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Image velocity in case of plane Mirror

Perpendicular to Mirror direction

$$\left[\vec{V}_I = 2\vec{V}_M - \vec{V}_O\right] \quad \left[\vec{V}_{I/M} = -\vec{V}_{O/M}\right]$$

Parallel to Mirror

$$\boxed{\left(\vec{V}_{I/M}\right)_{\parallel} = \left(\vec{V}_{O/M}\right)_{\parallel}}$$

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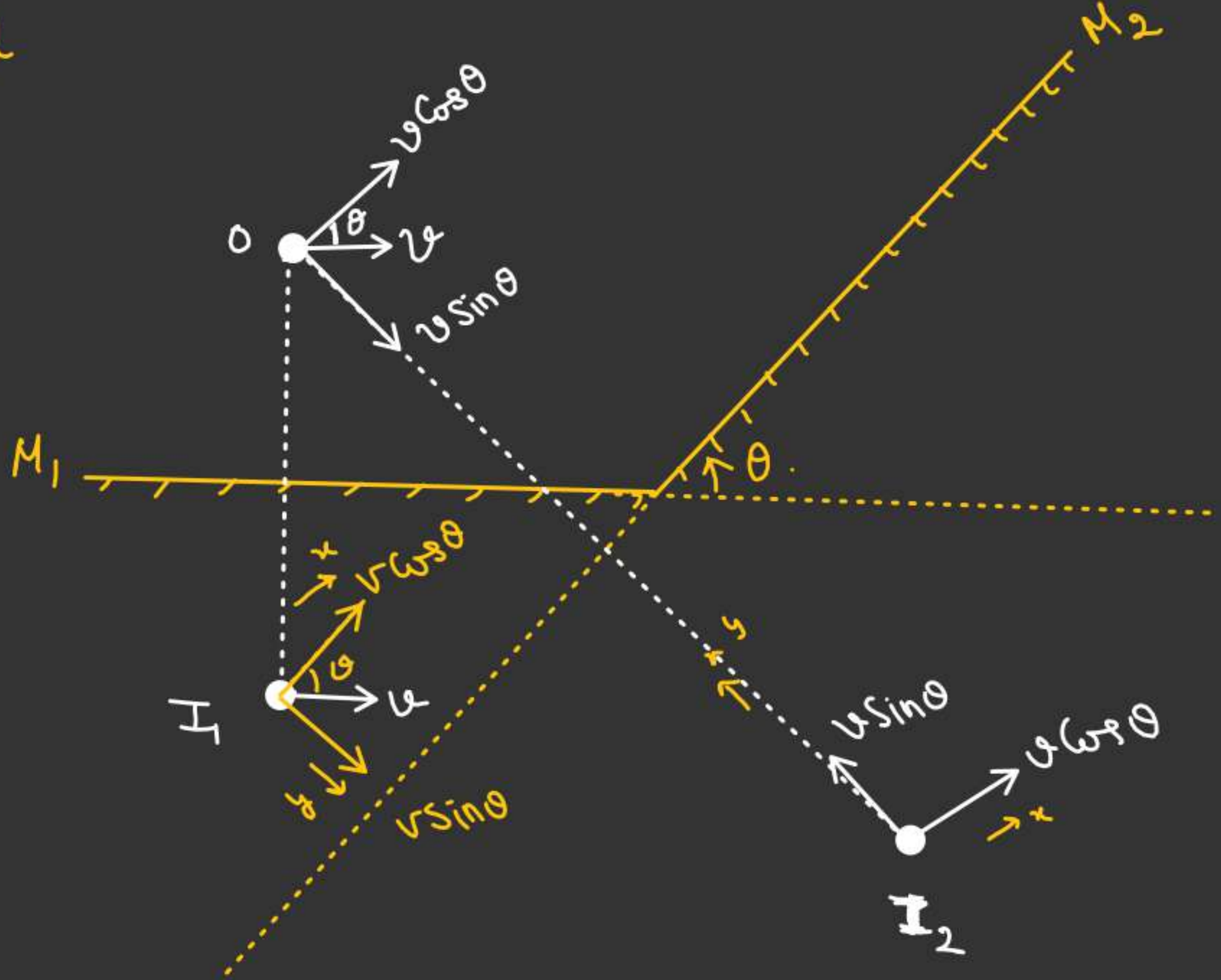
Find speed of image formed by mirror 2 w.r.t image formed by mirror-1

$$v_{I_2/I_1} = (2v\sin\theta)$$



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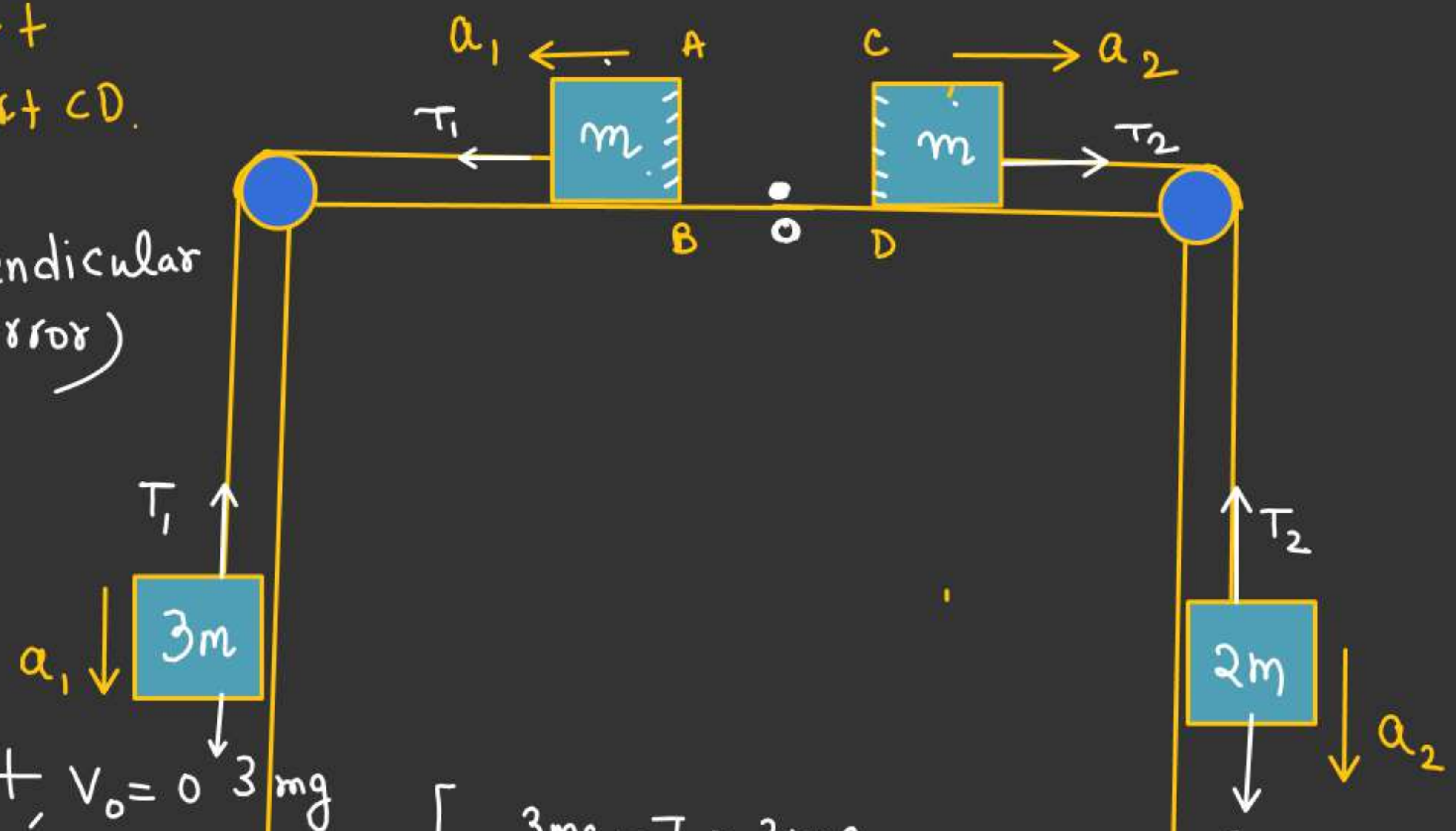
Q. Find accleration of image due to AB w.r.t acceleration of image w.r.t CD.



Sol^n $\vec{V}_I = 2\vec{V}_M - \vec{V}_o$ (Perpendicular to Mirror)

$$\frac{d\vec{V}_I}{dt} = 2\frac{d}{dt}(\vec{V}_M) - \frac{d}{dt}(\vec{V}_o)$$

$$\boxed{\vec{a}_I = 2\vec{a}_M - \vec{a}_o}$$

Object o at rest, $V_o = 0$

$$\vec{a}_o = 0$$

Q. $(\vec{a}_I = 2\vec{a}_M)$

Accleration of image due to AB mirror

$$(\vec{a}_I)_{AB} = 2\vec{a}_1 = -\frac{3g}{2}\hat{i}$$

$$(\vec{a}_I)_{CD} = 2\vec{a}_2 = \frac{4g}{3}\hat{i}$$

$$3mg - T_1 = 3ma_1$$
$$T_1 = ma_1$$
$$3mg = 4ma_1$$
$$a_1 = \left(\frac{3g}{4}\right)$$

$$2mg - T_2 = 2ma_2$$
$$T_2 = ma_2$$
$$2mg = 3ma_2$$
$$a_2 = \left(2g/3\right)$$

$$(\vec{a}_I)_{AB/CD} = -\left[\frac{3g}{2} + \frac{4g}{3}\right]\hat{i}$$

$$= -\left[\frac{9g+8g}{6}\right] = -\frac{17g}{6}\hat{i} \text{ Ans}$$

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Find the maximum velocity of image of block w.r.t block.

$$\omega = \sqrt{\frac{K}{m}}$$

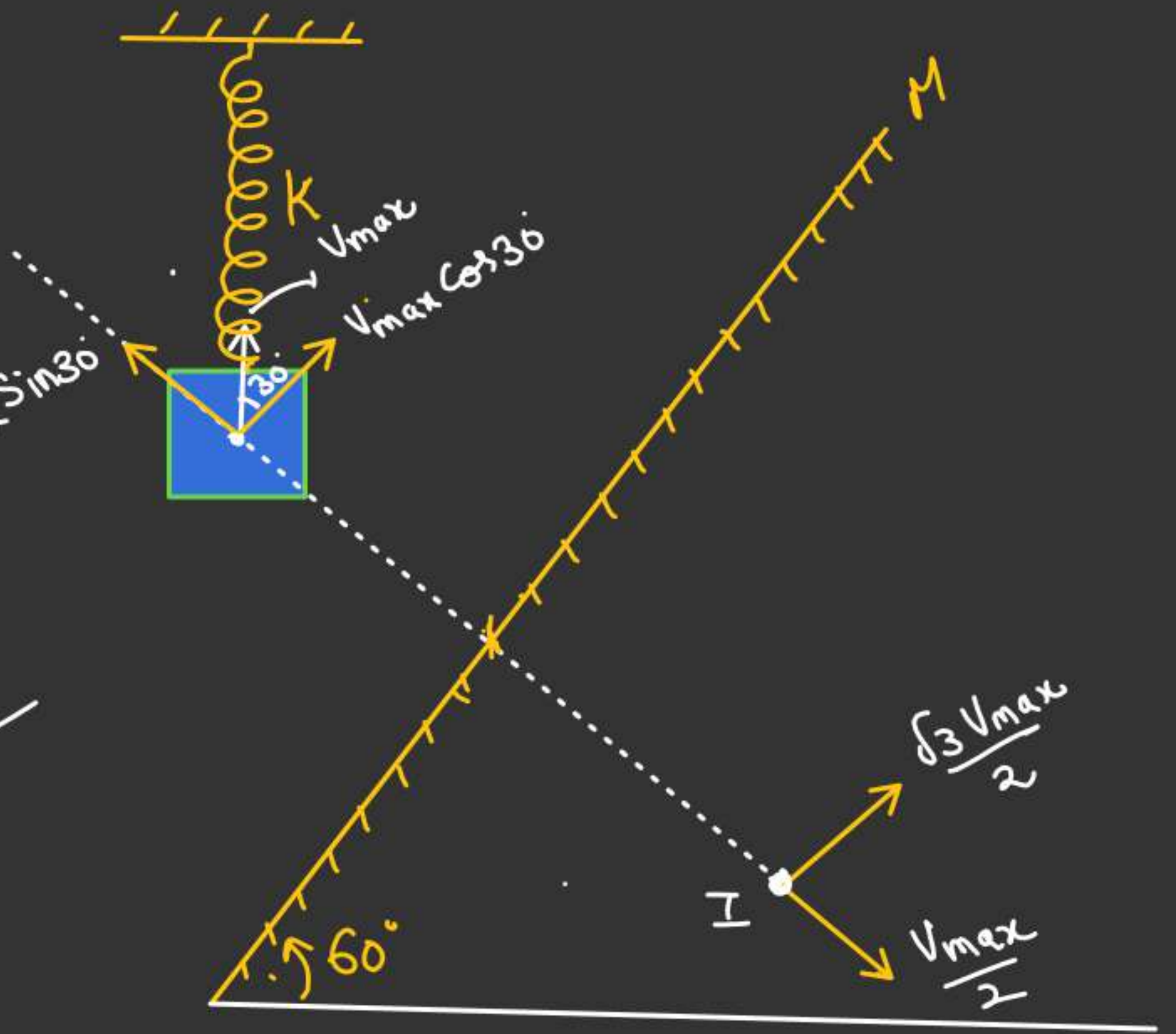
$$V_{max} = A\omega$$

$$V_{max} = A\sqrt{\frac{K}{m}}$$

$\Downarrow$ (of Block)

Maximum velocity of image w.r.t block = $V_{max} = A\sqrt{\frac{K}{m}}$ ✓

$\frac{V_{max}}{2} = V_{max}\sin 30$



In perpendicular direction of Mirror.

$$V_I = 2\cancel{V_M} - V_O$$

$$V_I = -V_O$$

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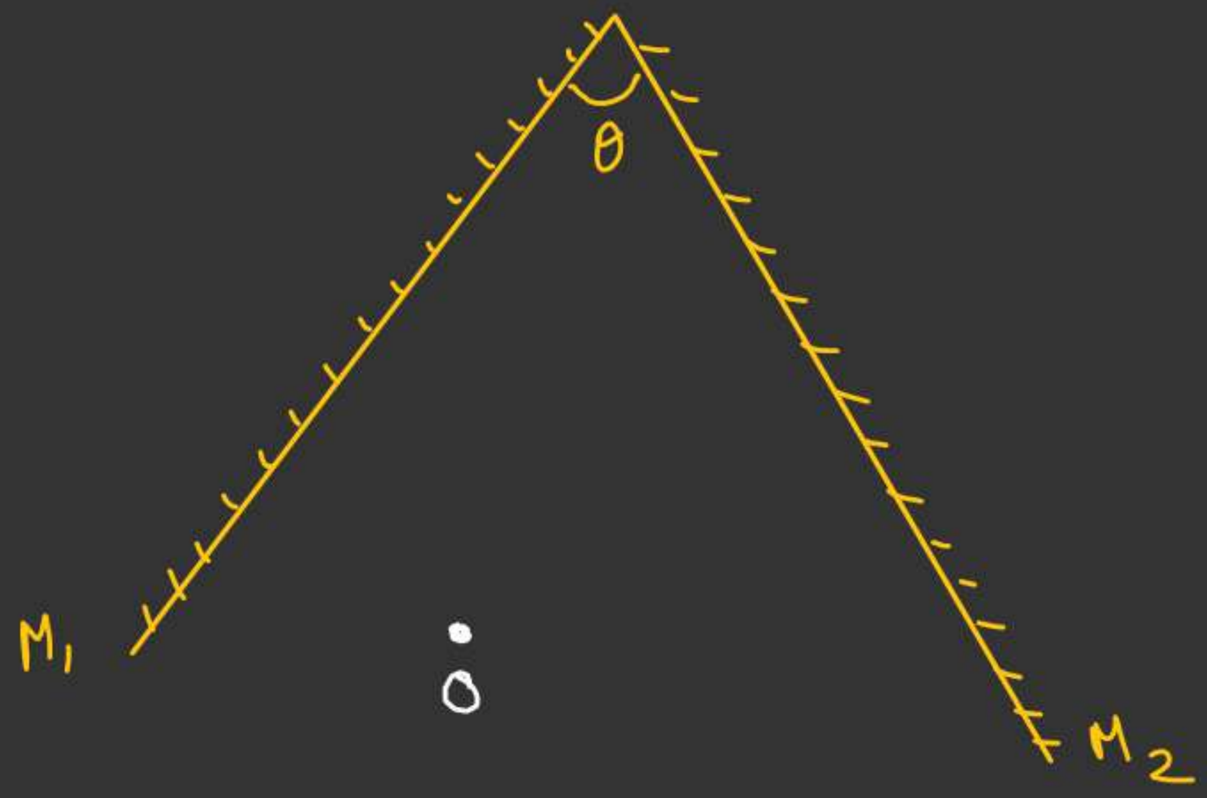
No of Images

Calculate $\frac{360^\circ}{\theta}$.

let, $\frac{360^\circ}{\theta} = K$



Case-1

If K is even

No of images $= (K-1)$

Case-2

If K is odd.

No of images $= K$ if object is not placed symmetrically

$(K-1)$ If object is placed symmetrically.

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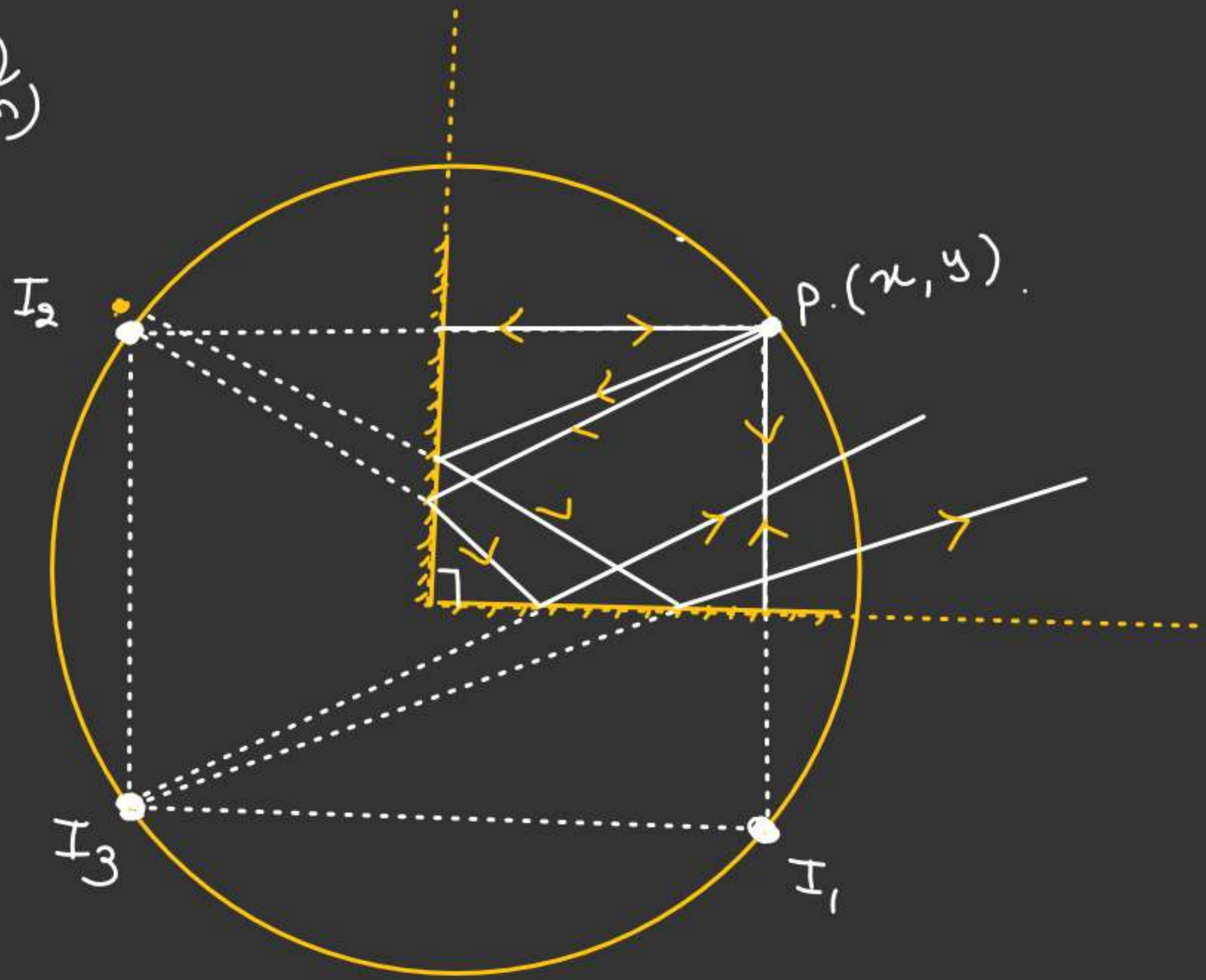
$\theta = 90^\circ$ $\quad K = \frac{360}{90} = 4$ (even)

No of image $= K-1$
$= 3$

3 - Image on the Circle of radius R



Locus

$$\left(x^2 + y^2 = R^2\right)$$

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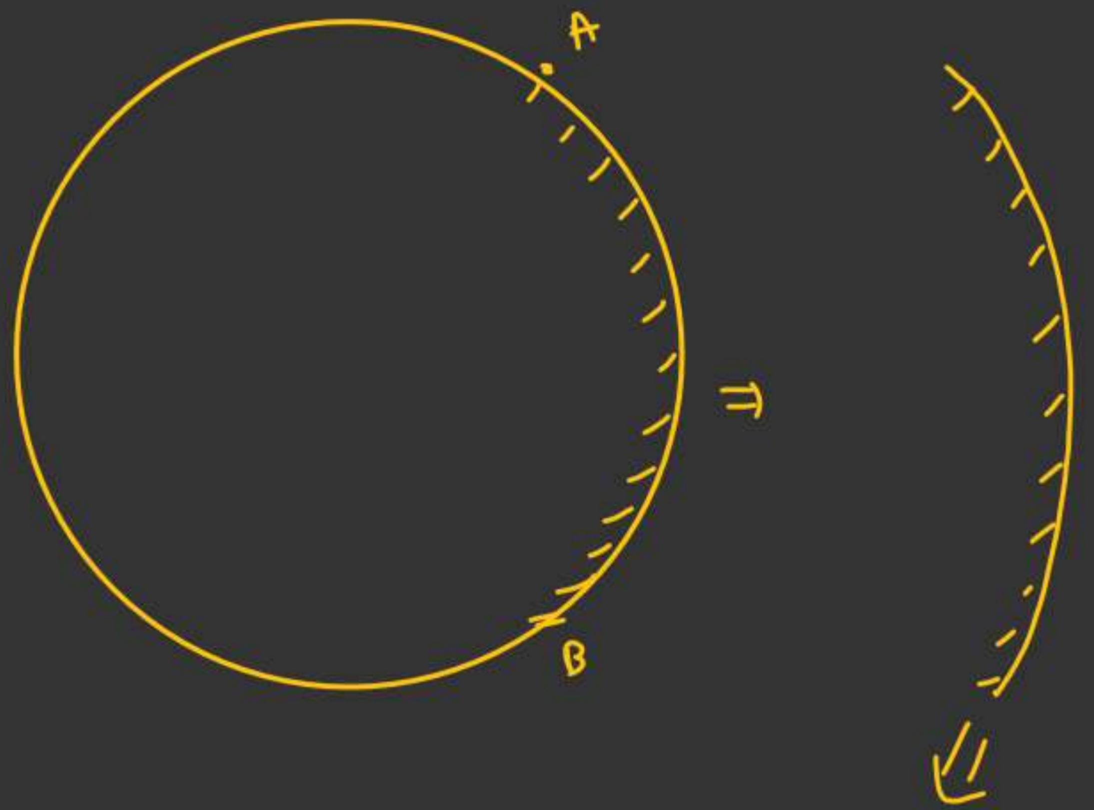
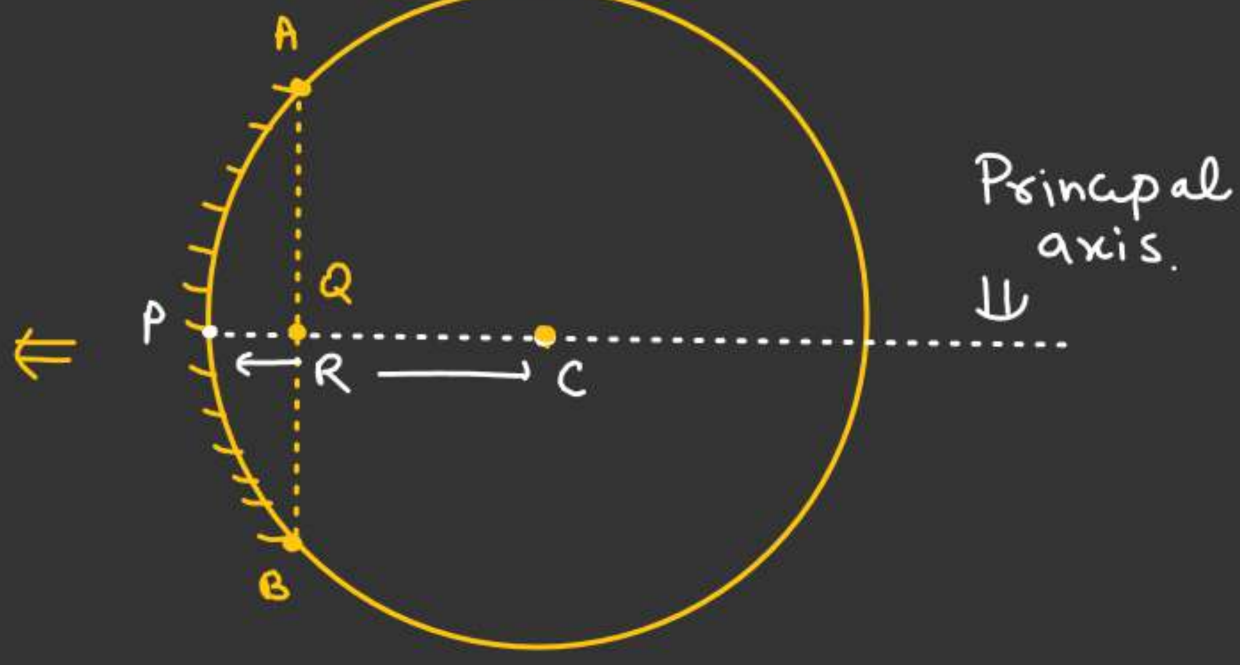
Spherical Mirror





(Convex Mirror)
Diverging Mirror

Concave Mirror
(Converging Mirror)

C = center of curvature.
R = Radius of curvature.
P = Pole.

Aperture = The part which is available for reflection

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Reflection from Spherical Mirror

Focus:

$AF = FC.$

$QF = PF.$

PQ = negligible.

$AF = FC = (R-f)$

In ΔAFQ

$$\cos 2\theta = \frac{QF}{AF}$$

$$Pf = QF = AF\cos 2\theta$$

$$f = (R-f)\cos 2\theta$$

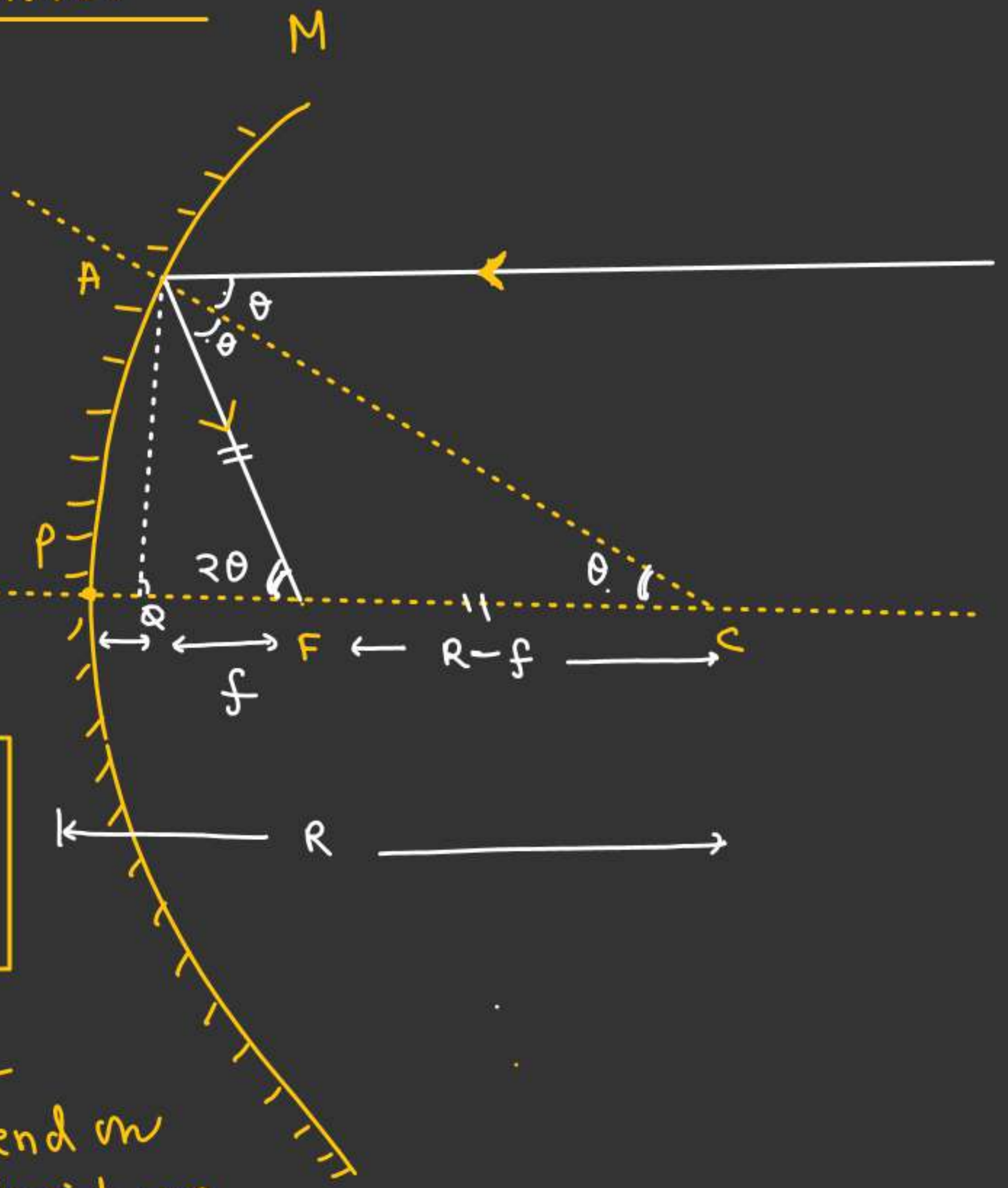
$$f(1+\cos 2\theta) = R\cos 2\theta.$$

$$f = \left(\frac{R\cos 2\theta}{1+\cos 2\theta}\right)$$

$$f = \frac{R(\cos^2\theta - \sin^2\theta)}{2\cos^2\theta}$$

$$\boxed{f = \frac{R}{2}(1-\tan^2\theta)}$$

Focal length of Mirror depend on angle of incidence



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Spherical Aberration

↳ Impossible to Converge the parallel light ray at a particular point due to which image become blurred.

Assumption

↳ Paraxial rays

↳ light rays very Closed to principal axis.

↳ Angle of incidence is very small.

$$f = \frac{R}{2}\left[1 - \tan^2\theta\right]$$

$\theta \to 0$

$$\boxed{f = R/2}$$