

Optical Ray Diagram Rules

Directions: Use the rules elaborated below to help you determine how to draw the optical ray diagram for mirrors and lenses to then find out what kind of image is produced.

Legend:

Incident Light Ray (coming from object toward the mirror or lens): \longrightarrow

Reflected or Refracted ray: $\cdots\cdots\cdots\longrightarrow$

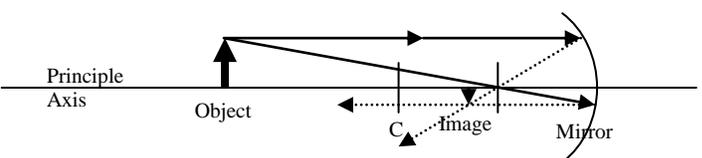
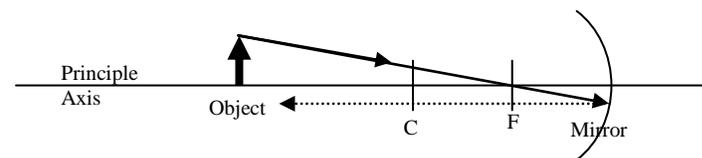
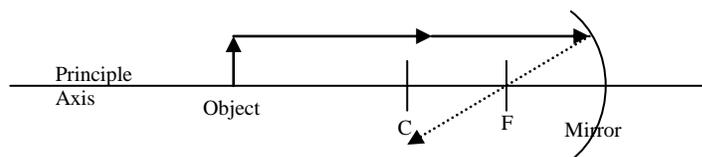
C = Location of the Center of Curvature for a mirror.

F = Location of the focus point for the mirror or lens.

2F = Location of twice the focal length of the lens.

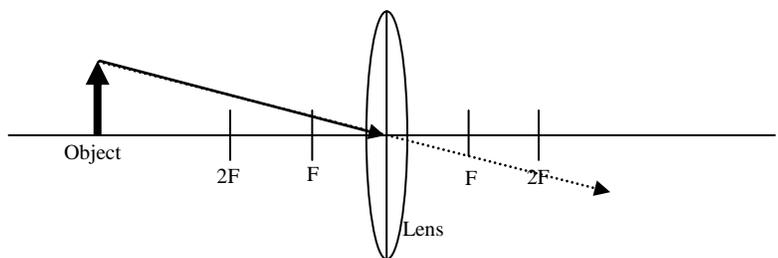
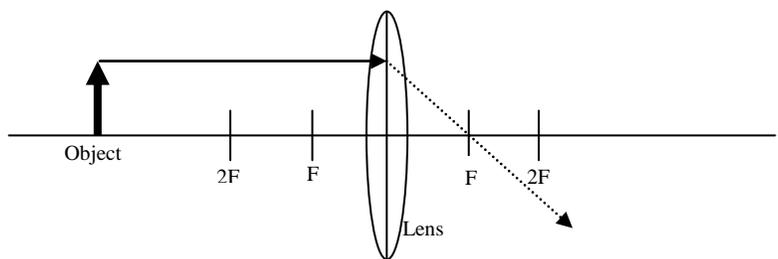
Mirror Ray Diagram Rules:

1. Any incident light ray coming from the object toward the mirror that is parallel to the principle axis of the mirror will be reflected through the focus point of the mirror.
2. Any incident light ray coming from the object that passes through the focus point on its way toward the mirror will be reflected back parallel to the principle axis of the mirror.
3. The point of intersection of the reflected rays of light from a certain point on the object represents the location in space of the same point on the image of the object.

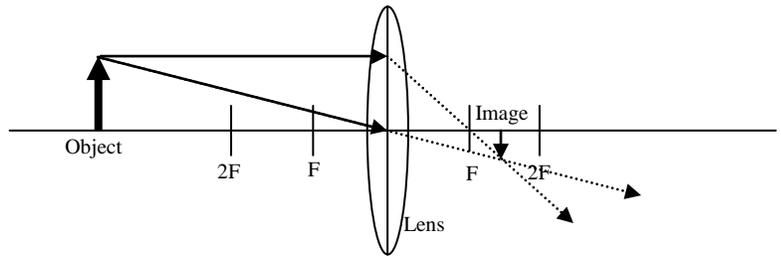


Lens Ray Diagrams:

1. Any incident light ray coming from the object will pass through the lens and be refracted at the midpoint of the lens such that it will pass through the focus on the other side of the lens from the object (for a converging (convex) lens only).
2. A second incident light ray from the same point on the object will pass directly through the center of the lens and its intersection with the principle axis. The refraction that takes place by the lens is reversed on each side of the lens, so the ray appears to pass straight through the lens at that point.



3. The point of intersection of the refracted light rays from a certain point on the object represents the location in space of the same point on the image.



Types of Images:

1. An image is a **real** image if:
 - A) It is inverted compared to the orientation of the object. *Note: in each of the diagram examples shown, it is a real image.*
 - B) It can be projected onto a screen. *This means that if you were to place a sheet of paper, or a projection screen at the expected location of the image, you would see an inverted image of the object at that location. This is the reason Movie film is run through the projector upside down, and why photocopies come out upside down.*
 - C) It appears on the same side of the mirror as the object, or the opposite side of the lens from the object.

2. An image is a **virtual** image if:
 - A) It is upright or erect compared to the orientation of the object. *Note: You are looking at a virtual image when you use a bathroom mirror to groom yourself.*
 - B) It appears “inside” or “behind” the mirror, or if it is “on the same side” of the lens as the object (in other words you have to look *back* through the lens at the object in order to see the image (in the same manner as you would use a magnifying glass to enlarge the print to read it better.)

The main test as to whether an image is “real” or “virtual” is its orientation as compared to the object. If it is inverted while the object is upright, the image must be a real image.