

W10.03

Ray-Tracing Rules for Plane Mirrors

adapted from <http://www.physicsclassroom.com>

Ray Diagrams

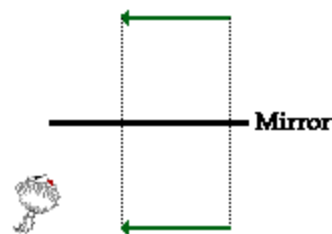
The line of sight principle suggests that in order to view an image of an object in a mirror, a person must sight along a line at the image of the object. When sighting along such a line, light from the object reflects off the mirror according to the law of reflection (the angle of reflection equals the angle of incidence) and travels to the person's eye. One useful tool which is frequently used to depict this idea is known as a ray diagram. A **ray diagram** is a diagram which traces the path which light takes in order for a person to view a point on the image of an object. On the diagram, rays (lines with arrows) are drawn for the incident ray and the reflected ray. Complex objects such as people are often represented by stick figures or arrows; in such cases it is customary to draw rays for the extreme positions on such objects.

Let's begin with the task of drawing a ray diagram to show how Suzie will be able to see the image of the green *object arrow* in the diagram below. For simplicity sake, we will suppose that Suzie is viewing the image with her left eye closed. Thus, we will focus on how light travels from the two extremities of the object arrow (the left and right side) to the mirror and finally to Suzie's right eye as she sights at the image. The four steps of the process for drawing a ray diagram are listed and applied below.



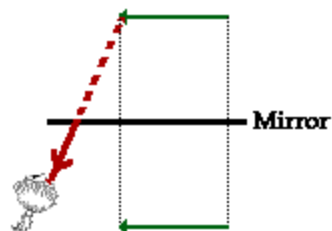
1. Draw the image of the object.

Use the principle that the object distance is equal to the image distance to determine the exact location of the image. Pick one *extreme* on the object and carefully measure the distance from this *extreme point* to the mirror. Mark off the same distance on the opposite side of the mirror and mark the image of this *extreme point*. Repeat this process for all extremes on the object until you have determined the complete location and shape of the image. Note that all distance measurements should be made by measuring along a segment which is perpendicular to the mirror.



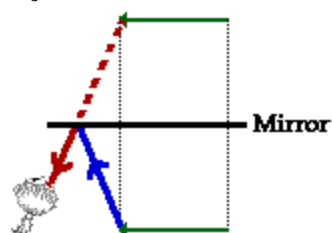
2. Pick one extreme on the image of the object and draw the reflected ray which will travel to the eye as it sights at this point.

Use the line of sight principle: the eye must sight along a line at the image of the object in order to see the image of the object. It is customary to draw a bold line for the reflected ray (from the mirror and to the eye) and a dashed line as an extension of this reflected ray; the dashed line extends behind the mirror to the location of the image point. The reflected ray should have an arrowhead upon it to indicate the direction that the light is traveling. The arrowhead should be pointing towards the eye since the light is traveling from the mirror to the eye.



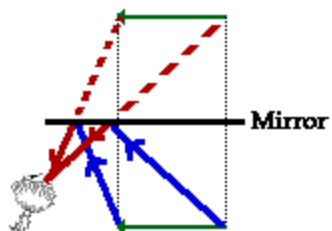
3. Draw the incident ray for light traveling from the corresponding extreme on the object to the mirror.

The incident ray will undergo the law of reflection at the mirror's surface. But rather than measuring angles, you can merely draw the incident ray from the *extreme* of the object to the point of incidence on the mirror's surface. Since you drew the reflected ray in step 2, the point of incidence has already been determined; the point of incidence is merely the point where the line of sight intersects the mirror's surface. Thus draw the incident ray from the *extreme point* to the point of incidence. Once more, be sure to draw an arrowhead upon the ray to indicate its direction of travel. The arrowhead should be pointing in the direction light travels, towards the mirror.



4. Repeat steps 2 and 3 for all other extremities on the object.

You have only shown how light travels from a single *extreme* on the object to the mirror and finally to the eye. You have to show how light travels from the other *extremes* on the object to the eye. Repeat steps 2 and 3 for each individual extreme. Once repeated for each extreme, your ray diagram is complete.



Sketch a ray diagram for the following mirrors.

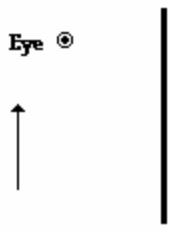


Diagram A

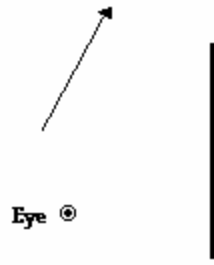


Diagram B