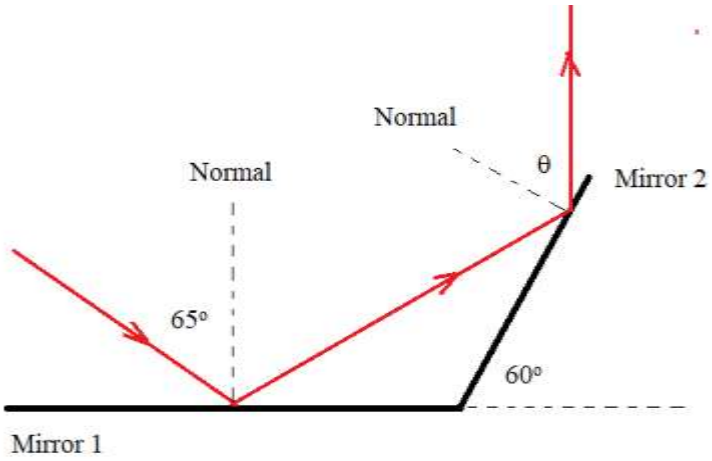
Physics 25 Practice Problems Chapter 25

Plane Mirrors

1. What is the angle θ in the figure below?

   Answer: 55°



Concave Mirrors

1. The focal point of a concave mirror is 60 cm from the mirror. A 20-cm tall object is placed 40 cm from the mirror. How far from the mirror is the image? What are the characteristics of the image?

2. The focal point of a concave mirror is 60 cm from the mirror. A 40-cm tall object is placed 100 cm from the mirror. How far from the mirror is the image? What are the characteristics of the image?

3. What would have to be the focal length of a concave mirror in order that the magnification of the image be -0.20 when the object is placed 100 cm from the mirror?

4. How far in front of a concave mirror whose focal length is 50 cm would an object have to be placed in order that the image be three times taller than the object, and upright?

5. Prove that with concave mirrors it is not possible to create an inverted image behind the mirror.

6. A concave mirror has a focal length of 12 cm. This mirror forms an image located 36 cm in front of the mirror. What are the attributes of this image?

7. Prove that upright, real images cannot be formed with a concave mirror.

Concave Mirror Problems Solutions

Helpful Rules Regarding Mirrors: If y is not positive, the image is not real, and therefore not on the eye-side. The object distance, x, is always positive.

1. 1/40 + 1/y = 1/60 y = -120 cm	The image distance is negative, so the image is behind the mirror, and therefore is virtual. The magnification, M = -(-120)/40, is positive, M = 3.0, so the image is upright and 3.0 times as tall as the object.
2. 1/100 + 1/y = 1/60 y = 150 cm	The image is on the eye side because y is positive, and, therefore, because it's on the eye-side, it's real. The magnification, M = -(150)/100, is negative, M = -1.5, so the image is inverted and 1.5 times as tall as the image.

3. - y/100 = -0.20 y = 20 cm 1/100 + 1/20 = 1/f f = 16.67 cm	**4.** -y/x = 3 y = -3x 1/x -1/3x = 1/50 x =33.33 cm

5. Recall: If an image is behind the mirror, the image distance, y, is negative. M = -y/x Inverted images have negative magnifications. Object distances, x, are always positive, so if y is negative, M would be positive and the image therefore would be upright.	**6.** 1/x + 1/36 = 1/12 x = 18 cm M = -36/18 = -2 The image distance is positive, so the image is on the eye-side and therefore is real. The magnification is negative, so the image is inverted, and twice as tall as the object.
7. Recall the rule: If the image distance, y, is negative, the image is virtual. However, if the image is real, and therefore the image distance is positive, M = -y/x is negative, which means the image would be inverted, not upright. Real, upright images cannot be formed with concave mirrors.	

Convex Mirrors Problems

Convex mirrors are a lot less interesting than concave mirrors. Whereas inverted or upright, real or virtual, and taller or shorter images are possible with concave mirrors, the images formed with convex mirrors are all *the same*: upright, virtual, behind the mirror, and shorter.

1. The focal length of a convex mirror is f = -60 cm. A 20-cm tall object is placed 40 cm from the mirror. What are the attributes of the image?

2. The magnification of an image formed with a convex mirror is 0.40, and the focal length of the mirror is f = -50 cm. What is the object distance?

Convex Mirrors Solutions

1.

$1/x + 1/y = 1/f$

$1/40 + 1/y = -1/60$

$y = -24$ cm

The image distance, y, is negative, so the image is behind the mirror and therefore virtual.

$M = -24/40$

$= 0.60$

Magnification is positive, so the image is upright.

Image Height = 0.60 (20)

= 12 cm

The image distance is negative, so the magnification, M = -y/x, is positive, M = 0.60. The image, therefore, is upright and 12 cm tall.

2.

$M = -y/x$

$= 0.40$

$y = -0.40\ x$

$1/x - 1/0.40x = -1/50$

$x = 75$ cm