

12.2.4: Plane Mirrors


 Identical twins that look like they are in a mirror

Figure 14.4.1

Is this a picture of one girl in front of a mirror or is this a picture of twins designed to look like a mirror image? The writing on the shirt is properly mirror reversed, and, as in plane mirror images, the right hand of the object becomes the left hand of the image. However, if you look closely, you will see that in the picture one girl is wearing a ring and the other isn't.

Image in a Plane Mirror

The sketch below shows how we see an image in a plane mirror. Plane mirrors work because the light rays create a **virtual image** behind the mirror. Light rays from the object strike the mirror and reflect according to the law of reflection. When some of the light rays enter our eye, our eye and brain interpret these rays as having traveled in a straight line path. Therefore, our eye and brain track the light rays backward to a position from which they appear to have come. At this position, we see an image.

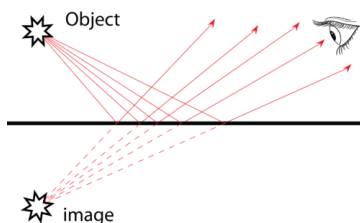


Figure 14.4.2

In a plane mirror, the image will be the same size as the object and will be the same distance behind the mirror as the object is in front of the mirror. This image is called a virtual image because the light does not actually pass through the image.


 Picture of a woman and her reflection in a mirror

Figure 14.4.3

When you look at an image of yourself in a plane mirror, there are some differences that are apparent. In the image above, you see a woman cleaning a mirror. The object woman has a cleaning cloth in her left hand. The image woman, however, appears to be holding the cleaning cloth in her right hand. Although the images in a plane mirror appear to flip horizontally, it is actually a result of them reversing in depth along the z-axis (in and out).

To learn more about why images in a mirror appear to flip horizontally watch the video below:



Launch the PLIX Interactive below to further explore virtual images and try to determine why you see a “mirror image” of yourself when you look at your reflection:

Example 14.4.1

A person 1.80 m tall stands in front of a plane mirror. What is the minimum height of the mirror, and how high must its lower edge be above the floor for the person to be able to see his/her whole body? Assume the person's eyes are 6.0 cm below the top of the head.

Solution

The law of reflection tells us that the angle of incidence equals the angle of reflection. From this, we know that the light ray leaving the person's toes will strike the mirror halfway between his toes and his eyes. The distance from the person's toes to eyes is 1.74 m, so the bottom of the mirror must be 0.87 m above the floor. The light ray that leaves the top of the person's head and reflects from the mirror into his eyes must strike the mirror 3.0 cm below the top of his head.

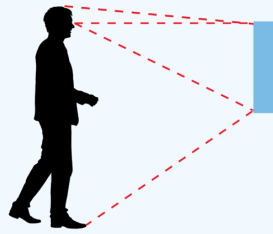


Figure 14.4.4

Therefore, the top of the mirror is 1.77 m above the floor and the bottom of the mirror is 0.87 m above the floor. The height of the mirror is $1.77\text{ m} - 0.87\text{ m} = 0.90\text{ m}$.

It doesn't take much analysis to recognize that the distance the person stands from the mirror does NOT affect the results. If you can't see your feet in a mirror, getting closer or farther away from the mirror won't make any difference. Try it out in this simulation below by adjusting the distance to the mirror and the length of the mirror:

Summary

- Our eye and brain interpret any light rays that enter an eye as having traveled in a straight line path.
- For a plane mirror, the image will be the same size as the object and will be the same distance behind the mirror as the object is in front of the mirror.
- Since the light forming the image does not pass through the image, it is called a virtual image.
- Images in a plane mirror are reversed left and right but are not reversed top and bottom.

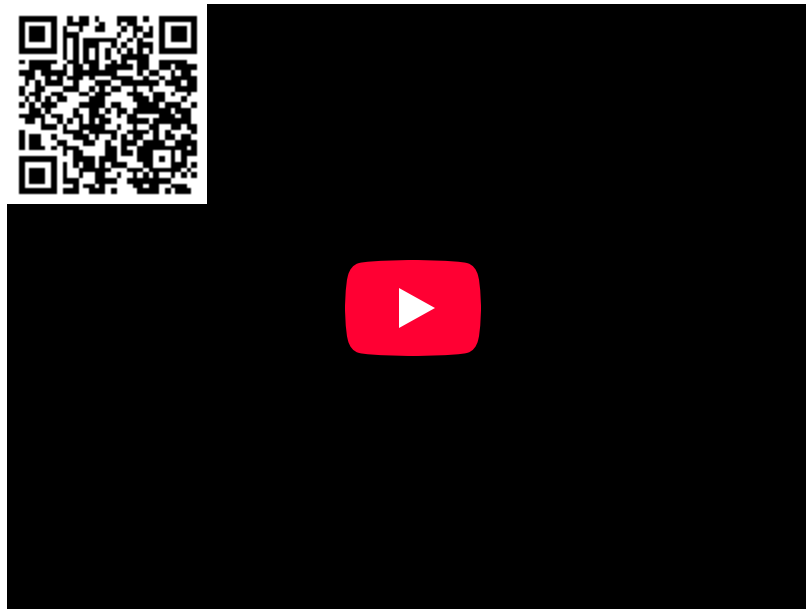
Review

1. A virtual image is one:
 1. toward which light rays converge but do not pass through.
 2. from which light rays diverge but do not pass through.
 3. from which light rays diverge as they pass through.
 4. toward which light rays converge and pass through.
 5. with a ray normal to a mirror passing through.
2. An object is 2.0 m in front of a plane mirror. Its image is:
 1. virtual, inverted, and 2.0 m behind the mirror.
 2. virtual, inverted, and 2.0 m in front of the mirror.
 3. virtual, erect, and 2.0 m in front of the mirror.
 4. real, erect, and 2.0 m behind the mirror.
 5. virtual, erect, and 2.0 m behind the mirror.
3. If the angle of incidence for an object and a plane mirror is 30° , what is the angle between the object and its image?
 1. 30°
 2. 60°
 3. 90°
 4. 120°
 5. 180°
4. If the angle of a car's windshield is 45° to vertical, what position of the sun is most likely to reflect into oncoming driver's eyes?
 1. Low in the sky behind the oncoming driver's car
 2. Low in the sky opposite the oncoming driver's car

3. Directly overhead
5. A 50. cm tall object is 3.0 m from a plane mirror.
 1. How tall will the image be?
 2. How far from the mirror will the image be?
 3. Will the image be real or virtual?
 4. Will the image be upright or inverted?
6. Which statement is true about the image produced by a plane mirror?
 1. It appears to be located on the same side of the mirror as the object.
 2. It appears to be larger than the object.
 3. It appears to be inverted relative to the object.
 4. It appears to be reversed left and right.
7. A light ray strikes a plane mirror at an angle of 80° to the normal. What is the angle that the reflected ray makes with the surface of the mirror?
8. A laser beam strikes a plane mirror with an angle of incidence of 38° . What is the angle between the incident beam and the reflected beam?

Explore More

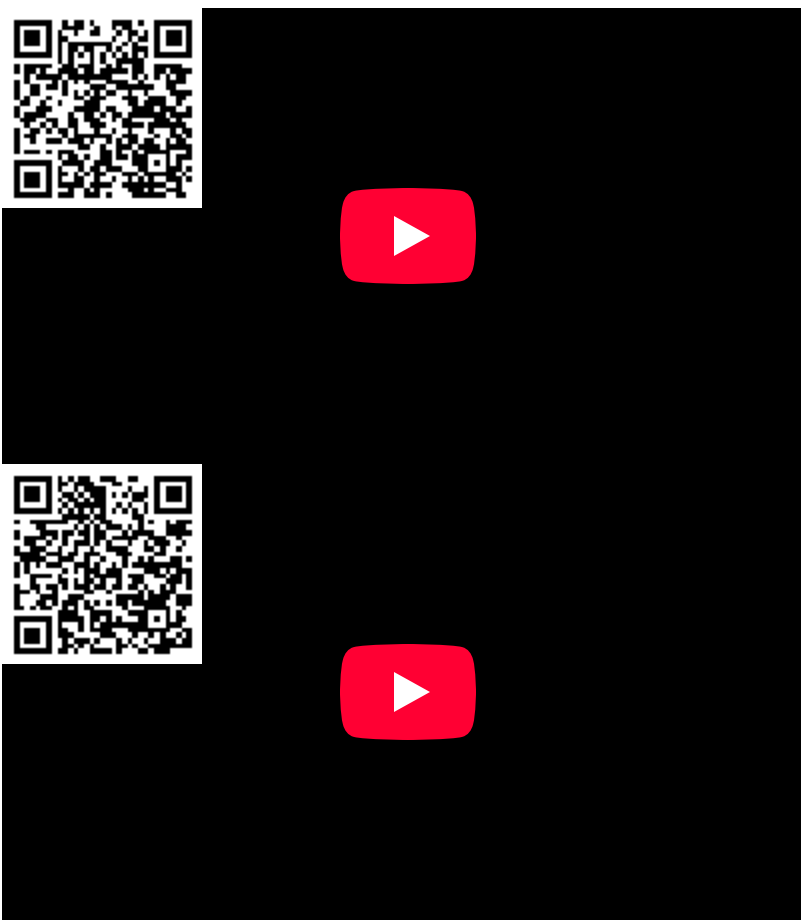
Use this resource to answer the questions that follow.



1. Are the images in the plane mirror upside down?
2. Are the images in the plane mirror reversed left and right?

Additional Resources

Videos:



Real World Application: The Person In The Mirror

Study Guide: Geometric Optics Study Guide

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