L03 - Reflection

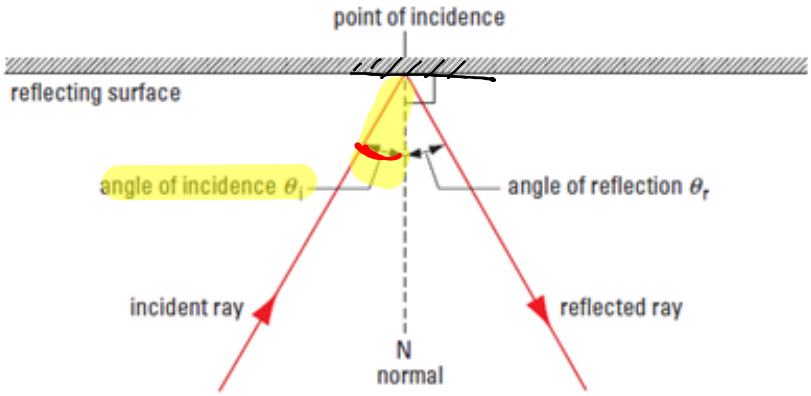
Demo - Holographic Pig

Why is there a nice reflection in one picture but not in theother?

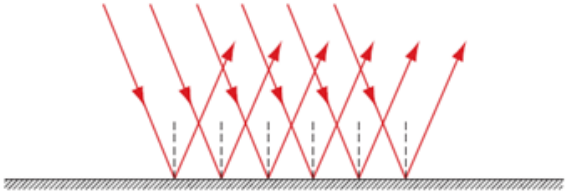
▲ **Figure 13.25** a) Reflection in a smooth lake

b) Diffuse reflection due to windy conditions

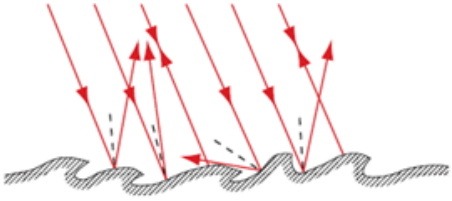
The law of reflection - the angle of incidence is equal to the angle of reflection



▲ **Figure 13.28** Ray diagram and terminology for regular reflection



▲ **Figure 13.26** Ray diagram of specular (regular) reflection



▲ **Figure 13.27** Ray diagram of diffuse (irregular) reflection

Characteristics of Reflected Images

Demo: Use the shaped mirrors to discuss different characteristics.

Image Characteristics

$m > 1 \rightarrow$ Enlarged
$m < 1 \rightarrow$ Diminished

Image Characteristics

- Magnification: Relates the size of the image to the size of the object
- Attitude: Erect or inverted ↑ ↓
- Position: Displacement from the mirror
- Type: Virtual or Real

- **Real Image –** an image from which light rays come; can be formed on a reflecting surface. (Ex. Projector)

- **Virtual image –** an image from which light rays appear to come; cannot be formed on a screen (Ex. Convex mirror in a gas station)

Demo – Holographic Pig

Definitions for Curved Mirrors

Centre of Curvature (C): The point in space that would represent the center of sphere from which the curved mirror was cut

Radius of Curvature (R): The distance from the center of curvature to the mirrors surface

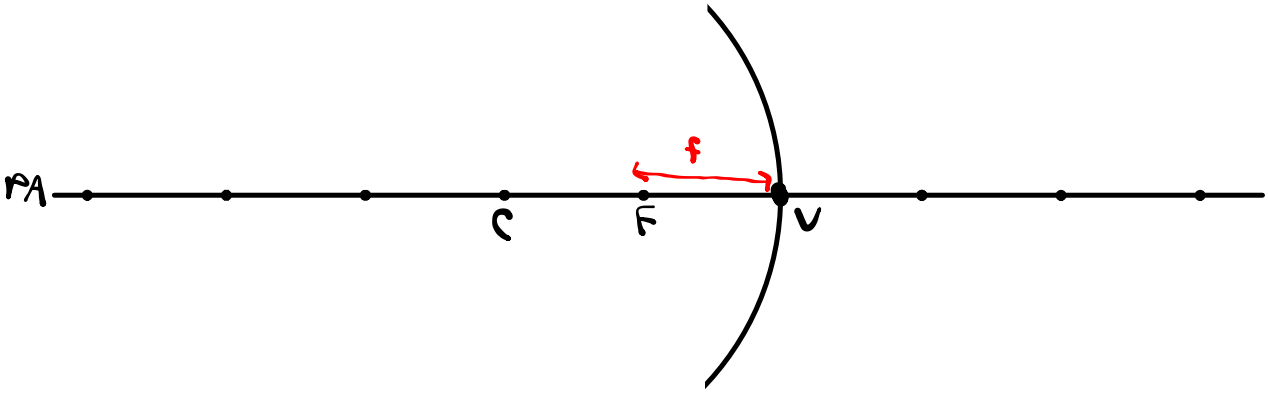
Vertex (V): The geometric center of the curved mirror

Principal Axis (PA): The horizontal line running through the Vertex (V) and Principal Focal Point (F)

Principal Focal Point (F): The point through which horizontal rays will reflect through; located on the Principal Axis.

Focal Length (f): The distance between the Vertex (V) and the Principal Focal Point (F)

Label the diagram below with the definitions.



Before going too far...

...what is a "Ray Diagram"...

...and what does it look like?

https://phet.colorado.edu/en/simulation/geometric-optics

Settings:

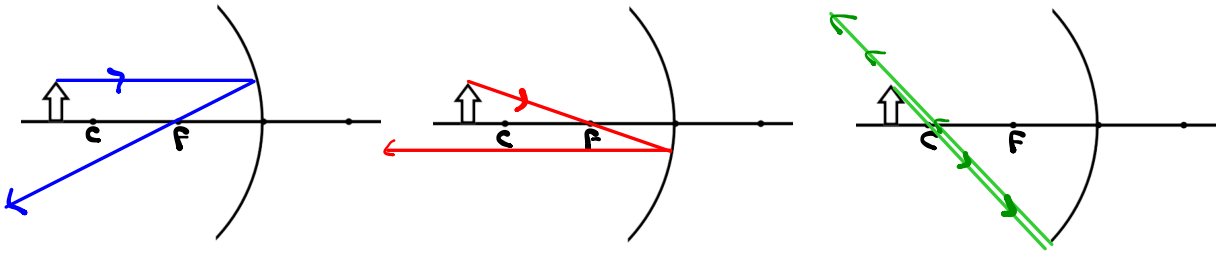
- Principal Rays
- Change object to Arrow (bottom of arrow on Principal Axis)
- Maximize diameter to 1.3 meters.
- Goggle on "Virtual Image"

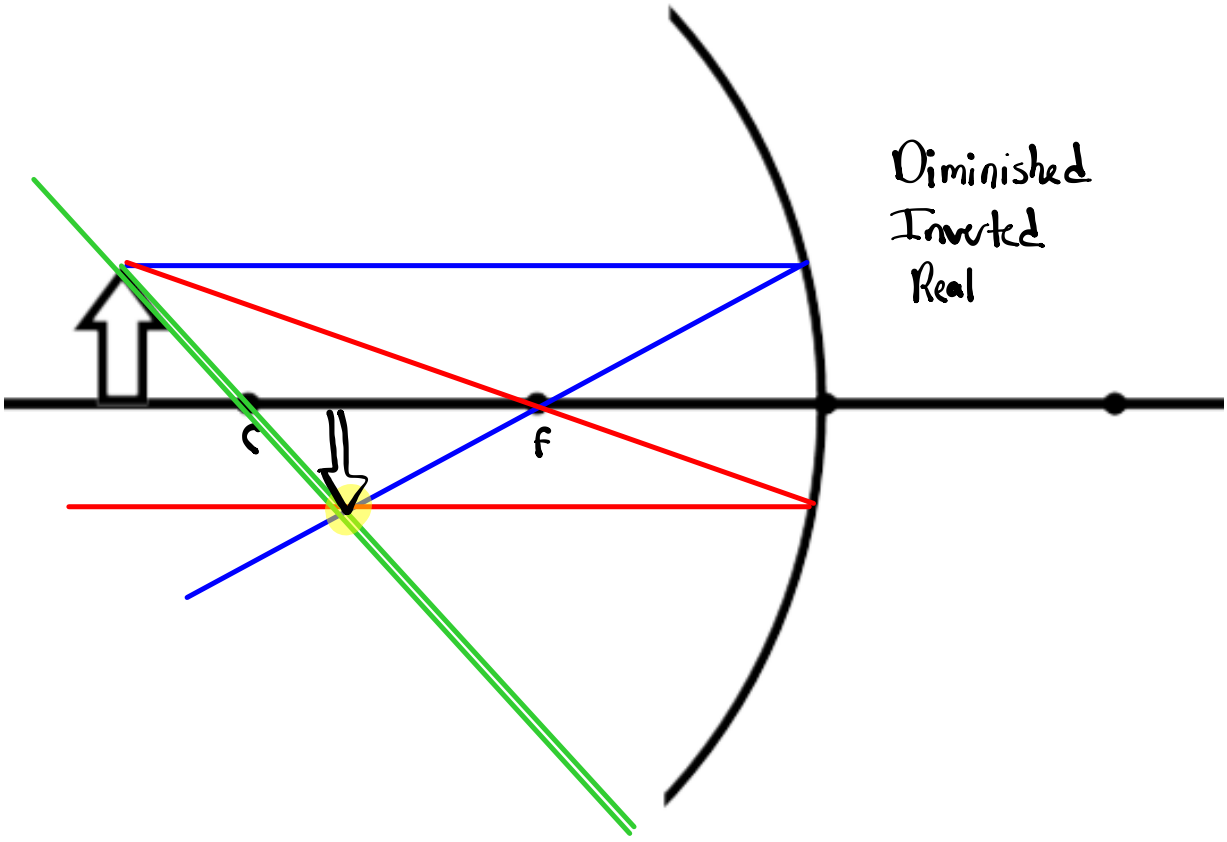
NOTE: This simulation is for Lenses, NOT mirrors. But it pretty much works the same way.

Ray Diagrams for Converging/Concave Mirrors

Drawing Ray Diagrams for Converging Curved Mirrors:

1) Parallel to the Principal Axis reflect through the Focal Point
2) Through the Focal Point reflect parallel to the Principal Axis
3) Through the Centre of Curvature reflects back through the Center of Curvature





Ray Diagrams for Converging/Concave Mirrors

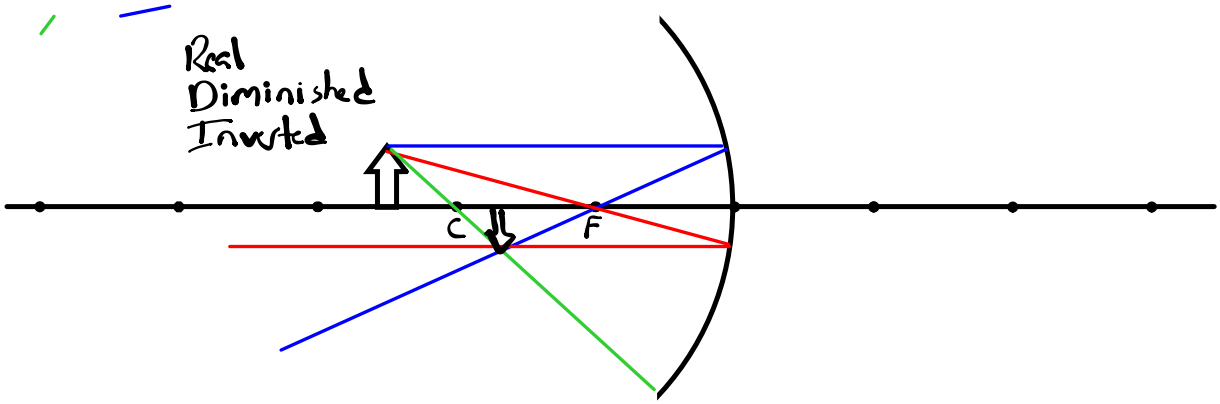
Drawing Ray Diagrams for Converging Curved Mirrors:

1) Parallel to the Principal Axis reflect through the Focal Point
2) Through the Focal Point reflect parallel to the Principal Axis
3) Through the Centre of Curvature reflects back through the Center of Curvature

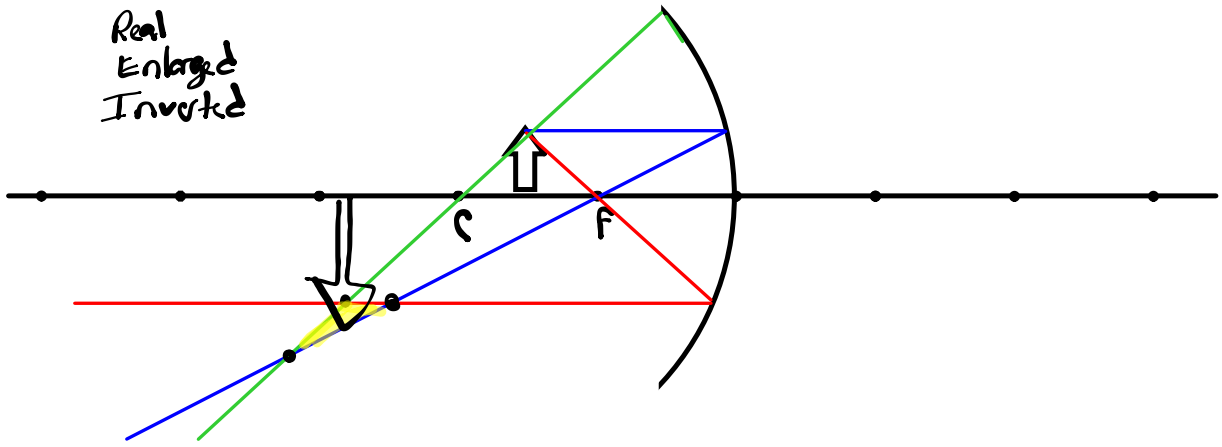
Image Characteristics

- Magnification: Relates the size of the image to the size of the object
- Attitude: Erect or inverted
- Position: Displacement from the mirror
- Type: Virtual or Real

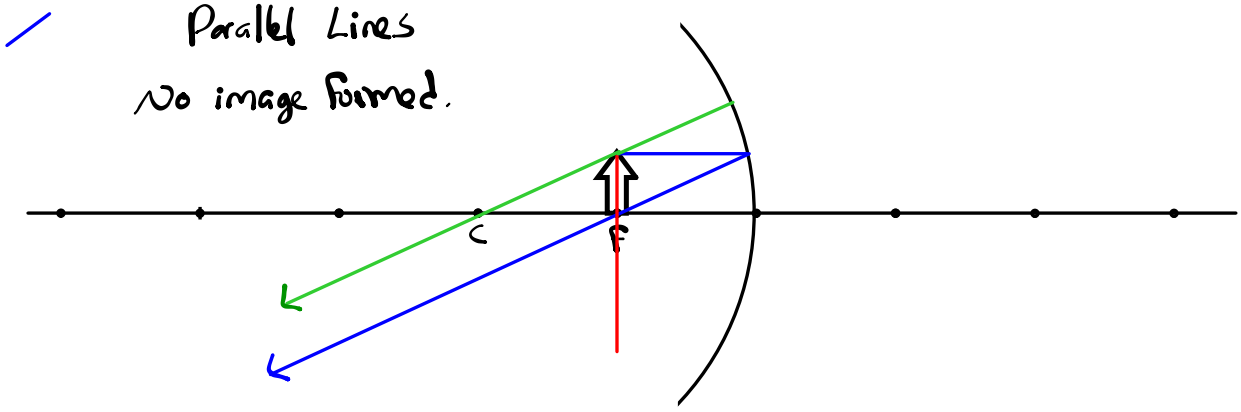
Q1: Draw a ray diagram for an object outside the Center of Curvature.
Describe its characteristics.



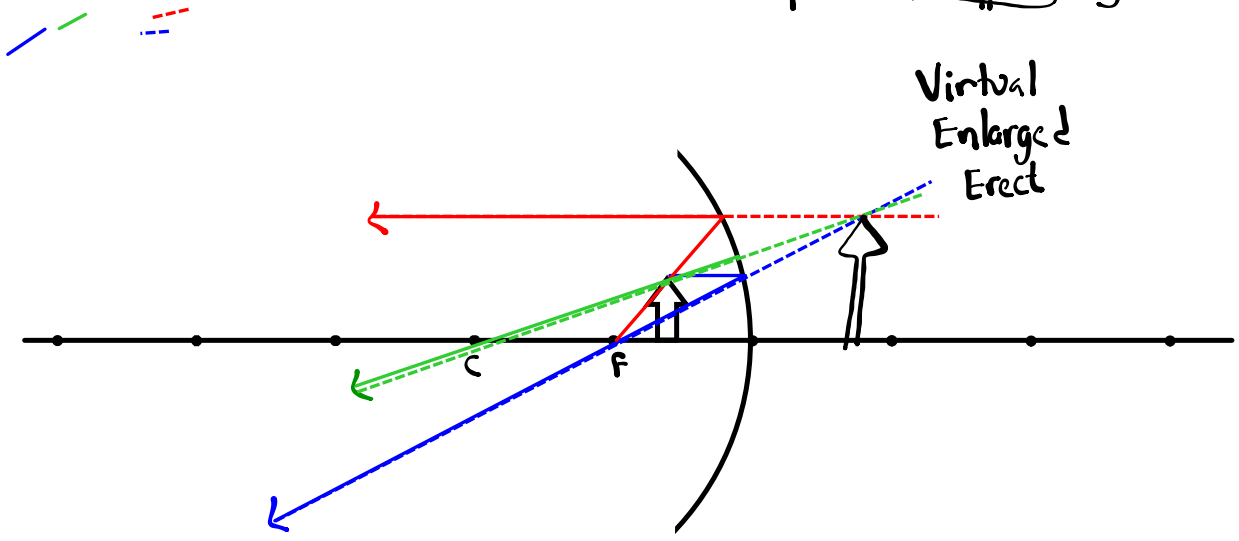
Q2: Draw a ray diagram for an object between the C and F
Describe its characteristics.



Q3: Draw a ray diagram for an object on the Focal Point
Describe its characteristics.



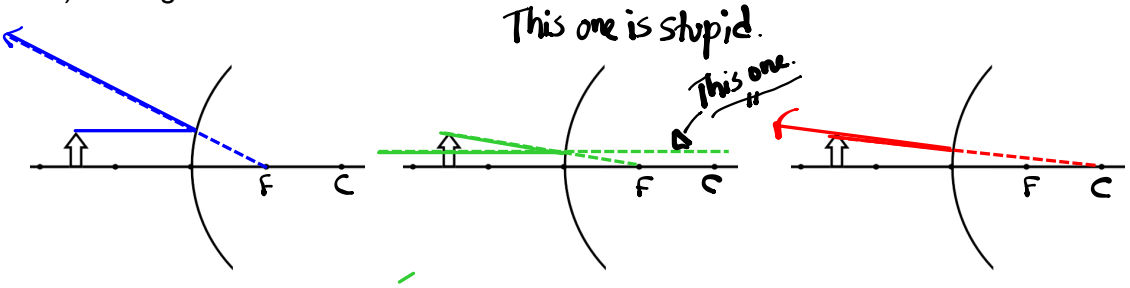
Q4: Draw a ray diagram for an object inside the Focal Point
Describe its characteristics.

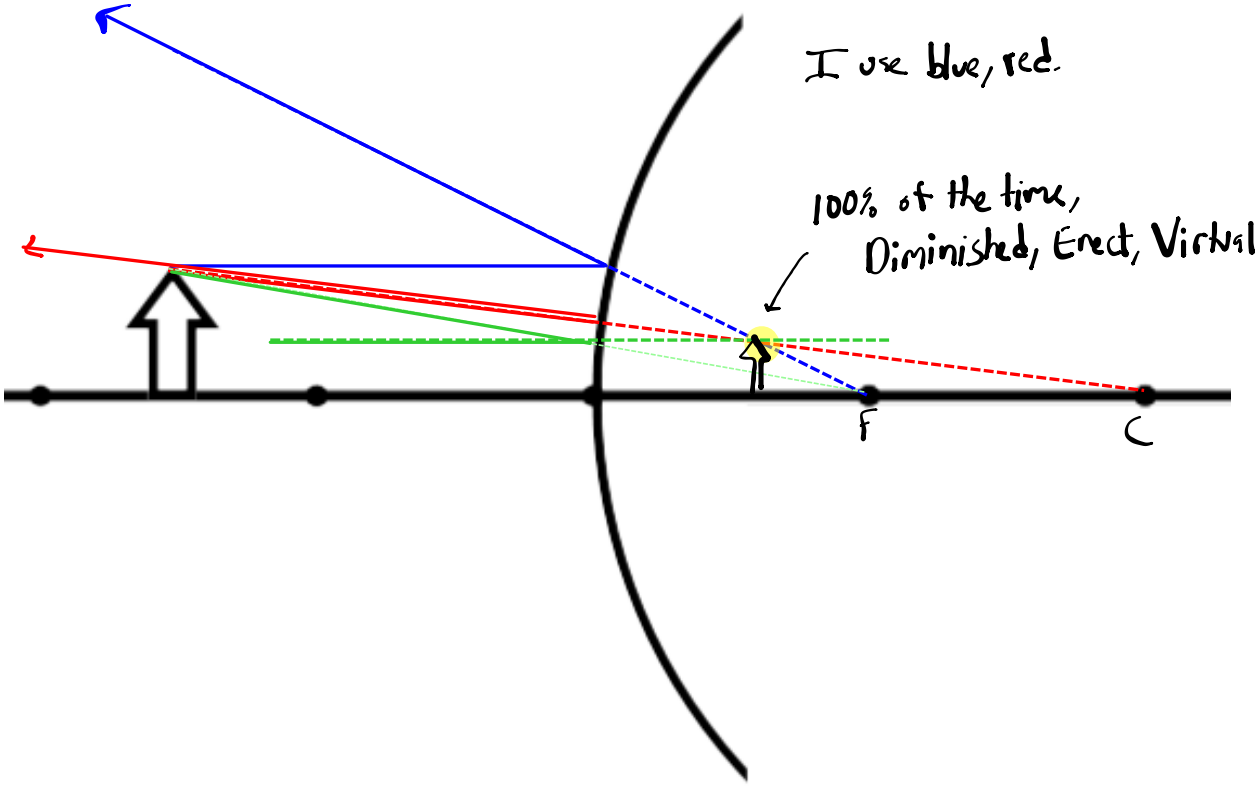


Ray Diagrams for Diverging/Convex Mirrors

Drawing Ray Diagrams for Diverging Curved Mirrors:

1) Parallel to the Principal Axis reflect away from the Focal Point
2) Through the Focal Point reflect parallel to the Principal Axis
3) Through the Center of Curvature reflects back from the Center of Curvature





Ray Diagrams for Diverging/Convex Mirrors

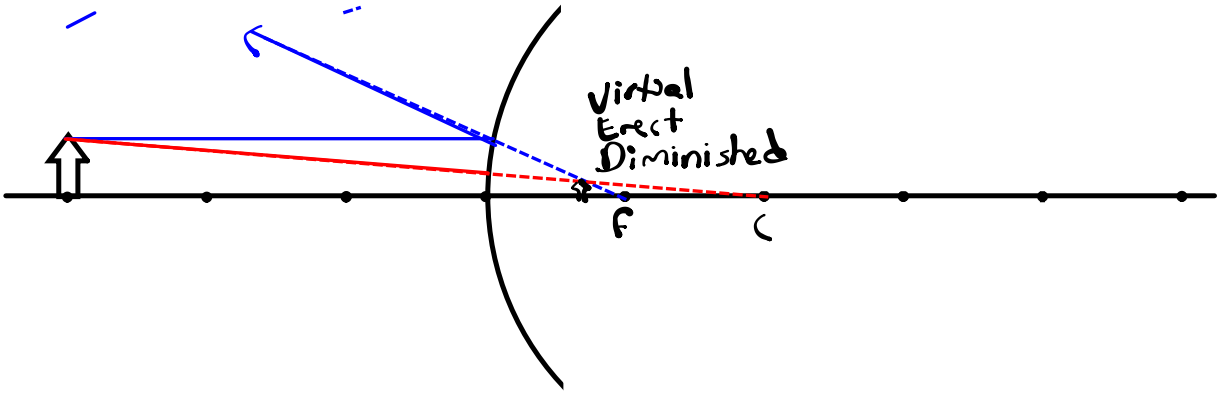
Drawing Ray Diagrams for Diverging Curved Mirrors:

1) Parallel to the Principal Axis reflect away from the Focal Point
2) Through the Focal Point reflect parallel to the Principal Axis
3) Through the Center of Curvature reflects back from the Center of Curvature

Image Characteristics

- Magnification: Relates the size of the image to the size of the object
- Attitude: Erect or inverted
- Position: Displacement from the mirror
- Type: Virtual or Real

Q5: Draw a ray diagram for an object 3 focal lengths away reflecting off a diverging mirror. Describe its characteristics.



Q6: Draw a ray diagram for an object 0.5 focal lengths away reflecting off a diverging mirror. Describe its characteristics.