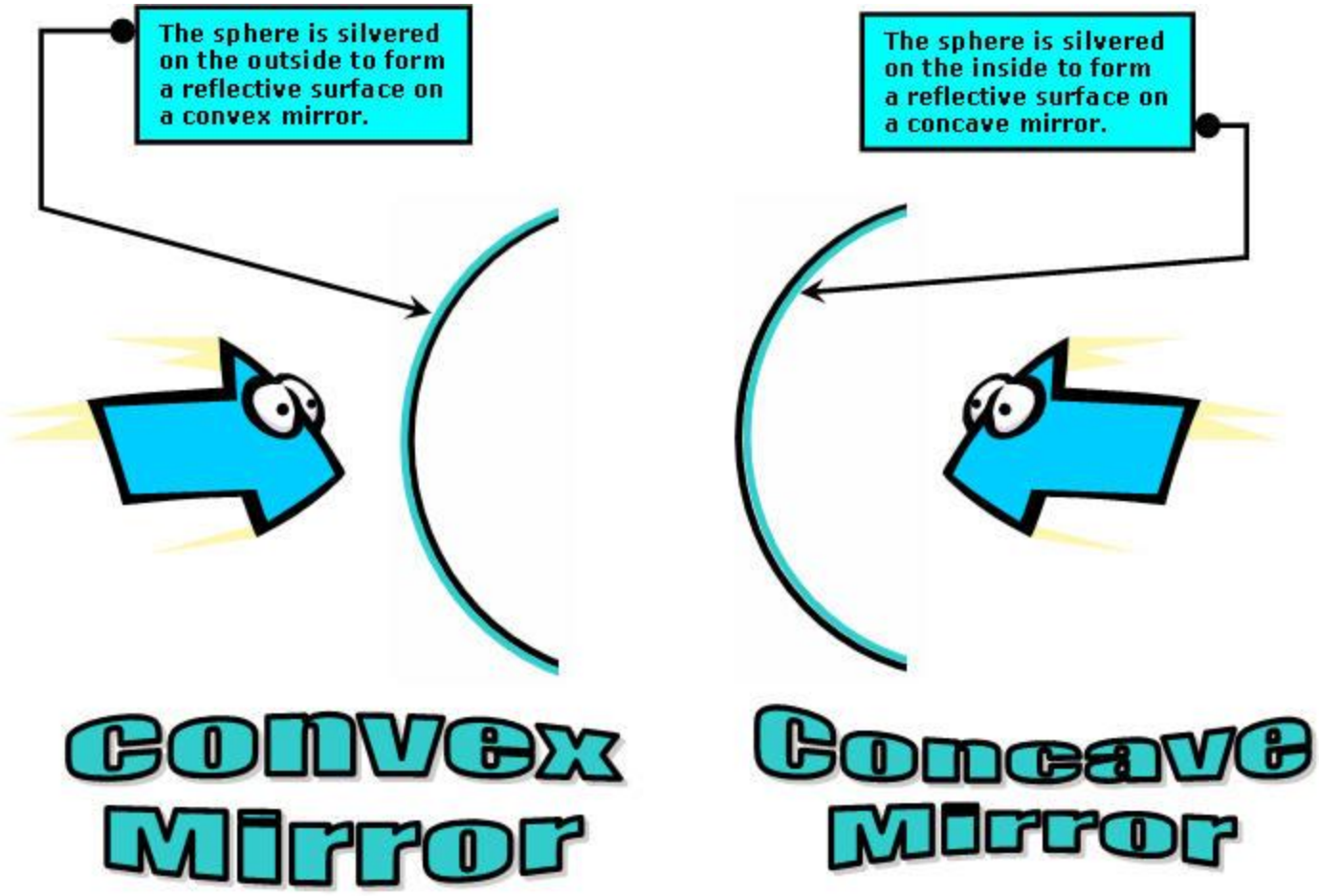
Learning Objectives

- To observe the effect of light travelling in straight lines on the formation of images
- To observe a ‘real’ image
- To apply the laws of reflection for curved mirrors

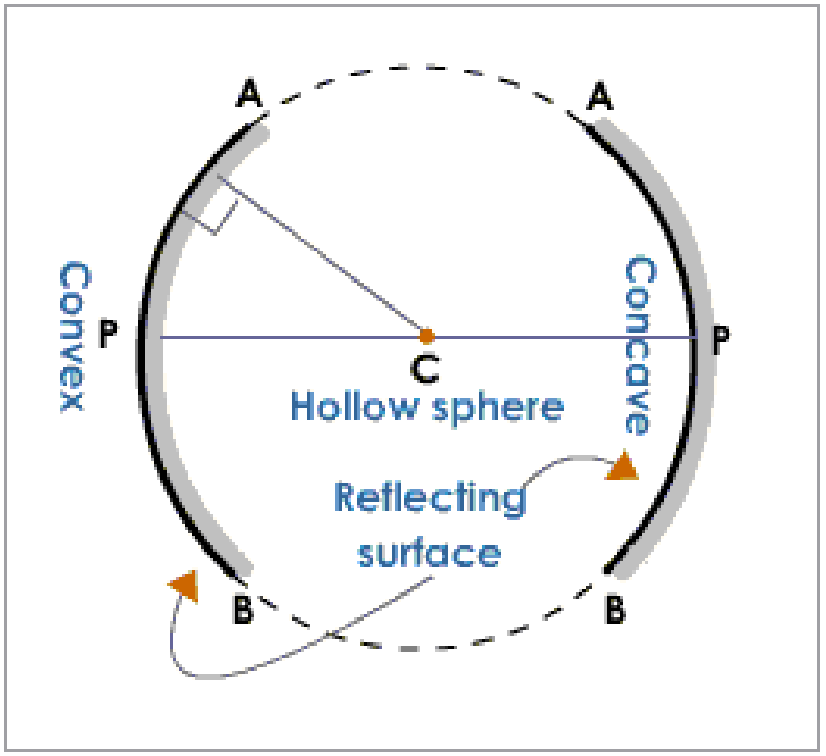
11.9: Images in Curved Mirrors

Convex vs. Concave



Terminology of Concave Mirrors

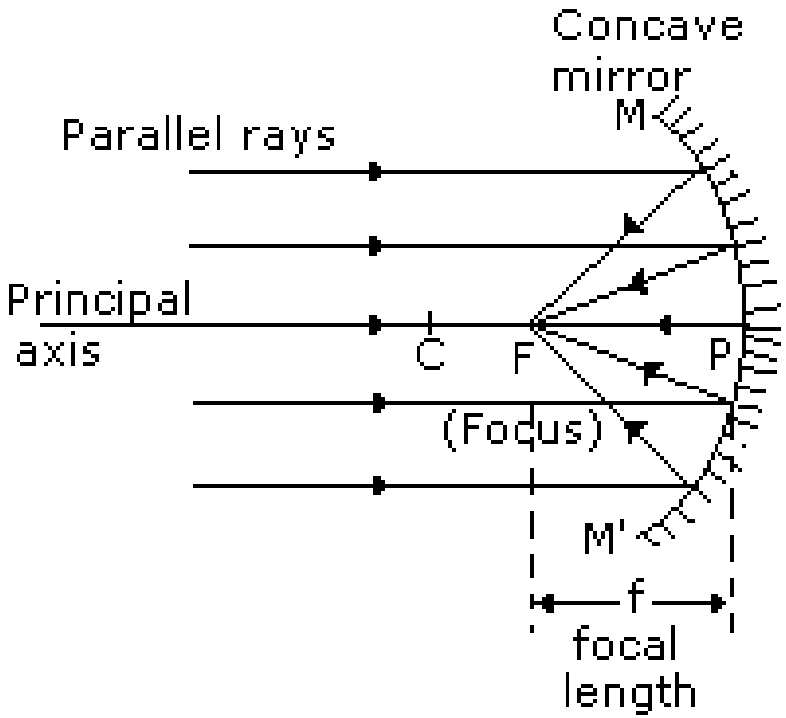
Centre of Curvature (C): The centre of the sphere whose surface has been used to make the mirror.

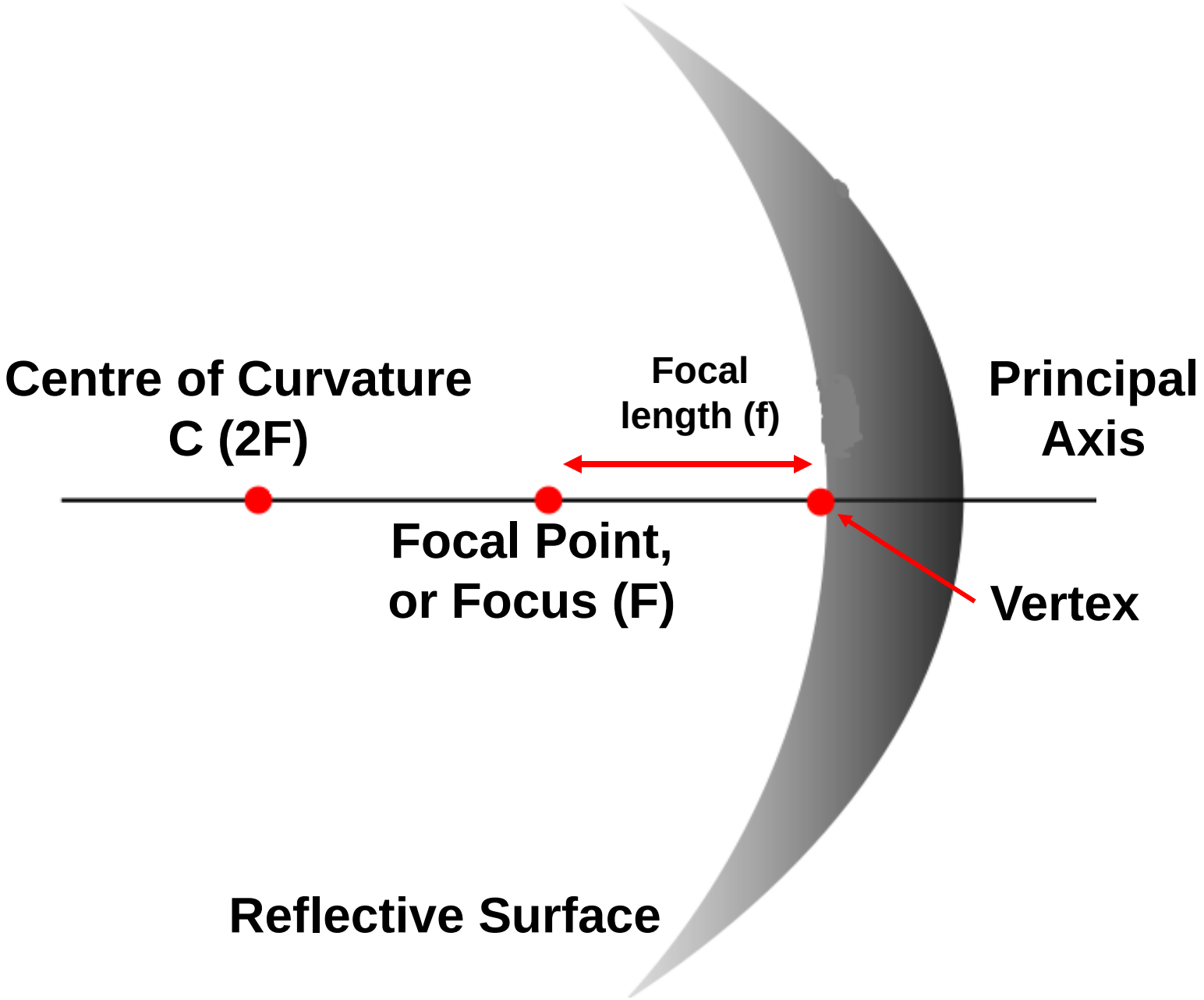


- **Principal Axis:** The line through the centre of curvature to the midpoint of the mirror.

- **Vertex (V):** The point where the principal axis meets the mirror.

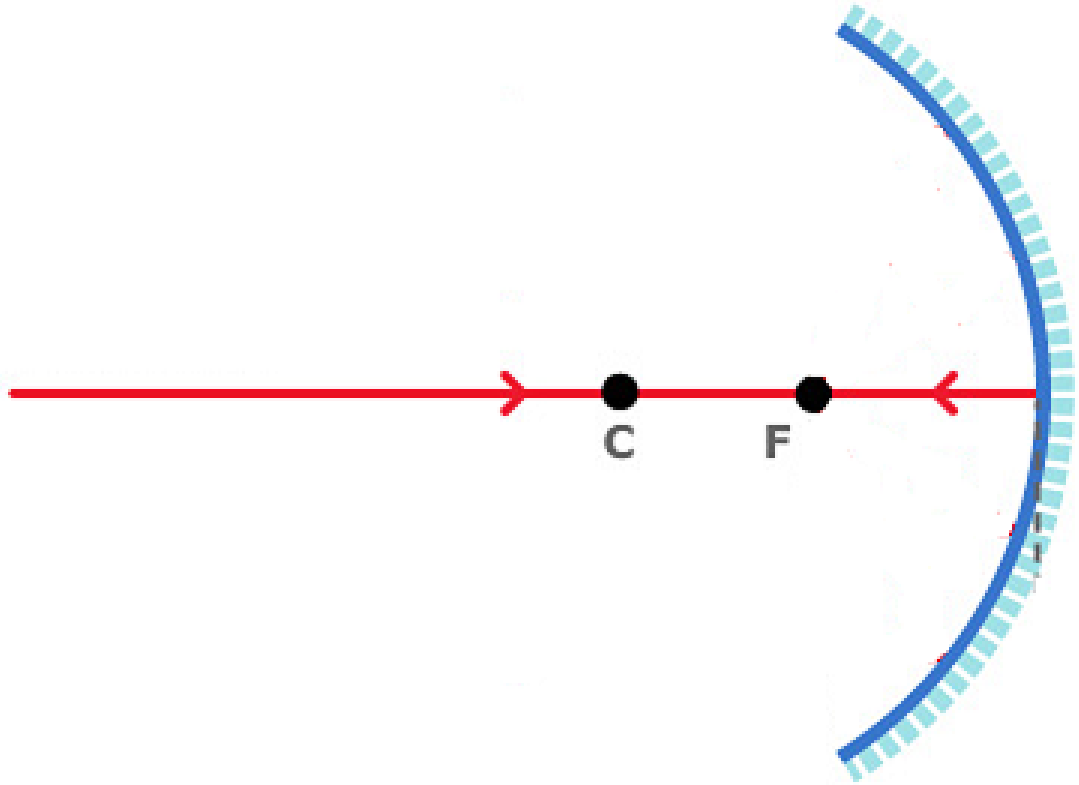
Focus (F): the point where reflected rays from parallel incident rays pass through, or **converge**. This is why concave mirrors are sometimes called ***converging*** mirrors.



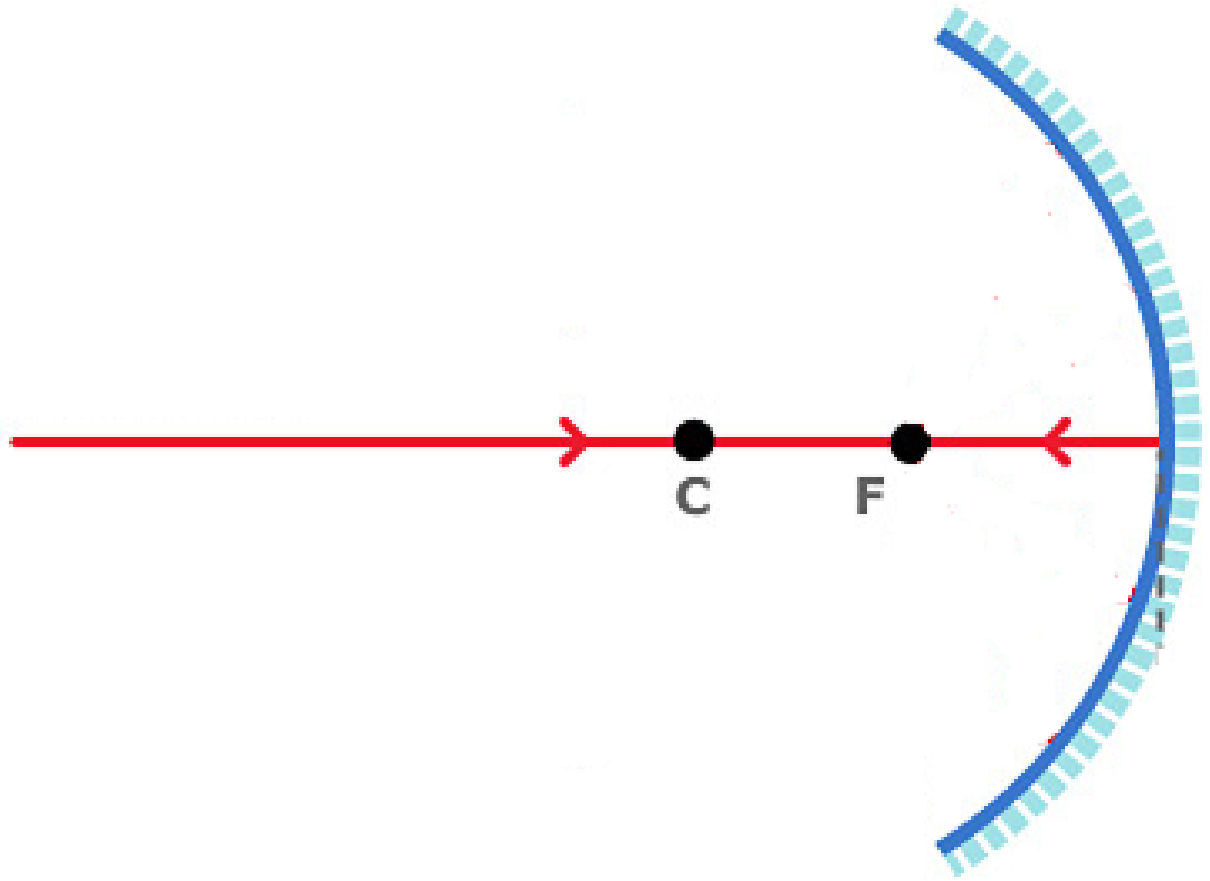

Centre of Curvature
C (2F)
Focal
length (f)
Principal
Axis
Focal Point,
or Focus (F)
Vertex
Reflective Surface

Laws of Reflection in Converging (Concave) Mirrors

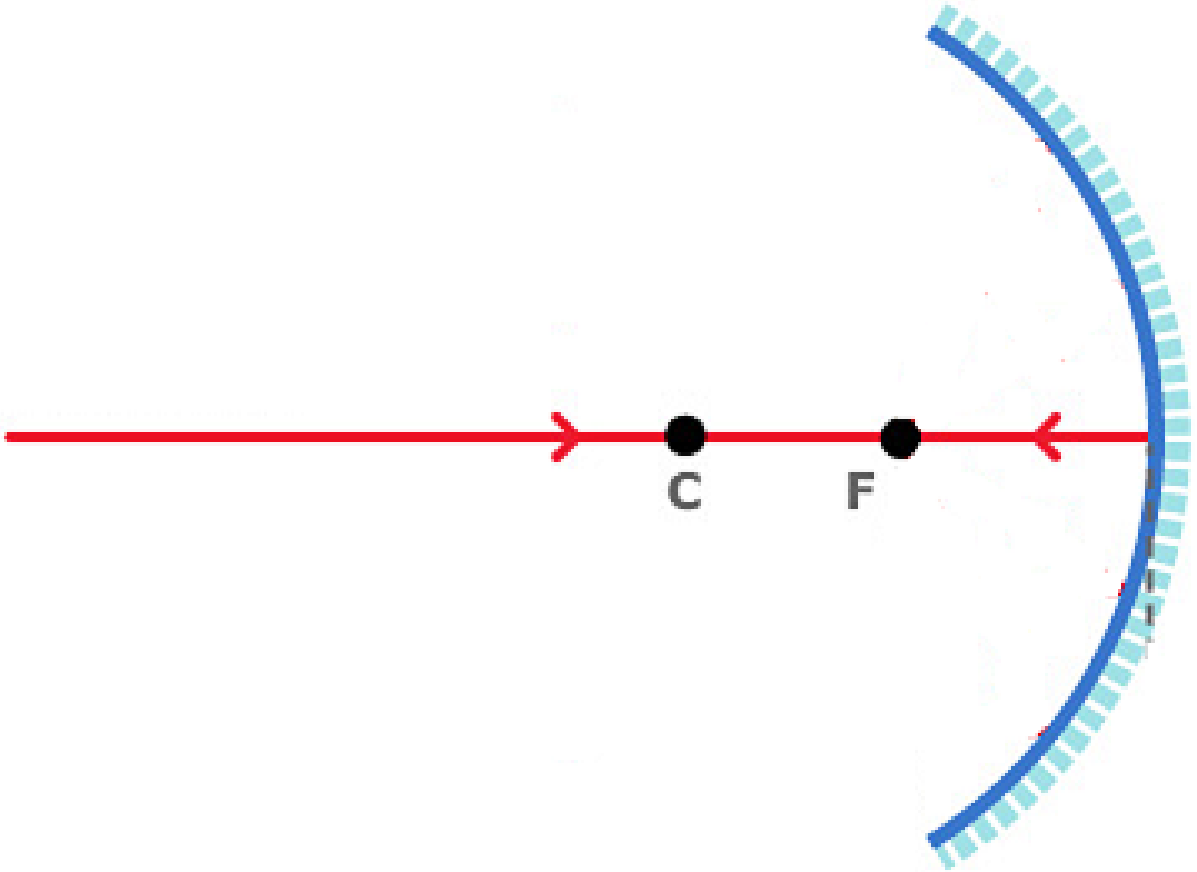
1. A light ray **parallel** to the **principal axis** is reflected **through** the **focus**.



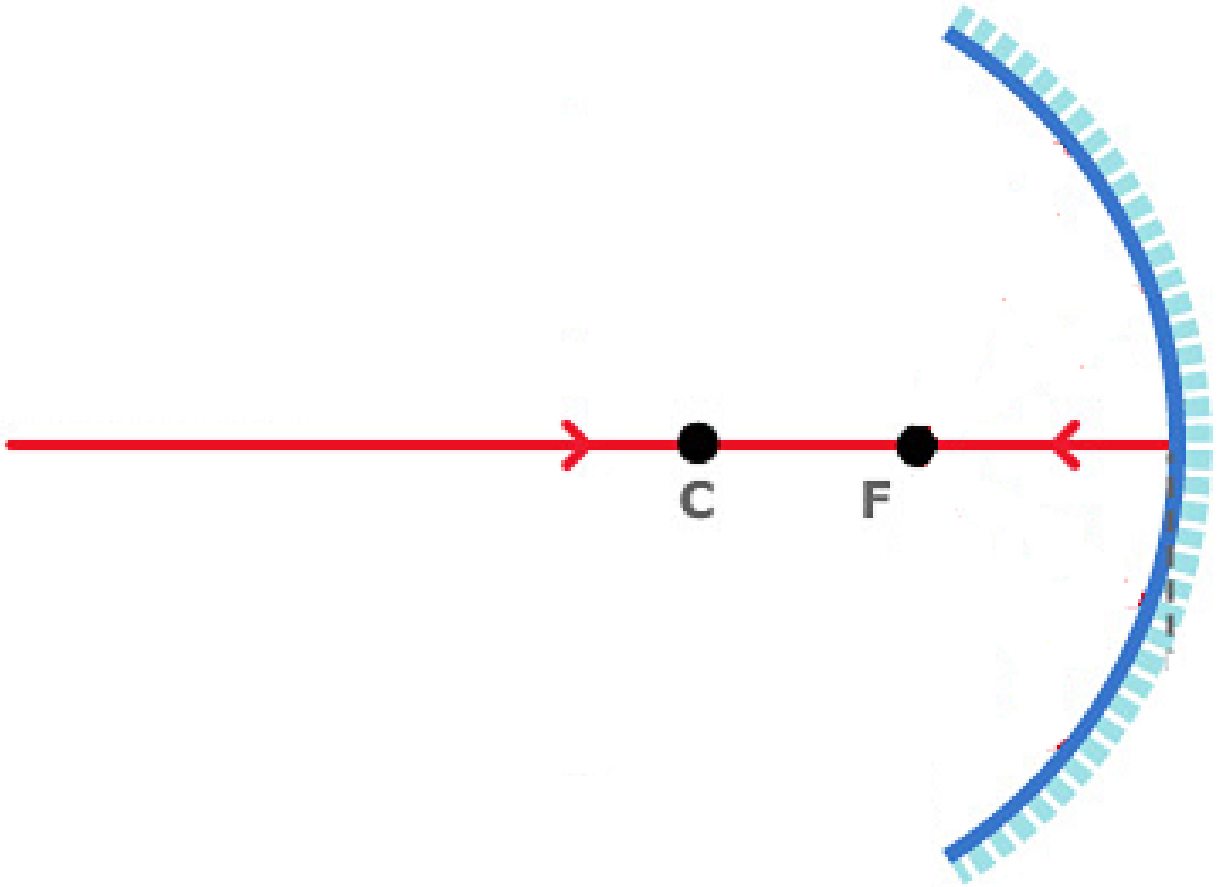
2. A ray **through** the **focus** will reflect **parallel** to the **principal axis**.



3. A ray **through the centre of curvature** is reflected **back on itself.**

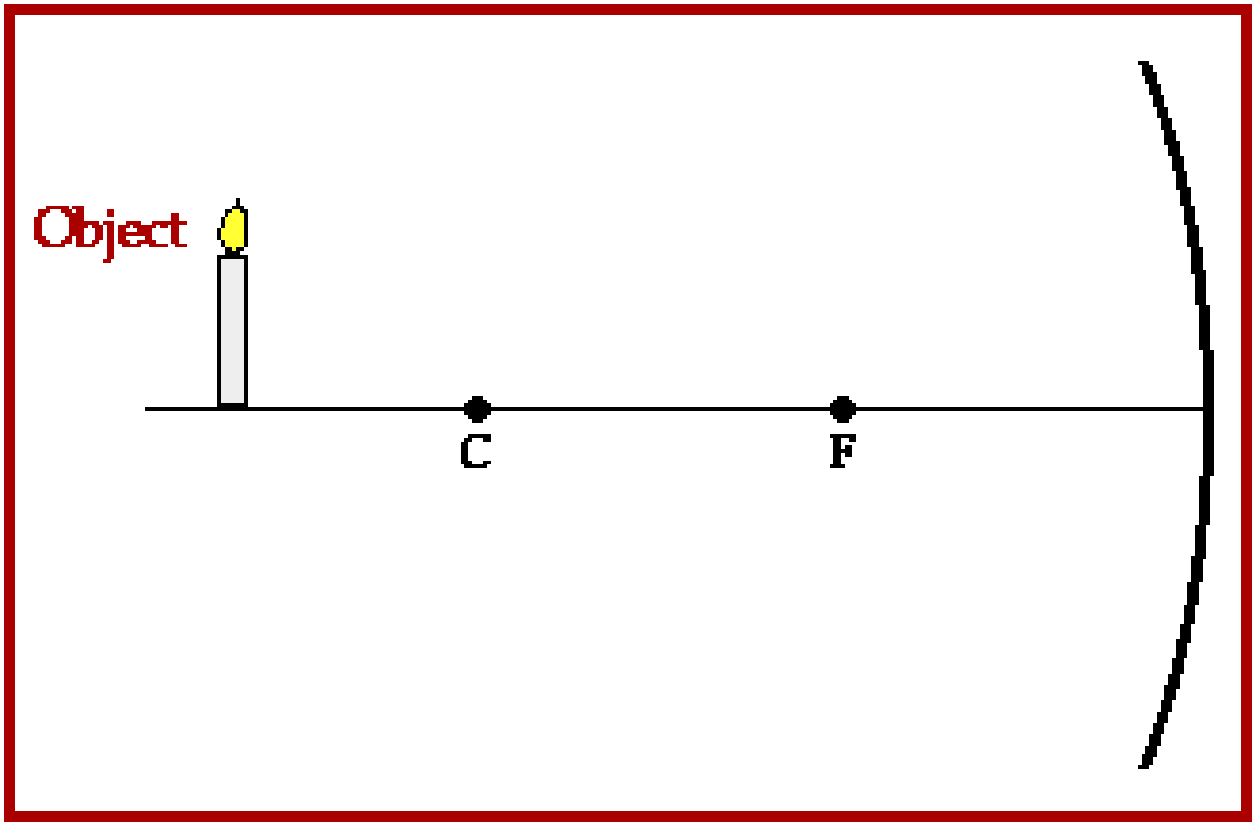


4. A ray **aimed at the vertex** will follow the **law of reflection**.

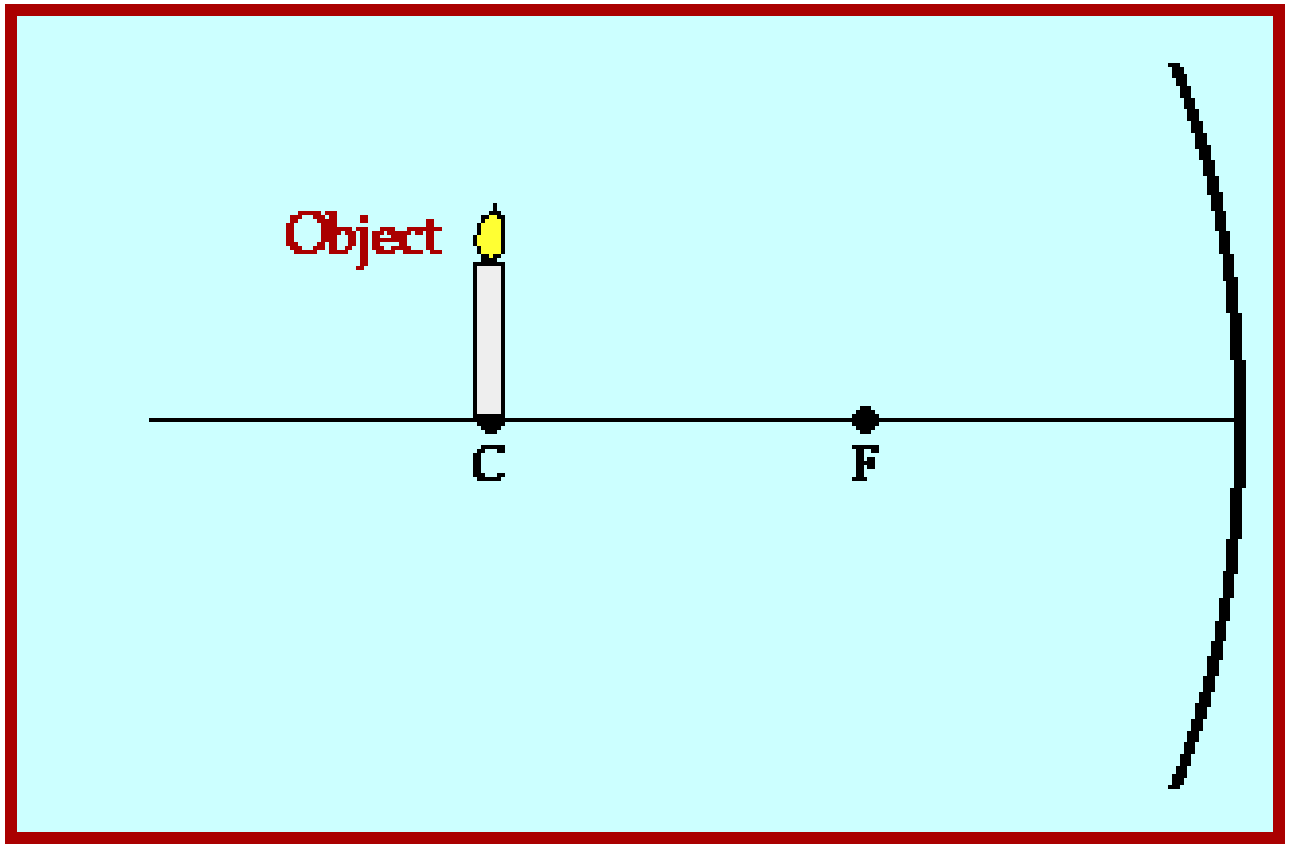


Locating the Image in a Concave Mirror

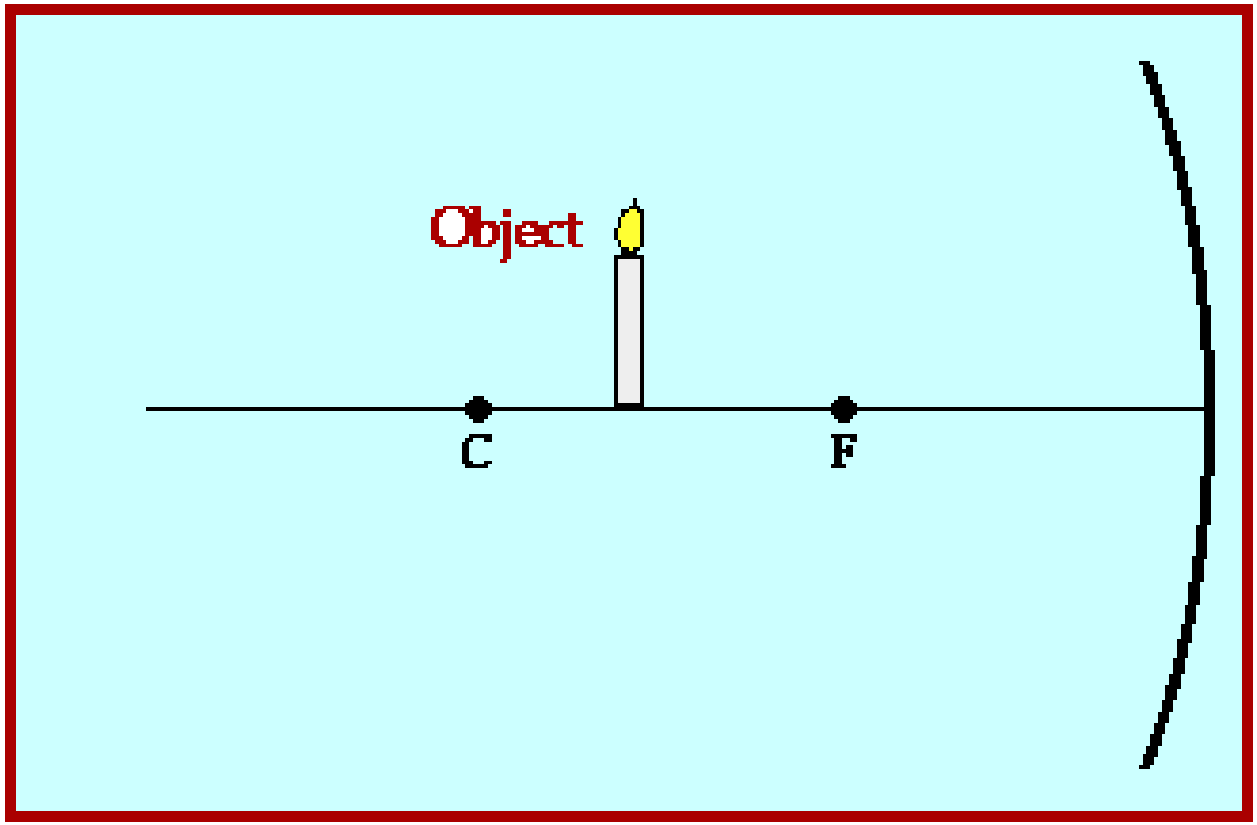
Case A: Object is placed behind C



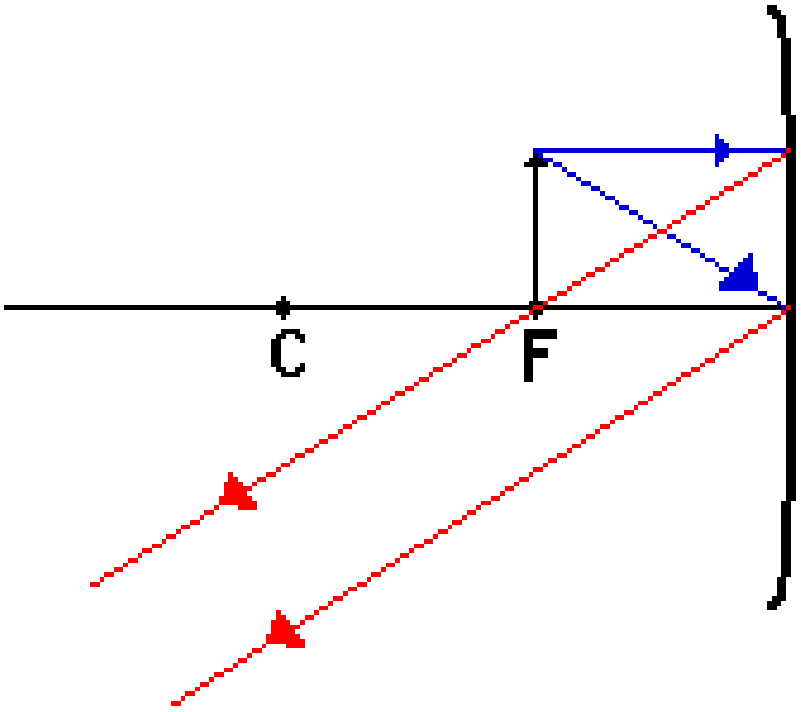
Case B: Object is placed at C



Case C: Object is placed between C and F

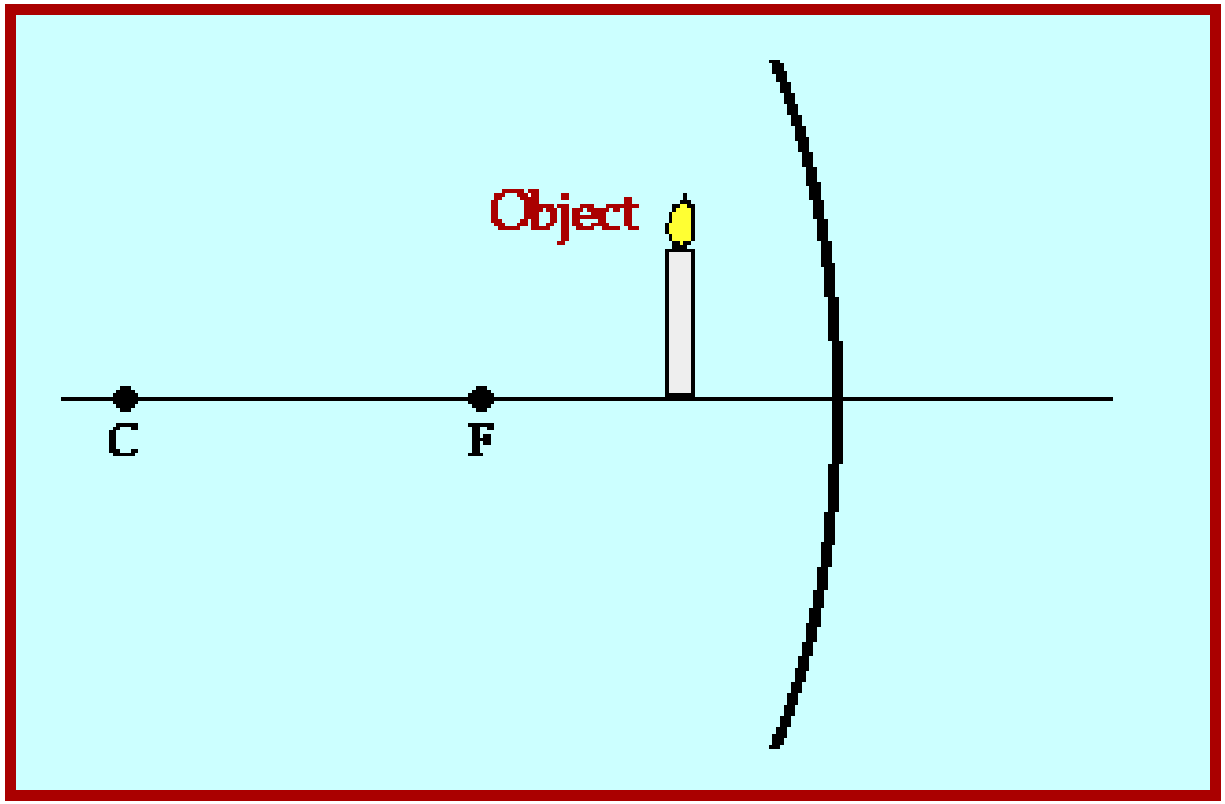


Case D: Object is placed at F



Ray Diagram for Object Located at F
(an image is not formed)

Case E: Object is placed in front of F



Real Images

- A real image is created when light rays **actually arrive** at the image location.
- If you place a screen in front of the mirror, a focused image will be seen.
- When an object is placed **beyond F**, an inverted, **real** image will be formed.
- When an object is placed **in front of F**, an upright, **virtual** image will be formed.

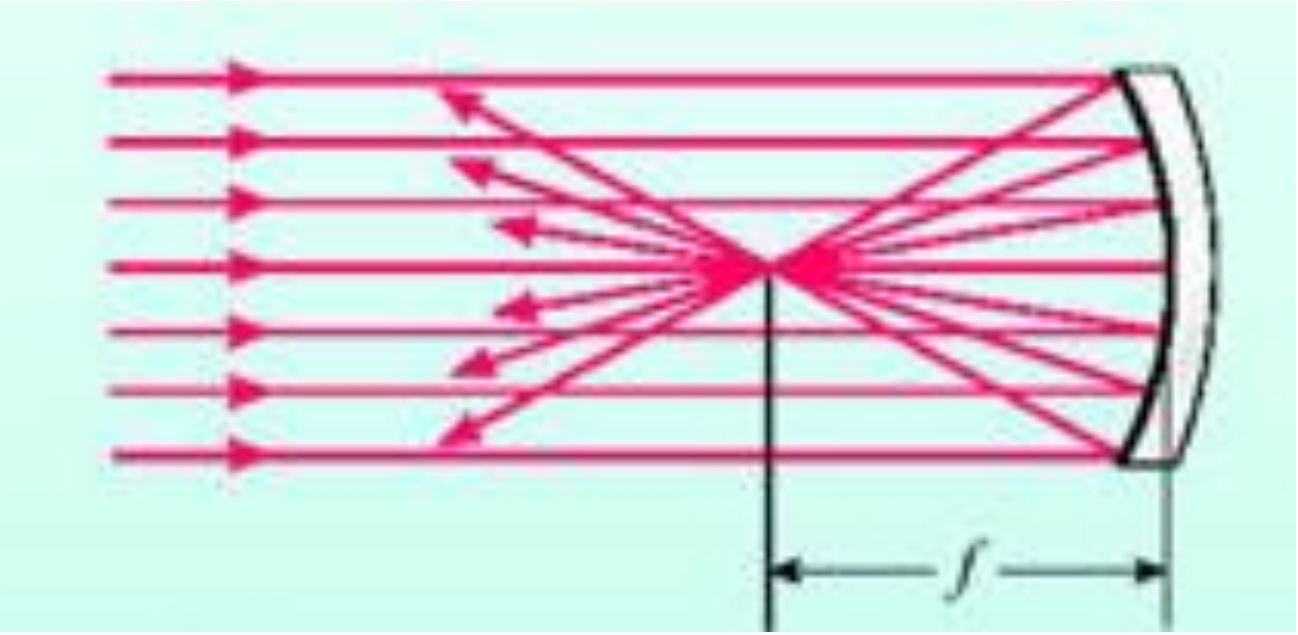
Properties of Images in Converging Mirrors

Object Location	Image **S**ize	Image **A**ttitude	Image **L**ocation	Image **T**ype
Beyond C	Smaller	Inverted	In front, closer	Real
At C	Same	Inverted	In front, same	Real
Between C & F	Larger	Inverted	In front, further	Real
At F	No	Clear	Image	
Inside F	Larger	Upright	Behind, further	Virtual

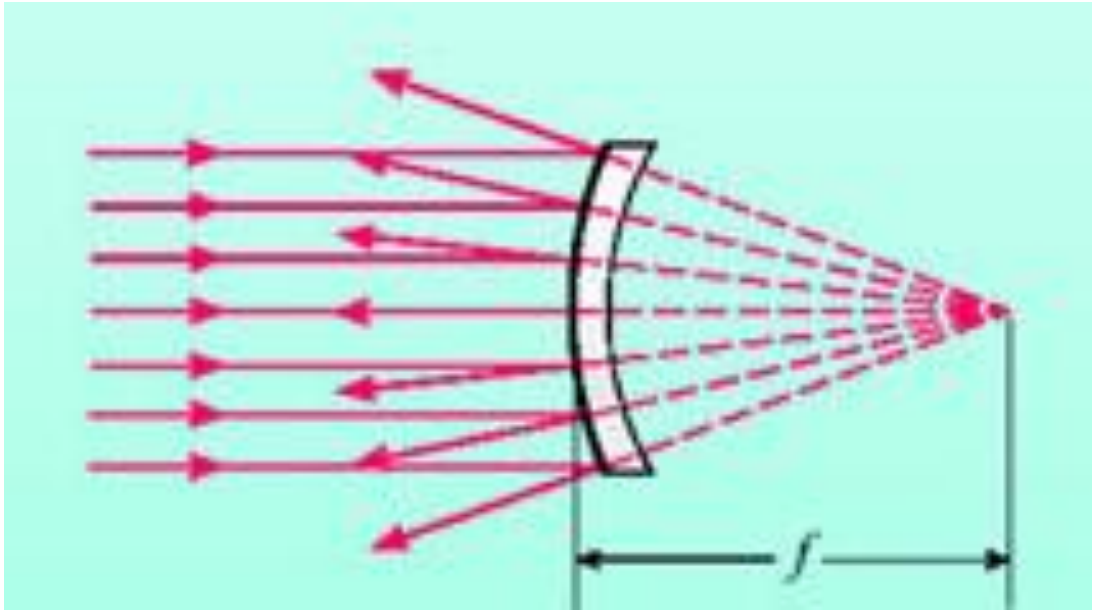
Applications of Converging Mirrors

- Searchlights
- Satellite dishes
- Solar cookers
- Stadium lighting

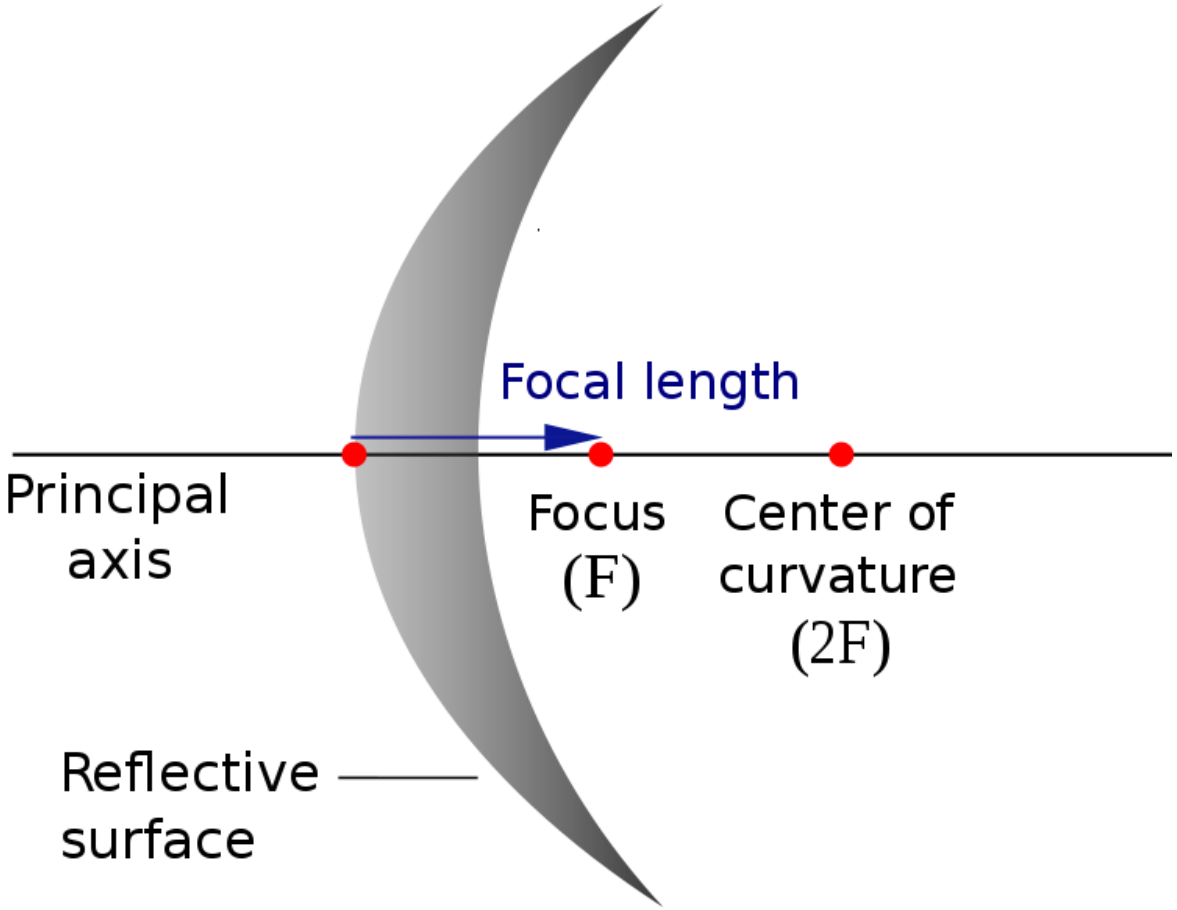
Concave mirrors cause reflected rays to **converge** to a central point (Focus), giving a bright, forward, beam of light. The less curvature, the longer the focal length.



Convex mirrors cause reflected rays to **diverge**, giving a much wider field of view.



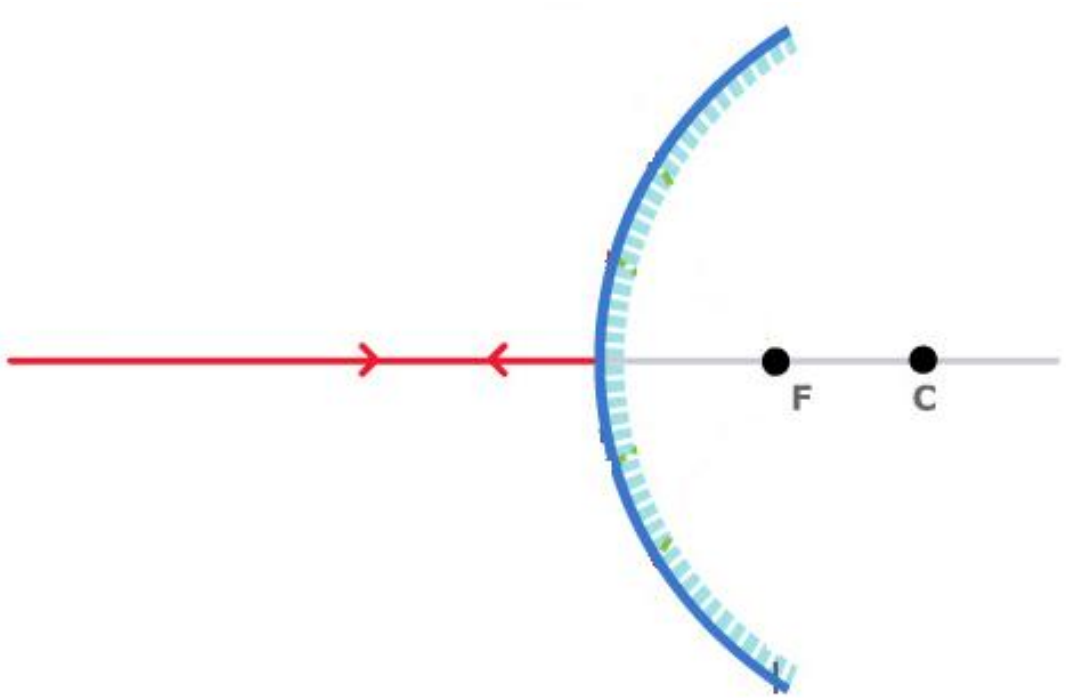
In a convex / diverging mirror, F and C are **behind** the reflective surface.



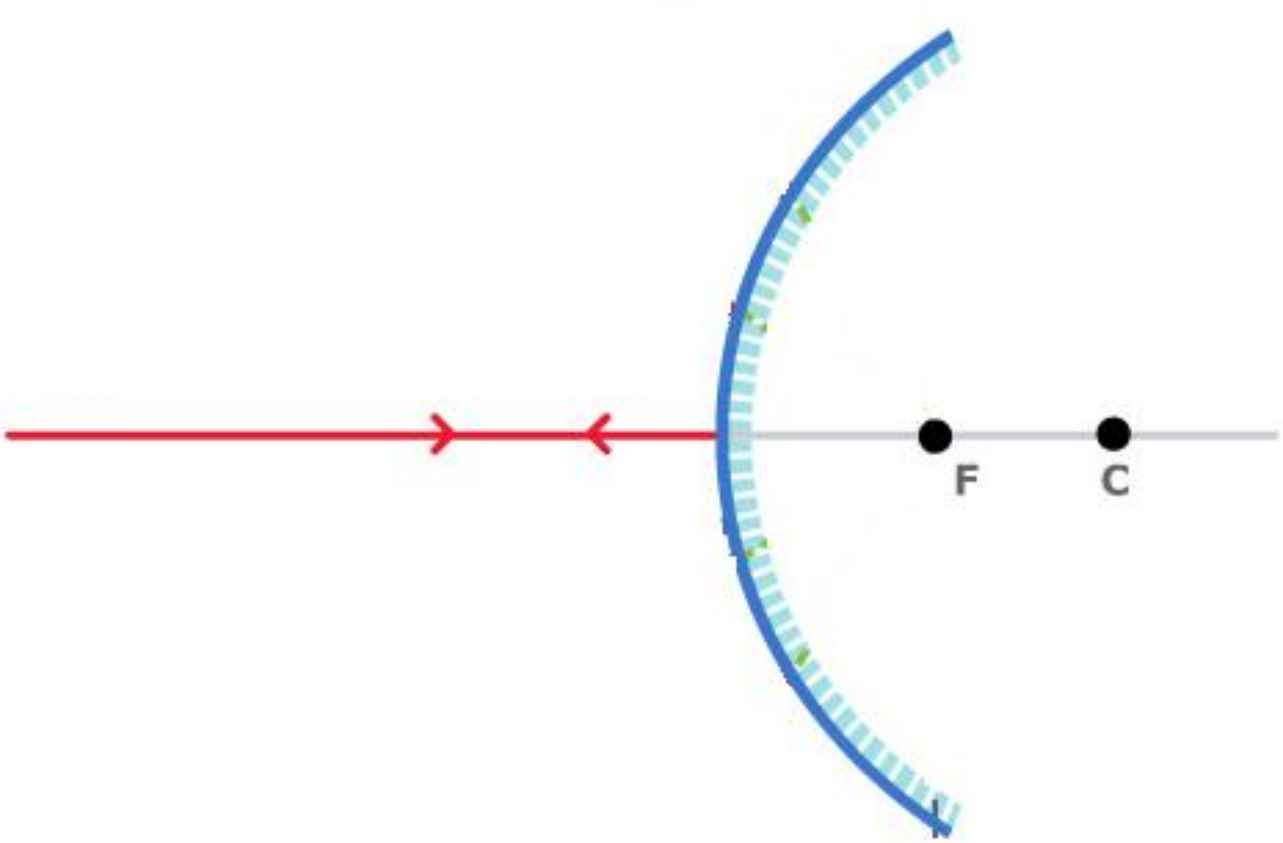
Locating Images in **Diverging** Mirrors

Rules:

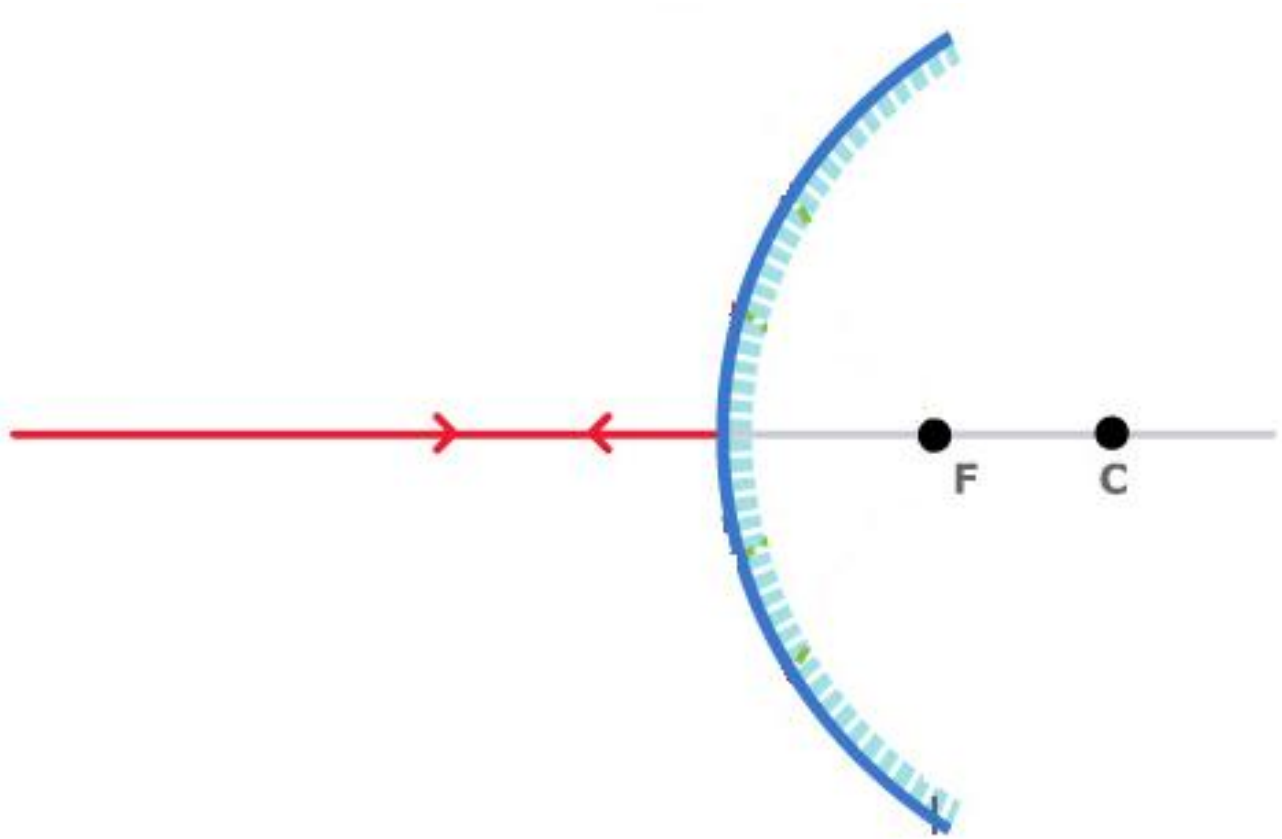
1. A ray parallel to the principal axis is reflected **as if** it had come through the focus.



2. A ray aimed at the focus is reflected parallel to the principal axis.

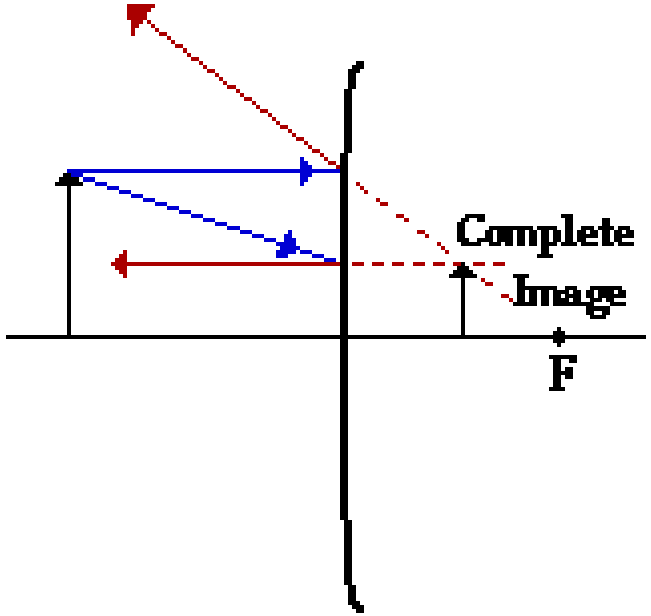


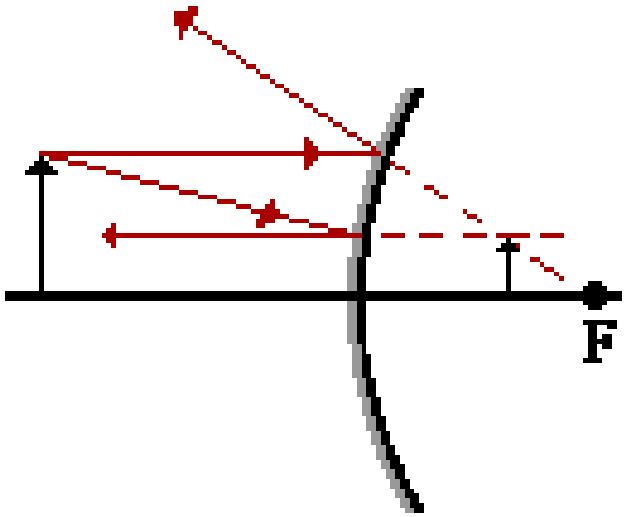
3. A ray aimed at the centre of curvature is reflected back on itself.

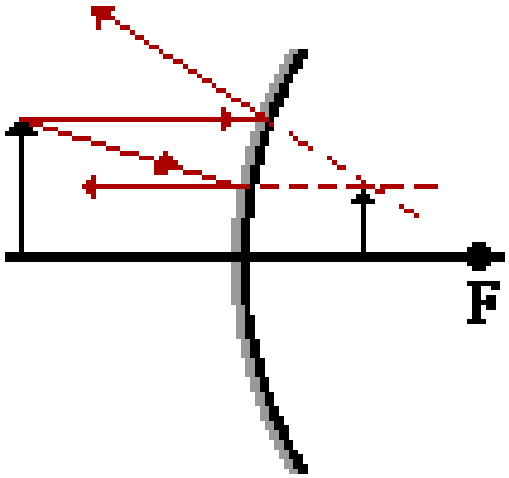


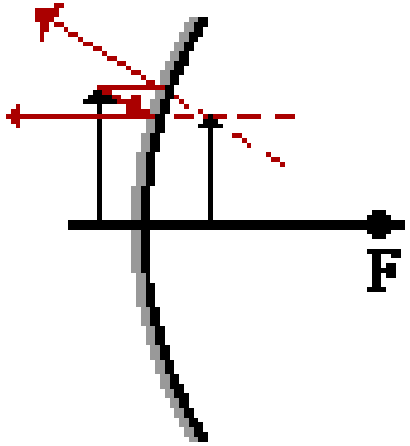
Images in a **Diverging** (Convex) Mirror

- Images will always be **smaller** and **virtual** because rays never cross to form a real image.




F


F


F

Applications of Diverging Mirrors

- Rear-view mirrors
- Security mirrors

ROY G BIV says:

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- Worksheet: Images in Curved Mirrors