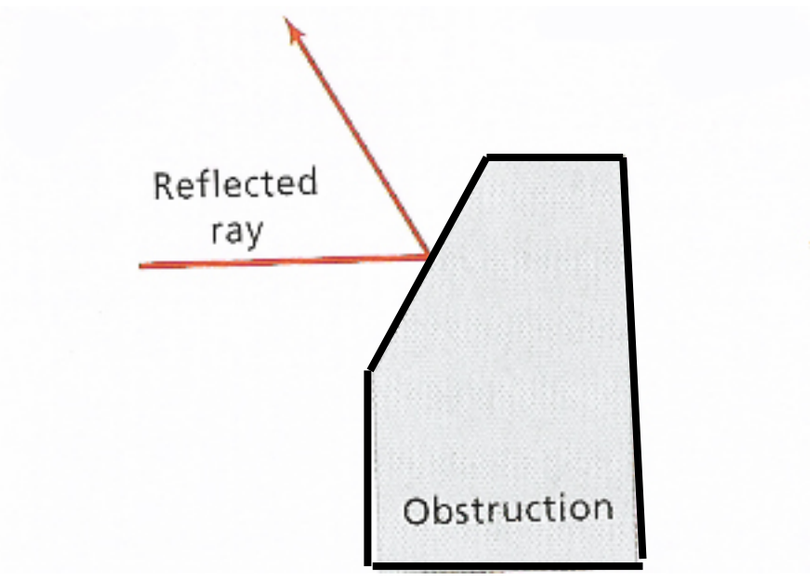
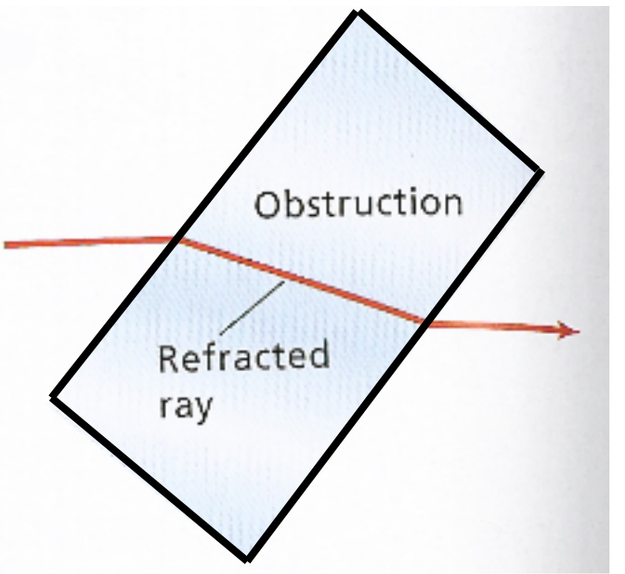
Light travels in straight lines except:
When it is reflected, refracted, diffracted

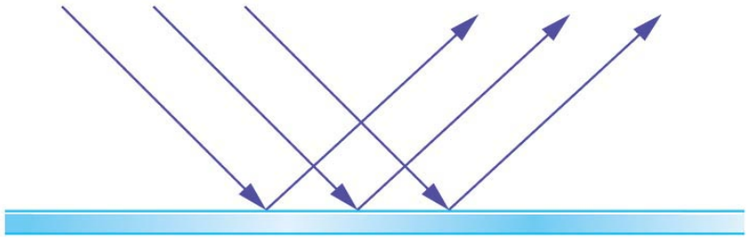


A reflected ray bounces back into the original medium

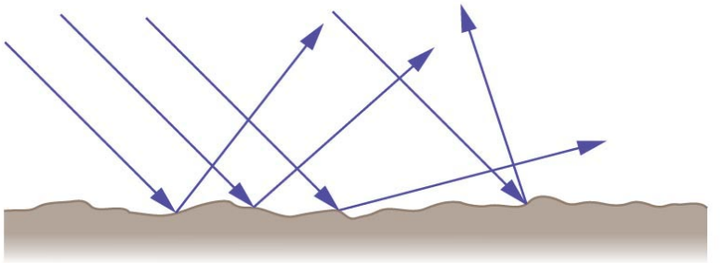


A refracted ray continues into the new medium.

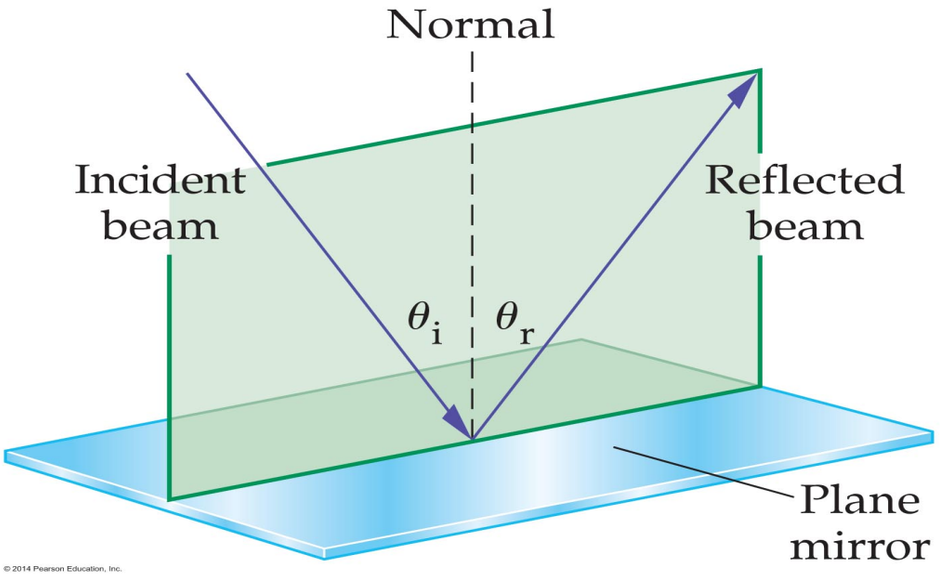
Revised 2.28.2021 Some diagrams from Pearson Physics by Walker. Used with permission



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



Diffuse reflection from
an irregular surface.



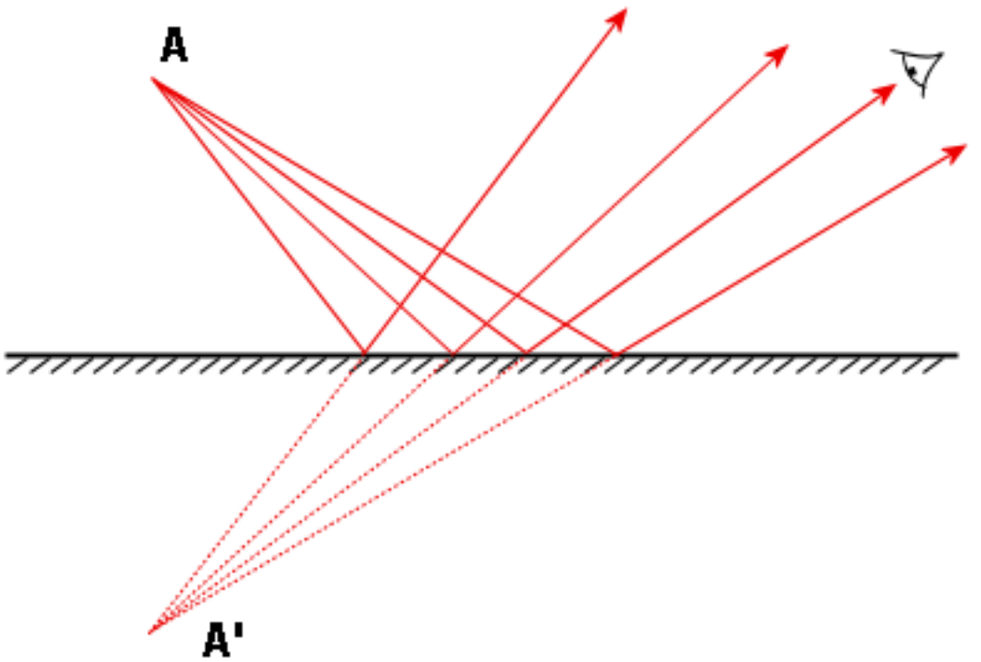
Normal: Line drawn perpendicular to the surface.
Angle of incidence = angle between the incident ray and the normal
Angle of reflection = angle between the reflected ray and the normal

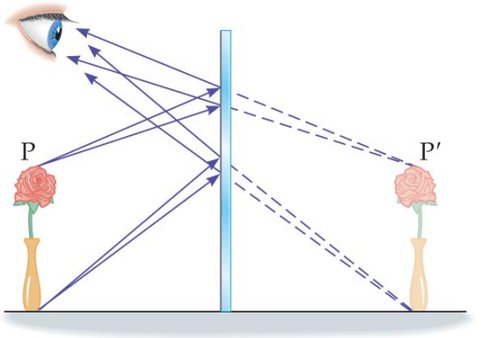
Reflection:

Angle of incidence = Angle of reflection

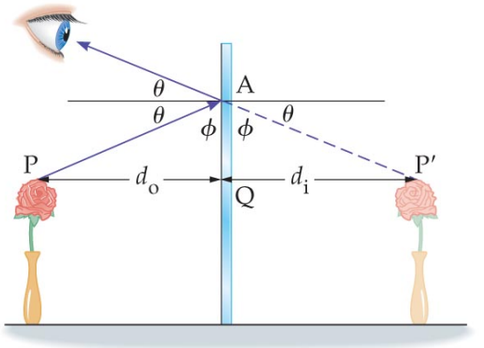
Example:
Light strikes a mirror at an angle of 32 degrees to the surface. What is the angle of reflection?

Plane (flat) mirror
image distance (di) = object distance (do)
The light rays leaving the object at A are reflected at the mirror. They appear to your eye to originate at A', which is what we call the image.



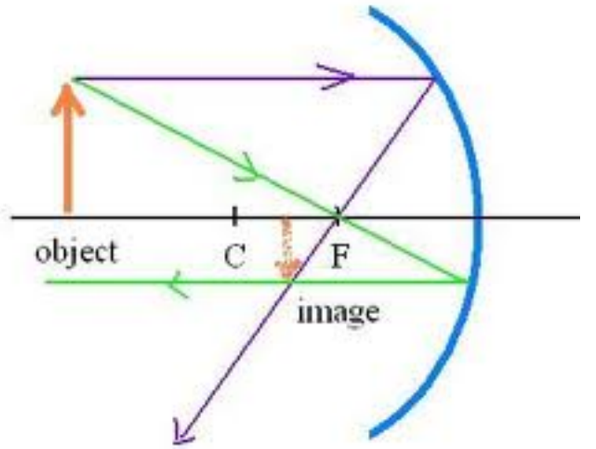


(a) Image formed by a plane mirror



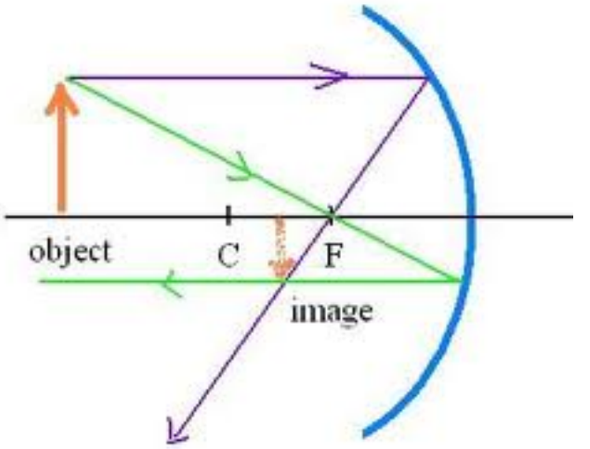
(b) Image appears as far behind the mirror as object is in front.

Curved mirrors:
Concave (converging)
This is a Concave Mirror:



Note that the image is inverted.
It is also called a real image because the reflected rays actually pass through the image.

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.

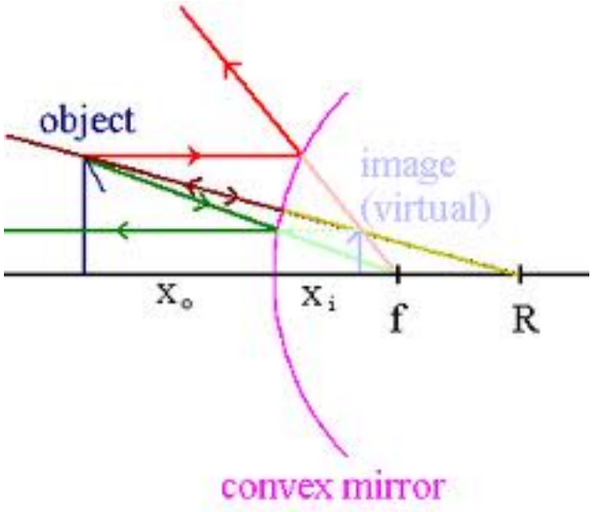
Concave Mirror
do = object distance
di = image distance
f = focal length

$1/do + 1/di = 1/f$

$ho/hi = do/di$
ho = height of the object
hi = height of the image.

Some books and the Regents reference sheet use So and Si for size of object and size of image
$So/Si = do/di$

Convex Mirror:
Also called a diverging 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.

Note that the reflected rays do not actually get behind the mirror, where the reflection is located. This is called a virtual image. A virtual image is one through which the reflected rays do not actually pass.

Convex Mirror

do = object distance

di = image distance

f = focal length

$1/do + 1/di = 1/f$ AND $ho/hi = do/di$

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