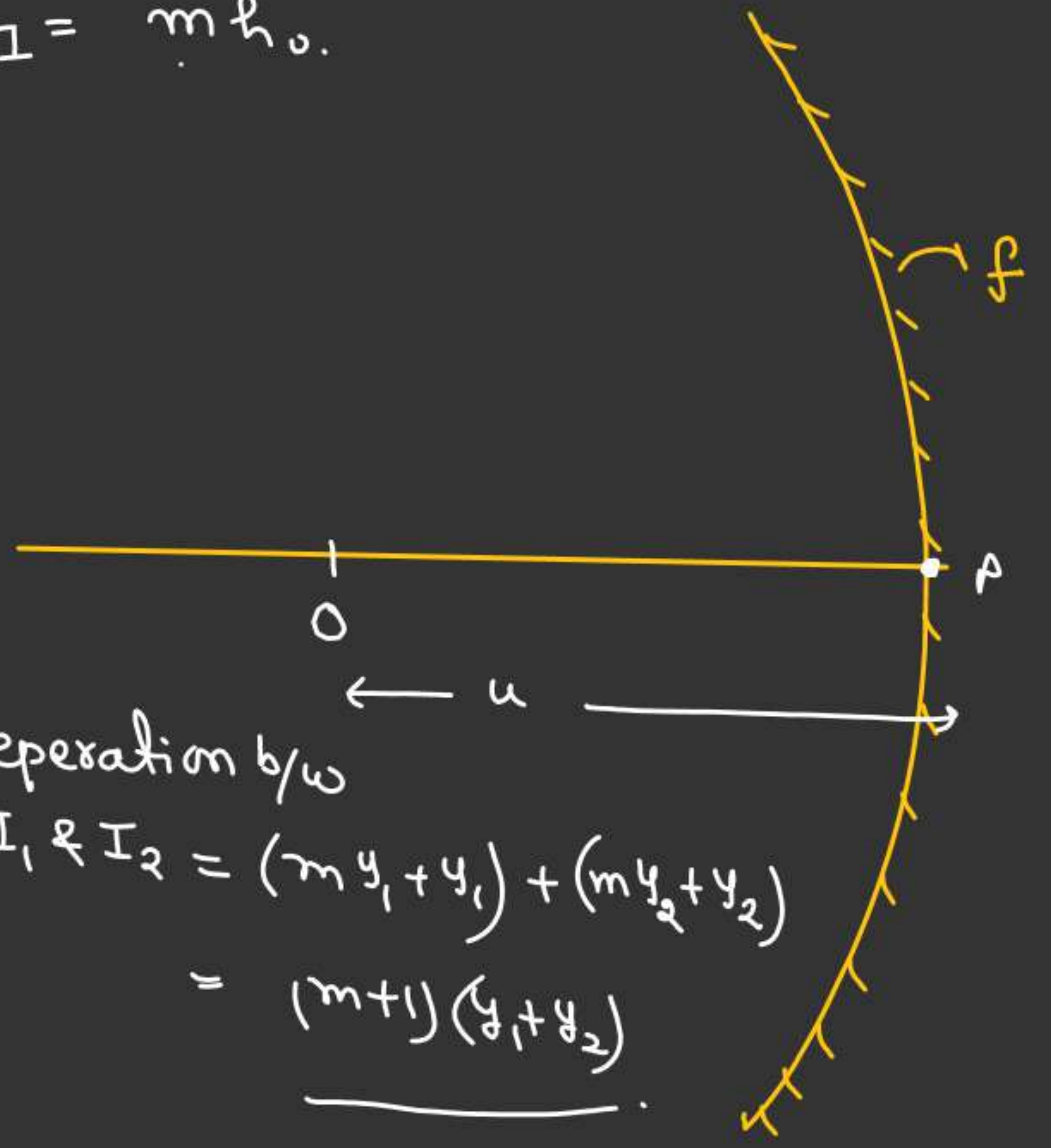
$$m = \left(\frac{-v}{u}\right)$$

⇓

Same for both Mirror

[V & u Same for both mirror





Seperation b/w

$$I_1 \,\&\, I_2 = (my_1 + y_1) + (my_2 + y_2)$$

$$= (m+1)(y_1 + y_2)$$

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If Splitting along the principal axis.

Reflection from M_1

let, v_1 be the image distance.

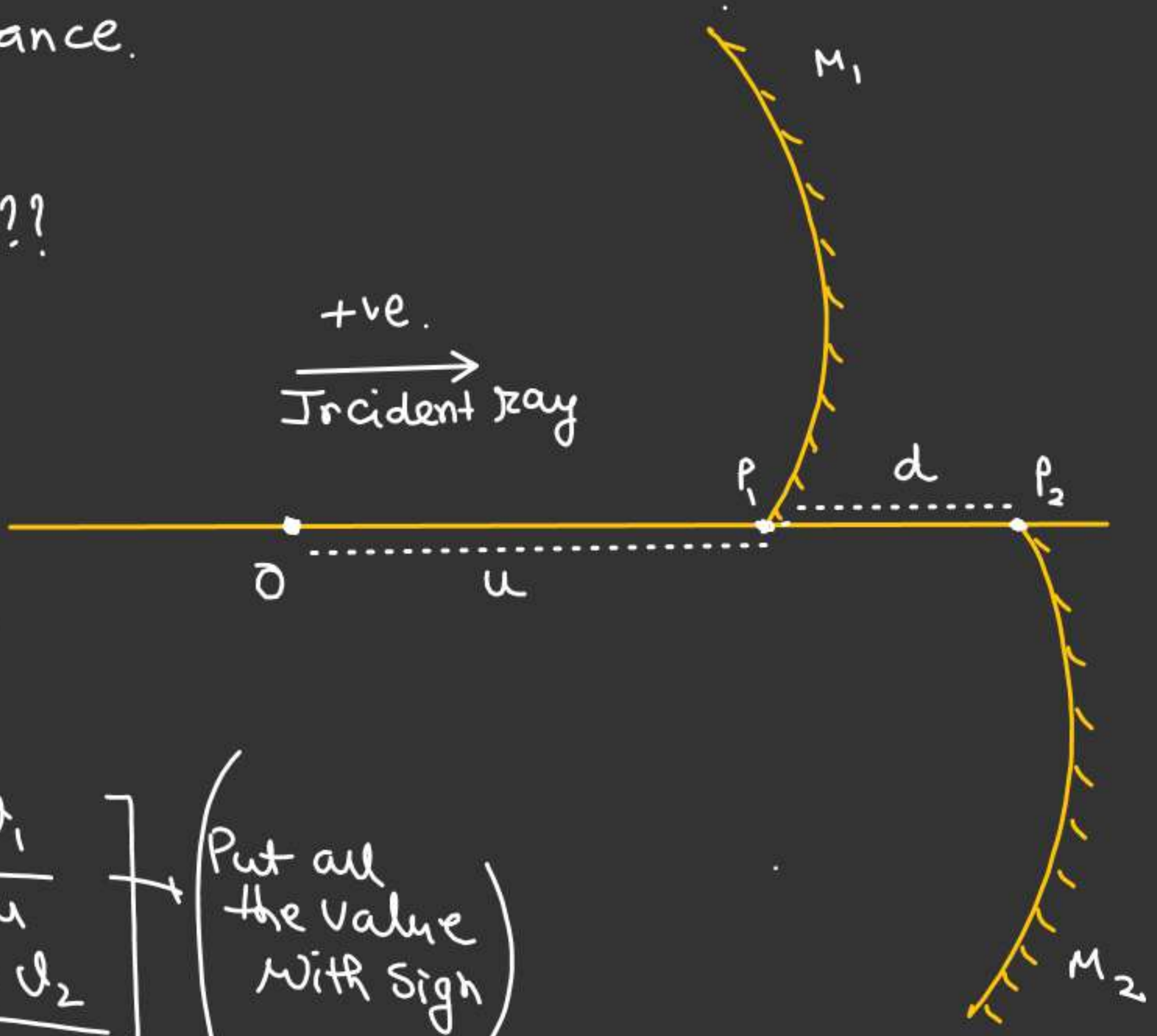
$$\frac{1}{v_1} + \frac{1}{(-u)} = \frac{1}{(-f)} \Rightarrow v_1 = ??$$

For M_2 v_2 be th

$$\frac{1}{v_2} + \frac{1}{-(u+d)} = \frac{1}{(-f)} \Rightarrow v_2 = ??$$

$$\left[\begin{aligned} m_{M_1} &= \frac{-v_1}{u} \\ m_{M_2} &= \frac{-v_2}{u+d} \end{aligned}\right]$$

(Put all the value with sign)



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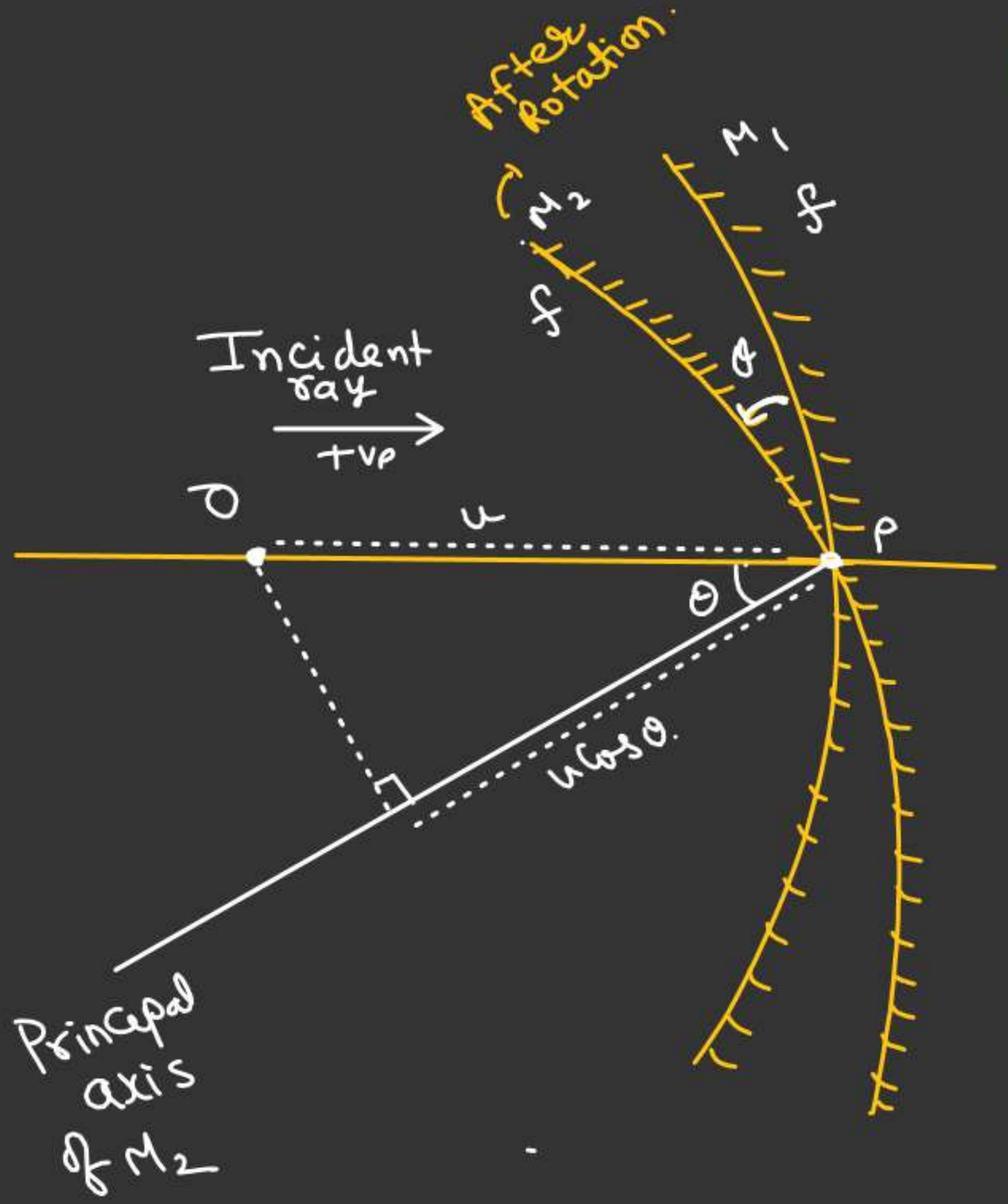
Rotating the Mirror about pole.

For M_2

object distance = $u\cos\theta$.

$$\frac{1}{v} + \frac{1}{(-u\cos\theta)} = \frac{1}{(-f)}$$

$v = (\checkmark)$ with Sign.



F = Focus (Point)

f = focal length.

⇓

Distance from pole and F.

(PF = f)

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If object and image distance measure from focus instead of pole.

[x_1 & x_2 distance of object and image from focus.]

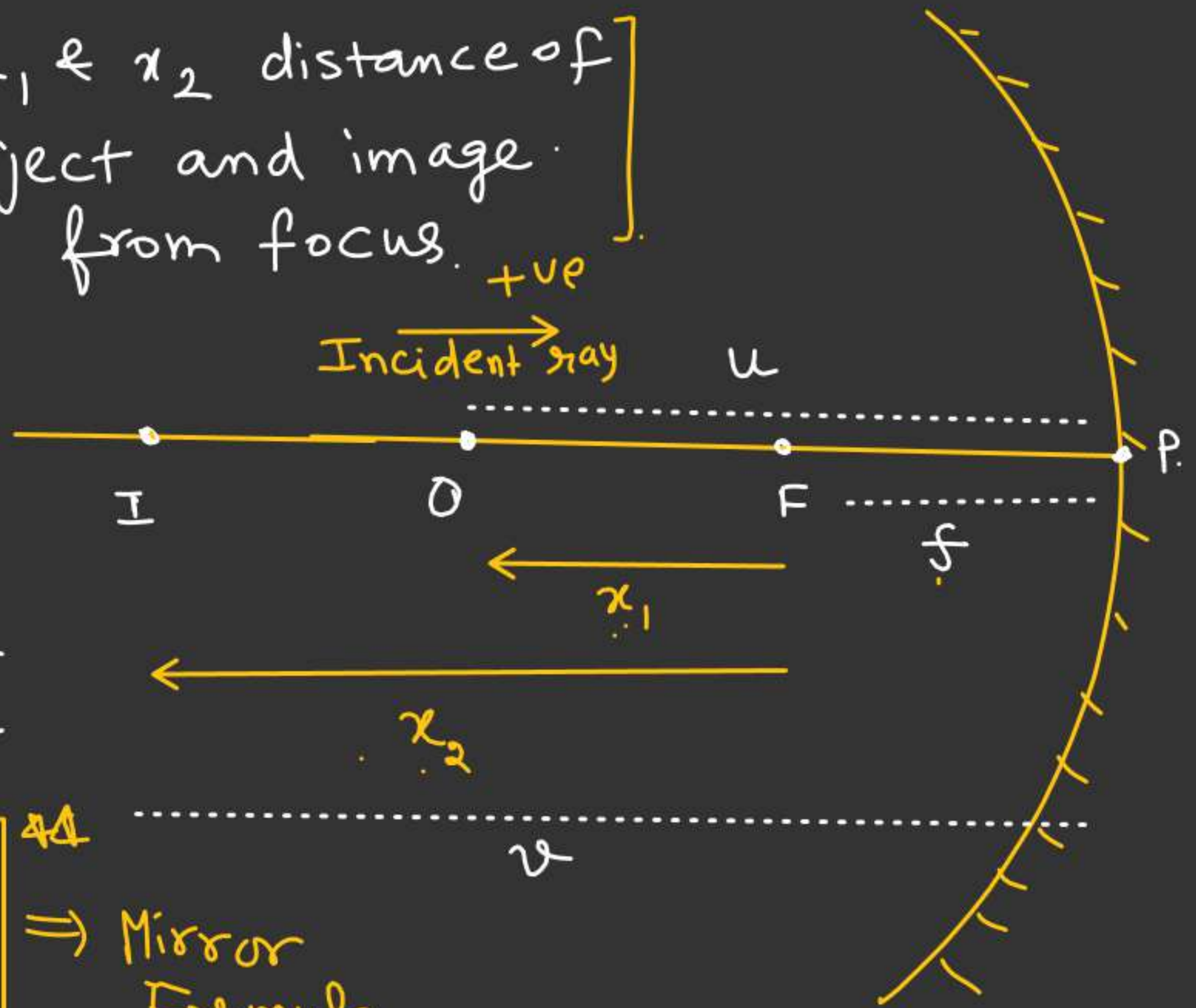
$$u = (x_1 + f)$$

$$v = (x_2 + f)$$

By Mirror formula

$$\frac{1}{-(x_2+f)} + \frac{1}{-(x_1+f)} = \frac{1}{-f}$$

$$\boxed{f^2 = x_1 x_2}$$ $\Rightarrow$ Mirror Formula



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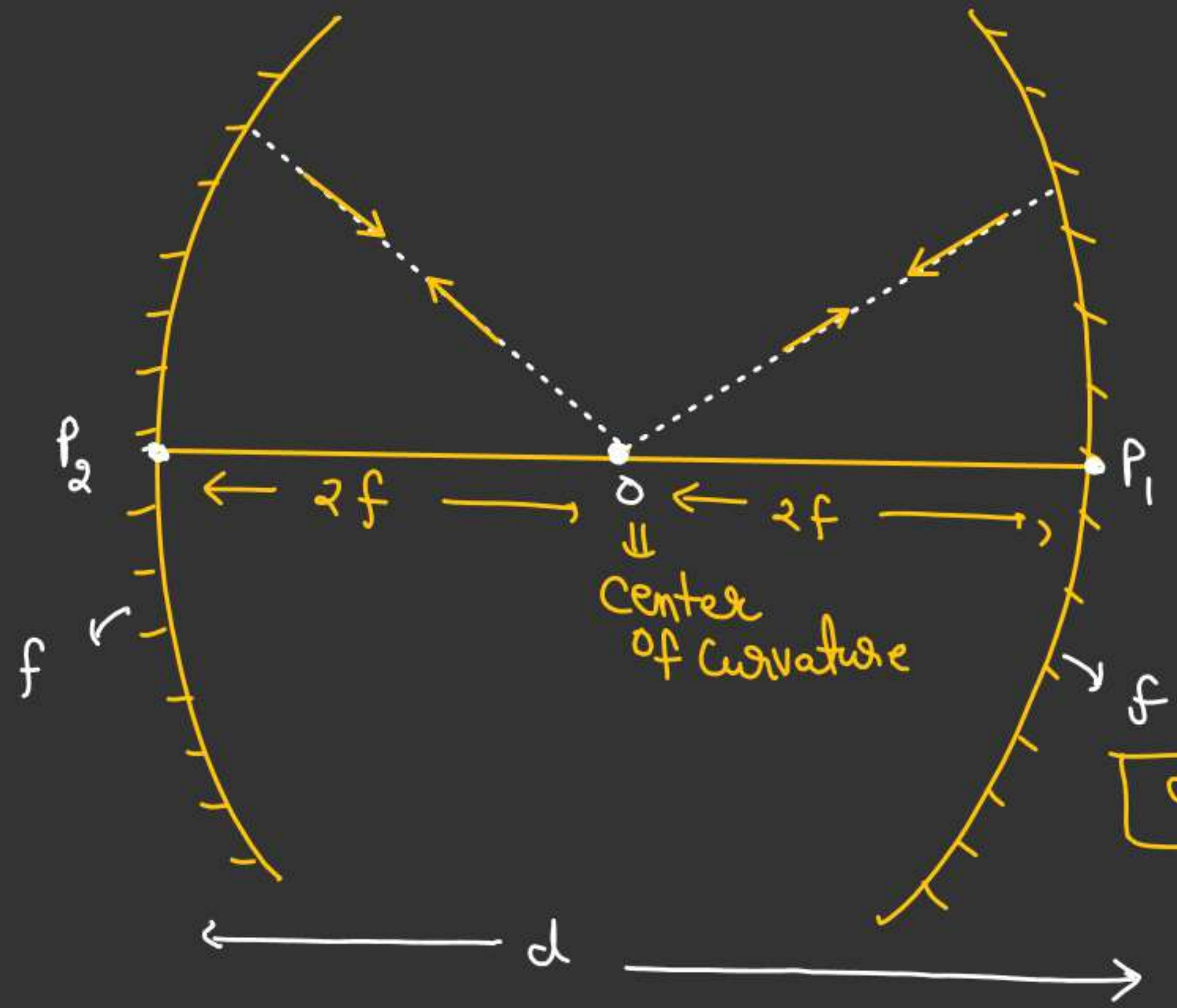
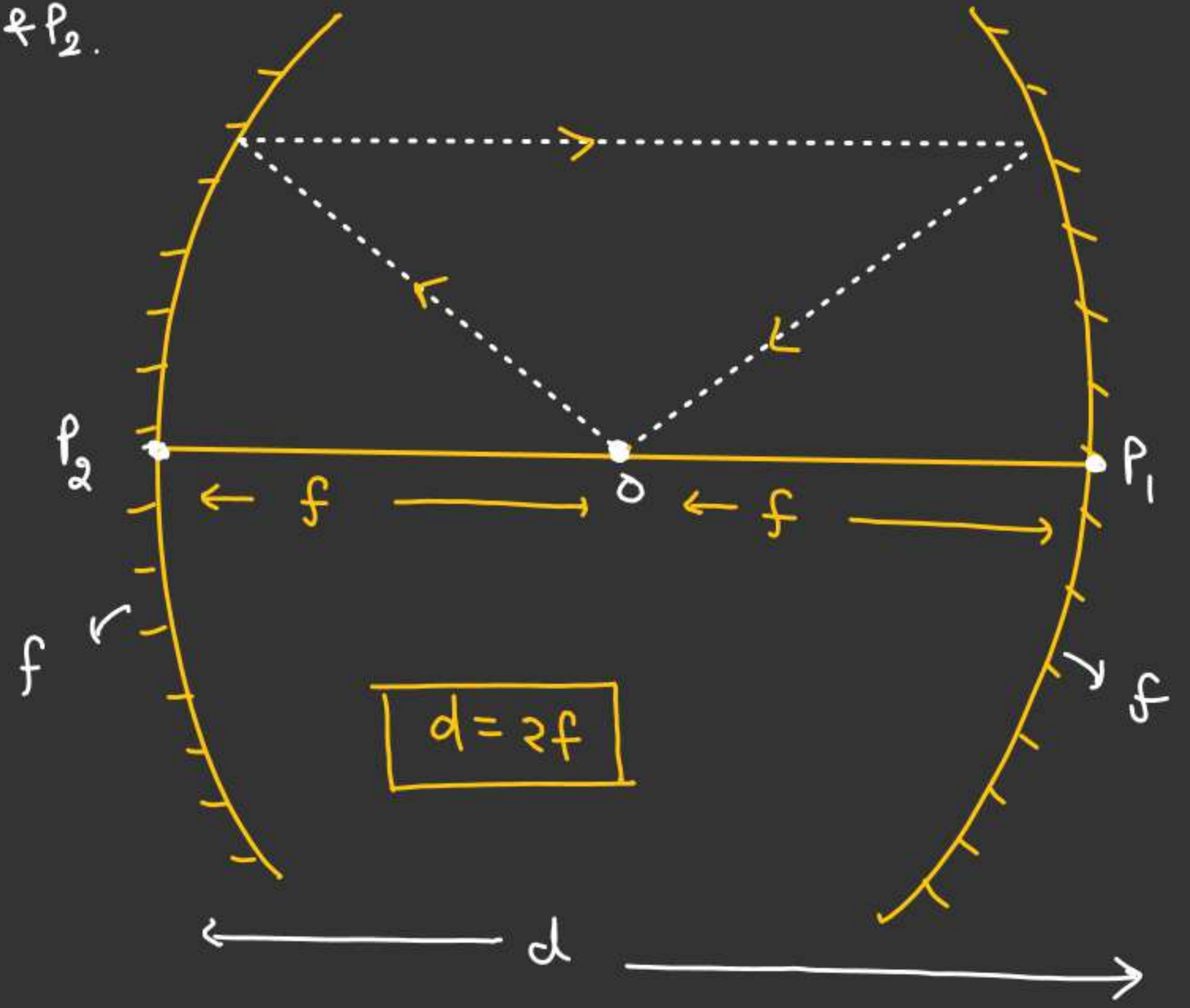
Q.

Find the value of d so that only one image is formed if an object placed b/w two Mirror.

d = Seperation b/w P_1 & P_2.



$\boxed{d = 4f}$



$\boxed{d = 2f}$

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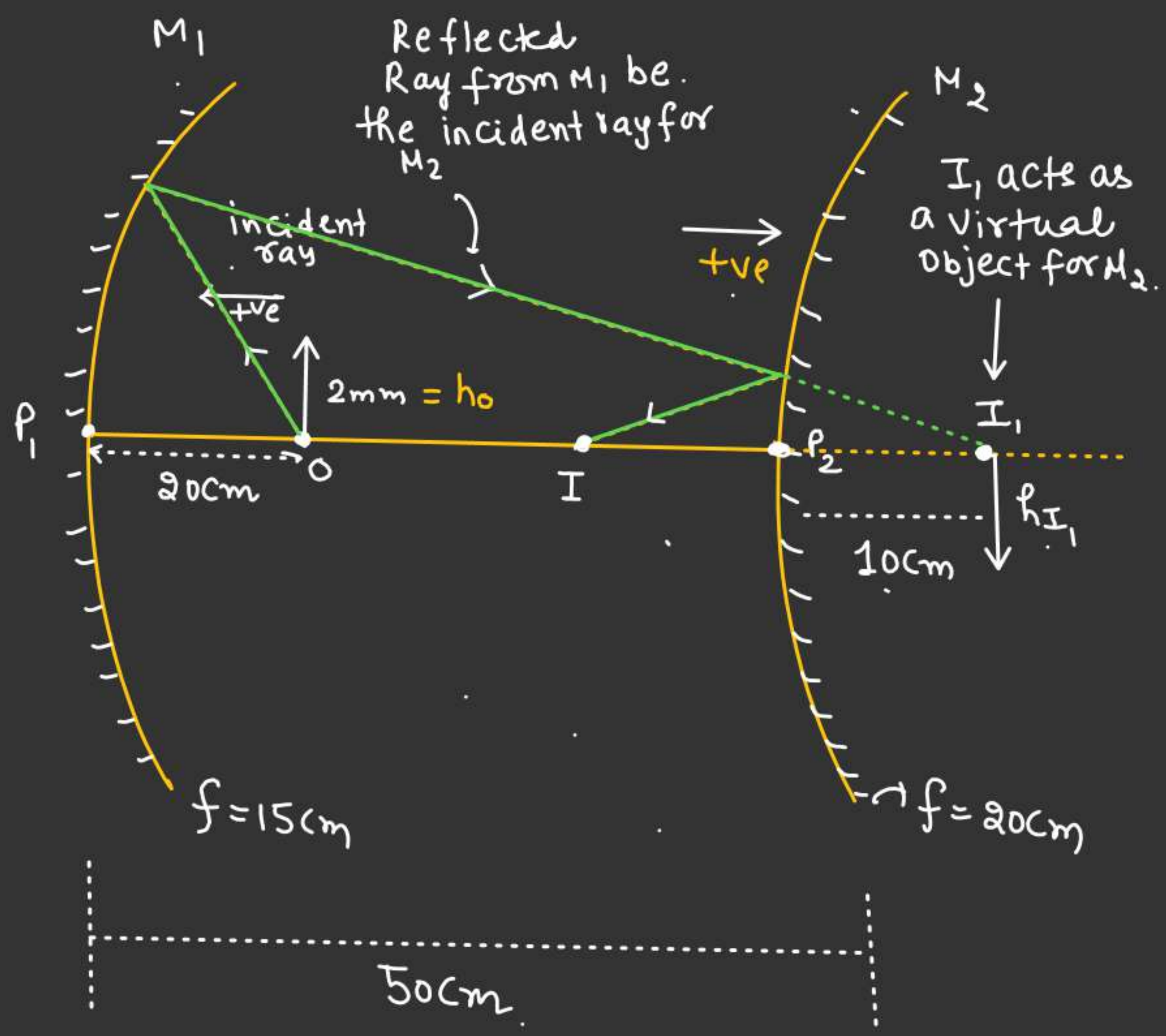
\# Considering Reflection from M_1 first. Find nature, size & location of final image after two successive reflection



Sol^n :- Reflection from Concave Mirror :-

$u = -20\,cm.$

$f = -15\,cm$

v_1 = Image distance after reflection from Concave Mirror.

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{v}=\left(\frac{1}{f}-\frac{1}{u}\right)=\frac{u-f}{uf}$$

$$v=\frac{uf}{u-f}=\frac{(-20)(-15)}{-20-(-15)}=-60\,cm.$$

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Magnification for M_1

$$\frac{h_{I_1}}{h_o} = \frac{-V_1}{u}$$

$$h_{I_1} = \frac{-V_1}{u} \times h_o$$

$$= \frac{-(-60)}{(-20)} \times 2mm$$

$$h_{I_1} = -6\,mm$$

Reflection from Convex Mirror

$u_2 = +10\,cm$, $f = +20\,cm$

$v_2 = ??$

$$\frac{1}{V_2} + \frac{1}{u_2} = \frac{1}{f}$$

$$V_2 = \left(\frac{u_2 f}{u_2 - f}\right) = \frac{(+10)(+20)}{(+10) - (20)}$$

Magnification for M_2 $= -20\,cm$

$$m_2 = \left(\frac{-V_2}{u_2}\right) \quad (h_{o_2} = h_{I_1})$$

$$m_2 = \frac{-(-20)}{+10} = (+2)$$

m_2 (+ve) means image along the direction of object i.e. downward.

$$|h_{I_2}| = |m_2 h_{o_2}|$$

$$= m_2 |h_{I}| = 12\,cm$$

↳ Inverted