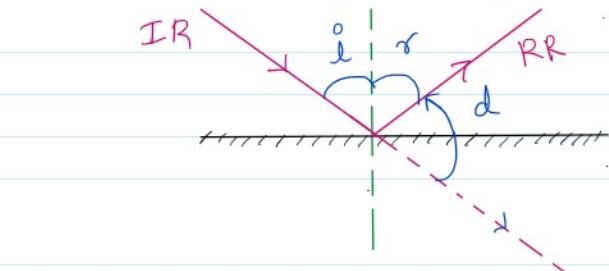


Reflection

Reflection : Bouncing back of light is called Reflection.



$$\therefore d = 180 - (i + r)$$

$$d = 180 - 2i$$

i : angle of incidence
r : angle of reflection
d : angle of deviation.

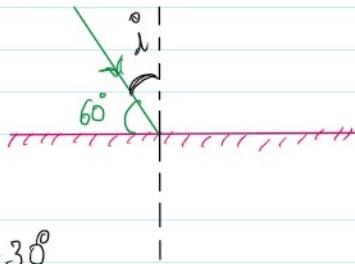
law of reflection

* The IR, RR and the normal drawn at the point of incidence lie on the same plane

* Angle of incidence = Angle of reflection

$$i = r$$

NOTE : This law of reflection holds good for any reflecting surface.

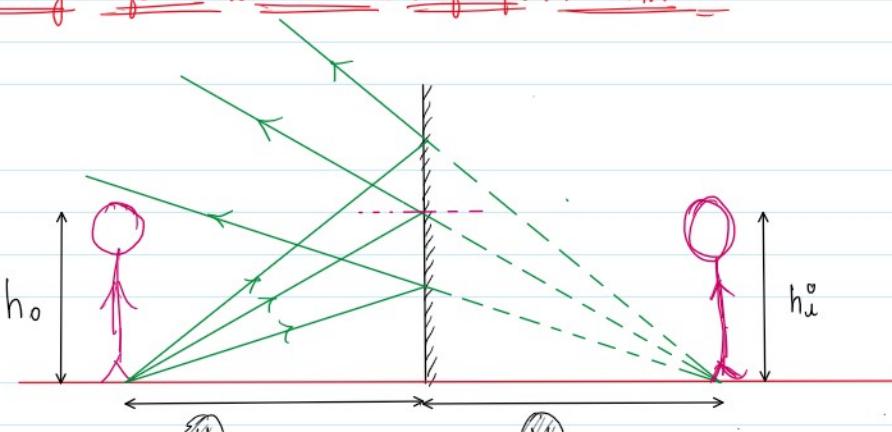
Sample problem

find angle of reflection & deviation.

$$i = 30^\circ$$

$$\therefore r = 30^\circ$$

$$\begin{aligned} d &= 180 - 2i \\ &= 180 - 2 \times 30 \\ &= 180 - 60 \\ \therefore d &= 120^\circ \end{aligned}$$

Image formation in case of plane mirror

* virtual image cannot be obtained on the screen.

* if the image is formed because of diverging rays then that image is virtual.

* Nature of image is

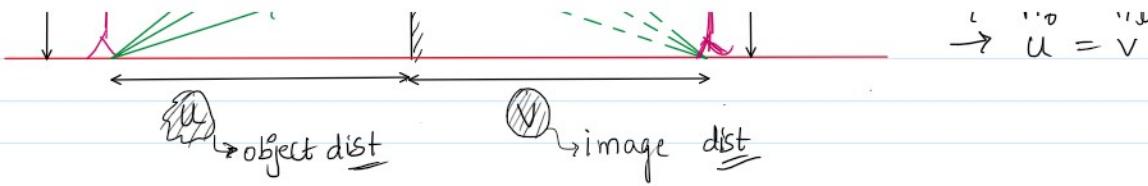
→ Virtual

→ Erect

→ Same size.

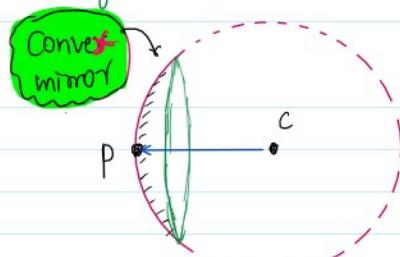
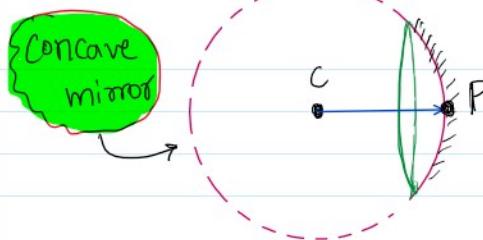
$$\rightarrow h_o = h_i$$

$$\rightarrow u = v$$



spherical mirror

it is a part of a sphere.



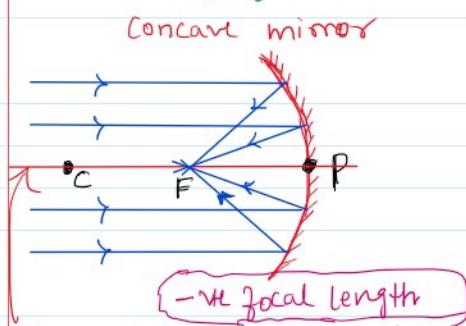
Centre of curvature: It is a centre of a sphere of which the mirror is a part.

Pole: Centre of mirror

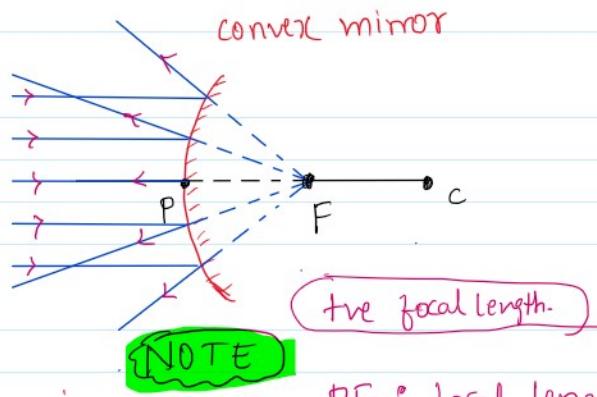
$$CP : R \text{ (Radius of curvature)}$$

Principal focus

It is the point on the principal axis about which the incident rays parallel to principal axis after reflection appear to be converging or diverging.



Principal axis: line going C to P



NOTE

$$PF : \text{focal length } (f)$$

$$R = 2f$$

$$PC = 2PF$$

$$R = 2f$$

Cartesian Sign Convention

* All measurements must be made from pole

* Any measurement made in the direction of

Incident ray is taken +ve and in the opposite direction of incident ray is taken -ve.

* Any measurement made above the principal axis is +ve and any measurement made below the principal axis is -ve.

Sample problem

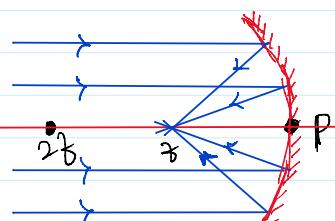
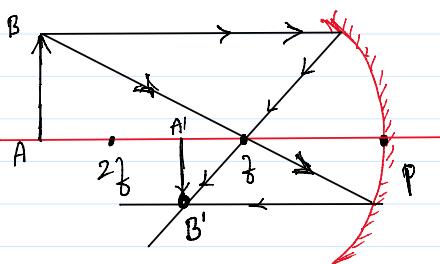
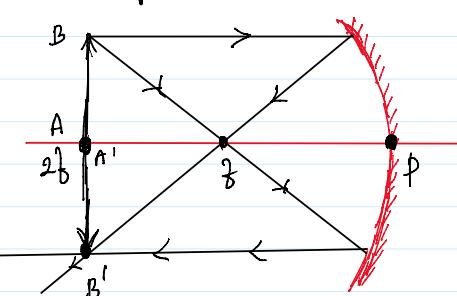
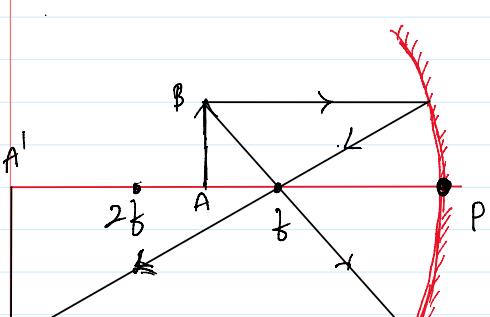
① A Concave mirror has radius of curvature of 10m. If the object is ∞ find at what distance from the pole the image will be formed.

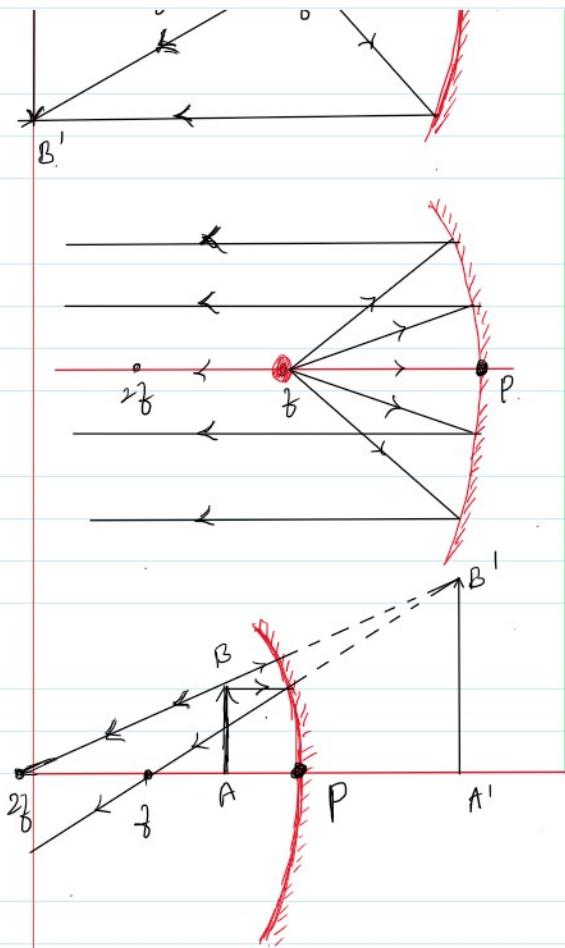
Solution

$$f = R/2$$

$$f = 10/2 = 5 \text{ m}$$

Image formation in case of concave mirror

Ray diagram	Object dist	Image dist	Nature of image
 Ray diagram showing parallel light rays from far away (object at infinity) hitting a concave mirror. The reflected rays converge at the focal point P. The focal length f is marked on the principal axis.	$u = \infty$	$v = f$	Real & point sized image.
 Ray diagram showing an object AB at a distance greater than twice the focal length (u > 2f). The image A'B' is real, inverted, and diminished. It is located between the focal point P and the center of curvature C, at a distance v where $2f > v > f$.	$u > 2f$	$2f > v > f$	Real Inverted & diminished.
 Ray diagram showing an object AB at exactly twice the focal length (u = 2f). The image A'B' is real, inverted, and of the same size as the object. It is located at the focal point P, at a distance v = 2f.	$u = 2f$	$v = 2f$	Real Inverted & same size.
 Ray diagram showing an object AB between the focal point P and the center of curvature C (2f > u > f). The image A'B' is real, inverted, and magnified. It is located beyond the center of curvature C, at a distance v where $v > 2f$.	$2f > u > f$	$v > 2f$	Real Inverted & magnified.



$$u = f$$

$$v = \infty$$

highly magnified.

$$u < f$$

Behind the
mirror

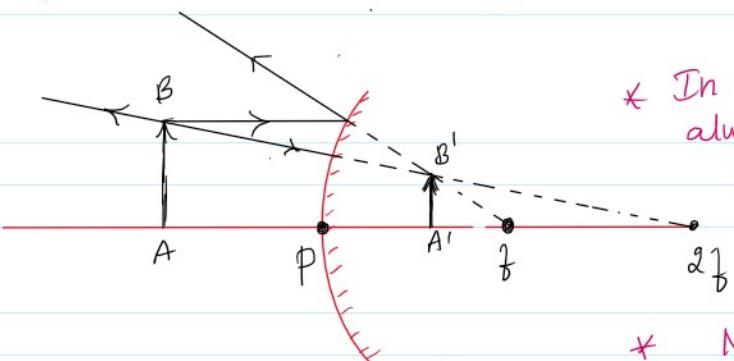
virtual Erect &
magnified.

NOTE : Under 2 situation a concave mirror produce a magnified image

(a) $2f > u > f$: Real inverted magnified

(b) $u < f$: virtual Erect magnified.

Image formation in case of convex mirror



* In case of convex mirror, the image is always formed b/w pole & focus irrespective of position of object.

* Nature of the image is
 → virtual
 → Erect
 → diminished.

NOTE

Mirror formula

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

where
 f : focal length
 u : object distance
 v : image distance.

Magnification

$$m = \frac{\text{height of image}}{\text{height of object}} = \frac{h_i}{h_o}$$

$$m = \frac{h_i}{h_o} = -\frac{v}{u}$$