

Light Reflection

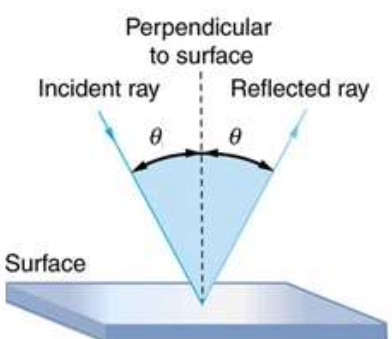
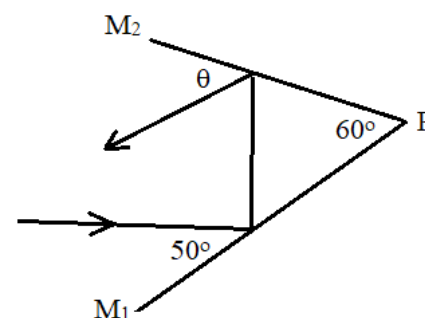
<p style="text-align: center;">Law of Reflection</p>  <p style="text-align: center;">The angle of reflection equals the angle of incidence.</p>	<p><u>Example:</u></p> <p>Two mirrors, M_1 and M_2, are joined at point P. A ray of light is incident on M_1 from the left and is reflected onto M_2. What is the angle θ?</p> 
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Image Formation with Plane Mirrors

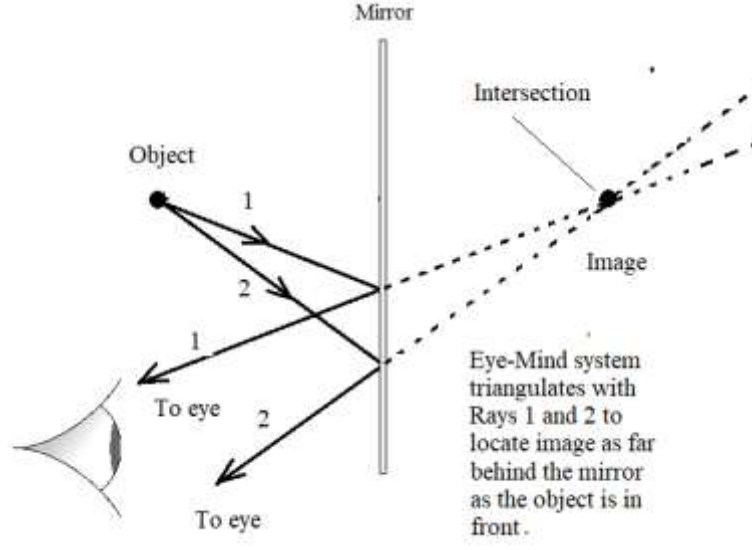
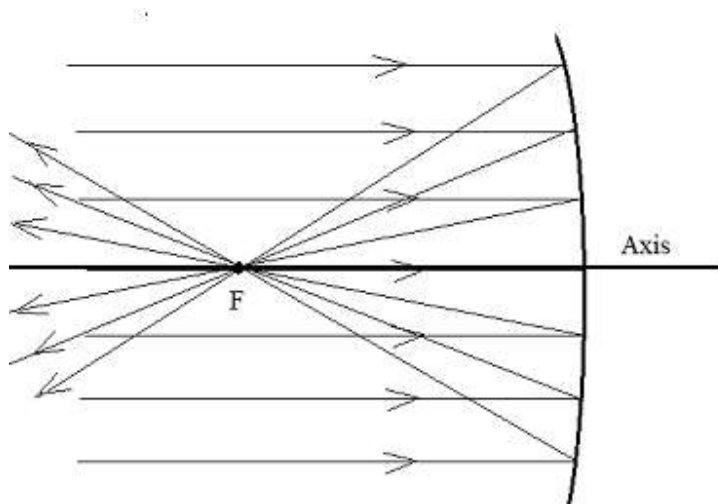
 <p style="text-align: center;">Eye-Mind system triangulates with Rays 1 and 2 to locate image as far behind the mirror as the object is in front.</p>	<p>Not drawn to scale. Any image that is behind a mirror is said to be “virtual,” which means not real, because light is not really leaving that place, passing through the mirror to the eye.</p> <p>Rule: If the image is not on the eye-side, i.e., in back of the mirror, it’s not real, i.e., it’s virtual.</p> <p>Images that are on the eye-side of the mirror are “real.”</p>
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Image Formation with Concave Mirrors

Paraxial Rays

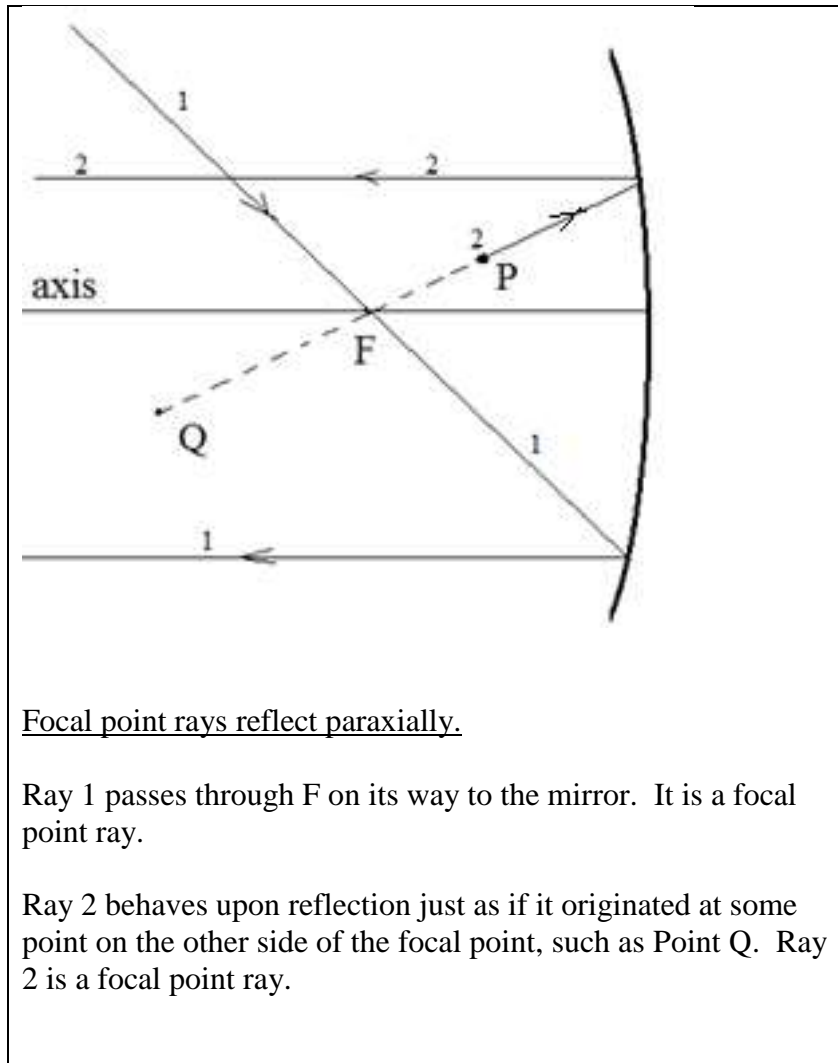
Paraxial rays are incident rays that are parallel to the axis.



Paraxial rays reflect through the focal point.

Focal Point Rays

Focal point rays are incident rays that lie on a line that passes through the focal point.



Focal point rays reflect paraxially.

Ray 1 passes through F on its way to the mirror. It is a focal point ray.

Ray 2 behaves upon reflection just as if it originated at some point on the other side of the focal point, such as Point Q. Ray 2 is a focal point ray.

Example: The focal point of the concave mirror in the figure below is 60 cm from the mirror. An object 30 cm tall is placed 100 cm from the mirror. We follow the two special rays leaving the top of the object, and use their behavior to triangulate to the location of the top of the image. Similar rays leaving other parts of the object would map to corresponding points on the image.

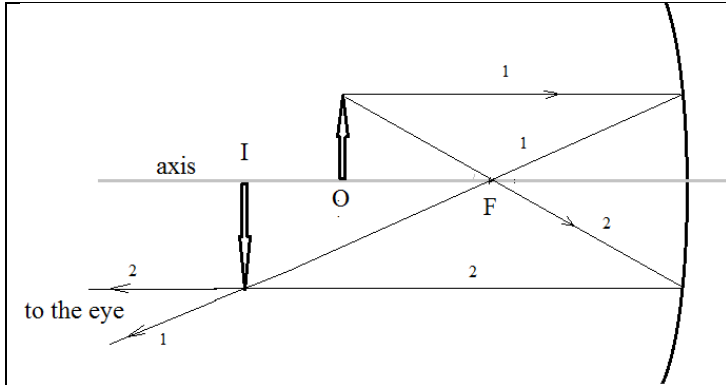


Image is inverted, taller, and in front of the mirror, about 40 cm tall. The image appears to be about 120 cm in front of the mirror. The image is real because it's on the eye-side.

Why does it matter whether the image is real, or virtual?

The value of knowing whether an image is real lies in the fact that real images can be projected onto a screen. If a camera film were placed where the real image is, the film would capture the image, because there really is light energy at that place that can cause chemical reactions on the film. Image capture is not possible for images that are not real, i.e., virtual images.

Example: The focal point of a concave mirror is 60 cm from the mirror. An object 30 cm tall is placed 100 cm from the mirror. We follow the two special rays leaving the top of the object, and use their behavior to triangulate to the location of the top of the image. Similar rays leaving other parts of the object would map to corresponding points on the image.

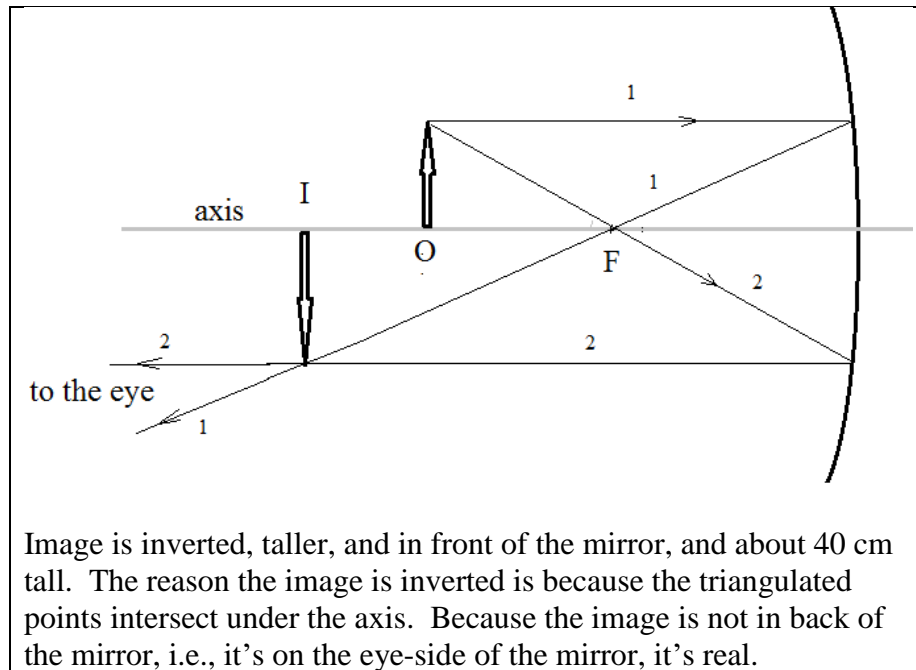


Image is inverted, taller, and in front of the mirror, and about 40 cm tall. The reason the image is inverted is because the triangulated points intersect under the axis. Because the image is not in back of the mirror, i.e., it's on the eye-side of the mirror, it's real.

Example: The focal point of a concave mirror is 60 cm from the mirror. A 30-cm tall object is placed 30 cm from the mirror. What

is the approximate height of the image?

Answer: 60 cm

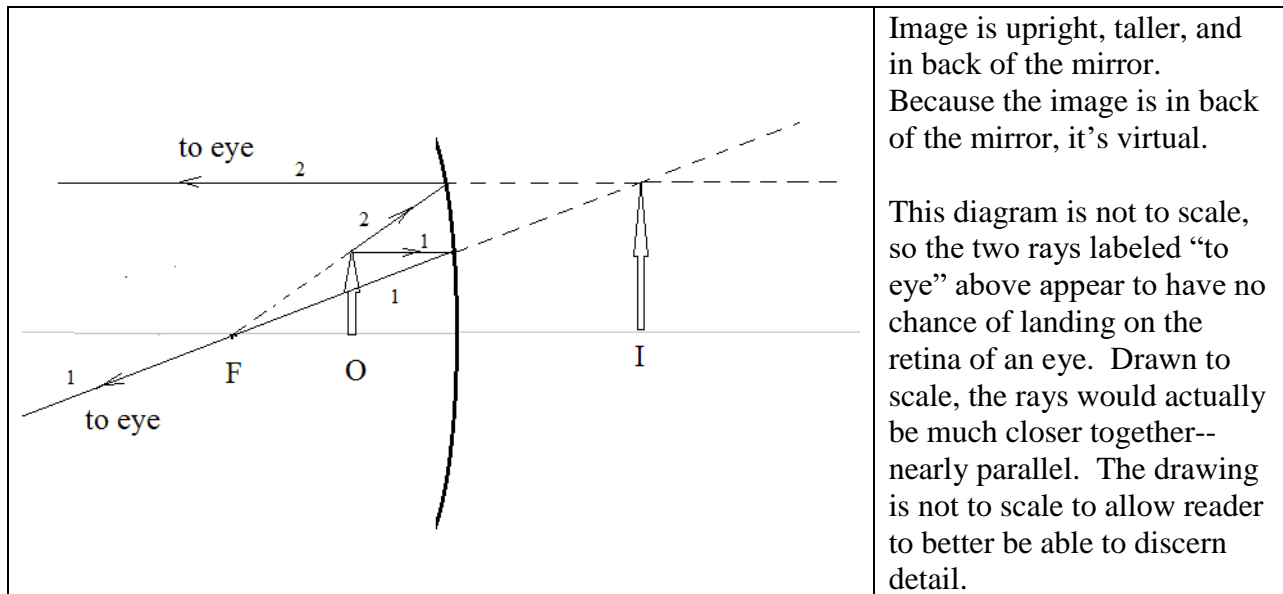
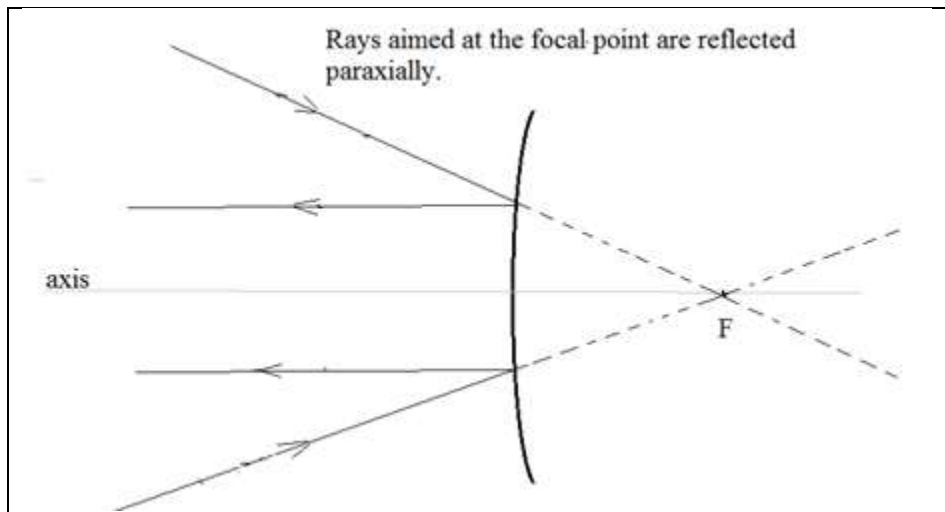
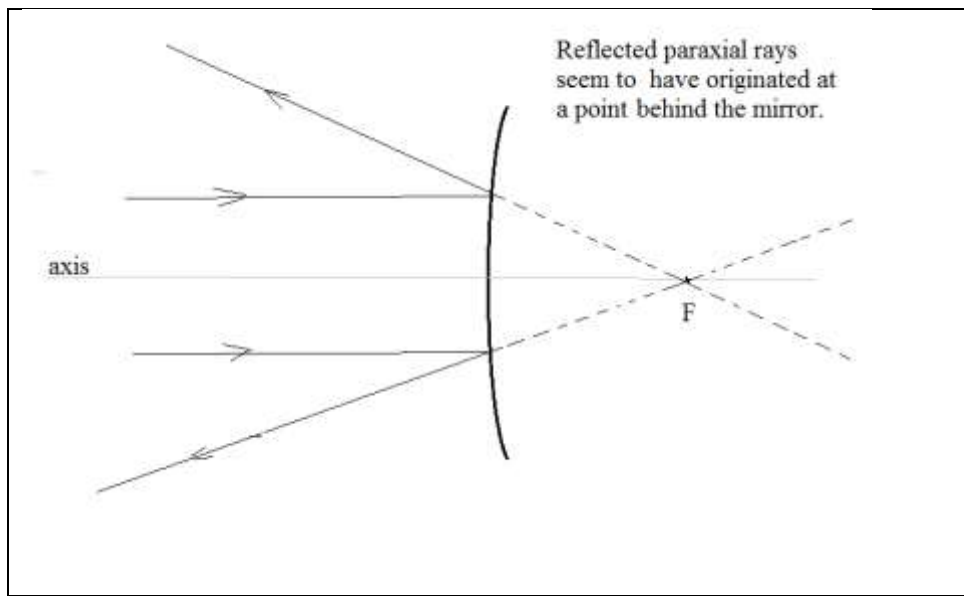
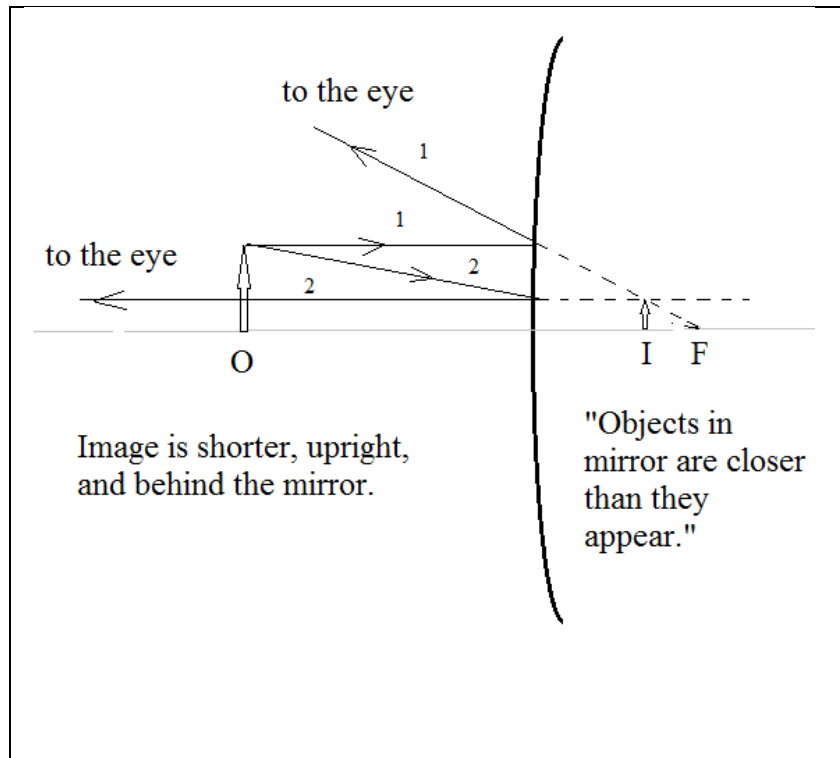


Image Formation with Convex Mirrors



Example: The focal point of a convex mirror (shown below) is 20 cm from the mirror. An object 12 cm tall is placed 30 cm from the mirror. What is the approximate

height of the image? After constructing a ray diagram, we estimate the height of the image to be about one-third the height of the object, or about 4 cm. The image is virtual because it's in back of the mirror.



Example: The focal point of a convex mirror is 30 cm from the mirror. A 10-cm tall object is 20 cm from the mirror. Use a ray diagram to

estimate the height of the image.

Answer: 30 cm