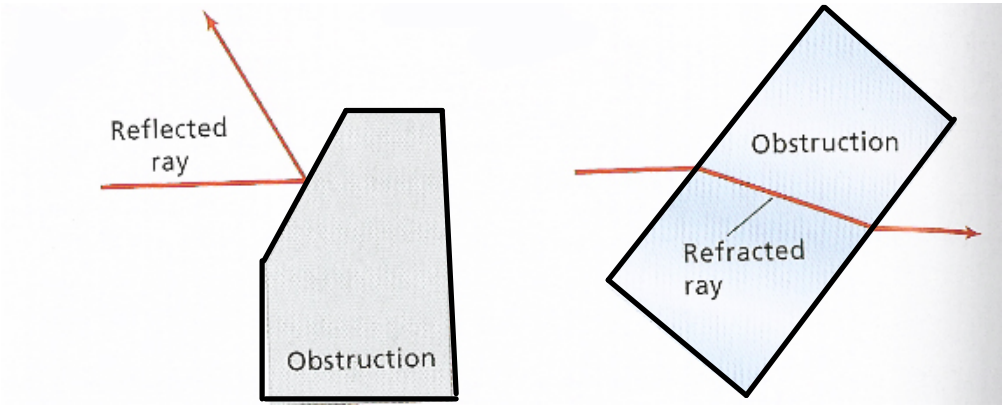
16- Reflection

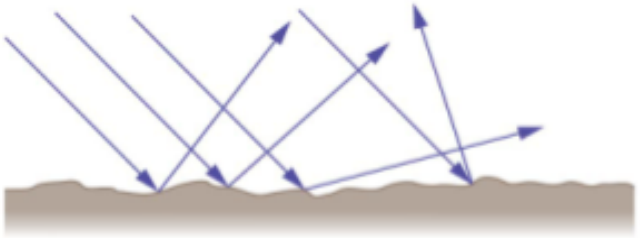
# Light travels in straight lines except: When it is reflected, refracted, diffracted



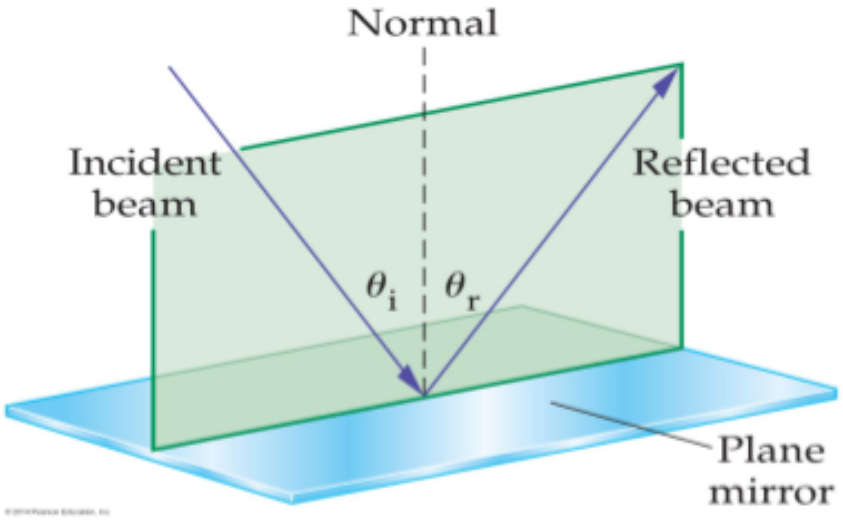

A reflected ray bounces back into the original medium

A refracted ray continues into the new medium.

Specular (Regular) reflection from a smooth surface (like a mirror).



Diffuse reflection from an irregular surface.

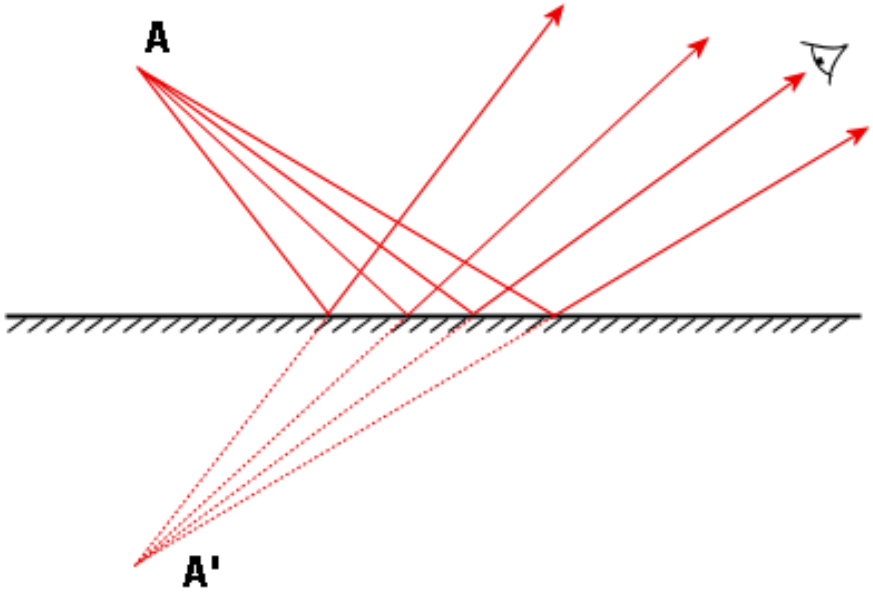


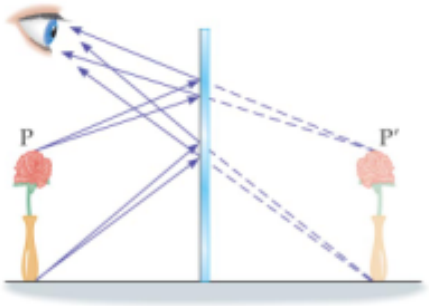

Normal: Line drawn perpendicular to the surface.
Angle of incidence = angle between the incident ray and the normal
Angle of reflection = angle between the reflected ray and the normal

Reflection:
Angle of incidence = Angle of reflection

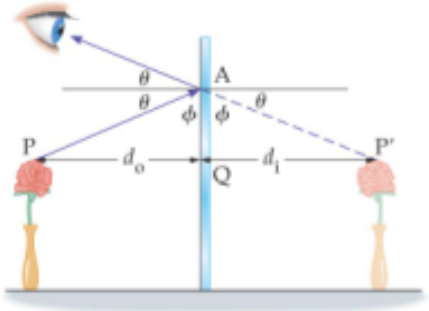
Example:
Light strikes a mirror at an angle of $32^{o}$ to the surface. What is the angle of reflection?

Plane (flat) mirror
image distance (di) = object distance (do)





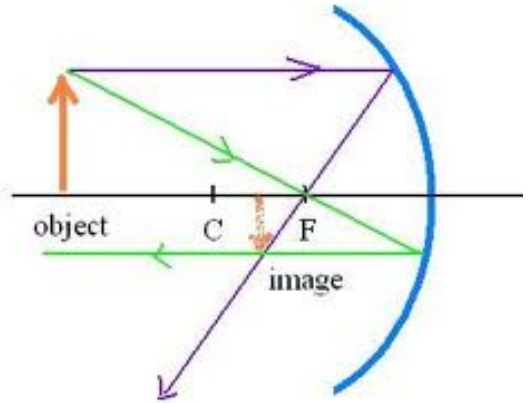

**(a)** Image formed by a plane mirror



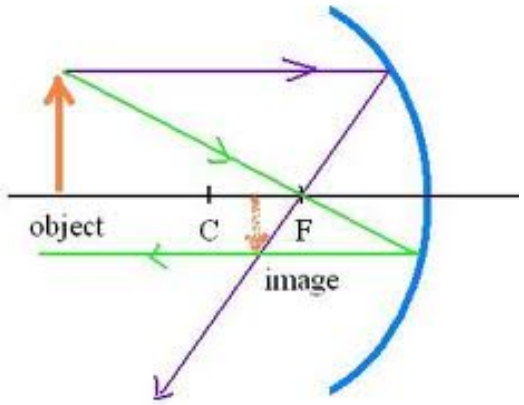

**(b)** Image appears as far behind the mirror as object is in front.

Curved mirrors:
Concave (converging)
Convex (diverging)

Concave Mirror:



# Concave Mirror




Find the image by ray tracing:

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

2. A ray through the center of curve is reflected back on itself.

3.A ray though the focus is reflected parallel to the principal axis.

The image is located at the intersection of the reflected rays.

Concave Mirror

$d_o$ = object distance

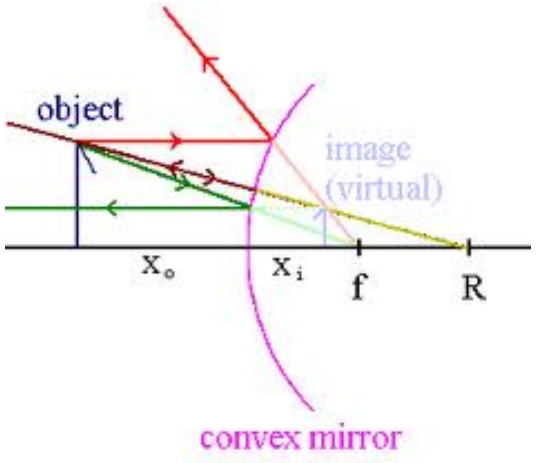
$d_i$ = image distance

$f$ = focal length

$$1/d_o + 1/d_i = 1/f$$

$$h_o/h_i = d_o/d_i$$

Convex Mirror:




Rays:

1. A ray parallel to the axis is reflected so it appears to have come from the focus.
2. A ray going toward the focus is reflected parallel to the axis.
3. A ray toward the center of curve is reflected back on itself.

Convex Mirror

$d_o$ = object distance

$d_i$ = image distance

$f$ = focal length

$1/d_o + 1/d_i = 1/f$ AND $h_o/h_i = d_o/d_i$

BUT the focal length is negative because the focus is virtual.