

Problems

Chapter 13

1. Jill is standing in front of a clothing store mirror 1.0m away from it. Jack is standing 3.0m away from the mirror. How far is Jill's image from Jack?
2. A man needs a magnification of 2.00 in his shaving mirror. The radius of curvature of the mirror is 40.0cm. How far from the mirror must he place his face?
3. The usual magnification m is sometimes called the *lateral magnification* as it is defined for object sizes perpendicular to the principal axis. However, real objects are three dimensional and they do extend along the principal axis as well. Consider an object that extends a length L along the principal axis. Assume L to be small compared to the object distance p and the focal length f .
 - (a) Show that the *longitudinal magnification* (defined as $m' = L'/L$) is approximately given by
$$m' = -\left(\frac{f}{p-f}\right)^2.$$
 - (b) Show that $m' = -m^2$.
4. An object is placed 10cm away from a thin diverging lens. The magnitude of its focal length is 15cm.
 - (a) Find the position of the image.
 - (b) Find the magnification of the image.
 - (c) Is the image real or virtual?
 - (d) Draw a ray diagram illustrating the image formation.
5. A child uses a converging lens of focal length 15.0cm to form a sharp image of the Sun on a piece of paper. The distance between the Sun and the Earth is 1.50×10^{11} m, and the diameter of the Sun is 1.39×10^9 m. Find the size of the image of the Sun.
6. The slide in a slide projector is 250cm away from the screen. The lens of the projector has a focal length of 10.0cm. Find the distance between the lens and the slide for which a sharp image of the slide will form on the screen.
7. A single lens produces a real inverted image of an object. The distance between the object and the image is known to be 50.0cm. Focused on a screen, the image is seen to be twice the size of the object.
 - (a) Is the lens diverging or converging?
 - (b) Find the distance of the lens from the object.
 - (c) Find the focal length of the lens.