Plane Mirrors

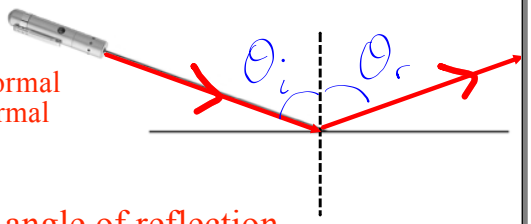
A laser pointer is aimed at the surface of a plane mirror. Use a straight-edge to construct the laser beam after it reflects from the mirror.

Plane Mirror: flat mirror

Normal: line perpendicular to surface

Angle of reflection: angle between reflected ray and normal

Angle of incidence: angle between incident ray and normal



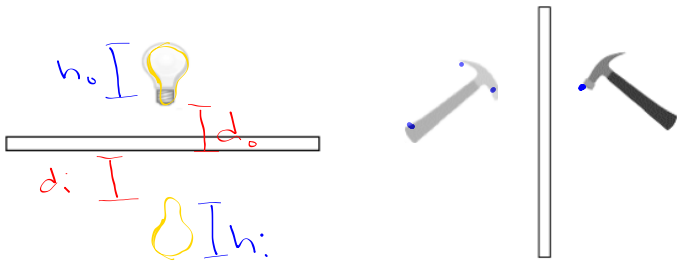
Law of Reflection

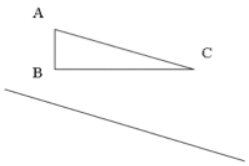
The angle of incidence is equal to the angle of reflection

$\theta_i = \theta_r$

Properties of Images formed by Plane Mirrors

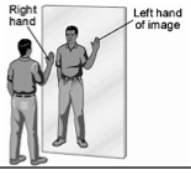
Each object below is in front of a plane mirror (seen on edge). Sketch the image that you would see in each case if you were looking into the mirror. Then, check your result by placing a plane mirror on top of this page at each location and looking into it.



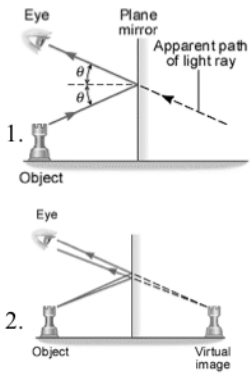


What are some properties of images formed by plane mirrors?

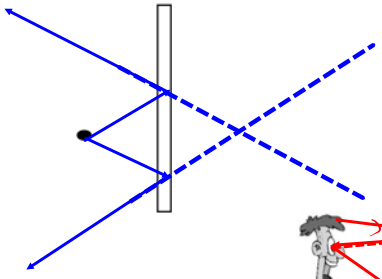
1. upright
2. same size
3. same distance away from mirror
4. orientation is reversed
5. virtual



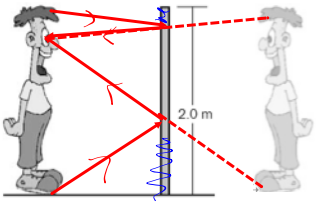
Locating Images using the Law of Reflection



Locate the image of this dot by means of two lines of sight.



How much of this 2.0 meter tall mirror is actually needed for the man to see the reflection of his entire body?

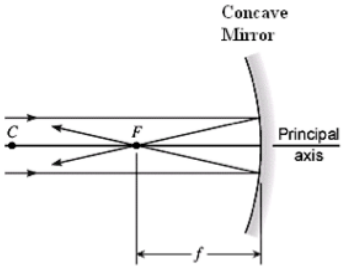


Virtual Image:
an image formed by light rays that only appear to intersect (converge) but do not actually intersect

Curved Mirrors

Source of Parallel Rays:
very distant object

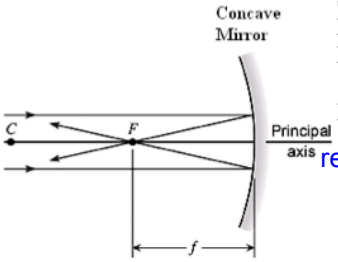
Method of locating focal point:
allow light from distant object to come into focus on a screen



Principal Axis: diameter of sphere
Center of Curvature (C): center of sphere
Radius of Curvature (R): radius of sphere
Focal Point (F): point where rays parallel to principal axis cross
Focal Length (f): distance between focal point and mirror

Relationship between radius of curvature and focal length
$R = 2f$

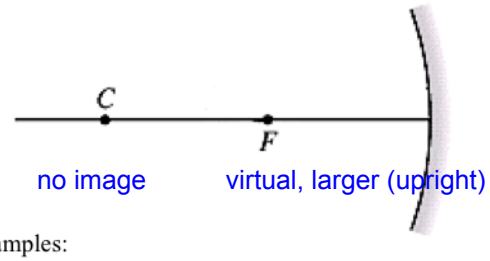
Converging Mirror



Shape: concave
Focal Point: real
Focal Length: positive

Images:
real/inverted -bigger
-smaller
-same size

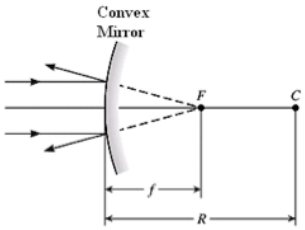
Examples:



no image

virtual, larger (upright)

Diverging Mirror

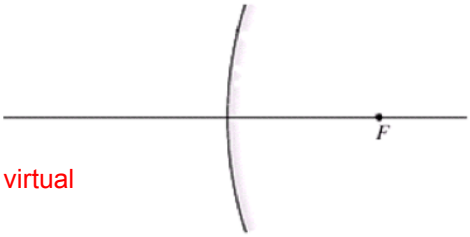


Shape: convex

Focal Point: virtual

Focal Length: negative

Images: smaller, upright, virtual



Examples:

Real and Virtual Images

Real image: formed where light rays actually intersect (converge)

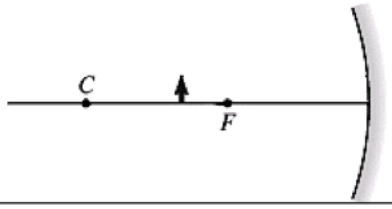
Properties:
1. can be projected on a screen
2. always inverted

Virtual image: formed where light rays only appear to intersect (converge)

Properties:
1. cannot be projected on a screen
2. always non-inverted (upright)

Ray Tracing (3-Ray diagrams) to Locate Images

Ray #1: In parallel, reflects out through focal point
Ray #2: In focus, reflects out parallel
Ray #3: In to center reflects out from center



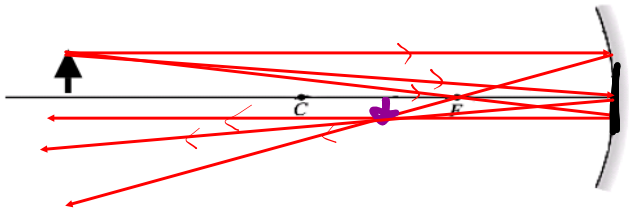


Image Properties
Case 1:

candle outside 2f:

real, inverted, smaller

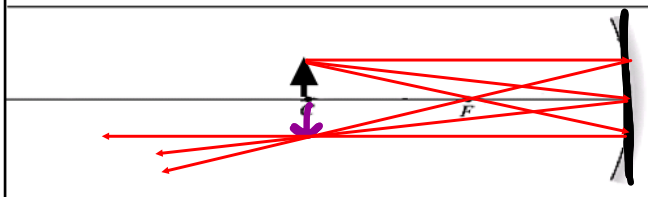


Image Properties
Case 2:

candle at 2f:

real, inverted, same size

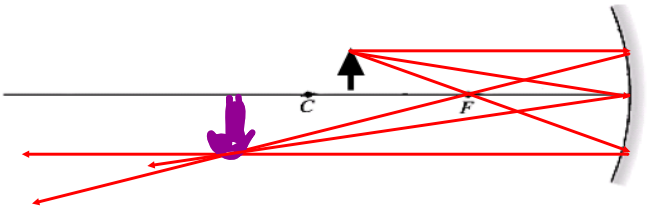


Image Properties
Case 3:

candle between f&2f:

real, inverted, larger

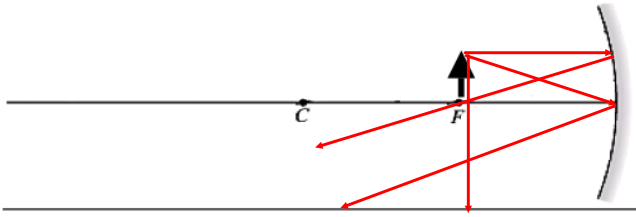


Image Properties
Case 4:

candle at f:

no image

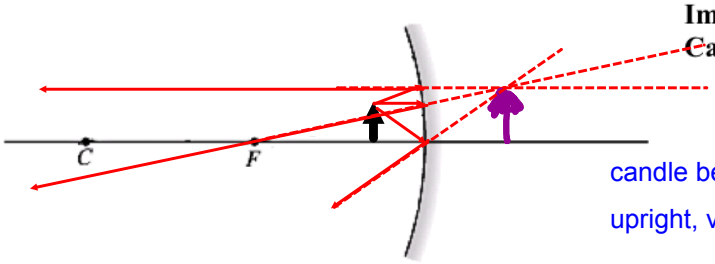


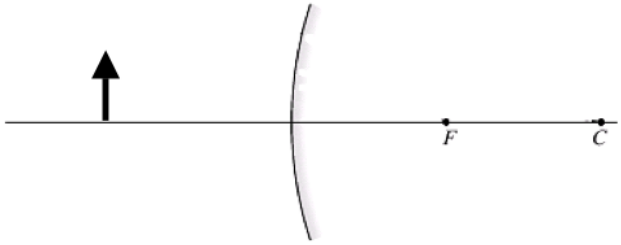
Image Properties
Case 5:

candle between mirror&f:

upright, virtual, enlarged

Application:

Convex Mirror



Application:

1. Under what circumstances will a mirror form a real image?
2. Under what circumstances will a mirror form a virtual image?