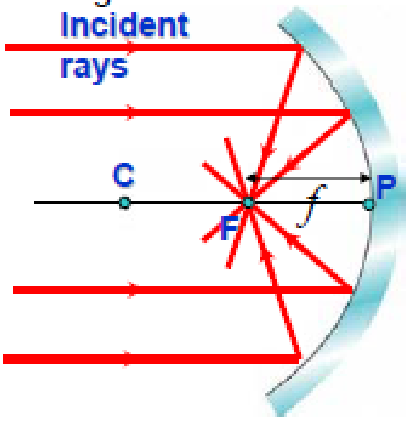
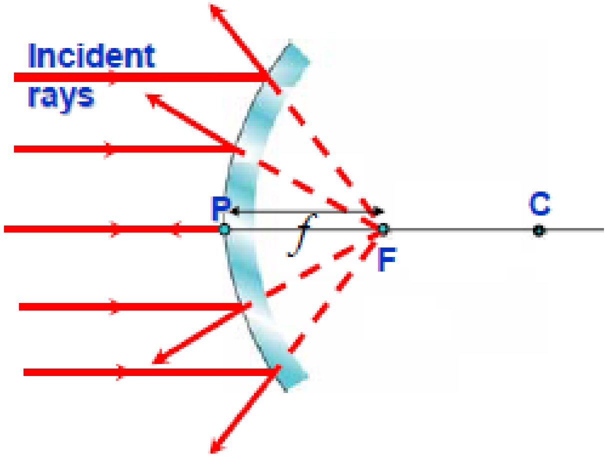
- **Radius of curvature, *r***
  - is defined as *the radius of the sphere of which a curved mirror forms a part.*
- **Pole or vertex (point P)**
  - is defined as *the point at the centre of the mirror.*
- **Principal axis**
  - is defined as *the straight line through the centre of curvature C and pole P of the mirror.*
- AB is called the **aperture** of the mirror.

1.2.2.Focal point (F) and Focal length (*f*) :

- Consider the ray diagram for concave and convex mirror as shown in figures below.

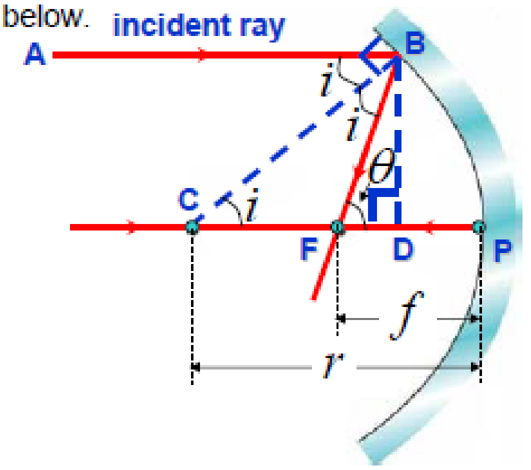




- From the figures,
  - Point F represents the focal point or focus of the mirrors.
  - Distance *f* represents the focal length of the mirrors.
  - The parallel incident rays represent the object infinitely far away from the spherical mirror e.g. the sun.
- **Focal point or focus, F**
  - for concave mirror – is defined as *a point where the incident parallel rays converge after reflection on the mirror.*
    - Its focal point is real (principal).
  - for convex mirror – is defined as *a point where the incident parallel rays seem to diverge from a point behind the mirror after reflection.*
    - Its focal point is virtual.
- **Focal length, *f***
  - Definition – is defined as *the distance between the focal point (focus) F and pole P of the spherical mirror.*
- The **paraxial rays** is defined as *the rays that are near to and almost parallel to the principal axis.*

2.2.2.Relationship Between focal length(*f*) and radius of curvature (r)

- Consider a ray AB parallel to the principal axis of concave mirror as shown in figure below.



- From the figure,

  △BCD ⟹ $\tan i = \dfrac{BD}{CD} \approx i$

  △BFD ⟹ $\tan \theta = \dfrac{BD}{FD} \approx \theta$

  Taken the angles are << small by considering the ray AB is paraxial ray.

- By using an isosceles triangle CBF, thus the angle θ is given by

$$\theta = 2i$$

then

$$\frac{BD}{FD} = 2\left(\frac{BD}{CD}\right)$$

$$CD = 2FD$$

- Because of AB is paraxial ray, thus point B is too close with pole P then

$$CD \approx CP = r$$

$$FD \approx FP = f$$

- Therefore

$$\boxed{r = 2f}$$

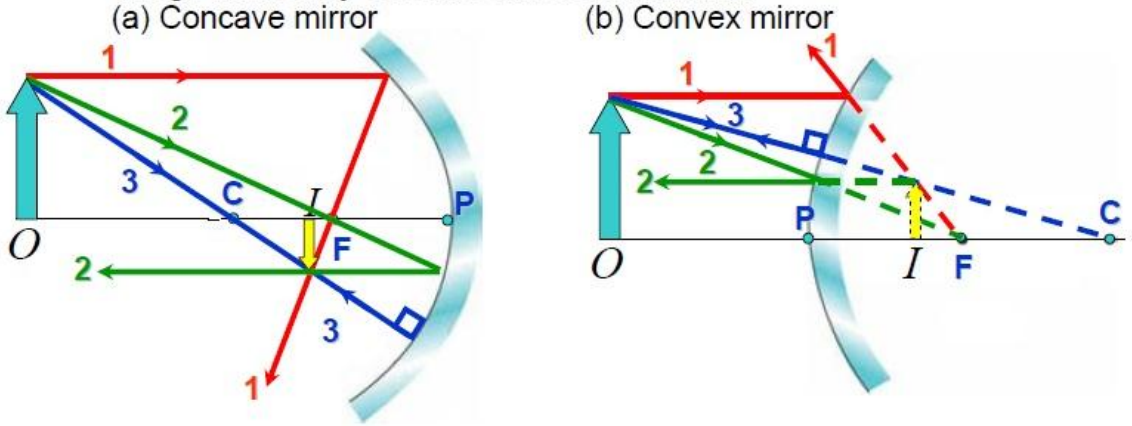
or

$$\boxed{f = \frac{r}{2}}$$

This relationship also valid for convex mirror.

3.2.Ray Diagrams for spherical mirrors

- Definition – is defined as *the simple graphical method to indicate the positions of the object and image in a system of mirrors or lenses.*
- Ray diagrams below showing the graphical method of locating an image formed by concave and convex mirror.

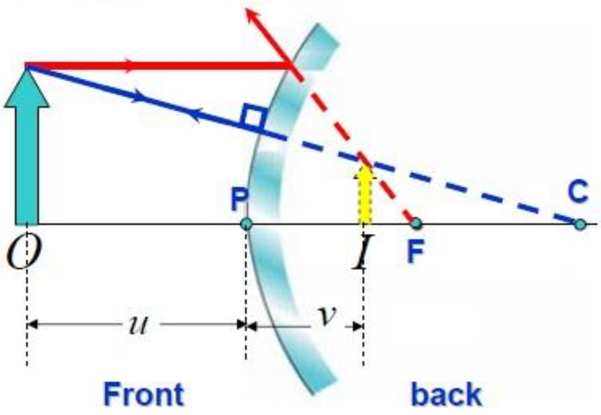


At least any two rays for drawing the ray diagram.

- **Ray 1** - Parallel to principal axis, after reflection, passes through the focal point (focus) F of a concave mirror or appears to come from the focal point F of a convex mirror.
- **Ray 2** - Passes or directed towards focal point F reflected parallel to principal axis.
- **Ray 3** - Passes or directed towards centre of curvature C, reflected back along the same path.

4.2. Images formed by a convex mirrors

- Ray diagrams below showing the graphical method of locating an image formed by a convex mirror.



- Properties of image formed are
  - virtual
  - upright
  - diminished (smaller than the object)
  - formed at the back of the mirror
- Object position $\rightarrow$ any position in front of the convex mirror.