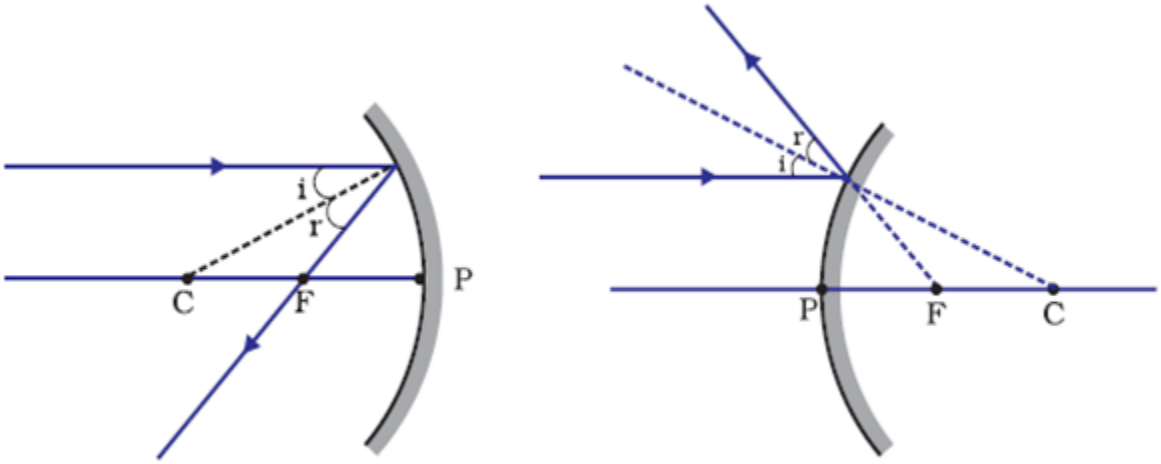
Rules for obtaining images formed by spherical mirrors

(1) Rule 1

A ray of light which is parallel to the principle axis of the mirror passes through its focus after reflection from the mirror as shown below in the figure

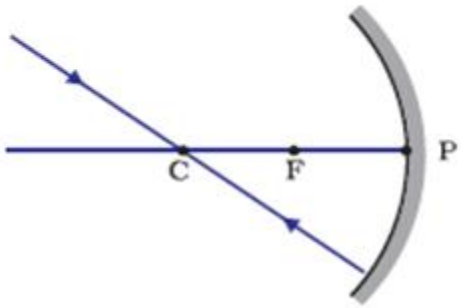


(a) concave mirror (b) convex mirror

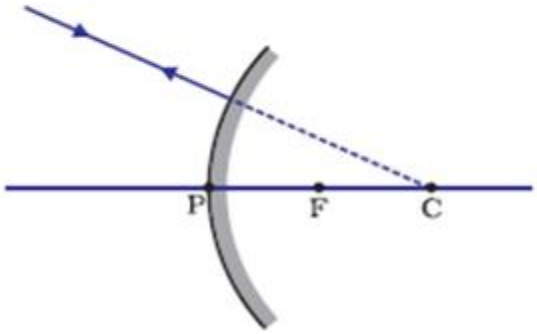
From the figure given above it can be clearly seen that the light rays passes through principle focus in case of concave mirrors and appears to diverge from principle focus in case of concave mirror.

(2) Rule 2

A ray of light passing through the center of curvature of the curvature of the concave mirror or directed in the direction of the center of curvature of a convex mirror, is reflected back along the same path as shown below in the figure



(a) concave mirror

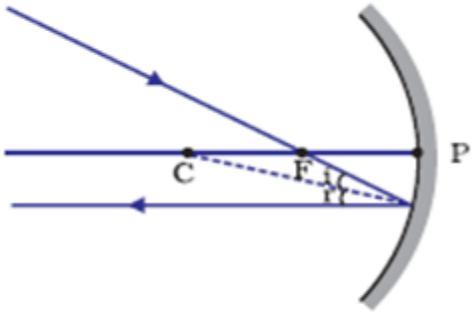


(b) convex mirror

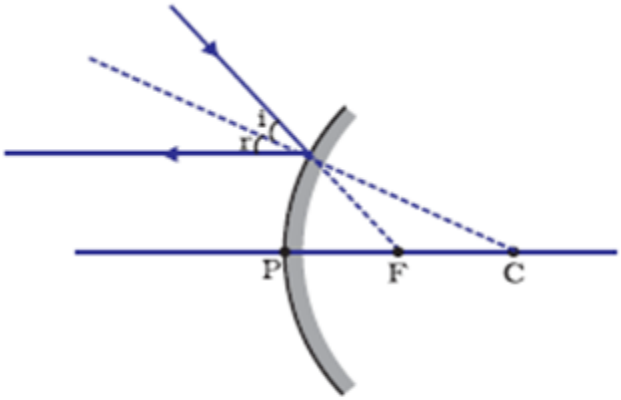
This happens because the incident rays fall on the mirror along the normal to the reflecting surface.

(3) Rule 3

A ray passing through principle focus of a concave mirror or a ray which is directed towards the principal focus of a convex mirror, becomes parallel to the principle axis after reflection and is shown below in the figure



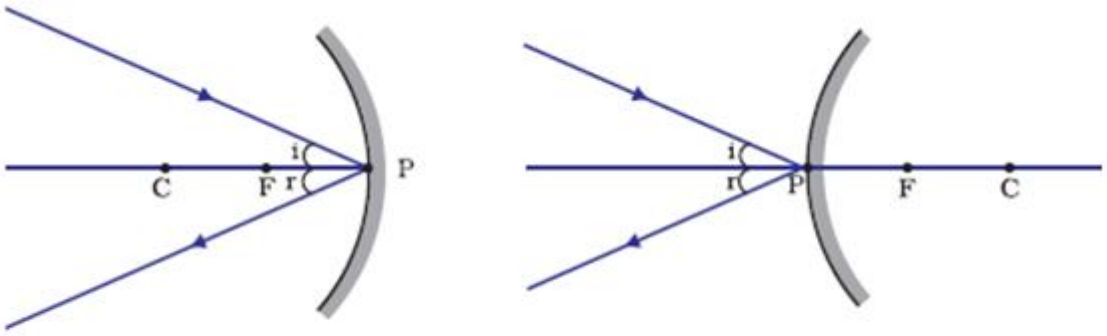
(a) concave mirror



(b) convex mirror

(4) Rule 4

A ray incident obliquely to the principal axis, towards a point P (pole of the mirror), on the concave mirror or a convex mirror, is reflected obliquely. The incident and reflected rays follow the laws of reflection at the point of incidence (point P), making equal angles with the principal axis and is shown below in the figure



(a) concave mirror (b) convex mirror

Image formation by spherical mirrors

Image formation by concave mirror

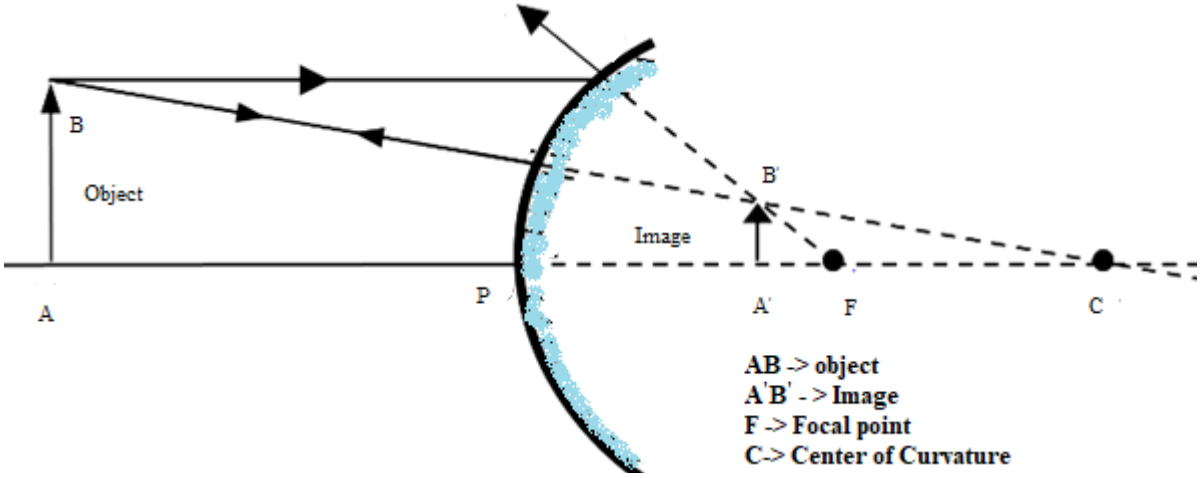
- The type of image formed by a concave mirror depends on the position of the object kept in front of the mirror. We can place the object at following places
    1. Between pole P and focus F
    2. At the focus
    3. Between focus F and center of curvature C
    4. At the center of curvature
    5. Beyond center of curvature
    6. At far off distances called infinity and cannot be shown in the figures
- Image formation by a concave mirror for different positions of the object is shown below in the table

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At focus F	Highly diminished, point sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

- Concave mirrors are used as shaving mirrors, reflectors in car headlights, hand torch and table lamps.
- Large concave mirrors are used in field of solar energy to focus sun rays on objects to be heated.

Image formation by convex mirrors

- In order to construct a ray diagram to find out the position, nature and size of image formed by convex mirror we should remember following path of rays of light.
- A ray of light parallel to the principle axis of a convex mirror appears to be coming from its focus after reflection from the mirror.
- A ray of light going towards the center of curvature of convex mirror is reflected back along its own path.
- Convex mirrors have its focus and center of curvature behind it and no light can go behind the convex mirror and all the rays that we show behind the convex mirror are virtual and no ray actually passes through the focus and center of curvature of the convex mirror.
- Whatever be the position of object in front of convex mirror, the image formed by a convex mirror is always behind the mirror, virtual, erect and smaller than the object.
- Nature, position and relative size of the image formed by a convex mirror is given below in the
  table



- Convex mirrors are used as rear view mirrors in automobiles to see the traffic at back side as they give erect images and also highly diminished one giving the wide field view of traffic behind.

Sign convention for reflection by spherical mirrors

Reflection of light by spherical mirrors follow a set of sign conventions called the New Cartesian Sign Convention. In this convention, the pole (P) of the mirror is taken as the origin. The principal axis of the mirror is taken as the x-axis (X'X) of the coordinate system. The conventions are as follows -

- The object is always placed to the left of the mirror. This implies that the light from the object falls on the mirror from the left-hand side.
- All distances parallel to the principal axis are measured from the pole of the mirror.
- All the distances measured to the right of the origin (along + x-axis) are taken as positive while those measured to the left of the origin (along - x-axis) are taken as negative.
- Distances measured perpendicular to and above the principal axis (along + y-axis) are taken as positive.
- Distances measured perpendicular to and below the principal axis (along -y-axis) are taken as negative.

These new Cartesian sign convention for spherical mirrors are shown below

