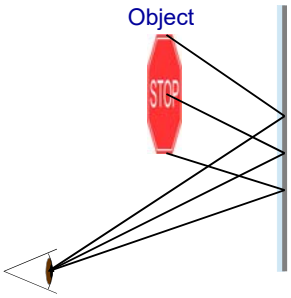
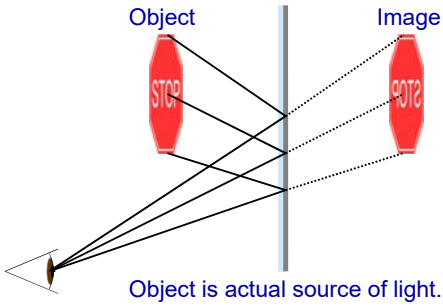
Plane Mirror



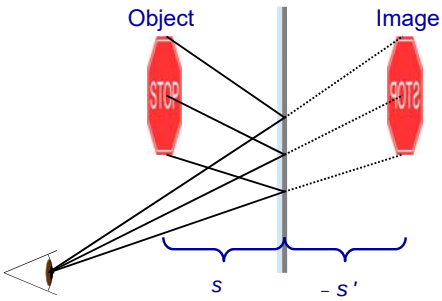
Object is source of light.
Every point of the object is a source of light.

Plane Mirror



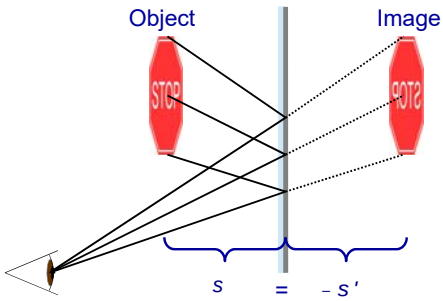
Object is actual source of light.
Image is perceived source of light.

Plane Mirror



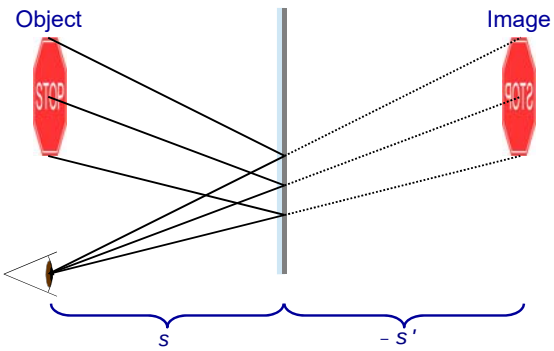
Object and image distances are positive on side with light rays and negative on opposite side.

Plane Mirror

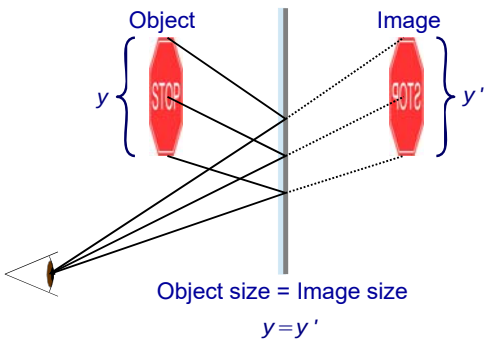


Object distance = - Image Distance

Plane Mirror



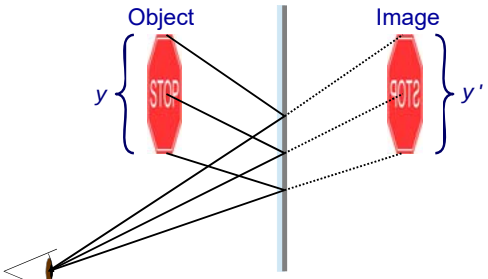
Plane Mirror



Object size = Image size

$y = y'$

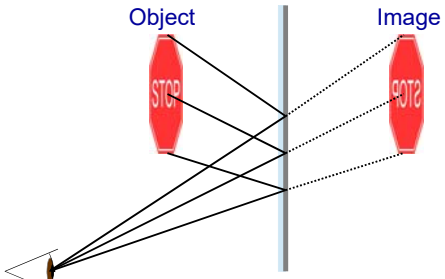
Plane Mirror



Magnification is image size relative to object size

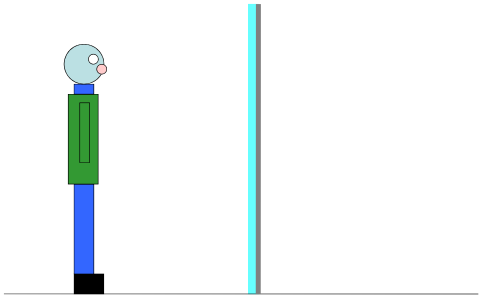
$$m = \frac{y'}{y}$$

Plane Mirror

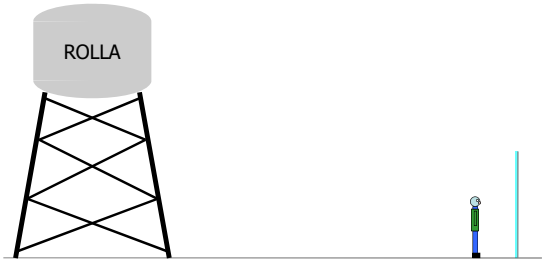


Plane mirrors produce images that are upright, virtual, the same size as the object and reversed front-to-back.

Example: How tall of a plane mirror is required for a person to see their full image in the mirror from their feet to the top of their head?

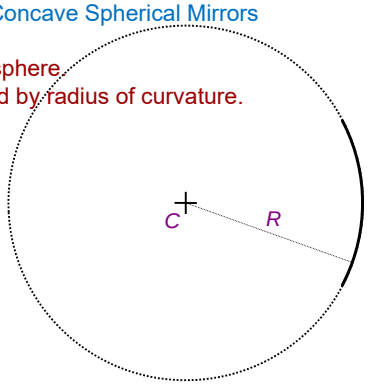


Example: How tall of a plane mirror is required for a person to see the full image of a distant object?



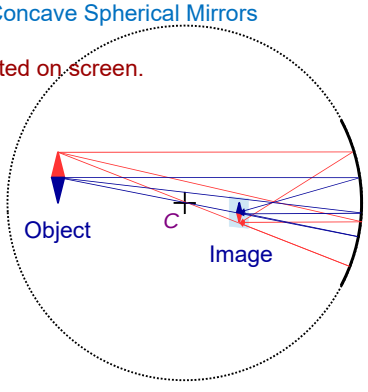
Concave Spherical Mirrors

Portion of a sphere.
Characterized by radius of curvature.

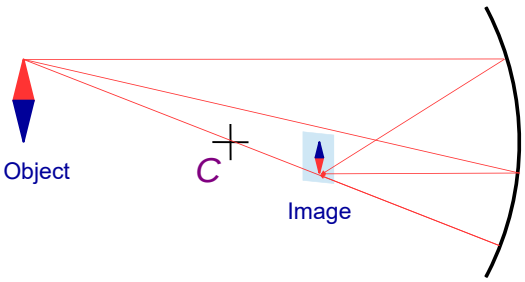


Concave Spherical Mirrors

Image projected on screen.

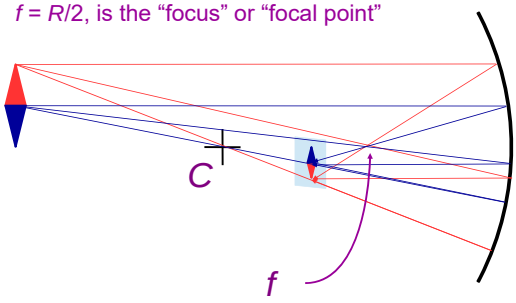


Concave Spherical Mirrors



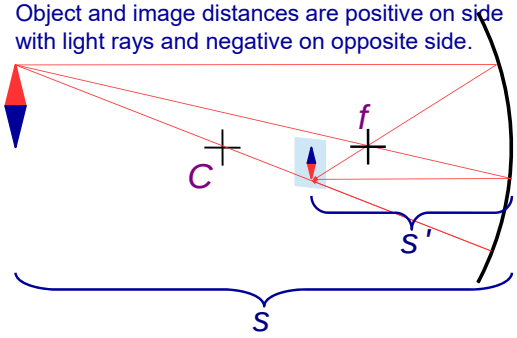
Concave Spherical Mirrors

$f = R/2$, is the "focus" or "focal point"



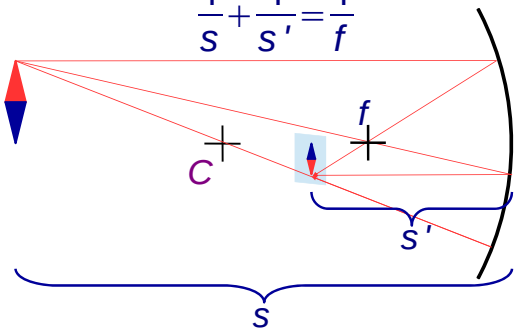
Concave Spherical Mirrors

Object and image distances are positive on side with light rays and negative on opposite side.



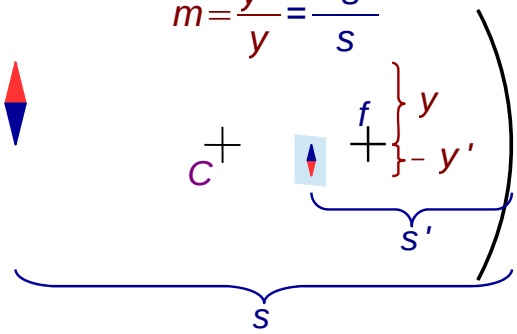
Concave Spherical Mirrors

$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$$



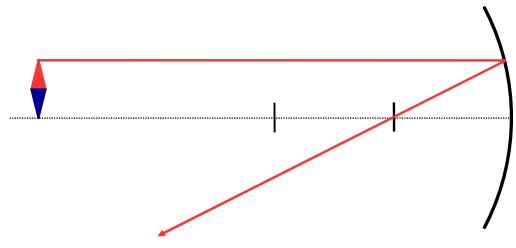
Concave Spherical Mirrors

$$m=\frac{y'}{y}=\frac{-s'}{s}$$



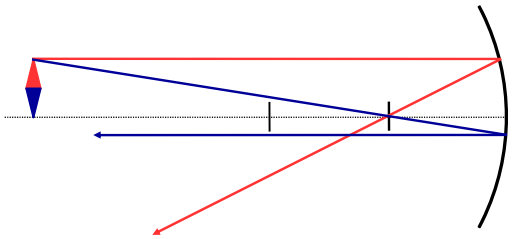
Graphical Determination of Image Location
Draw principle rays

- From object to mirror, parallel to principle axis - From there (mirror) through focus



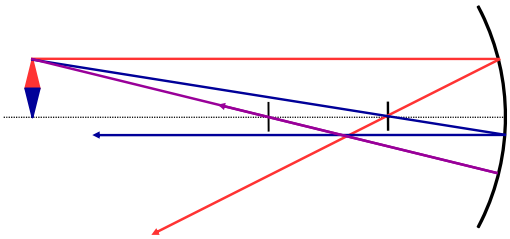
Graphical Determination of Image Location
Draw principle rays

- From object to mirror, through focus - From there (mirror) parallel to principle axis



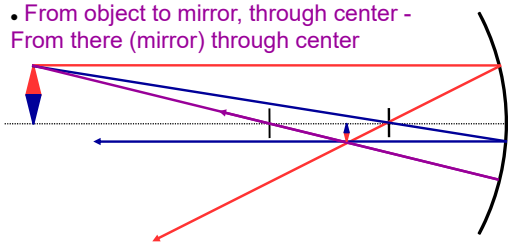
Graphical Determination of Image Location
Draw principle rays

- From object to mirror, through center - From there (mirror) through center



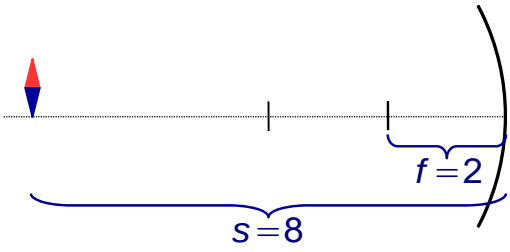
Draw principle rays

- From object to mirror, parallel to principle axis - From there (mirror) through focus
- From object to mirror, through focus - From there (mirror) parallel to principle axis
- From object to mirror, through center - From there (mirror) through center



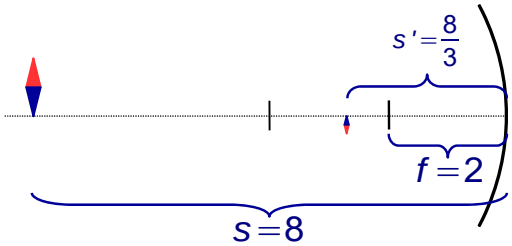
Calculation of Image Location

$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$$



Calculation of Image Location

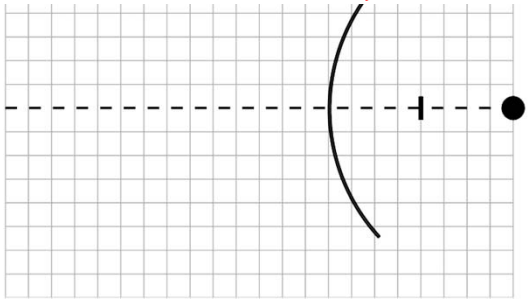
$$\frac{1}{8}+\frac{1}{s'}=\frac{1}{2}$$

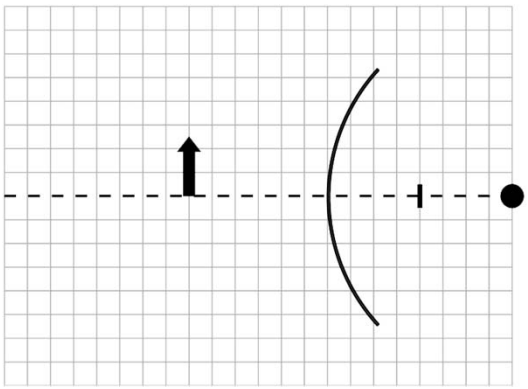


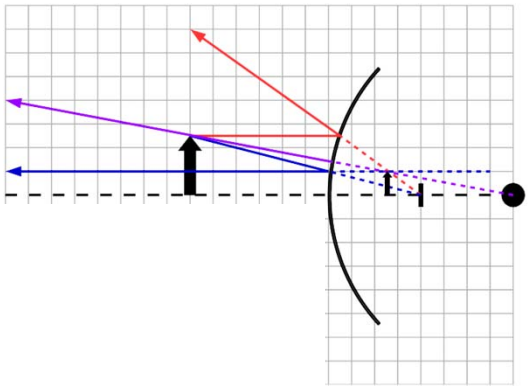
Example: a dime (height is 1.8 cm) is placed 100 cm away from a concave mirror. The image height is 0.9 cm and the image is inverted. What is the focal length of the mirror.

Convex Spherical Mirrors

Same rules with $R < 0$ and $f < 0$.







Convex Spherical Mirrors

Image is virtual, upright, and smaller than object.

Example: a convex rearview car mirror has a radius of curvature of 40 cm. Determine the location of the image and its magnification for an object 10 m from the mirror.

Additional Examples

An additional file is provided on the lecture web page including each possible type of image due to a concave spherical mirror.