Ray Drawings for Images

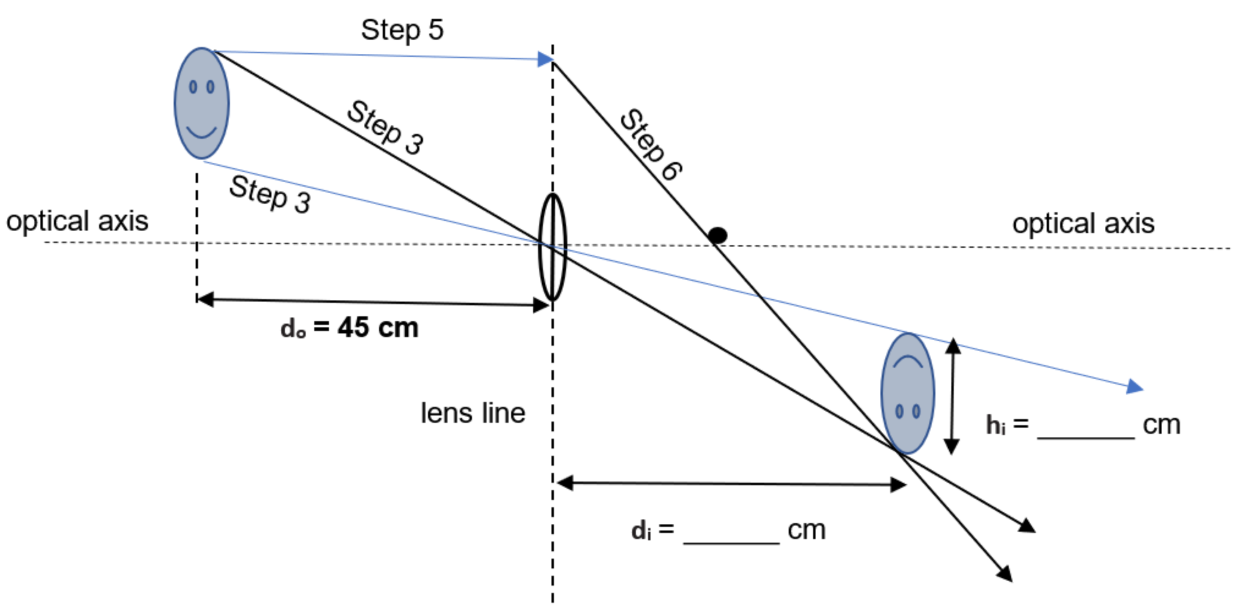
The size and position of images created by lenses can be predicted by making a scale model of the object and lens. Here are the rules:

1. Select a scale factor: for example, let 1 cm = 10 cm
2. Draw the lens and the object to scale.
3. Draw lines from the top and bottom of the object through the center of the lens.
4. Extend the lens line up or down as needed.
5. Draw a ray from the top (or bottom) of the object so that the ray is parallel to the axis and intersects the lens line.
6. From this intersection point, draw the ray through the focal point of the lens so that it crosses the pinhole lines. Locate the intersection of the lines from the top of object.
7. Draw the top of the image at the intersection of lines 3 & 6.
8. Measure and label the **h_i** and with the scale factor!

Example:

Scale: Let 1.0 cm = 10 cm

d_o = 45 cm, **h_o** = 20 cm, f = 24 cm

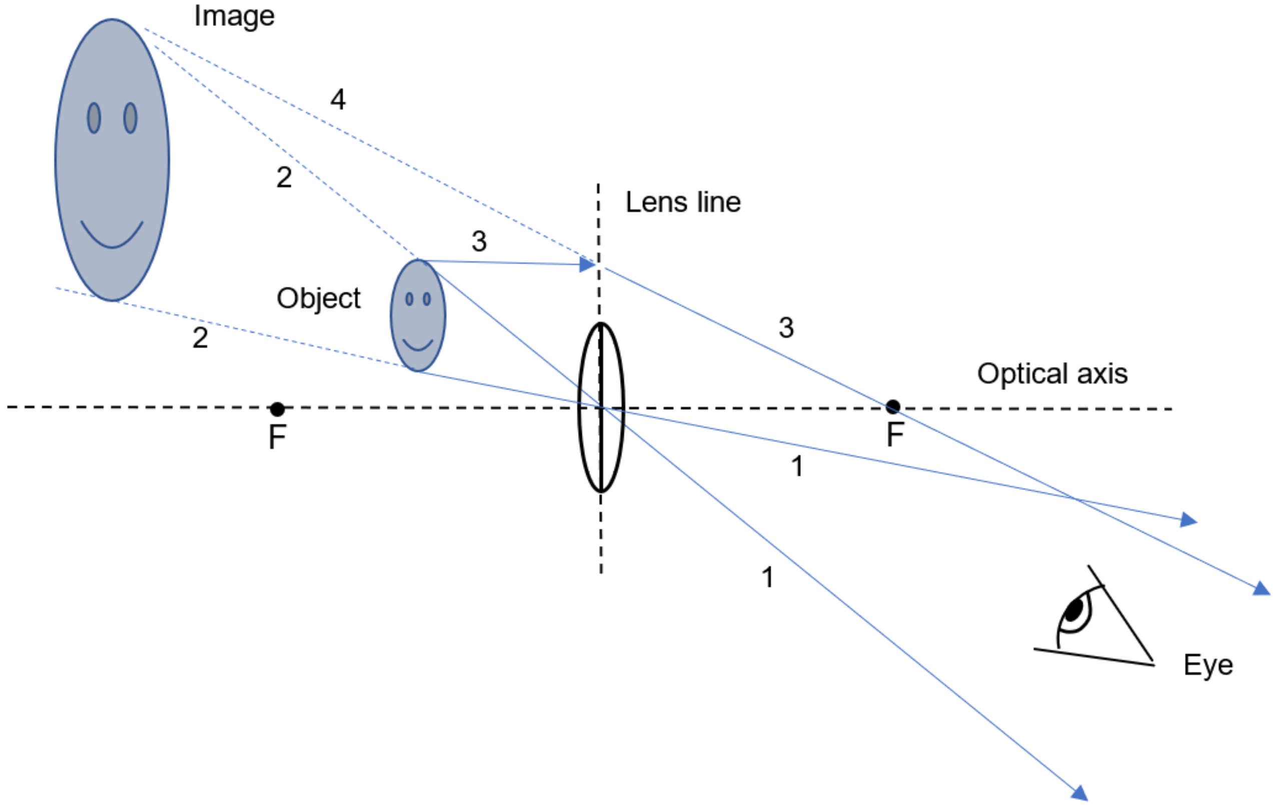


Note that the image is upside down and taller than the object.

Measure and label the values of **h_i** and **d_i**.

Note: when the object is outside the focal point of a converging lens, the lens will always form a REAL, upside down image on the opposite side of the lens. This image can be seen on a screen.

Here is the drawing when the object is **inside the focal length of a converging lens**:



This is an example of a **magnifying glass**.
The object must be inside the focal length:
A **LARGER image** will be seen on the **same side of the lens**. This image will be **right-side up and farther from the lens**.

1. Draw the lines from the top and bottom of the object through the center of the lens. (1)
2. Extend these lines backwards away from the lens (see dashed lines.) (2)
3. Draw a from the top of the object to the lens and then through the far focal length. (3)
4. Extend this line backwards. (4)

The top of the image will be located where these construction lines cross. (2 & 4)
Look **through the lens to see this magnified image**. This is named a VIRTUAL image. Virtual images are always right side up and on the same side of the lens as the object.

Note: The object is too close to the lens to make a real image.